INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**INFORMATION TECHNOLOGY**				
Course Title	**LINEAR ALGEBRA AND CALCULUS**				
Course Code	AHSBO2				
Program	B.Tech				
Semester	I				
Course Type	Foundation				
Regulation	R- 18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	1	4	-	-
Course Coordinator	Ms.P.Rajani, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
10+2	-	-	Basic Principles of Algebra and Calculus

II COURSE OVERVIEW:

The Linear algebra is a sub-field of mathematics concerned with vectors, matrices, and linear transforms. Calculus is the branch of mathematics which majorly deals with derivatives and integrals. Linear algebra is a key foundation to the field of machine learning. The course includes types of Matrices, Rank, methods of finding rank, Eigen values and Eigen vectors, maxima and minima of functions of several variables, solutions of higher order ordinary differential equations and Fourier series. Matrices are used in computer animations, color image processing. Eigen values are used by engineers to discover new and better designs for the future. The laws of physics are generally written down as differential equations. So, differential equations and Fourier series expansions have wide applications in various engineering and science disciplines. This course enables the students to gain basic knowledge on the mathematics which is used in modeling the real time engineering problems very often.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Linear Algebra and Calculus	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

C	PPT	C	Chalk & Talk	x	Assignments	x	MOOC		
C	Open Ended Experiments	x	Seminars	x	Mini Project	C	Videos		
x	Others								

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The expected percentage of cognitive level of the questions is broadly based on the criteria given in Table: 1.

Table 1: The expected percentage of cognitive level of questions in SEE.

10 %	Remember
30 %	Understand
60 %	Apply
0 %	Analyze
0 %	Evaluate
0 %	Create

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

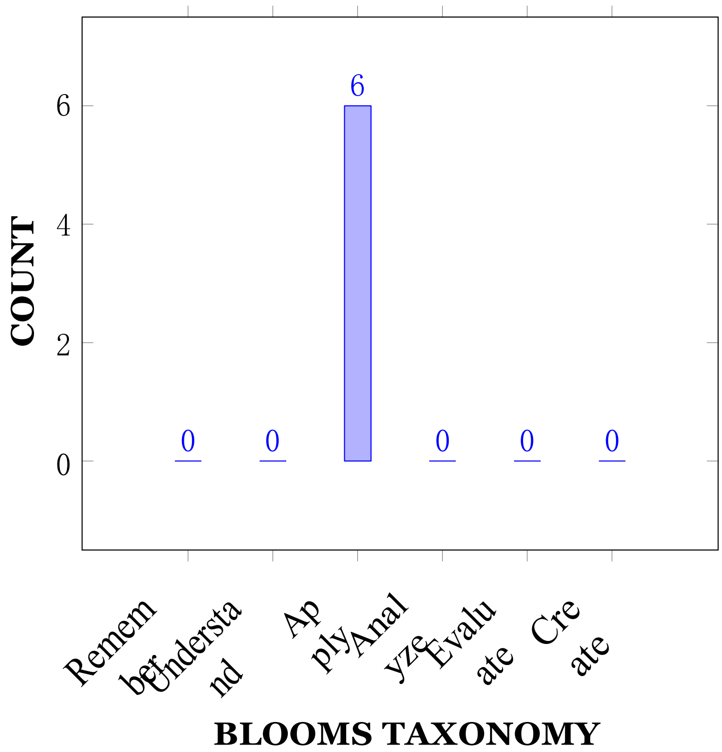
I	The principles of Eigen value analysis and linear transformations, Matrix rank finding methods.
II	The calculus of functions of several variables and the concept of maxima-minima for a three-dimensional surface.
III	The analytical methods for solving higher order differential equations with constant coefficients.
IV	Fourier series expansions in standard intervals as well as arbitrary intervals.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Compute** the rank and inverse of real and complex matrices with elementary transformation methods.	Apply
CO 2	**Use** the Eigen values, Eigen vectors for developing modal and Spectral matrices from the given matrix..	Apply
CO 3	**Make use of** Cayley Hamilton theorem for finding positive and negative powers of the matrix.	Apply
CO 4	**Utilize** the mean–value theorems and partial derivatives in estimating the extreme values for functions of several variables	Apply
CO 5	**Solve** the Second and higher order linear differential equations with constant coefficients by using substitution and method of variation of parameters..	Apply
CO 6	**Apply** the Fourier Series expansion of periodic, even and odd functions in analyzing the square wave, sine wave rectifiers.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Program Outcomes	
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/Quiz/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	CIE/Quiz/AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	-	-
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	-	-

PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	-	-

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	**C**	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	**C**	**C**	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	**C**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	**C**	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 5	**C**	**C**	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	**C**	**C**	-	-	-	-	-	-	-	-	-		-	-	-

XII JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 1	**Explain** the role of rank and inverse of real and complex matrices in solving **complex engineering problems** by using elementary transformation methods **(principles of mathematics).**	2
CO 2	PO 1	**Determine** the Eigen values, Eigen vectors, Spectral matrix **complex engineering problems modeled by matrices** with help of Characterstic Equation **(principles of mathematics).**	2
	PO 2	**Model** the problem into matrices, prepare precise **statement** of the problem and apply the concepts of Eigen values and Eigen vectors to **develop the solution** and **interpret, validate** the results through proper **documentation**	6
CO 3	PO 1	**Make use of** Cayley Hamilton theorem for finding positive and negative powers of the matrix and apply them in the **complex engineering problems** modeled by matrices **(principles of mathematics).**	2
CO 4	PO 1	**Explain** the mean–value theorems for the single variable functions andthe extreme values for functions of several variables apply them in the **complex engineering problems** Ordinary and Partial derivatives .	2

CO 5	PO 1	**Determine**the solution of **complex engineering problems** modeled by Second and higher order linear differential equations with constant coefficients by using substitution method and method of variation of parameters.	2
	PO 2	**Model** the problem with the help of ordinary differential equations, prepare precise **statement** of the problem and apply method of variation of parameters and other analytical methods to **develop the solution** and **interpret, validate** the results through proper **documentation**	6
CO 6	PO 1	**Build** the Fourier series expansion **for the complex engineering problems** modeled by given periodic, even and odd functions in various intervals with the help of Fourier coefficients formulae **(principles of mathematics).**	2
	PO 2	**Model** the problem with the help of suitable periodic functions, prepare precise **statement** of the problem and apply Fourier series expansions to **develop the solution** and **interpret, validate** the results through proper **documentation**	6

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – (PO, PSO) MAPPING:

COURSE	**Program Outcomes/No.of Key Competencies Matched**											**PSO'S**		
OUTCOMES	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	2	6	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	2	6	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	2	6	-	-	-	-	-	-	-	-	-	-	-	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – (PO, PSO):

COURSE	**PROGRAM OUTCOMES**												**PSO'S**		
OUTCOMES	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	67	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	67	60	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	67	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	67	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	67	60	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	67	60	-	-	-	-	-	-	-	-	-	-	-	-	-

XV COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - 0% $\leqslant$ C $\leqslant$ 5% – No correlation
1 - 5% < C $\leqslant$ 40% – Low/ Slight
2 - 40 % < C < 60% –Moderate
3 - 60% $\leqslant$ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	18	9	-	-	-	-	-	-	-	-	-	-	-	-	-
AVERAGE	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-

XVI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	C	SEE Exams	C	Assign-ments	-	Seminars	-
Labora-tory Practices	-	Student Viva	-	Mini Project	-	Certifica-tion	-
Term Paper	-	Tech - talk	C	Concept Video	PO 1, PO 2	-	-

XVII ASSESSMENT METHODOLOGY-INDIRECT:

x	Assessment of mini projects by experts	C	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**THEORY OF MATRICES**
	Real matrices: Symmetric, Skew-Symmetric and Orthogonal matrices; Complex matrices: Hermitian, Skew- Hermitian and Unitary matrices; Elementary row and column transformations, finding rank of a matrix by reducing to Echelon form and Normal form; Finding the inverse of a matrix using Gauss-Jordan method
MODULE II	**LINEAR TRANSFORMATIONS**

	Cayley-Hamilton theorem: Statement, verification, finding inverse and powers of a matrix; Linear dependence and independence of vectors; Linear transformation; Eigen values and Eigen vectors of a matrix; Diagonalization of matrix.
MODULE III	**FUNCTIONS OF SINGLE AND SEVERAL VARIABLES**
	Mean value theorems: Rolle's theorem, Lagrange's theorem, Cauchy's theorem-without proof; Functions of several variables: Partial differentiation, Jacobian, functional dependence, maxima and minima of functions with two variables and three variables. Method of Lagrange multipliers.
MODULE IV	**HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS**
	Linear differential equations of second and higher order with constant coefficients. Non-homogeneous term of the type f(x) = e^{ax} , sinax , cosax , x^n , e^{ax}v(x) and Method of variation of parameters.
MODULE V	**FOURIER SERIES**
	Fourier expansion of periodic function in a given interval of length 2π; Fourier series of even and odd functions; Fourier series in an arbitrary interval;

TEXT BOOKS

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36^{th} Edition, 2010
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint 2010.

REFERENCE BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9^{th} Edition, John Wiley & Sons, 2006.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. D. Poole, Linear Algebra: A Modern Introduction, 2^{nd} Edition, Brooks/Cole, 2005.

WEB REFERENCES:

1. https://nptel.ac.in/courses/111/108/111108157/

COURSE WEB PAGE:

1. lms.iare.ac.in

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Refer-ence
OBE DISCUSSION			
1	Outcome based education	-	-
CONTENT DELIVERY (THEORY)			
2	Theory of Matrices: Types of Real Matrices	CO 1	T2:32.1 R1:4.1
3	Real Matrices: Symmetric, Skew-Symmetric Matrices	CO 1	T2:32.1 R1:4.2
4	Real Matrices: Orthogonal Matrices	CO 1	T2:32.1 R1:4.3
5	Complex Matrices: Hermitian, Skew- Hermitian	CO 1	T2:32.1 R1:4.3
6	Complex Matrices: Unitary Matrices	CO 1	T2:32.5 R1:4.6
7	Elementary Operations: Elementary Row and Column Transformations	CO 1	T2:32.5 R1:4.6
8	Rank of a Matrix by Echelon Form	CO 1	T2:32.4 R1:4.5
9	Rank of a Matrix by Normal Form	CO 1	T2:32.7 R1:4.8
10	Inverse of a Matrix by Gauss-Jordan Method	CO 1	T2-7.1 R1:7.4
11	Eigen Values of a Matrix	CO 2	T2-7.1 R1:7.4
12	Eigen Vectors of a Matrix	CO 2	T2-7.1 R1:7.4
13	Diagonalization of Matrix by Linear Transformation.	CO 2	T2:7.1 R1:7.4
14	Cayley-Hamilton Theorem- Statement, Verification	CO 3	T2:7.1 R1:7.4
15	Applications of Cayley – Hamilton: Finding Inverse and Powers of a Matrix	CO 3	T3-2.9 R1:2.1
16	Linear Dependence and Independence of Vectors	CO 2	T3-2.5 R1:2.8
17	Mean Value Theorems:1: Rolle's Theorem	CO 4	T3-2.5 R1:2.8
18	Mean Value Theorems:2: Lagrange's Theorem	CO 4	T3-2.5 R1:2.8

19	Mean Value Theorems:3: Cauchy's Theorem	CO 4	T3-2.5 R1:2.8
20	Functions of Several Variables: Partial Differentiation	CO 4	T3-2.5 R1:2.8
21	Jacobian Transformations	CO 4	T3-2.61 R1:2.10
22	Functional Dependence	CO 4	T1-7.1 R2:7.5
23	Maxima and Minima of Functions with Two Variables	CO 4	T3-2.61 R1:2.10
24	Maxima and Minima of Functions with Three Variables	CO 4	T1-7.1 R2:7.6
25	Application Method of Lagrange Multipliers	CO 4	T1-7.1 R2:7.7
26	Method of Lagrange Multipliers	CO 4	T3-2.5 R1:2.8
27	Linear Differential Equations of Second and Higher Order with Constant Coefficients	CO 5	T3-2.5 R1:2.8
28	Linear Differential Equations of Second and Higher Order with Constant Coefficients	CO 5	T3-2.5 R1:2.8
29	Non-Homogeneous term of the type F (X) = e^{ax}	CO 5	T3-2.5 R1:2.8
30	Non-Homogeneous term of the type F (X) = Sinax , Cosax	CO 5	T2-7.1 R1:7.4
31	Non-Homogeneous term of the type F (X) = X^n	CO 5	T2:7.1 R1:7.4
32	Non-Homogeneous term of the type F (X) = e^{ax}v(X)	CO 5	T2:7.1 R1:7.4
33	Method of Variation of Parameters	CO 5	T3-2.9 R1:2.1
34	Fourier Expansion of Periodic Function in a Given Interval of Length 2π	CO 6	T3-2.5 R1:2.8
35	Fourier Expansion of Periodic Function in a Given Interval of Length $(-\pi,\pi)$	CO 6	T3-2.5 R1:2.8
36	Fourier Series of Even Functions in a Given Interval of Length $(-\pi,\pi)$	CO 6	T2:7.1 R1:7.4
37	Fourier Series of Odd Functions in a Given Interval of Length $(-\pi,\pi)$	CO 6	T3-2.9 R1:2.1
38	Fourier Series in an Arbitrary Interval (0,2l)	CO 6	T3-2.5 R1:2.8
39	Fourier Series in an Arbitrary Interval (-l,l)	CO 6	T2:7.1 R1:7.4
40	Half- Range Fourier Sine Expansions in a Given Interval of Length $(0,\pi)$	CO 6	T3-2.9 R1:2.1

41	Half- Range Fourier Cosine Expansions in a Given Interval of Length (0,π)	CO 6	T3-2.5 R1:2.8
PROBLEM SOLVING/ CASE STUDIES			
42	Rank of the Matrix by Echelon and Normal Form	CO 1	T2:32.1 R1:4.2
43	Eigen Values and Eigen Vectors of The Matrix	CO 2	T2:32.1 R1:4.3
44	Finding Powers of the Matrix by Cayley Hamilton Theorem	CO 3	T2:32.1 R1:4.3
45	Finding Spectral Matrix by Linear Transformation.	CO 2	T2-7.1 R1:7.4
46	Jacobian Transformation in Cartesian and Polar Forms	CO 4	T2-7.1 R1:7.4
47	Finding Functional Relationship.	CO 4	T2:7.1 R1:7.4
48	Finding Critical Points.	CO 4	T2:7.1 R1:7.4
49	Solving Non-Homogeneous Differential Equations.	CO 5	T3-2.5 R1:2.8
50	Solving Second Order Non-Homogeneous Differential Equations by Method of Variation of Parameters.	CO 5	T3-2.5 R1:2.8
51	Finding Fourier Series	CO 6	T3-2.5 R1:2.8
52	Fourier Expansion of Periodic Function in a Given Interval of Length 2π	CO 6	T3-2.5 R1:2.8
53	Fourier Expansion of Periodic Function in a Given Interval of Length (-π,π)	CO 6	T3-2.61 R1:2.10
54	Fourier Series in An Arbitrary Interval (-l,l)	CO 6	T2:7.1 R1:7.4
55	Finding Fourier Sine Series in Interval (0,l)	CO 6	T3-2.9 R1:2.1
56	Finding Fourier Cosine Series in Interval (0,l)	CO 6	T3-2.5 R1:2.8
DISCUSSION OF DEFINITION AND TERMINOLOGY			
57	Real, Complex Matrices and Rank of a Matrix	CO 1	T3-2.5 R1:2.8
58	Eigen Values and Eigen Vectors, Diagonalization	CO 2,C0 3	T3-2.5 R1:2.8
59	Mean Value Theorems, Jacobian Transformations, Functionally Dependent and Independent	CO 4	T3-2.5 R1:2.8
60	Higher Order Differential Equations	CO 5	T3-2.5 R1:2.8
61	Fourier Series (Even, Odd, Neither Functions)	CO 6	T3-2.61 R1:2.10

DISCUSSION OF QUESTION BANK			
62	Theory of Matrices	CO 1	T2:7.1 R1:7.4
63	Linear Transformations	CO 2,C0 3	T3-2.9 R1:2.1
64	Functions of Several Variables	CO 4	T3-2.5 R1:2.8
65	Higher Order Differential Equations	CO 5	T2:32.1 R1:4.3
66	Fourier Series.	CO 6	T2-7.1 R1:7.4

Signature of Course Coordinator **HOD, IT**
Ms.P.Rajani, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**INFORMATION TECHNOLOGY**				
Course Title	**ENGINEERING CHEMISTRY**				
Course Code	**AHSB03**				
Program	**B.Tech**				
Semester	**I**				
Course Type	**FOUNDATION**				
Regulation	R-18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	1	4	3	1.5
Course Coordinator	Mr G Mahesh Kumar, Assiatant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
10+2	-	-	Vital principles of chemistry

II COURSE OVERVIEW:

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the Intermediate level. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels; one has to base the description of all chemical processes at molecular levels.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Engineering Chemistry	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with either or choice will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with ”either” or ”choice” will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
0%	Remember
50%	Understand
50%	Apply
0 %	Analyze
0%	Evaluate
0 %	Create

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Quiz	AAT	
CIA Marks	20	05	05	30

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination

Two Quiz exams shall be online examination consisting of 50 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

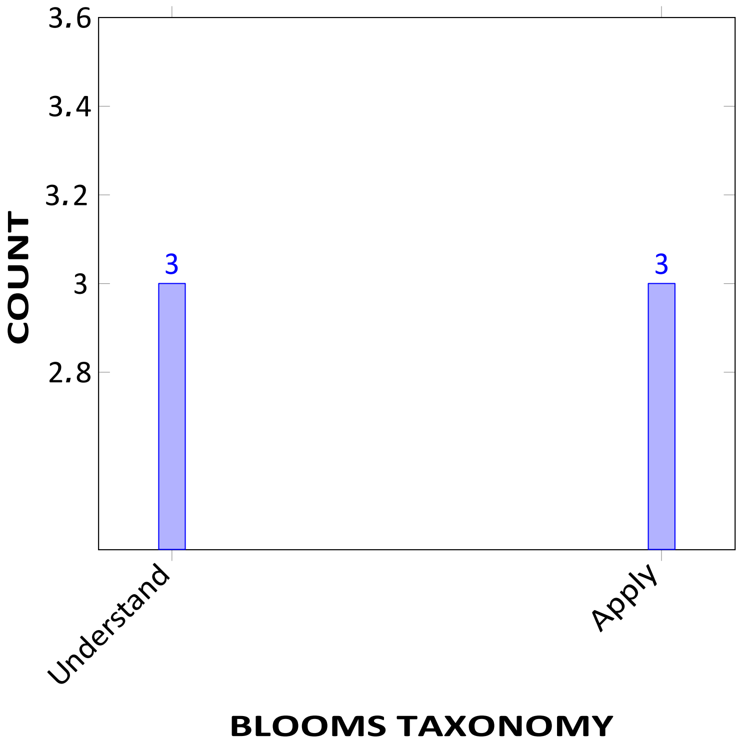
I	The concepts of electrochemical principles and causes of corrosion in the new development and breakthroughs efficiently in engineering and technology.
II	The different parameters to remove causes of hardness of water and their reactions towards the complexometric method.
III	The microscopic chemistry in terms of atomic, molecular orbitals and Intermolecular forces.
IV	The different molecular organic chemical reactions that are used in the synthesis of molecules.
V	The properties, separation techniques of natural gas and crude oil along with potential applications in major chemical reactions.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Explain** the electrochemical principles, corrosion process in metalsfor protection of different metals from corrosion.	Understand
CO 2	**Utilize** electrochemical cell parameters, electrochemical active surface area, current and over potential under given conditionfor calculating the electromotive force and electrode potential.	Apply
CO 3	**Identify** the hardness of water by different treatment methodsfor finding the hardness causing salts in water.	Apply
CO 4	**Illustrate** the molecular orbital energy level diagrams of different molecules and theories of bondingfor understanding the magnetic properties of coordination compounds.	Understand
CO 5	**Explain** the mechanism of different chemical reactions, stereo isomers for finding the optically active compounds and synthesizing the drug molecules.	Understand
CO 6	**Make use of** green synthesis methods, different types of solid, liquid and gaseous fuels in terms of calorific valuefor utilizing in industries and automobiles.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Program Outcomes	
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	2.5	SEE/CIE/Quiz/ AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	1	SEE/CIE/Quiz/ AAT
PO 7	**Environment and sustainability:** understand the impact of the professional engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	2	SEE/CIE/Quiz/ AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	-	-
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	-	-
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	-	-

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	✓	✓	-	-	-	-	✓	-	-	-	-	-	-	-	

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Explain the electrochemical properties for producing electrical energy (understand) by using principles of science for solving engineering problems.	2
CO 2	PO 1	Choose different electrodes for finding pH of unknown solutions by applying mathematical expressions of cell potential by using principles of science and mathematics for solving engineering problems	3
	PO 2	Identify the problem formulation and abstraction for calculating electrode potential under non standard conditions by applying Nernst equation from the provided information.	2
CO3	PO1	Explain the concept of corrosion processes in metals by exposing to acidic environment for solving engineering problems by applying the principles of science	3

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO2	Identify the problem and formulate for finding the hardness of water in terms of CaCO3 equivalents with given information and data by applying principles of science.	2
CO4	PO1	Explain the formation of molecular orbitals by linear combination of atomic orbitals, splitting of d orbitals for formation of octahedral, tetrahedral and square planar complexes for solving engineering problems by applying the principles of science.	2
CO5	PO1	Illustrate the structural and stereo isomers of optically active compounds, different types of molecular organic reactions for synthesizing drugs by using principles of science for solving engineering problems.	2
CO6	PO1	Classify different types of solid, liquid and gaseous fuels with their characteristics and calorific value by using principles of science and mathematics for solving engineering problems.	3
	PO2	Identify the given problem and formulate for finding the calorific value of fuel with the given information and data by applying principles of science.	2
	PO7	Make use of gaseous fuels like LPG, CNG to reduce the pollutants in atmosphere and know the impact in socio economic and environmental contexts for sustainable development.	2

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	3	2	-	-	-	-	2	-	-	-	-	-	-	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	66.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	100	20.0	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	100	20.0	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	66.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	66.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	100	20.0	-	-	-	-	66.6	-	-	-	-	-	-	-	-

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation

1 - $5 < C \leq 40\%$ – Low/ Slight

2 - $40\% < C < 60\%$ –Moderate

3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	
CO 2	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	3	1	-	-	-	-	2	-	-	-	-	-	-	-	-
TOTAL	15	3	-	-	-	-	2	-	-	-	-	-	-	-	-
AVERAGE	2.5	1	-	-	-	-	2	-	-	-	-	-	-	-	-

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	5 minutes video	✓
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	✓	-	-	-	-

XVII ASSESSMENT METHODOLOGY-INDIRECT:

x	Early Semester Feedback	✓	End Semester OBE Feedback
x	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	**ELECTROCHEMISTRY AND BATTERIES**
	Electro chemical cells: Electrode potential, standard electrode potential, types of electrodes; Calomel, Quinhydrone and glass electrode; Nernst equation; Electrochemical series and its applications; Numerical problems; Batteries: Primary (Dry cell) and secondary batteries (Lead-acid storage battery and Lithium ion battery). Causes and effects of corrosion: Theories of chemical and electrochemical corrosion, mechanism of electrochemical corrosion; Types of corrosion: Galvanic, water-line and pitting corrosion; Factors affecting rate of corrosion; Corrosion control methods: Cathodic protection, sacrificial anode and impressed current; Surface coatings: Metallic coatings- Methods of coating- Hot dipping, cementation, electroplating and Electroless plating of copper.
MODULE II	**WATER AND ITS TREATMENT**
	Introduction: Hardness of water, Causes of hardness; Types of hardness: temporary and permanent, expression and units of hardness; Estimation of hardness of water by complexometric method; Potable water and its specifications, Steps involved in treatment of water, Disinfection of water by chlorination and ozonization; Boiler feed water and its treatment, Calgon conditioning, Phosphate conditioning and Colloidal conditioning; External treatment of water; Ion-exchange process; Desalination of water: Reverse osmosis, numerical problems.
MODULE III	**MOLECULAR STRUCTURE AND THEORIES OF BONDING**
	Atomic and Molecular orbitals: Linear Combination of Atomic Orbitals LCAO), molecular orbitals of diatomic molecules; Molecular orbital energy level diagrams of N2, O2F2, CO and NO molecules. Crystal Field Theory (CFT): Salient Features of CFT-Crystal Field; Splitting of transition metal ion d- orbitals in Tetrahedral, Octahedral and square planar geometries; Band structure of solids and effect of doping on conductance.
MODULE IV	**STEREOCHEMISTRY, REACTION MECHANISM AND SYNTHESIS OF DRUG MOLECULES**
	Introduction to representation of 3-dimensional structures: Structural and stereoisomers, configurations, symmetry and chirality; Enantiomers, diastereomers, optical activity and Absolute configuration; Conformation analysis of n- butane. Substitution reactions: Nucleophilic substitution reactions, Mechanism of SN1, SN2 reactions; Electrophilic and nucleophilic addition reactions; Addition of HBr to propene; Markownikoff and anti Markownikoff’s additions; Grignard additions on carbonyl compounds; Elimination reactions: Dehydro halogenation of alkylhalides; Saytzeff rule; Oxidation reactions: Oxidation of alcohols using KMnO4 and chromic acid; Reduction reactions: Reduction of carbonyl compounds using LiAlH4 & NaBH4; Hydroboration of olefins; Structure, synthesis and pharmaceutical applications of Paracetamol and Aspirin.
MODULE V	**FUELS AND COMBUSTION**

	Fuels: Definition, classification of fuels and characteristics of a good fuels; Solid fuels: Coal; Analysis of coal: Proximate and ultimate analysis; Liquid fuels: Petroleum and its refining; Cracking: Fixed bed catalytic cracking; Knocking: Octane and cetane numbers; Gaseous fuels: Composition, characteristics and applications of natural gas, LPG and CNG; Combustion: Calorific value: Gross Calorific Value(GCV) and Net Calorific Value(NCV), calculation of air quantity required for complete combustion of fuel, numerical problems.

TEXTBOOKS

1. P. C. Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company, 16th Edition, 2017.
2. Shashi Chawla, "Engineering Chemistry", Dhanat Rai and Company, 2011, 1st Edition.
3. R.T. Morrison, RN Boyd and SK Bhattacharya, "Organic Chemistry", Pearson, 7th Edition, 2011
4. K.F. Purcell and J.C. Kotz, "Inorganic Chemistry", Cengage learning, 2017.

REFERENCE BOOKS:

1. K. P. C. Volhardt and N. E. Schore, "Organic Chemistry Structure and Functions", Oxford Publications, 7th Edition 2010.
2. B. H. Mahan, "University Chemistry", Narosa Publishers, 4th Edition, 2009.

WEB REFERENCES:

1. https://nptel.ac.in/courses/112105171/1

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO-PO Mapping		
CONTENT DELIVERY (THEORY)			
2	Concept of Electro chemical cells	CO1	T1,T2
3	Numerical problems on EMF: Galvanic Cells	CO 2	T1,T2
4	Types of Electrodes: Calomel, Quinhydrone and Glass electrode	CO 2	T1,T2
5	Nernst equation and its applications	CO 2	T1,T2
6	Batteries: Primary cells (dry cells)	CO 1	T1,T2
7	Secondary cells (lead-Acid cell). Applications of batteries	CO 1	T1,T2
8	Corrosion-Definition ,Causes and effects of corrosion, Theories of corrosion – Chemical corrosion theory	CO 1	T1,T2

9	Types of corrosion (water line and pitting), Factors affecting rate of corrosion	CO 1	T1,T2
10	Corrosion control methods – Cathodic protection and metallic coating.	CO 1	T1,T2
11	Hardness of water, expression of hardness-units; Types of hardness: Temporary hardness, permanent hardness and numerical problems.	CO 3	T1,T2
12	Estimation of temporary and permanent hardness of water by EDTA	CO 3	T1,T2
13	Potable water and its specifications, steps involved in its treatment of water.	CO 3	T1,T2
14	Boiler troubles – Priming and foaming, caustic embrittlement	CO 3	T1,T2
15	Treatment of boiler feed water – Internal treatment (Phosphate, carbonate and calgon conditioning)	CO 3	T1,T2
16	Ion exchange process, steps involved in the treatment of this process	CO 3	T1,T2
17	Sterilization of potable water by chlorination and ozonization	CO 3	T1,T2
18	purification of water by reverse osmosis process. Numerical problems	CO 3	T1,T2
19	Shapes of Atomic Orbitals	CO 4	T1,T2
20	Linear combination of Atomic orbitals (LACO)	CO 4	T1,T2
21	Molecular orbitals of diatomic molecules N2 O2 and F2.	CO 4	T1,T2
22	Molecular orbitals diatomic CO and NO molecule	CO 4	T1,T2
23	Crystal Field Theory (CFT), Salient Features of CFT-Crystal Fields	CO 4	T1,T2
24	Splitting of transition metal ion d- orbitals in Tetrahedral	CO 4	T1,T2
25	Splitting of transition metal ion Octahedral and square planar geometries	CO 4	T1,T2
26	Band structure of solids and effect of doping on conductance	CO 4	T1,T2
27	Introduction to representation of 3-dimensional structures	CO 5	T1,T2
28	Structural and stereoisomers of organic compounds	CO 5	T3
29	Configurations, symmetry and chirality.	CO 5	T3
30	Enantiomers, diastereomers, optical activity and Absolute configuration	CO 5	T3
31	Conformation alanalysis of n- butane	CO 5	T3
32	Nucleophilic substitution reactions, Mechanism of SN1, SN2 reactions	CO 5	T3
33	Electrophilic and nucleophilic addition reactions; Addition of HBr to Propene; Markownikoff and anti Markownikoff's additions	CO 5	T3
34	Grignard additions on carbonyl compounds, EliminationreactionsDehydro halogenations of alkylhalides	CO 5	T3
35	Oxidation reactions: Oxidation of alcohols using KMnO4 and chromicacid.	CO 5	T3
36	Reduction reactions: Reduction of carbonyl compounds using LiAlH4& NaBH4	CO 5	T3

37	Hydroboration of olefins	CO 5	T3
38	Structure, synthesis and pharmaceutical applications of Paracetamol and Aspirin.		T3
39	Definition, classification of fuels and characteristics of a good fuels	CO 5	T1,T2
40	Solid fuel Coal, analysis of coal- proximate analysis	CO 6	T1,T2
41	Analysis of coal -ultimate analysis.	CO 6	T1,T2
42	Liquid fuels: Petroleum and its refining Cracking: Fixed bed catalytic cracking;	CO 6	T1,T2
43	Knocking: Octane and cetane numbers	CO 6	T1,T2
44	Gaseous fuels: Composition, characteristics and applications of Natural gas, LPG and CNG	CO 6	T1,T2
45	Combustion: Calorific value-Gross calorific value(GCV) and net calorific value(NCV)	CO 6	T1,T2
46	Calculation of air quantity required for complete combustion of fuel, numerical problems.	CO 6	T1,T2
PROBLEM SOLVING			
1	Probelms on EMF	CO 1	T1:3.3.1; R3:3.2
2	Probelms on Nernst equation	CO 1	T2:16.5; R3:8.10
3	Determination of Electrode potential	CO 2	T2:16.5; R3:8.10
4	Determination of Hardness	CO 3	T1:3.3.1; R3:3.2
5	Determination of Hardness by EDTA	CO 3	T2:16.5; R3:8.10
6	Crystal field stabalization energy	CO 4	T2:16.5; R3:8.10
7	Proximate Analysis of coal	CO 6	T1:3.3.1; R3:3.2
8	ultimate Analysis of coal	CO 6	T2:16.5; R3:8.10
9	Dulungs Equation for coal analysis	CO 6	T2:16.5; R3:8.10
10	Probelms on Combustion	CO 6	T1:3.3.1; R3:3.2
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Electro Chemistry and Batteries	CO 1	T2:16.5; R3:8.10
2	Water and Its Treatment	CO 2	T1:3.3.1; R3:3.2
3	Molecular Structure and Theories of Bonding	CO 3	T2:16.5; R3:8.10
4	Streo chemistry,Reaction Mechanisim	CO 4	T2:16.5; R3:8.10

5	Fuels and Combustion	CO 6	T2:16.5; R3:8.10
DISCUSSION OF QUESTION BANK			
1	Electro Chemistry and Batteries	CO 1	T2:16.5; R3:8.10
2	Water and Its Treatment	CO 2	T1:3.3.1; R3:3.2
3	Molecular Structure and Theories of Bonding	CO 3	T2:16.5; R3:8.10
4	Streo chemistry,Reaction Mechanisim	CO 4	T2:16.5; R3:8.10
5	Fuels and Combustion	CO 6	T2:16.5; R3:8.10

Signature of Course Coordinator **HOD,IT**
Mr G Mahesh Kumar, Assiatant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**INFORMATION TECHNOLOGY**				
Course Title	**FUNDAMENTALS OF ELECTRICAL ENGINEERING**				
Course Code	AEEB01				
Program	B.Tech				
Semester	I	IT			
Course Type	Foundation				
Regulation	IARE - R18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	1	4	-	-
Course Coordinator	Mr.A Naresh Kumar, Assistant Professor,				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AHSB02	I	Linear Algebra and Calculus

II COURSE OVERVIEW:

This course introduces the concepts of basic electrical engineering parameters, quantities, analysis of DC circuits. The course teaches different fundamental laws Ohms laws, Kirchhoff laws and different electrical concepts. The students will be able to analyze networks using graph theory and circuit theorems like Thevenin's and Norton's theorems. It also describes the concept of AC circuits and their applications.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Fundamentals of Electrical Engineering	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
17%	Remember
50%	Understand
33%	Apply
0 %	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Quiz	AAT	
CIA Marks	20	05	05	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination
Two Quiz exams shall be online examination consisting of 50 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

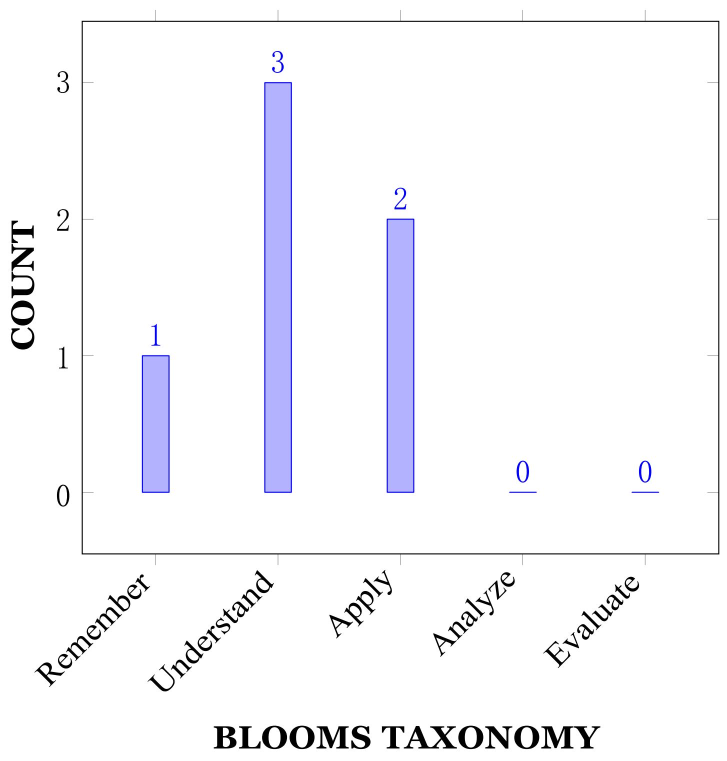
I	Understand the basic electrical circuits and circuit laws to study behavior of electrical networks.
II	Use different network reduction techniques to study characteristics of electrical networks and graph theory to simplify complex networks.
III	Analyze series and parallel AC circuits using complex notation.
IV	State and use DC circuit theorems to determine unknown currents and voltages.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Know** the fundamental concepts of electric circuits for computing voltage and current relationship of passive elements.	Understand
CO 2	**Solve** complex electrical circuits by applying network reduction techniques for reducing into a simplified circuit.	Apply
CO 3	**Make use of** various network theorems for simplifying complex electrical networks.	Apply
CO 4	**Define** basic nomenclature of single phase AC circuits for obtaining impedance, admittance of series and parallel circuits.	Remember
CO 5	**Interpret** the power factor in single phase circuits with various combination of network elements for computing active and reactive power.	Understand
CO 6	**Explain formation of** incident, cut-set and tie set matrices using which characteristics of electrical circuits can be studied.	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	SEE / CIE / AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	SEE / CIE / AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools	1	Quiz

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	✓	✓	-	-	-	-	-	-	-	-	-	-	✓	-	-
CO 3	✓	✓	-	-	-	-	-	-	-	-	-	-	✓	-	-
CO 4	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	✓	-	-	-	-	-	-	-	-	-	-	-	✓	-	-
CO 6	✓	-	-	-	-	-	-	-	-	-	-	-	✓	-	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	**PO 1**	Recollect the concept of electricity is described through scientific principles, importance Kirchhoff laws in relation with law of conservation of energy and charge circuits are explained using mathematical principles and various source transformation techniques are adopted for solving complex circuits.	3

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 2	**PO 1**	Recollect the concept of electricity is described throughscientific principles, importance Kirchhoff laws in relation with law of conservation of energy and charge circuits are explained using mathematical principles and various source transformation techniques are adopted for solving complex circuits.	3
	PO 2	Derive standard expressions for equivalent resistances,inductances and capacitance by using series-parallel networks i.e mathematical calculations.	1
	PSO1	Solve complex electrical circuits by applying basiccircuit concepts by using computer programs.	1
CO 3	**PO 1**	Demonstrate the various network theorems in order todetermine the same using principles of mathematics, science, and engineering fundamentals.	3
	PO 2	Verify various network theorems for their validationusing mathematical calculations.	1
	PSO1	Simplify complex electrical networks by applying various circuit theorems by using computer programs.	1
CO 4	**PO 1**	Make use of Alternating quantity for obtaining form,peak factor concept of impedance and admittance using the knowledge of mathematics, science, and engineering fundamentals.	3
CO 5	**PO 1**	Understand the power factor in single phase AC circuits using the knowledge of mathematics and engineering fundamentals.	3
	PSO1	Give the power factor in single phase AC circuits withdifferent elements by writing computer programs.	1
CO 6	**PO 1**	Understand basic terms graph, tree, incidence matrix,cut-set and Tie-set matrix using the knowledge of mathematics and engineering fundamentals.	3
	PSO1	Explain formation of incident, cut-set and tie-set matrices by writing computer programs.	1

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	1	-	-	-	-	-	-	-	-	-	-	1	-	-
CO 3	3	1	-	-	-	-	-	-	-	-	-	-	1	-	-
CO 4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-

CO 6	3	-	-	-	-	-	-	-	-	-	-	1	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	100	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	100	10	-	-	-	-	-	-	-	-	-	-	25	-	-
CO 3	100	10	-	-	-	-	-	-	-	-	-	-	25	-	-
CO 4	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	100	-	-	-	-	-	-	-	-	-	-	-	25	-	-
CO 6	100	-	-	-	-	-	-	-	-	-	-		25	-	-

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation
1 - $5 < C \leq 40\%$ – Low/ Slight
2 - $40\% < C < 60\%$ –Moderate
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	1	-	-	-	-	-	-	-	-	-	-	1	-	-
CO 3	3	1	-	-	-	-	-	-	-	-	-	-	1	-	-
CO 4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO 6	3	-	-	-	-	-	-	-	-	-	-		1	-	-
TOTAL	**18**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**
AVER-AGE	**3**	**0.3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.7**	**0**	**0**

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	Open Ended Experiments	-
Assignments	✓				

XVII ASSESSMENT METHODOLOGY-INDIRECT:

	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	INTRODUCTION TO ELECTRICAL CIRCUITS
	Circuit concept: Basic definitions, Ohm's law at constant temperature, classification of elements, R, L, C parameters, independent and dependent sources, Kirchhoff's laws, equivalent resistance of series, parallel and series parallel networks.
MODULE II	ANALYSIS OF ELECTRICAL CIRCUITS
	Circuit analysis: Source transformation, Star to delta and delta to star transformation, mesh analysis and nodal analysis, inspection method, super mesh, super node analysis; DC Theorems: Thevenin's and Norton's.
MODULE III	INTRODUCTION TO AC CIRCUITS
	Single phase AC circuits: Representation of alternating quantities, instantaneous, peak, RMS, average, form factor and peak factor for different periodic wave forms. Phase and phase difference: J notation, representation of rectangular and polar forms. Concept of reactance, impedance, susceptance and admittance.
MODULE IV	COMPLEX POWER ANALYSIS
	Complex power analysis: Concept of real, reactive, apparent power and complex power, power factor in single phase AC circuits consisting of R, L, C, RL, RC and RLC combinations.
MODULE V	NETWORK TOPOLOGY
	Network Topology: Definitions, Graph, Tree, Incidence matrix, Basic cut set and Basic Tie set Matrices for Planar Networks, Duality and Dual Networks.

TEXTBOOKS

1. A Chakrabarti, "Circuit Theory", Dhanpat Rai Publications, 6thEdition,2004.
2. K S Suresh Kumar, "Electric Circuit Analysis", Pearson Education, 1stEdition,2013.
3. WillianmHayt, Jack E Kemmerly S M Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 7thEdition,2010.
4. J P J Millman, C CHalkias, SatyabrataJit, "Millman s Electronic Devices and Circuits", Tata McGraw Hill, 2ndEdition,1998.
5. R L Boylestad, Louis Nashelsky, "Electronic Devices and Circuits", PEI / PHI, 9th Edition, 2006.
6. V K Mehta, Rohit Mehta, Principles of electrical engineering, S CHAND, 1st Edition, 2003.

REFERENCE BOOKS:

1. David A Bell, "Electric Circuits", Oxford University Press, 9thEdition,2016.
2. U A Bakshi,Atul P Godse "Basic Electrical and Electronics Engineering"TechnicalPublications, 9thEdition,2016.
3. A Bruce Carlson, "Circuits", Cengage Learning, 1stEdition,2008.

4. M Arshad, “Network Analysis and Circuits”, Infinity Science Press, 9thEdition,2016.

WEB REFERENCES:

1. http://www.igniteengineers.com
2. http://www.ocw.nthu.edu.tw
3. http://www.uotechnology.edu.iq

COURSE WEB PAGE:

1. https://www.iare.ac.in/?q=courses/computer -science-engineering-autonomous/Fundamentals-of-electrical-engineering

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO’s	Reference T1: 4.1
OBE DISCUSSION			
1			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO - PO Mapping	-	-
CONTENT DELIVERY (THEORY)			
2	Electrical Circuits: Basic definitions, Types of elements	CO 1	T1-5.2 to 5.3
3	Ohm’s Law, Kirchhoff Laws	CO 1	T1-5.4 to 5.5
4	Series, parallel circuits	CO 2	T1-5.5 to 5.8
5	Derivation for Star-delta and delta-star transformations	CO 2	T1-5.8 to 5.9
6	Mesh analysis and Nodal Analysis	CO 2	T1-5.11 to 5.12
7	Representation of alternating quantities	CO 3	T1-5.14 to 5.15
8	RMS and Average values of an AC signal	CO 2	T1-5.16 to 5.16
9	Form and peak factor, concept of impedance and admittance	CO 2	T1-5.16 to 5.16
10	Superposition theorem for DC excitations circuits	CO 3	T1-6.1 to 6.3
11	Reciprocity theorem for DC excitation	CO 3	T1-6.8 to 6.9
12	Thevenin’s theorem for DC excitations circuits	CO 3	T1-6.2 to 6.3

13	Norton's theorem for DC excitations circuits	CO 3	T1-6.3 to 6.4
14	Maximum power transfer theorem for DC excitations circuits	CO 3	T1-11.1
15	Incidence matrix for planar networks	CO 3	T1-11.2 to 11.3
16	Basic Cut Set matrix for planar networks	CO 4	T1-11.2 to 11.3
17	Basic Tie Set matrix for planar networks	CO 4	T1-11.9 to 11.10
18	Understand the representation of rectangular and polar forms	CO 5	R2-7.1 to 7.2
19	Understand the concepts of alternating quantities.	CO 5	R2-7.4
20	Analyze the real, reactive, apparent power and complex power.	CO 6	R2-7.3
21	Explain the concept of power factor in single phase AC circuits.	CO 6	R2-7.3.1 to 7.3.2
22	Understand the consisting of single phase AC circuit consisting of R.	CO 6	R2-7.3.3 to 7.3.6
23	Understand the consisting of single phase AC circuit consisting of L.	CO 6	R2-7.6
24	Understand the consisting of single phase AC circuit consisting of C	CO 5	T1-13.1 to 13.3
25	Understand the consisting of single phase AC circuit consisting of RL combination.	CO 5	T1-13.1 to 13.3
26	Understand the consisting of single phase AC circuit consisting of RC combination	CO 6	T1-13.5 to 13.6
27	Understand the consisting of single phase AC circuit consisting of RLC combination.	CO 6	T1-13.6 to 13.7
28	Understand the concept of duality and dual networks.	CO 6	T1-13.7 to 13.9
PROBLEM SOLVING/ CASE STUDIES			
42	Numerical Examples on electrical quantities, Ohm's law, KCL, KVL	CO 2	T1-5.8 to 5.9
43	Numerical Examples on series, parallel elements and star to delta transformation and mesh analysis	CO 2	T1-5.5 to 5.8
44	Numerical Examples on nodal analysis and alternating quantities	CO 3	T1-6.8 to 6.9
45	Numerical Examples on Superposition theorem	CO 3	T1-6.2 to 6.3
46	Numerical Examples on reciprocity and maximum power transfer theorems	CO 3	R2-7.1 to 7.2
47	Numerical Examples on Thevenin's and Norton's theorems	CO 3	T1-13.1 to 13.3
48	Numerical Examples on Basic cut set and Tie set matrices	CO 4	T1-13.5 to 13.6
49	Numerical Examples on Single phase AC circuit with only R	CO 5	T1-13.6 to 13.7

50	Numerical Examples on Single phase AC circuit with only L	CO 5	T1-13.1 to 13.3
51	Numerical Examples on Single phase AC circuit with only C	CO 5	T1-13.13
52	Numerical Examples on Single phase AC circuit with RL combination	CO 5	T1-13.16 to 13.18
53	Numerical Examples on Single phase AC circuit with RC combination	CO 5	T1-13.14
54	Numerical Examples on Single phase AC circuit with RLC combination	CO 5	T1-13.16 to 13.18
DISCUSSION OF DEFINITION AND TERMINOLOGY			
57	Definitions and terminology from basics of electrical circuits	CO 1	T1-5.1 to 5.3
58	Definitions on network theorems	CO 3	T1-6.1 to 6.3
59	Definitions on single phase AC circuits	CO 4	R2-7.1 to 7.2
60	Definitions on complex power analysis	CO 5	T1-13.1 to 13.3
61	Definitions on network topology	CO 6	T1-13.11
DISCUSSION OF QUESTION BANK			
62	Questions from electrical circuits	CO 1	T1-5.1 to 5.3
63	Questions from network theorems	CO 3	T1-6.1 to 6.3
64	Questions from single phase AC circuits	CO 4	R2-7.1 to 7.2
65	Questions from complex power analysis	CO 5	T1-13.1 to 13.3
66	Questions from network topology	CO 6	T1-13.11

Signature of Course Coordinator **HOD,IT**

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

INFORMATION TECHNOLOGY

COURSE DESCRIPTION

Course Title	**ENGINEERING CHEMISTRY LABORATORY**				
Course Code	AHSB09				
Program	B.Tech				
Semester	II				
Course Type	FOUNDATION				
Regulation	IARE – R18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	3	2
Course Coordinator	Mr G Mahesh Kumar, Assiatant Professor				

I COURSE OVERVIEW:

The aim of this Engineering Chemistry laboratory is to develop the analytical ability of the students by better understanding the concepts experimental chemistry. The experiments carried out like preparation of aspirin, thiokol rubber, conductometry, potentiometry, physical properties like viscosity and surface tension of liquids. The volumetric analytical experiments like determination of hardness of water, dissolved oxygen and copper in brass can be carried out in the laboratory.

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
10+2	-	-	Basic principles of chemistry laboratory	-

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Engineering Workshop Practice	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

√	Demo Video	√	Lab Worksheets	√	Viva Questions	√	Probing Further Experiments

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day-to-day performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being Internal Examiner and the other being External Examiner, both nominated by the principal from the panel of experts recommended by Chairman, BOS.

The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component	**Laboratory**		Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

A. Experiment Based

Objective	**Analysis**	**Design**	**Conclusion**	**Viva**	**Total**
2	2	2	2	2	10

B. Programming Based

Purpose	**Algorithm**	**Program**	**Conclusion**	**Viva**	**Total**
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

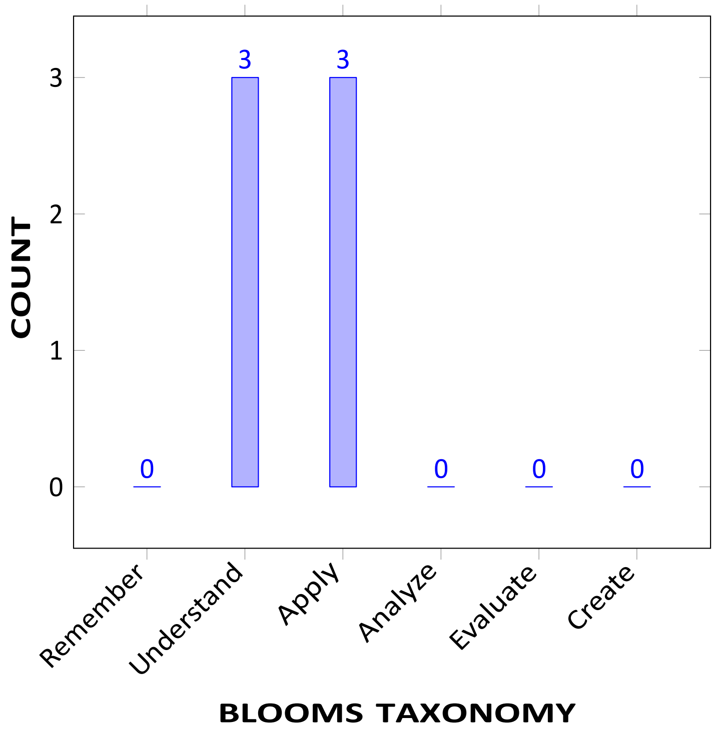
I	The basic principles involved in chemical analysis and mechanism of synthetic organic reactions. processes.
II	The need and importance of quality of water for industrial and domestic use..
III	The measurement of physical properties like surface tension and viscosity.
IV	The knowledge on existing future upcoming devices, materials and methodology.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Identify** Explain the mechanism of chemical reactions for synthesizing drug molecules.for making a desired product with given work piece.	Understand
CO 2	**Determine** Identify the total hardness, dissolved oxygen in water by volumetric analysis for finding the hardness causing salts in water.to demonstrating proficiency with hand tools common in fitting.	Apply
CO 3	**Create** Make use of conductometric and potentiometric titrations for finding the concentration of unknown solutions.to convert given shape into useable elements using basic blacksmith techniques.	Apply
CO 4	**Organize** the moulding techniques along with suitable toolsChoose different types of liquids for finding the surface tension and viscosity of lubricants.	Apply
CO 5	**Develop** Explain the preparation of synthetic rubbers for utilizing in industries and domestic purpose.for manufacturing the tin boxes, cans, funnels, ducts etc., from a flat sheet of metal.	Understand
CO 6	**Compare** various electrical circuits by using conduit system of wiring Relate the importance of different types of materials for understanding their composition and applications.	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	-	SEE/CIE
PO 2	**Design/development of solutions:** Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	-	SEE/CIE
PO 7	**Modern tool usage:** Environment and sustainability: understand the impact of the professional engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	-	SEE/CIE

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	-	-
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges	-	-
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	-	-

3 = High; 2 = Medium; 1 = Low

X JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 1	Explain the mechanism of chemical reactions for synthesizing drug molecules by applying mathematical expressions for finding the percentage of Aspirin by using principles of science for solving engineering problems.	3

CO 2	PO 1	Demonstrate the total hardness, dissolved oxygen in water by volumetric analysis for finding the hardness causing salts in water by applying mathematical expressions by using principles of science for solving engineering problems. .	3
	PO 2	Identify the problem and formulate for finding the hardness of water in terms of CaCO3 equivalents with given information and data by applying principles of science..	2
	PO 7	Identify the dissolved oxygen content in raw water and reduce the pollutants in atmosphere to protect aquatic organisms and know the impact in socio economic and environmental contexts for sustainable development..	2
CO 3	PO 1	Choose different electrodes for finding pH of unknown solutions by applying mathematical expressions of cell potential by using principles of science for solving engineering problems.	3
	PO 2	Identify the problem formulation and abstraction for calculating the concentration of unknown solutions by applying normality of standard solution from the provided information.	2
CO 4	PO 1	Choose different types of liquids for finding the surface tension and viscosity of lubricants by applying mathematical expressions by using principles of science for solving engineering problems..	3
	PO 2	Identify the problem formulation and abstraction for calculating viscosity and surface tension of test liquids by applying viscosity and surface tension of standard liquids, density of liquids from the provided information.	2
CO 5	PO 1	Explain the preparation of synthetic rubbers for utilizing in industries and domestic purpose by using principles of science for solving engineering problems.	2
CO 6	PO 1	Demonstrate the percentage of copper in brass, manganese dioxide in pyrolusite by volumetric analysis using mathematical expressions by using principles of science for solving engineering problems. .	3

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

COURSE OUTCOMES	PROGRAM OUTCOMES				PSO'S
	PO 1	PO 2	PO 7		
CO 1	1				
CO 2	1	2	-	-	
CO 3	1	2	-	-	-
CO 4	1	2	-	-	-
CO 5	-	-	2	2	-
CO 6	1	-	2	2	2

3 = High; 2 = Medium; 1 = Low

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	PO 1, PO 2,	SEE Exams	PO 1,PO 2, PO 7,	Seminars	-
Laboratory Practices	PO 1,PO 2, PO 7,	Student Viva	PO 1, PO 5	Certification	-
Assignments	-				

XIII ASSESSMENT METHODOLOGY INDIRECT:

√	Early Semester Feedback	√	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK 1	**PREPARATIONS OF ORGANIC COMPOUNDS**
	Preparation of Aspirin
WEEK 2	**VOLUMETRIC ANALYSIS**
	Estimation of hardness of water by EDTA method
WEEK 3	**CONDUCTOMETRIC TITRATIONS**
	Conductometric titration of strong acid Vs strong base
WEEK 4	**POTENTIOMETRIC TITRATIONS**
	Potentiometric titration of strong acid Vs strong base
WEEK 5	**CONDUCTOMETRIC TITRATIONS**
	Conductometric titration of mixture of acid Vs strong base
WEEK 6	**POTENTIOMETRIC TITRATIONS**
	Potentiometric titration of weak acid Vs strong base .
WEEK 7	**PHYSICAL PROPERTIES**
	Determination of surface tension of a given liquid using stalagmometer
WEEK 8	**PHYSICAL PROPERTIES**
	Determination of viscosity of a given liquid by using Ostwald’s viscometer
WEEK 9	**VOLUMETRIC ANALYSIS**
	Estimation of dissolved oxygen in water
WEEK 10	**PREPARATIONS OF RUBBER**
	Preparation of Thiokol rubber .

WEEK 11	**VOLUMETRIC ANALYSIS**
	Determination of percentage of copper in brass. .
WEEK 12	**VOLUMETRIC ANALYSIS**
	Estimation of MnO 2 in pyrolusite .

TEXTBOOKS

1. Vogel's, "Quantitative Chemical Analaysis", Prentice Hall, 6th Edition, 2000.
2. Gary D.Christian, "Analytical Chemistry",Wiley India, 6th Edition, 2007.

REFERENCE BOOKS:

1. A text book on experiments and calculation Engg. S.S. Dara.
2. Instrumental methods of chemical analysis, Chatwal, Anand, Himalaya Publications

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Preparation of Aspirin.	CO 1, CO 2	R1, R2
2	Estimation of hardness of water by EDTA method.	CO 2	R1, R2
3	Conductometric titration of strong acid Vs strong base	CO 3,	R1, R2
4	Potentiometric titration of strong acid Vs strong base.	CO 3	R1, R2
5	Conductometric titration of mixture of acid Vs strong base	CO 3	R1, R2
6	Potentiometric titration of weak acid Vs strong base	CO 3	R1, R2
7	Determination of surface tension of a given liquid using stalagmometer	CO4	R1, R2
8	Determination of viscosity of a given liquid by using Ostwald's viscometer	CO4	R1, R2
9	Estimation of dissolved oxygen in water	CO 2	R1, R2
10	Preparation of Thiokol rubber	CO 5	R1, R2
11	Determination of percentage of copper in brass.	CO 6	R1, R2
12	Estimation of MnO 2 in pyrolusite	CO6	R1, R2

Signature of Course Coordinator **HOD,IT**
Mr G Mahesh Kumar, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

INFORMATION TECHNOLOGY

COURSE DESCRIPTION

Course Title	**FUNDAMENTALS OF ELECTRICAL ENGG LABORATORY**				
Course Code	AEEB05				
Program	B.Tech				
Semester	I	IT			
Course Type	Foundation				
Regulation	IARE - R18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	3	2
Course Coordinator	Mr. A Naresh Kumar, Assistant Professor				

I COURSE OVERVIEW:

The objective of the Basic Electrical Engineering Laboratory lab is to expose the students to the electrical circuits and give them experimental skill. The purpose of lab experiment is to continue to build circuit construction skills using different circuit element. It provides hands-on experience by examining the performance of electrical components.

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
UG	AHSB02	I	Linear ALgebra and Calculus

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Basic Electrical Engineering Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

√	Demo Video	√	Lab Worksheets	√	Viva Questions	√	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component			Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

I	The basic laws, network reduction techniques and theorems for different circuits.
II	The performance characteristics of AC series and parallel circuits for measurement of electrical quantities using digital simulation tools.
III	Gain knowledge on electrical components like choke coil and fluorescent lamp.

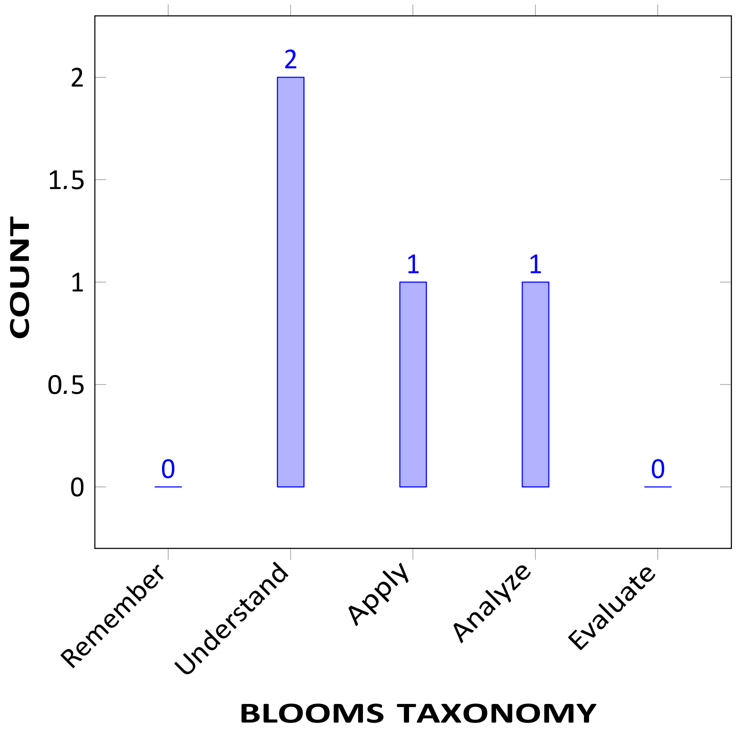
VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Analyze** an electric circuitusing Ohm's and Kirchhoff's laws, nodal and mesh analysis.	Analyze

CO 2	**Apply** various network theoremsfor reducing complex networks into simple equivalent network.	Apply
CO 3	**Examine** the alternating quantitiesfor different periodic wave forms and the passive networks.	Understand
CO 4	**Examine** the performance of choke coil and fluorescent lampby measuring various electrical qunatities.	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Laboratory experiments, internal and external lab exam
PO 5	**Modern Tool Usage:** Create,select and apply appropriate techniques,resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of limitation.	1	Laboratory experiments, internal and external lab exam

PO 8	**Ethics:** Apply ethical principles and commit to professikonal ethics and responsibilties and norms of the engineering practice.	3	Laboratory experiments, internal and external lab exam
PO 9	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	2	Laboratory experiments, internal and external lab exam
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2	Laboratory experi-ments,internal and external lab exam
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	2	Laboratory experiments, internal and external lab exam

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	-	-

3 = High; 2 = Medium; 1 = Low

X JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 1	Recollect the concept of electricity is described through scientific principles, importance Kirchhoff laws in relation with law of conservation of energy and charge circuits are explained using **knowledge of mathematics, science and engineering fundamentals.**and various source transformation techniques are adopted for solving complex circuits.	3
	PO 5	Create,select and apply appropriate techniques,resources and modern engineering and IT tools **in solving the circuits**	1

	PO 8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice **in solving the circuits**	1
	PO 9	Work effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings **in solving the circuits**.	3
	PO 10	Communicate effectively on complex engineering activities with the engineering community and with society **in solving the circuits**.	5
	PO 12	The preparation and ability to engage in independent and life-long learning in the broadest context of technological change **in solving the circuits**.	3
	PSO 1	Solve complex electrical circuits by applying basic circuit concepts **by using computer programs.**	1
CO 2	PO 1	Demonstrate the various network theorems in order to determine the same **using principles of mathematics, science and engineering fundamentals.**	3
	PO 5	Create,select and apply appropriate techniques,resources and modern engineering and IT tools **in solving the complex circuits**	1
	PO 8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice **in solving complex circuits by using theroems**	1
	PO 9	Work effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings **in solving complex circuits by using theroems**	3
	PO 10	Communicate effectively on complex engineering activities with the engineering community and with society **in solving complex circuits by using theroems**	5
	PO 12	The preparation and ability to engage in independent and life-long learning in the broadest context of technological change **in solving the circuits by using theroems**	3
	PSO 1	Simplify complex electrical networks by applying various circuit theorems **by using computer programs.**	1
CO 3	PO 1	Understand the concept of alternating quantities with peak, average and root mean square values for different periodic wave forms and impedance of series RC,RL and RLC circuits by **knounderstanding and applying the fundamentals of mathematics, science and engineering.**	3
	PO 5	Create,select and apply appropriate techniques,resources and modern engineering and IT tools **in solving the circuits**	1
	PO 8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice **in understanding concept of alternating quantities with peak, average and root mean square values for different periodic wave forms and impedance of series RC,RL and RLC circuit**	1

	PO 9	Work effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings **in understanding concept of alternating quantities with peak, average and root mean square values for different periodic wave forms and impedance of series RC,RL and RLC circuits**	3
	PO 10	Communicate effectively on complex engineering activities with the engineering community and with society **in understanding concept of alternating quantities with peak, average and root mean square values for different periodic wave forms and impedance of series RC,RL and RLC circuits**	5
CO 4	PO 1	Examine the performance of choke coil anmd fluorescent lamp by **analyzing complex engineering problems using the principles of mathematics, engineering science.**	3
	PO 8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice **in examining the performance of choke coil anmd fluorescent lamp**	1
	PO 9	Work effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings **in examining the performance of choke coil anmd fluorescent lamp**	3
	PO 10	Communicate effectively on complex engineering activities with the engineering community and with society **in examining the performance of choke coil anmd fluorescent lamp**	3

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

COURSE OUTCOMES	PROGRAM OUTCOMES						PROGRAM SPECIFIC OUT-COMES
	PO 1	PO 5	PO 8	PO 9	PO10	PO12	PSO1
CO 1	3	1	1	3	3	3	1
CO 2	3	1	1	3	3	3	1
CO 3	3	1	1	3	3		
CO 4	3		1	3	3		

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	√	SEE Exams	√	Seminars	-
Laboratory Practices	√	Student Viva	√	Certification	-
Assignments	-				

XIII ASSESSMENT METHODOLOGY INDIRECT:

√	Early Semester Feedback	√	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK I	**OHM'S LAW, KVL AND KCL**
	Verification of Ohm's, Verification of Kirchhoff's current law and Voltage law using hardware and digital simulation.
WEEK II	**VOLT - AMPHERE METHOD**
	Determination of unknown resistance and its temperature dependency.
WEEK III	**MESH ANALYSIS**
	Determination of mesh currents using hardware and digital simulation
WEEK IV	**NODAL ANALYSIS**
	Measurement of nodal voltages using hardware and digital simulation.
WEEK V	**SINGLE PHASE AC CIRCUITS**
	Determination of average value, RMS value, form factor, peak factor of sinusoidal wave using digital simulation.
WEEK VI	**IMPEDANCE OF SERIES RL CIRCUIT**
	Examine the impedance of series RL circuit using hardware and digital simulation
WEEK VII	**IMPEDANCE OF SERIES RC CIRCUIT**
	Measure the impedance of series RC Circuit using hardware and digital simulation.
WEEK VIII	**IMPEDANCE OF SERIES RLC CIRCUIT**
	Measure the impedance of series RLC Circuit using hardware and digital simulation.
WEEK IX	**MEASUREMENT OF POWER CONSUMED BY A FLUORESCENT LAMP**
	To obtain power consumed and power factor of a fluorescent lamp, operated at different voltages.
WEEK X	**CHOKE COIL PARAMETERS**

	Determination of internal resistance and inductance of choke coil.
WEEK XI	**THEVENIN'S THEOREM**
	Reform conversion of complex network into simple series circuit.
WEEK XI	**NORTON'S THEOREM**
	Reform conversion of complex network into simple parallel circuit.

TEXTBOOKS

1.A Sudhakar, Shyammohan S Palli, "Circuits and Networks", Tata McGraw-Hill, 4th Edition, 20103

2.P S Bimbhra, "Electrical Machinery", Khanna Publishers, 1 st Edition,2011.

REFERENCE BOOKS:

1.A Chakrabarti, "Circuit Theory", Dhanpat Rai Publications, 6th Edition, 2006.

2.K S Suresh Kumar, "Electric Circuit Analysis", Pearson Education, 1st Edition, 2013.

3.Etter, "Introduction to MATLAB 7", Pearson Education, 1st Edition, 2008.

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Verification of Ohm's, Verification of Kirchhoff's current law and voltage law using hardware.	CO 1	T1:1.1
2	Determination of unknown resistance and its temperature dependency.	CO 2	T1:2.1
3	Determination of mesh currents using hardware and digital simulation.	CO 2	T1:2.4
4	Measurement of nodal voltages using hardware and digital simulation.	CO 3	T1:6.1
5	Determination of average value, RMS value, form factor, peak factor of sinusoidal wave using digital simulation.	CO 3	T1:4.6
6	Examine the impedance of series RL circuit using hardware and digital simulation.	CO 3	T1:5.1
7	Examine the impedance of series RC circuit using hardware and digital simulation.	CO 2	R3: T1:4.1
8	Examine the impedance of series RLC circuit using hardware and digital simulation.	CO 2	T1:4.7
9	To obtain power consumed and power factor of a fluorescent lamp, operated at different voltages.	CO 4	T2:4.11
10	Determination of internal resistance and inductance of choke coil.	CO 4	T2:4.11
11	Reform conversion of complex network into simple series circuit.	CO 4	T2:4.12
12	Reform conversion of complex network into simple parallel circuit.	CO 4	T2:4.14

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	Verification of reciprocity theorem.
2	Verification of superposition theorem.
3	Verification of maximum power transfer theorem.

Signature of Course Coordinator **HOD,IT**
Mr. A Naresh Kumar, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**INFORMATION TECHNOLOGY**				
Course Title	**ENGLISH**				
Course Code	AHSB01				
Program	B. Tech				
Semester	II				
Course Type	Foundation				
Regulation	R-18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	2	-	2	-	-
Course Coordinator	Mr.K.Poul,Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
-	-	-	-

II COURSE OVERVIEW:

The principle aim of the course is that the students will have awareness about the importance of English language in the contemporary times and also it emphasizes the students to learn this language as a skill (listening skill, speaking skill, reading skill and writing skill). Moreover, the course benefits the students how to solve their day-to-day problems in speaking English language. Besides, it assists the students to reduce the mother tongue influence and acquire the knowledge of neutral accent. The course provides theoretical and practical knowledge of English language and it enables students to participate in debates about informative, persuasive, didactic, and commercial purposes.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
English	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	LCD / PPT	x	Chalk & Talk	x	Assignments	x	MOOC
✓	Open Ended Experiments	✓	Seminars	x	Mini Project	✓	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
37%	Remember
63 %	Understand
-	Apply
-	Analyze

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

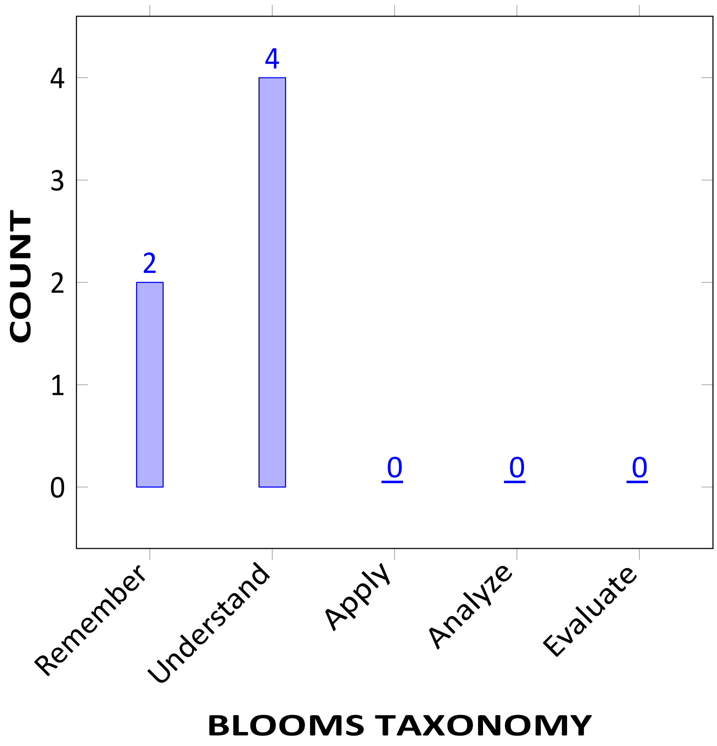
I	Communicate in an intelligible English pronunciation to meet the global standards.
II	Effectively use of four language skills (listening skill, speaking skill, reading skill and writing skill) in day-to-day affairs.
III	A critical aspect of speaking and reading for interpreting in-depth meaning between the sentences.
IV	Develop the art of writing in English keeping the standards of reader's understanding levels.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Describe** that Listening skills are essential to leadershipwhich is useful in the real-world situations.	Remember
CO 2	**Illustrate** appropriate speaking strategiessuch as keeping the discussion going, turn-taking, asking for clarification or confirmation, paraphrasing, keeping the discussion on topic, and trying to reach a consensus.	Understand
CO 3	**Define** the value of English as a Lingua-Franca and recall the knowledge in soft skillsfor the perfect language usage.	Understand
CO 4	**Explain** the effective usage of functional English grammar and lexical itemsat academic and non-academic platforms.	Remember
CO 5	**Understand** the importance of critical reading to catch on the in-depth meaning of a written textat various levels of professional career.	Understand
CO 6	**Demonstrate** the role of written communication as a key aspect to meet the academic and professional challenges.	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 10	**Communication :** Communicate effectively on complex Engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions (Communication). "Students should demonstrate the ability to communicate effectively in writing / Orally." 1. Clarity (Writing); 2. Grammar/Punctuation (Writing); 3. References (Writing); 4. Speaking Style (Oral); 5. Subject Matter (Oral).	5	Seminar/ Conferences/ Research Papers IE/AAT / Discussion

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools	-	-
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	-	-
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry	-	-

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	-
CO 2	-	-	-	-	-	-	-	-	-	✓-	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	-
CO 4	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	-
CO 5	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	-

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 6	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Discuss the heeds of functional grammar and punctuation tools in speaking and writing by generating the clarity of an audio text.	5
CO 2	PO 10	Illustrate essential aspects of grammar as well as punctuation marks for speaking or writing towards a discussion on a topic to give the clarity.	5
CO3	PO 10	Choose suitable grammatical structures and punctuation marks at speaking and writing areas maintaining clarity at professional platform.	5
CO4	PO 10	Interpret the grammatical knowledge and punctuation marks systematically towards providing the clarity in speaking and writing.	5
CO5	PO 10	Demonstrate the role of grammar and punctuation marks understanding the meaning between the sentences as well as paragraphs in speaking or writing for a clarity.	5
CO6	PO 10	Describe the clarity of grammatical usage and the obligation of punctuation marks in speaking and writing.	5

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-
CO 2	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-
CO 4	-	-	-	-		-	-	-	-	5	-		-	-	-
CO 5	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-
CO 6	-	-	-	-	-	-	-	-	-	5	-		-	-	- -

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	-	-	-	-	-	-	-	-	100	-		-	-	-
CO 2	-	-	-	-	-	-	-	-	-	100	-	-	-	-	-
CO 3	-		-	-	-	-	-	-	-	100	-	-	-	-	-
CO 4	-	-	-	-		-	-	-	-	100	-	-	-	-	-
CO 5	-	-	-	-	-	-	-	-	-	100	-	-	- -	-	-
CO 6	-	-	-	-		-	-	-	-	100	-		-	-	- -

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - 0 ≤ C≤ 5% – No correlation

1 -5 <C≤ 40% – Low/ Slight

2 - 40 % <C < 60% –Moderate

3 - 60% ≤ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	-	-	-	-	-	-	-	-	3	-	-	-	-	
CO 2	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO 4	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO 5	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO 6	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
TOTAL	-	-	-	-	-	-	-	-	-	18	-	-	-	-	-
AVERAGE	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	✓
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	Open Ended Experiments	✓
Assignments					

XVII ASSESSMENT METHODOLOGY-INDIRECT:

	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**GENERAL INTRODUCTION AND LISTENING SKILL**
	Introduction to communication skills; Communication process; Elements of communication; Soft skills vs. hard skills; Importance of soft skills for engineers; Listening skills; Significance; Stages of listening; Barriers and effectiveness of listening; Listening comprehension.
MODULE II	**SPEAKING SKILL**
	Significance; Essentials; Barriers and effectiveness of speaking; Verbal and non-verbal communication. Generating talks based on visual prompts; Public speaking; Exposure to structured talks; Addressing a small group or a large formal gathering; Oral presentation; Power point presentation.
MODULE III	**VOCABULARY AND GRAMMAR**
	The concept of Word Formation; Root words from foreign languages and their use in English; Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives; Synonyms; Antonyms; Standard abbreviations; Idioms and phrases; One-word substitutes Sentence structure; Uses of phrases and clauses; Punctuation; Subject verb agreement; Modifiers; Articles; Prepositions.
MODULE IV	**READING SKILL**
	Significance, Techniques of reading, Skimming-Reading for the gist of a text, Scanning - Reading for specific information, Intensive, Extensive reading, Reading comprehension, Reading for information transfer, Text to diagram, Diagram to text.
MODULE V	**WRITING SKILL**
	Significance; Effectiveness of writing; Organizing principles of Paragraphs in documents; Writing Introduction and conclusion; Techniques for writing precisely, Letter writing; Formal and Informal letter writing, E-mail writing, Report Writing.

TEXTBOOKS

1. Handbook of English (Prepared by the faculty of English, IARE).

REFERENCE BOOKS:

1.1. Norman Whitby, Business Benchmark: Pre-Intermediate to Intermediate – BEC Preliminary, Cambridge University Press, 2nd Edition,2008.

2. Devaki Reddy, Shreesh Chaudhary, Technical English, Macmillan, 1st Edition,2009.

3. Rutherford, Andrea J, Basic Communication Skills for Technology, Pearson Education,2nd Edition, 2010.

4. Raymond Murphy, Essential English Grammar with Answers, Cambridge University Press, 2nd Edition,2010.

5. Dr. N V Sudershan, President Kalam’s Call to the Nation, Bala Bharathi Publications, Secunderabad, 1st Edition,2003

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
OBE DISCUSSION			
1	Discussion on mapping COs with POs. (OBE)		
CONTENT DELIVERY (THEORY)			
2	Introduction to communication skills.	CO 1	T1:06.06
3	Communication process.	CO 1	T1:06.09
4	Soft skills vs hard skills.	CO 3	T1:09.10
5	Significance of LSRW skills.	CO 1	T1:10.11
6	Significance of listening skill.	CO 1	TI:12.16
7	Different stages of listening.	CO 1	T1:16.18
8	Barriers of listening skill.	CO 1	TI:18.21
9	Different types of listeners.	CO 1	TI:21.22
10	Effectiveness of listening skill.	CO 1	T1:22.24
11	Phonetics: Listening to the sounds of English language.	CO 1	T1:24.29
12	Introduction to speaking skills.	CO 2	T1:30.32
13	Effectiveness of speaking skills.	CO 2	T1:33.34
14	Verbal and non-verbal communication.	CO 2	T1:34.35
15	Generating talks based on visual or written prompts.	CO 2	T1:36.37
16	Developing public speaking skills.	CO 2	T1:38.39
17	Oral presentation with power-point.	CO 3	TI:39.42
18	The concept of word formation.	CO 4	T1:43.100
19	Antonyms and synonyms.	CO 4	TI:49.56
20	Idioms and phrases.	CO 4	TI:57.60
21	One-word substitutes.	CO 4	TI:60.62
22	Root words from foreign languages and their usage in English.	CO 4	TI:60.62
23	Sentence structure.	CO 4	T1:58.62
24	Punctuation tools and their role in a language.	CO 4	TI:63.66
25	Subject-verb agreement.	CO 4	TI:66.69
26	Usage of Adjectives.	CO 4	TI:70.73
27	Significance of articles and their usage	CO 4	TI:74.75
28	The usage of prepositions.	CO 4	T1:76.77
29	Significance of reading skill.	CO 5	T1:78.79
30	Different techniques of reading skill.	CO 6	T1:80.82
31	How to Read Your Textbook More Efficiently.	CO 6	TI:83.85
32	Different types of reading comprehension.	CO 6	TI:85.86
33	Reading for information transfer.	CO 6	TI:85.96
34	Significance and effectiveness of writing skill.	CO 6	TI:96.98

35	Organizing principles of a paragraph in documents and types of paragraphs.	CO 5	T1:101.103
36	Writing introduction and conclusion.	CO 5	T1:103.103
37	Techniques for writing precis.	CO 8	T1:103.103
38	Introduction to informal letters.	CO 7	TI:105.108
39	Introduction to formal letters.	CO 7	TI:109.110
40	Introduction of email writing and formal and informal emails.	CO 7	TI:111.112
41	Significance of Report Writing.	CO 8	TI: 113. 114
PROBLEM SOLVING/ CASE STUDIES			
42	The aspects to improve listening comprehension Discuss in detail.	CO 1	TI:10,11
43	Different types of listeners with examples	CO 1	TI: 19,21
44	The sounds of English language	CO 1	TI:23,27
45	verbal communication or written communication.	CO 2	TI: 27,30
46	Various difficulties in public speaking.	CO 2	TI: 32,33
47	Different ways of greeting people in formal and informal situation and discuss how do they matter in communication?	CO 2	TI: 35,37
48	'Oral presentation requires a good planning'.	CO 2	TI:36,38
49	Power point presentation and the ways to make Power point presentation.	CO 2	TI: 37,38
50	Methods that are used to establish the process of building vocabulary with examples from the most used words in spoken English.	CO 4	TI:39,41
51	The usage of idioms and phrases in spoken English.	CO 4	TI: 47,50
52	'Structure proposition-evaluation' -Reading technique.	CO 5	TI:56,58
53	Active reading, detailed reading, and speed-reading techniques used in different situations.	CO 5	TI: 79,81
54	The elements of paragraph writing in detail.	CO 8	TI:100,102
55	Logical bridges and Verbal bridges in writing.	CO 8	TI:102,104
56	Soft skills and Interpersonal Communication.	CO 8	TI:102,104
DISCUSSION OF DEFINITION AND TERMINOLOGY			
57	Soft skills and Interpersonal Communication.	CO 1	TI 8,9
58	Language acquisition is a process.	CO 1	TI: 11,12
59	Communication.	CO 1	TI: 14,16
60	Time management.	CO 3	TI:9,10
61	Stress management.	CO 3	TI:9,10
DISCUSSION OF QUESTION BANK			
62	Soft Skills for difficult situations in terms of reassurance and reliability.	CO 3	TI:9,10
63	Verbal and non-verbal communication.	CO 2	TI: 34,35

64	Honesty, Respect, Self-Control and Accountability their role in building long lasting interpersonal skills?	CO 3	TI: 9,10
65	Etiquette and manners. Its importance in social, personal and professional communication.	CO 23	TI: 9,10
66	Problem solving and decision making.	CO 3	TI: 9,10

Signature of Course Coordinator **HOD IT**
Mr.K.Poul, Assiatant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**INFORMATION TECHNOLOGY**				
Course Title	**PROBABILITY AND STATISTICS**				
Course Code	AHSB12				
Program	B.Tech				
Semester	II				
Course Type	Foundation				
Regulation	R- 18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	1	4	-	-
Course Coordinator	Ms. P. Srilatha, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
10+2	-	-	Fundamentals of Statistics

II COURSE OVERVIEW:

Probability theory is the branch of mathematics that deals with modelling uncertainty. Inferential Statistics and regression analysis together with random variate distributions are playing an exceptional role in designing data driven technology which is familiarly known as data centric engineering. They also have wide variety applications in telecommunications and other engineering disciplines. The course covers advanced topics of probability and statistics with applications over real-world engineering problems.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Probability and Statistics	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with ”either” or ”choice” will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
30 %	Understand
60%	Apply
0 %	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Quiz	AAT	
CIA Marks	20	05	05	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination
Two Quiz exams shall be online examination consisting of 50 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

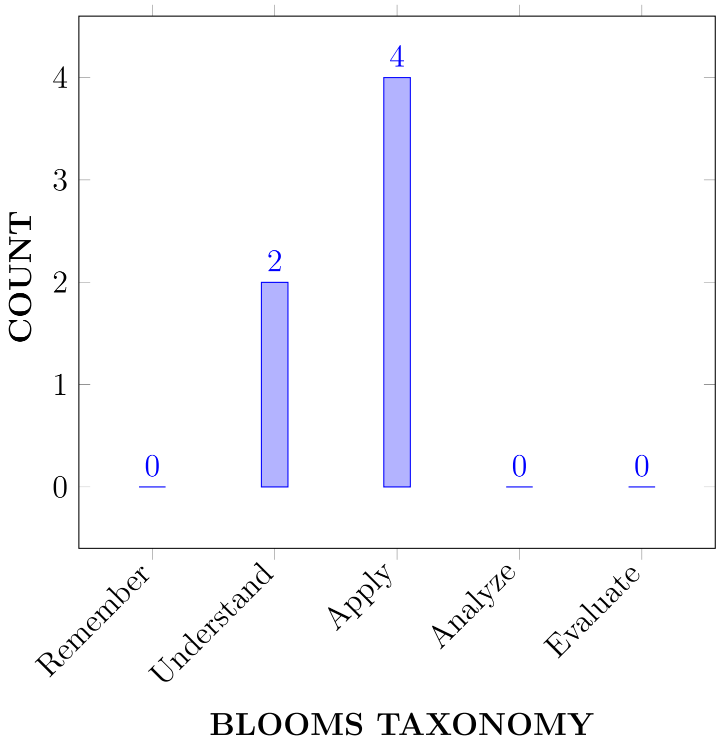
I	The Principles of probability, the theory of random variables, basic random variate distributions and their applications.
II	The Methods and techniques for quantifying the degree of closeness among two or more variables and linear regression analysis.
III	The Estimation statistics and Hypothesis testing which play a vital role in the assessment of the quality of the materials, products and ensuring the standards of the engineering process.
IV	The statistical tools which are essential for translating an engineering problem into probability model.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Explain** the concepts of Baye's theorem, discrete and continuous random variables under randomized probabilistic conditions.	Understand
CO 2	**Interpret** the parameters of random variate Probability distributions such as Binomial, Poisson and Normal distribution by using their probability functions, expectation and variance.	Understand
CO 3	**Apply** Bivariate Regression as well as Correlation Analysis for statistical forecasting.	Apply
CO 4	**Make Use of** estimation statistics in computing confidence intervals, Regression analysis and hypothesis testing.	Apply
CO 5	**Identify** the role of statistical hypotheses, types of errors, confidence intervals, the tests of hypotheses for large sample in making decisions over statistical claims in hypothesis testing	Apply
CO 6	**Identify** the tests of hypothesis for small sample in making decisions over statistical claims in hypothesis testing	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Program Outcomes	
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/Quiz/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	CIE/Quiz/AAT

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	1	Seminar/ Conferences/ Research Papers

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	-	-
PSO 2	Focus on improving software reliability, network security or information retrieval systems.	-	-
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	-	-

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	✓	-	-	-	-	-	-	-	-	-	-	-
CO 2	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	✓	-	-	✓	-	-	-	-	-	-	-	-	-	-	-
CO 5	✓	✓	-	✓	-	-	-	-	-	-	-	-	-	-	-
CO 6	✓	-	-	✓	-	-	-	-	-	-	-		-	-	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	**PO 1**	Explain (understanding) the concept of random variables and their role in solving complex engineering problems involving random events and uncertainty by using Mathematical functions (principles of mathematics).	2
	PO 4	The expected values, variances for the given discrete random variables will be quantitatively measured by using statistical computer software (R-software).	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 2	**PO 1**	Interpret the Probability distributions such as Binomial, Poisson and Normal distribution (Understanding) with the support of evaluation of integrals (principles of mathematics) and appreciate their importance and applicability (Apply) in solving complex engineering problems involving uncertainty.	2
	PO 2	Understand the statement and formulation of a complex engineering problem which involves the events of uncertainty, Model it with suitable probability distribution and Apply the concepts of discrete or continuous distributions along with basic principles of mathematics to develop the solution and reaching substantiated conclusions by the interpretation of results	5
CO 3	**PO 1**	Interpret (Understand) the results of Bivariate and Correlation Analysis by using ratios, square roots, straight lines and planes (principles of mathematics) for statistical forecasting (Apply)in complex engineering problems involving bivariate or multivariate data.	2
CO 4	**PO 1**	Select appropriate statistical methods (understand) for solving some real-time complex engineering problems governed by correlation with the knowledge of fundamental principles of mathematics.	2
	PO 4	Interpret the results of Bivariate and Multivariate Regression and quantifying the degree of closeness between two or more variables by using statistical computer software (R-software, SPSS-software).	1
CO 5	**PO 1**	Apply tests of hypotheses which involves the role of mathematical tools like statements, sets, ratios and percentages (principles of mathematics) for both large samples and small samples (knowledge) in making decisions over statistical claims that arise in complex engineering problems which requires sampling inspections.	2
	PO 2	Understand the statement and formulation of a complex engineering problem which needs verification of truth values of numerical or statistical hypothesis, collect the necessary information and data through sampling techniques, apply tests of hypotheses (both large and small samples) along with basic principles of mathematics to develop the solution and reaching substantiated conclusions by the interpretation of results	5
	PO 4	Make Use of R software package in computing confidence intervals, statistical averages and hypothesis testing. (Computer software relevance)	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 6	**PO 1**	Identify the role of types of statistical hypotheses, types of errors, sampling distributions of means and confidence intervals with the aid of statements and sets, percentages (principles of mathematics) in hypothesis testing of complex engineering problems which requires sampling inspections.	2
	PO 4	Test for the assessment of goodness of fit of the given probability distribution model by using statistical quantitative methods and statistical computer software (R-software).	1

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-
CO 2	2	5	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	2	-	-	1	-	-	-	-	-	-	-		-	-	-
CO 5	2	5	-	1	-	-	-	-	-	-	-	-	-	-	-
CO 6	2	-	-	1	-	-	-	-	-	-	-		-	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	66.7	-	-	9.0	-	-	-	-	-	-	-		-	-	-
CO 2	66.7	50.0	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	66.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	66.7	-	-	9.0	-	-	-	-	-	-	-	-	-	-	-
CO 5	66.7	50.0	-	9.0	-	-	-	-	-	-	-	-	-	-	-
CO 6	66.7	-	-	9.0	-	-	-	-	-	-	-		-	-	-

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation
1 -5 $< C \leq 40\%$ – Low/ Slight
2 - 40 % $< C < 60\%$ –Moderate
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	1	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	3	-	-	1	-	-	-	-	-	-	-	-	-	-	-
CO 5	3	2	-	1	-	-	-	-	-	-	-	-	-	-	-
CO 6	3	-	-	1	-	-	-	-	-	-	-		-	-	-
TOTAL	18	4	-	4	-	-	-	-	-	-	-	-	-	-	-
AVERAGE	3	2	-	1	-	-	-	-	-	-	-	-	-	-	-

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	PO 4	Open Ended Experiments	-
Assignments	✓				

XVII ASSESSMENT METHODOLOGY-INDIRECT:

X	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**PROBABILITY AND RANDOM VARIABLES**
	Probability, Conditional Probability, Baye's Theorem; Random variables: Basic definitions, discrete and continuous random variables; Probability distribution: Probability mass function and probability density functions; Mathematical expectation.
MODULE II	**PROBABILITY DISTRIBUTION**
	Binomial distribution; Mean and variances of Binomial distribution, Recurrence formula for the Binomial distribution; Poisson distribution: Poisson distribution as a limiting case of Binomial distribution, mean and variance of Poisson distribution, Recurrence formula for the Poisson distribution; Normal distribution; Mean, Variance, Mode, Median, Characteristics of normal distribution.
MODULE III	**CORRELATION AND REGRESSION**
	Correlation: Karl Pearson's Coefficient of correlation, Computation of correlation coefficient, Rank correlation, Repeated Ranks; Properties of correlation. Regression: Lines of regression, Regression coefficient, Properties of Regression coefficient, Angle between two lines of regression; Multiple correlation and Regression.

MODULE IV	**TEST OF HYPOTHESIS - I**
	Sampling: Definitions of population, Sampling, Parameter of statistics, standard error; Test of significance: Null hypothesis, alternate hypothesis, type I and type II errors, critical region, confidence interval, level of significance. One sided test, two-sided test. Large sample test: Test of significance for single mean, Test of significance for difference between two sample means, Tests of significance single proportion and Test of difference between proportions.
MODULE V	**TEST OF HYPOTHESIS - II**
	Small sample tests: Student t-distribution, its properties: Test of significance difference between sample mean and population mean; difference between means of two small samples. Snedecor's F-distribution and its properties; Test of equality of two population variances Chi-square distribution and it's properties; Chi-square test of goodness of fit.

TEXTBOOKS

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons Publishers, 9th Edition, 2014.
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43rd Edition, 2012.

REFERENCE BOOKS:

1. N. P. Bali, "Engineering Mathematics", Laxmi Publications, 9th Edition, 2016.& Co., 6th Edition, 2014.
2. S. C. Gupta, V. K. Kapoor, "Fundamentals of Mathematical Statistics", S. Chand & Co., 10th Edition, 2000.
3. Richard Arnold Johnson, Irwin Miller and John E. Freund, "Probability and Statistics for Engineers", Prentice Hall, 8th Edition, 2013.

WEB REFERENCES:

1. http://e4uhu.com/down/Applied/9th
2. https://toaz.info/32fa2f50-8490-42cf-9e6a-f50cb7ea9a5b
3. http://www.mathworld.wolfram.com

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	Course outcomes	Reference
OBE DISCUSSION			
1	Identify the types of sampling (random, stratified, systematic, cluster). Identify the misuses of statistics. Student will use appropriate statistical methods to collect, organize, display, and analyze relevant data. Probability & Statistics introduces students to the basic concepts and logic of statistical reasoning and gives the students introductory-level practical ability to choose, generate, and properly interpret appropriate descriptive and inferential methods. Identify the types of data (qualitative, quantitative, discrete, and continuous).		
CONTENT DELIVERY (THEORY)			
2	Introduction on probability	CO 1	T2:26.3
3	conditional probability	CO 1	R2:21.48
4	Baye's law	CO 1	T2:26.6 R2:21.50
5	Discrete Random variables	CO 1	T2:26.7 R2:21.51
6	Mean and variance, probability distribution of discrete Random variables.	CO 1	T2:26.8
7	Continuous Random variables	CO 1	T2:26.10
8	Mean and variance, probability distribution of continuous Random variables.	CO 1	T2:26.14 R2:21.55
9	Properties of random variables	CO 1	T2:26.15 R2:21.58
10	Binomial distribution	CO 2	T2:26.16 R2:21.61
11	Mean and variances of Binomial distribution	CO 2	T2:25.12 R2:21.24
12	Recurrence formula for the Binomial distribution	CO 2	T2:25.16 R2:21.29
13	Poisson distribution	CO 2	T2:25.14 R2:21.31
14	Mean and variance of Poisson distribution	CO 2	T2:25.14 R2:21.33
15	Recurrence formula for the Poisson	CO 2	R2:21.33
16	Normal distribution.	CO 2	T2:27.2 R2:21.64
17	Mean, Variance, Mode, Median, Characteristics of normal distribution	CO 2	T2:27.2

18	Correlation	CO 3	T2:27.2 R2:21.67
19	Karl Pearson's Coefficient of correlation	CO 3	T2:27.2
20	Rank correlation	CO 3	T2:27.3 R2:21.71
21	Properties of correlation	CO 3	T2:27.4 R2:21.68
22	Regression coefficients	CO 4	T2:27.7 R2:21.74
23	Properties of Regression coefficients	CO 4	T2:27.12 R2:21.75
24	Angle between two lines of regression	CO 4	T2:27.8 R2:21.72
25	Lines of regression,	CO 4	T2:27.8 R2:21.73
26	Sampling: Definitions	CO 5	T2:27.14 R2:21.78
27	Types of sampling	CO 5	T2:27.19 R2:21.814
28	Parameter vs. statistics, standard error.	CO 5	T2:27.12 R2:21.82
29	Type I and type II errors, critical region, confidence interval, level of significance. One sided test, two-sided test.	CO 5	T2:27.18 R2:21.82
30	Tests of significance of single mean	CO 5	T2:26.15 R2:21.58
31	Test of difference between means	CO 5	T2:26.16 R2:21.61
32	Tests of significance of single proportion	CO 5	T2:25.14 R2:21.33
33	Test of difference between proportions	CO 5	R2:21.33
34	Small sample tests: Test of equality of two population variances.	CO 6	T2:27.2 R2:21.64
35	Student t-distribution, its properties	CO 6	T2:27.2
36	Test of significance difference between sample mean and population mean.	CO 6	T2:26.16 R2:21.61
37	difference between means of two small samples	CO 6	T2:25.12 R2:21.24
38	Snedecor's F-distribution properties.	CO 6	T2:25.16 R2:21.29
39	F-distribution properties	CO 6	T2:27.14 R2:21.78
40	Chi-square distribution and it's properties	CO 6	T2:27.19 R2:21.814
41	Applications of Chi-square –Distribution	CO 6	T2:27.12 R2:21.82

PROBLEM SOLVING/ CASE STUDIES			
42	Problem solving session on discrete random variable	CO 1	T2:26.3
43	Problem solving session on continuous random variables	CO 1	R2:21.48
44	Problem solving session on mathematical expectation	CO 1	T2:26.6 R2:21.50
45	Problem solving session on Binomial distribution	CO 1	T2:26.7 R2:21.51
46	Problem solving session on Poisson distribution	CO 2	T2:26.8
47	Problem solving session on Normal distribution	CO 2	T2:26.10
48	Problem solving session on Karl Pearson's correlation	CO 3	T2:26.14 R2:21.55
49	Problem solving session on Spearman's rank correlation	CO 3	T2:26.15 R2:21.58
50	Problem solving session on linear regression	CO 4	T2:26.16 R2:21.61
51	Problem solving session on sampling distribution of means	CO 5	T2:25.12 R2:21.24
52	Problem solving session on central limit theorem	CO 5	T2:25.16 R2:21.29
53	Problem solving session on large sample tests	CO 5	T2:25.14 R2:21.31
54	Problem solving session on t-test	CO 6	T2:25.14 R2:21.33
55	Problem solving session on F-test	CO 6	R2:21.33
56	Problem solving session on Chi-square - test	CO 6	T2:27.2 R2:21.64
DISCUSSION OF DEFINITION AND TERMINOLOGY			
57	Definitions & terminology discussion on probability and random variables	CO 1	T2:26.6 R2:21.50
58	Definitions & terminology discussion on probability distributions.	CO 2	T2:26.7 R2:21.51
59	Definitions & terminology discussion on correlation and regression.	CO 3, CO 4	T2:25.14 R2:21.33
60	Definitions & terminology discussion on Tests of Hypothesis.	CO 5	R2:21.33
61	Definitions & terminology discussion on Tests of significance.	CO 6	R2:21.33

DISCUSSION OF QUESTION BANK			
62	Question bank discussion on probability and random variables.	CO 1	T2:26.6 R2:21.50
63	Question bank discussion on probability distributions.	CO 2	T2:26.7 R2:21.51
64	Question bank discussion on correlation and regression.	CO 3,CO 4	T2:25.14 R2:21.33
65	Question bank discussion on Tests of Hypothesis.	CO 5	R2:21.33
66	Question bank discussion on Tests of significance..	CO 6	R2:21.33

Course Coordinator: **HOD IT**
Ms. P. Srilatha

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**INFORMATION TECHNOLOGY**					
Course Title	**PROGRAMMING FOR PROBLEM SOLVING**					
Course Code	**ACSB01**					
Program	B.Tech					
Semester	II					
Course Type	FOUNDATION					
Regulation	R-18					
Course Structure	Theory			Practical		
	Lecture	Tutorials	Credits	Laboratory	Credits	
	3	-	3	-	-	
Course Coordinator	Ms.K.LaxmiNarayanamma,Assistant Professor					

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	-	-	Basic Programming Concepts

II COURSE OVERVIEW:

The course emphasis on the problem-solving aspects in using C programming. It is the fundamental course and is interdisciplinary in nature for all engineering applications. The students will understand programming language, programming, concepts of loops, reading a set of data, step wise refinements, functions, control structures, arrays, dynamic memory allocations, enumerated data types, structures, unions, and file handling. This course provides adequate knowledge to solve problems in their respective domains.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
PPSC	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
✓	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
20%	Remember
30%	Understand
50%	Apply
0 %	Analyze

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

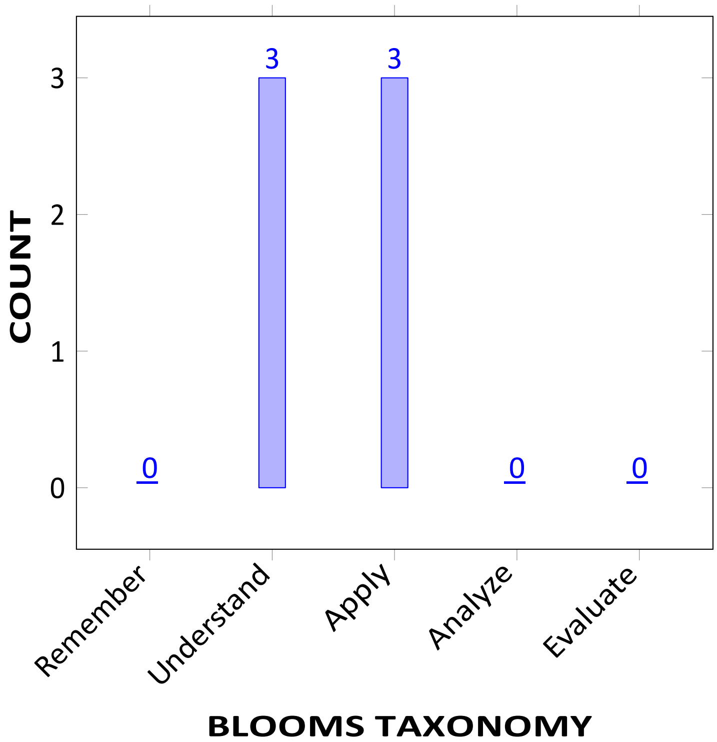
I	Learn adequate knowledge by problem solving techniques.
II	Understand programming skills using the fundamentals and basics of C Language.
III	Improve problem solving skills using arrays, strings, and functions.
IV	Understand the dynamics of memory by pointers.
V	Study files creation process with access permissions.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Illustrate** problem solving steps in terms of algorithms, pseudocode, flowcharts and programs with basic data types and operations for Mathematical and Engineering problems.	Understandi g
CO 2	**Implement** derived data types, operators in C program statements.	Apply
CO 3	**Construct** programs involving decision structures, loops, arrays and strings.	Apply
CO 4	**Make use of** arious types of functions, parameters, and return values for complex problem solving.	Understand
CO 5	**Illustrate** the static and dynamic memory management with the help of structures, unios and pointers.	Understand
CO 6	**Extend** file input and output operations in implementation of real time applications.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/SEE
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	CIE/SEE
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	2	CIE/SEE
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	2	Open Ended Experiments

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	2	Tech talk/Open ended experiments
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	2	Tech talk/Open ended experiments

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	✓	-	-	-	-	-	-	-	-	-	-	✓	-	-
CO 2	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	✓	✓	-	-	✓	-	-	-	-	-	-	-	-	-	-
CO 4	✓	✓	-	-	✓	-	-	-	-	-	-		-	-	-
CO 5	✓	-	-	-	✓	-	-	-	-	-	-	-	-	-	-
CO 6	-	-	-	-	-	-	-	-	-	-	-	✓	-	-	✓

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Developing algorithms and draw flowcharts for solving **mathematical** and **engineering problems** related to **areas of computer science.**	3
	PO 2	Understand the various symbols to **draw** a flowchart, **identify** the appropriate symbols to solve a problem, then **formulate** the solution, and **interpret** the result for the **improvement** of the **solution.**	6
	PSO 1	Understand the features of procedural programming for **designing** and **analyzing** computer programs for **problem-solving.**	3
CO 2	PO 1	Understand branching statements, loop statements, and apply the fundamentals of **mathematics**, **science** and **engineering**.	3
	PO 2	Understand the **problem statement**, **control** the flow of data, **design** the solution and **analyze** the same to **validate** the results in a program to solve **complex** engineering problems.	6
	PO 3	**Recognize** an appropriate control structure to **design** and **develop** a solution for a **real-time** scenario, and **communicating** effectively with engineering community.	5
CO 3	PO 1	Recognize the importance of recursionfor developing programs in real-time scenarios using principles of **mathematics**, and **engineering fundamentals**.	3
	PO 2	Understand the various kinds of **functions**, **identify** the suitable type of function to **solve** a problem, **formulate** the solution, and **interpret** the result for the **improvement** of the solution.	6
	PO 5	Apply techniques of **structured decomposition** to dividea problem into smaller pieces with an understanding of its limitations.	1

CO 4	PO 1	Extend the focus on the usage of heterogeneous data types as a **basic building block** in problem solving using principles of **science**, and **engineering** fundamentals.	3
	PO 2	**Recognize** the representation of the structure, **assess** in solving a problem, **express the solution**, and **analyze** the result for **solution enhancement**.	5
	PO 5	Understand pointers conceptually and apply them in modeling a **complex engineering** activity.	1
CO 5	PO 1	Make a use of an appropriate type of file to store a large volume of **persistent data** and give solution to **engineering problems**.	2
	PO 5	To identify appropriate mode to access a file and run the same **program** multiple times.	1
CO 6	PO 12	**Realize** the need and the desire to **train** and **invest** in autonomous and **lifelong learning** in the widest sense of **technical transition** to achieve **employability expertise** and excel advanced **engineering concepts**.	7
	PSO 3	Attain the **knowledge** and **skills** for employability and to succeed in national and international level **competitive examinations**.	3

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	6	-	-	-	-	-	-	-	-	-	-	3	-	-
CO 2	3	6	5	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	6	-	-	1	-	-	-	-	-	-	-	-		-
CO 4	3	5	-	-	1	-	-	-	-	-	-	-	-	-	-
CO 5	2	-	-	-	1	-	-	-	-	-	-	-	-	-	-
CO 6	-	-	-	-	-	-	-	-	-	-	-	7	-	-	3

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	100	60	-	-	-	-	-	-	-	-	-	-	50	-	-
CO 2	100	60	50	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	100	60	-	-	100	-	-	-	-	-	-	-	-	-	-
CO 4	100	50	-	-	100	-	-	-	-	-	-	-	-	-	-
CO 5	66	-	-	-	100	-	-	-	-	-	-	-	-	-	-
CO 6	-	-	-	-	-	-	-	-	-	-	-	58	-	-	50

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - 0 ≤ C≤ 5% – No correlation

1 -5 <C≤ 40% – Low/ Slight

2 - 40 % <C < 60% –Moderate

3 - 60% ≤ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO 2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	3	-	-	3	-	-	-	-	-	-	-	-		-
CO 4	3	2	-	-	3	-	-	-	-	-	-	-	-	-	-
CO 5	3	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO 6	-	-	-	-	-	-	-	-	-	-	-	2	-	-	2
TOTAL	15	11	2	-	9	-	-	-	-	-	-	2	2	-	2
AVERAGE	3	2.7	2.5	-	3	-	-	-	-	-	-	2	2	-	2

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	Open Ended Experiments	-
Assignments	-				

XVII ASSESSMENT METHODOLOGY-INDIRECT:

-	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	INTRODUCTION
	Introduction to components of a computers: Introduction to Programming: Computer system, components of a computer system, computing environments, computer languages, creating and running programs, algorithms, flowcharts;**Introduction to C Language:** Computer languages, History of C, basic structure of C programs, process of compiling and running a C program, C tokens, keywords, identifiers, constants, strings, special symbols, variables, data types; Operators and expressions.

MODULE II	**CONTROL STRUCTRES**
	Conditional Control structures: Decision statements; Simple if, if-else, else if ladder, Nested if and Case Statement-switch statement; **Loop control statements:** while, for and do while loops. jump statements, break, continue, goto statements;
MODULE III	**ARRAYS AND FUNCTIONS**
	Arrays: Need for user defined functions, function declaration, function prototype, category of functions, inter function communication, function calls, parameter passing mechanisms, recursion, passing arrays to functions, passing strings to functions, storage classes, preprocessor directives; **Functions:** Need for user defined functions, function declaration, function prototype, category of functions, inter function communication, function calls, parameter passing mechanisms, recursion, passing arrays to functions, passing strings to functions, storage classes, preprocessor directive.
MODULE IV	**STRUCTURES, UNIONS AND POINTERS**
	Structures and unions: Structure definition, initialization, accessing structures, nested structures, arrays of structures, structures and functions, passing structures through pointers, self-referential structures, unions, bit fields, typedef, enumerations; **Pointers:**Pointer basics, pointer arithmetic, pointers to pointers, generic pointers, array of pointers, pointers and arrays, pointers as functions arguments, functions returning pointers.**Dynamic memory allocation:**Basic concepts, library functions.
MODULE V	**FILE HANDLING AND BASIC ALGORITHMS**
	Files: Streams, basic file operations, file types, file opening modes, input and output operations with files, special functions for working with files, file positioning functions, command line arguments. Searching, basic sorting algorithms (bubble, insertion, selection), algorithm complexity through example programs (no formal definitions required).

TEXTBOOKS

1. Byron Gottfried, "Programming with C", Schaum's Outlines Series, McGraw Hill Education, 3rd Edition, 2017

2. Reema Thareja, "Programming in C", Oxford university press, 2nd Edition, 2016.

REFERENCE BOOKS:

1. W. Kernighan Brian, Dennis M. Ritchie, "The C Programming Language", PHI Learning, 2nd Edition, 1988.

2. Yashavant Kanetkar, "Exploring C", BPB Publishers, 2nd Edition, 2003.

3. Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education, 4th Edition, 2014.

4. R. S. Bichkar, "Programming with C", Universities Press, 2 nd Edition, 2012.

5. Dey Pradeep, Manas Ghosh, "Computer Fundamentals and Programming in C", Oxford University Press, 2nd Edition, 2006.

6. Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4th Edition, 2014.

WEB REFERENCES:

1. https://www.nptel.ac.in/courses/108106073/
2. https://www.iare.ac.in

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	PSO'S Course Description on Outcome Based Education (OBE): Course Objectives,Course Outcomes (CO), ProgramOutcomes (PO) and CO-PO Mapping		
CONTENT DELIVERY (THEORY)			
2	Understand components of a computer	CO 1	T2: 1.1-1.2,R4: 1.1-1.3
3	Identify and apply algorithms and flowcharts for problem solving	CO 1	T2: 2.1-2.2,R4: 1.4
4	Understand pseudo code for a given problem	CO 1	T2: 2.1-2.2
5	Understand the basic structure, process of compiling and running a C program	CO 1	T2: 2.1-2.2,
6	Understand keywords, identifiers, constants, strings, special symbols, variables	CO 1	T2: 1.4 -1.5, R4: 2.1 - 2.4
7	Define the data types, and operators to write C Program	CO 1	T2: 2.1-2.2
8	Understand precedence of operators, expression evaluation	CO 1	T2: 2.3-2.6
9	Understand formatted input/output functions, Type Conversion and type casting in C Programming	CO 1	T2:2.3-2.7
10	Identify and apply decision making statements in C programming	CO 2	T2: 3.1-3.5
11	Identify and apply loop control structures in C programming	CO 2	T2: 5.2-5.3
12	Identify and apply unconditional control structures in C programming	CO 2	T2: 6.1-6.6
13	Understand single dimensional array and multi-deimensional array: declaration, initialization, accessing	CO 3	T2: 6.7
14	Operations on arrays: traversal, reverse, insertion	CO 3	T2: 8.1-8.2, R4: 15.1
15	Operations on arrays: deletion, merge, search	CO 3	T2: 8.3, R4: 15.1

16	Arrays of characters, Reading and writing strings, String handling functions	CO 3	T2: 11.1-11.5
17	Operations on strings: array of strings	CO 3	T2: 4.1-4.5
18	Concept of user defined functions, Function declaration	CO 3	T1: 7
19	return statement, Function prototype	CO 3	T2: 6.9
20	Types of functions, Inter function communication	CO 3	T1: 10, T2:10.1-10.2
21	Function calls, Parameter passing mechanisms, Recursion	CO 3	T2: 10.3-10.4, R4:8.3-8.4
22	Passing arrays to functions, passing strings to functions	CO 3	T2:10.5
23	Storage classes	CO 3	T1: 8.9, R4:8.6.3
24	Basics of pointers, Pointer arithmetic	CO 4	T2: 3.1, R4:11.1
25	Pointer to pointers	CO 4	T2: 3.2
26	Array of pointers	CO 4	T2: 3.2
27	Generic pointer, Null pointers	CO 4	T2: 3.3
28	Pointers as function arguments, Functions returning pointers	CO 4	T2: 3.4-3.5
29	Dynamic memory allocation	CO 4	T2: 6.1-6.6
30	Structure definition, initialization, structure members	CO 4	T2: 12.3-12.4, R4:13.4
31	Nested structures	CO 4	T2: 12.3-12.4, R4:13.4
32	Arrays of structures, structures and functions	CO 4	T2: 2.1-2.2, R4:13.2
33	Structures and pointers, self-referential structures	CO 4	T2: 2.1-2.2
34	Union, bit fields, typedef	CO 4	T2: 12.4
35	Enumerations, Preprocessor directives	CO 4	T1: 8.9, T2: 2.3-2.5
36	Concept of a file, text files and binary files, streams	CO 5	T2: 10.4, R4:14.1-14.4
37	Standard I/O, formatted I/O, file I/O operations	CO 5	T2: 10.4, R4:14.1-14.4
38	Error handling	CO 5	R3: 12.1 - 12.3

39	Line I/O, miscellaneous functions	CO 5	R3: 12.1 - 12.3
40	Applications of C	CO 6	R4: 17
PROBLEM SOLVING/ CASE STUDIES			
1	Write a program in C that takes minutes as input, and display the total number of hours and minutes.	CO 1	T2:2.3-2.6
2	Write a program in C that reads a forename, surname and year of birth and display the names and the year one after another sequentially.	CO 1	T2:2.3-2.7
3	Write a C program to find the third angle of a triangle if two angles are given.	CO 2	T2:3.1-3.5
4	Write a program in C to display the such a pattern for n number of rows using a number which will start with the number 1 and the first and a last number of each row will be 1.	CO 2	T2:5.2-5.3
5	Write a program in C to find the prime numbers within a range of numbers.	CO 2	T2:5.2-5.3
6	Write a program in C to display the n terms of harmonic series and their sum.	CO 2	T2:6.1-6.6
7	Write a program in C to display the pattern like right angle triangle using an asterisk.	CO 2	T2:5.2-5.3
8	Program to accept N integer number and store them in an array AR. The odd elements in the AR are copied into OAR and other elements are copied into EAR. Display the contents of OAR and EAR	CO 3	T2: 6.7
9	Write a C program to illustrate how user authentication is made before allowing the user to access the secured resources. It asks for the user name and then the password. The password that you enter will not be displayed, instead that character is replaced by '*'	CO 3	T2: 8.3, R4:15.1
10	Write a C program to accept a matric and determine whether it is a sparse matrix. A sparse martix is matrix which has more zero elements than nonzero elements	CO 3	T2: 8.1-8.2, R4: 15.1
11	Write a C program to accept a amtric of order MxN and sort all rows of the matrix in ascending order and all columns in descendng order	CO 3	T2: 6.7
12	Write a C program to accept a set of names and sort them in an alphabetical order, Use structures to store the names	CO 4	T2:12.3-12.4, R4:13.4
13	Write a C program to find the sum of two one-dimensional arrays using Dynamic Memory Allocation	CO 4	T2:6.1-6.6
14	Write a program in C to find the content of the file and number of lines in a Text File.	CO 5	T2:10.4, R4:14.1-14.4
15	Write a program in C to replace a specific line with another text in a file.	CO 5	T2:10.4, R4:14.1-14.4
DISCUSSION OF DEFINITION AND TERMINOLOGY			

1	Module I- Components of computers, C programming language	CO 1	T2:1.1-2.6, R4:1.1-2.4
2	Module II- Control structures	CO 2	T2:3.1-6.6
3	Module III- Arrays, Strings and Functions	CO 3	T1:7, T2:6.7-11.5
4	Module IV- Pointers and Structures	CO 4	T2:3.1-6.6, R4:11.1-13.4
5	Module V- File handling functions	CO 5	T2:10.4, R4:14.1-14.4, R3:12.1-12.3
DISCUSSION OF QUESTION BANK			
1	Module I- Components of computers, C programming language	CO 1	T2:1.1-2.6, R4:1.1-2.4
2	Module II- Control structures	CO 2	T2:3.1-6.6
3	Module III- Arrays, Strings and Functions	CO 3	T1:7, T2:6.7-11.5
4	Module IV- Pointers and Structures	CO 4	T2:3.1-6.6, R4:11.1-13.4
5	Module V- File handling functions	CO 5	T2:10.4, R4:14.1-14.4, R3:12.1-12.3

Signature of Course Coordinator **HOD,**

Ms.K.LaxmiNarayanamma, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
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INFORMATION TECHNOLOGY
COURSE DESCRIPTION

Course Title	ENGLISH LANGUAGE AND COMMUNICATION SKILLS LABORATORY				
Course Code	AHSB08				
Program	B.Tech				
Semester	II				
Course Type	Foundation				
Regulation	R18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	2	1
Course Coordinator	Dr. Jetty Wilson, Professor				

I COURSE OVERVIEW:

This lab course is designed to introduce the students to create wide exposure on language learning techniques regarding the basic elements of Listening, Speaking, Reading and Writing. In this lab the students are trained in communicative English language skills, phonetics, word accent, word stress, rhythm and intonation, oral presentations, extempore and Prepared-seminars, group-discussions, presenting techniques of writing, participating role plays, telephonic etiquettes, asking and giving directions, information transfer , debates, description of persons, places, objects etc; . The lab encourages the students to work in a group, engage in peer-reviews and inculcate team spirit through various exercises on grammar, vocabulary, and pronunciation games etc. Students will make use of all these language skills in academic, professional and real time situations.

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
-	-	-	-

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
English Language and Communication Skills Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Demo Video	✓	Lab Worksheets	✓	Viva Questions	✓	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Sofware based
20 %	To test the perfection of primary tonic stress accent, pre-tonic secondary stress accent and post-tonic secondary stress accent.
20 %	To test the performance to achieve neutralization of accent.
20 %	To test the awareness while pronouncing gemination, elision and assimilation.
20 %	To test the presentation skills in the ICS laboratory.
20 %	To test the subject knowledge through viva.

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component			Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Sofware based**

Objective	Analysis	Design	Conclusion	Viva	Total
4	4	4	4	4	20

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
-	-	-	-	-	-

VI COURSE OBJECTIVES:

The students will try to learn:

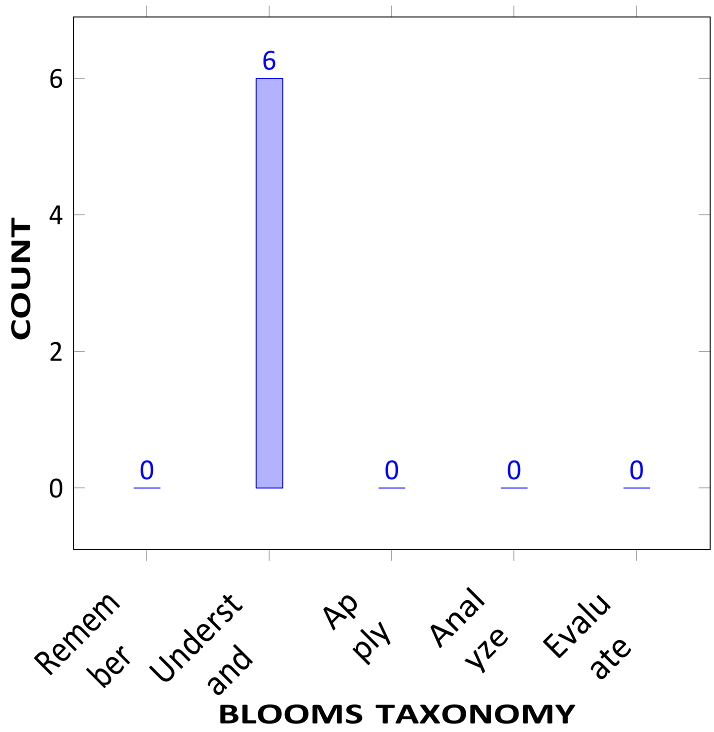
I	Facilitate computer-assisted multi-media instructions to make possible individualized and independent language learning.
II	The critical aspect of speaking and reading for interpreting in-depth meaning of the sentences.
III	Use language appropriately for social interactions such as public speaking, group discussions and interviews.
IV	Habituate using English speech sounds, word accent, intonation and rhythm.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Discuss** the prime necessities of listening skill for improving pronunciation in academic and non-academic purposes.	Understand
CO 2	**Summarize** the knowledge of English phonetics for speaking accepted language and describe the procedure of phonemic transcriptions and intonation patterns.	Understand
CO 3	**Express** about necessity of stressed and unstressed syllables in a word with appropriate length and clarity.	Understand
CO 4	**Explain** how writing skill fulfill the academic and non-academic requirements of various written communicative functions.	Understand
CO 5	**Generalize** appropriate concepts and methods from a variety of disciplines to solve problems effectively and creatively.	Understand
CO 6	**Classify** the roles of collaboration, risk-taking, multi-disciplinary awareness, and the imagination in achieving creative responses to problems.	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	3	Day-to-day evaluation / CIE/SEE
PO 10	**Communicate:** effectively on complex Engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions (Communication).	5	Day-to-day evaluation / CIE/SEE

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	-	-
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	-	-
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	-	-

3 = High; 2 = Medium; 1 = Low

X JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 10	Discuss the heeds of functional **grammar** and **punctuation** tools in **speaking** and **writing** by generating the **clarity** of an audio text.	5
CO 2	PO 9	Define the meaning of **individual work** and **team work** and also participate effectively to develop **leadership** qualities among the **diverse teams** in **multidisciplinary** settings.	5

CO 3	PO 10	Describe the **clarity** of **grammatical** usage and the obligation of **punctuation** marks in **speaking** and **writing**.	5
CO 4	PO 10	Choose suitable **grammatical** structures and **punctuation** marks at **speaking** and **writing** areas maintaining **clarity** at professional platform.	5
CO 5	PO 10	Interpret the **grammatical** knowledge and **punctuation** marks systematically towards providing the **clarity** in **speaking** and **writing**.	5
CO 6	PO 10	Demonstrate the role of **grammar** and **punctuation** marks understanding the meaning between the sentences as well as paragraphs in **speaking** or **writing** for a **clarity**.	5

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

COURSE OUTCOMES	PROGRAM OUTCOMES			PSO'S
	PO 9	PO 10	-	PSO
CO 1	-	5	-	-
CO 2	3	-	-	-
CO 3	-	5	-	-
CO 4	-	5	-	-
CO 5	-	5	-	-
CO 6	-	5	-	

XII ASSESSMENT METHODOLOGY DIRECT:

Laboratory Practices	PO 9, PO 10	Student Viva	PO 9, PO 10	Certification	-
Assignments	-	-	-	-	

XIII ASSESSMENT METHODOLOGY INDIRECT:

√	Early Semester Feedback	√	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK I	**INTRODUCTION ABOUT ELCS LAB..**
	Introducing Self and Introducing Others – feedback.
WEEK II	**INTRODUCTION TO PHONETICS AND PRACTICING CONSONANTS**
	Describing a person or place or a thing using relevant adjectives – feedback.
WEEK III	**PRACTICING VOWEL SOUNDS.**
	JAM Sessions using public address system.

WEEK IV	**STRUCTURE OF SYLLABLES.**
	Giving directions with help of using appropriate phrases – activities.
WEEK V	**WORD ACCENT AND STRESS SHIFTS. – PRACTICE EXERCISES.**
	Starting a conversation, developing and closing appropriately using fixed expressions..
WEEK VI	**PAST TENSE AND PLURAL MARKERS.**
	Role Play activities.
WEEK VII	**WEAK FORMS AND STRONG FORMS.**
	Oral Presentation..
WEEK VIII	**INTRODUCTION TO INTONATION- USES OF INTONATION - TYPES OF INTONATION- PRACTICE EXERCISES.**
	Expresions In Various Situations.
WEEK IX	**NEUTRALIZATION OF MOTHER TONGUE INFLUENCE (MTI).**
	Sharing Summaries Or Reviews On The Topics Of Students' Choice.
WEEK X	**COMMON ERRORS IN PRONUNCIATION AND PRONUNCIATION PRACTICE THROUGH TONGUE TWISTERS.**
	Interpretation Of Proverbs And Idioms.
WEEK XI	**LISENING COMPREHENSION.**
	Etiquettes.
WEEK XII	**TECHNIQUES AND METHODS TO WRITE SUMMARIES AND REVIEWS OF VIDEOS.**
	Writing Messages, Leaflets And Notices Etc.
WEEK XIII	**COMMON ERRORS.**
	Resume Writing.
WEEK XIV	**INTRODUCTION TO WORD DICTIONARY.**
	Group Discussions – Video Recording – Feedback.
WEEK XV	**INTRODUCTION TO CONVERSATION SKILLS.**
	Mock Interviews.

TEXTBOOKS

1. ENGLISH LANGUAGE AND COMMUNICATION SKILLS: LAB MANUAL

REFERENCE BOOKS:

1. . Meenakshi Raman, Sangeetha Sharma, "Technical Communication Principles and Practices", Oxford University Press, New Delhi, 3rd Edition, 2015.

2. Rhirdion, Daniel, "Technical Communication", Cengage Learning, New Delhi, 1st Edition, 2009.

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Introduction About Elcs Lab, Introducing Self And Introducing Others – Feedback.	CO 2	R1: 1.2

2	Introduction To Phonetics And Practicing Consonants, Describing A Person Or Place Or A Thing Using Relevant Adjectives – Feedback.	CO 2	R2: 25-30
3	Practicing Vowel Sounds,Jam Sessions Using Public Address System.	CO 2	R1: 28-29,49-54
4	Structure Of Syllables, Giving Directions With Help Of Using Appropriate Phrases – Activities.	CO 3	R1: 23-38
5	Word Accent And Stress Shifts. – Practice Exercises, Starting A Conversation, Developing And Closing Appropriately Using Fixed Expressions.	CO 3	R1: 2.4
6	Past Tense And Plural Markers,	CO 2	R3: 4.5
7	Weak Forms And Strong Forms,Oral Presentation.	CO 2	R3: 4.6
8	Introduction To Intonation- Uses Of Intonation - Types Of Intonation- Practice Exercises, Expresions In Various Situations.	CO 2	R2: 39-42
9	Neutralization Of Mother Tongue Influence (Mti), Sharing Summaries Or Reviews On The Topics Of Students' Choice.	CO 2	R2: 5.2
10	Common Errors In Pronunciation And Pronunciation Practice Through Tongue Twisters, Interpretation Of Proverbs And Idioms.	CO 2	R1:42-43
11	Lisening Comprehension, Etiquettes	CO 5	R1:44-48
12	Techniques And Methods To Write Summaries And Reviews Of Videos,Writing Messages, Leaflets And Notices Etc.	CO 4	R1:107-110
13	Common Errors, Resume Writing.	CO 4	R1:7.3
14	Introduction To Word Dictionary,Group Discussions – Video Recording – Feedback.	CO 5	R1:7.3
15	Introduction To Conversation Skills,Mock Interviews.	CO 6	R1: 54-58

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments.
1	**Effective listening skills can be used in professional and personal platforms in future.**
2	**By learning LSRW skills, students can enhance desired language skills to fulfill their needs.**
3	**Practicing presentation skills will boost confidence at work place.**
4	**The overall experiments of the laboratory will lead to be an effective communicator.**
5	**The Students will develop critical comprehensive skills to solve the career related problems in future.**

Signature of Course Coordinator **HOD**
Dr. Jetty Wilson, Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

INFORMATION TECHNOLOGY

COURSE DESCRIPTION

Course Title	**ENGINEERING PHYSICS LABORATORY**				
Course Code	**AHSB10**				
Program	B.Tech				
Semester	II				
Course Type	FOUNDATION				
Regulation	IARE - 8				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	3	1.5
Course Coordinator	Ms. S.Charavani, Assistant Professor				

I COURSE OVERVIEW:

This lab course provides hands on experience in a number of experimental techniques and developscompetenceintheinstrumentationtypicallyusedinphysics.This also develops student's expertise in applying physical concepts to practical problem and in learning about experimental techniques with advanced equipments. This laboratory includes experiments involving electromagnetism and optoelectronics.

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
-	-	-	Basic principles of physics	1.5

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Physics laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

√	Demo Video	√	Lab Worksheets	√	Viva Questions	√	Probing Further Experiments

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day-to-day performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being Internal Examiner and the other being External Examiner, both nominated by the principal from the panel of experts recommended by Chairman, BOS.

The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component	**Laboratory**		Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

A. Experiment Based

Objective	**Analysis**	**Design**	**Conclusion**	**Viva**	**Total**
2	2	2	2	2	10

B. Programming Based

Purpose	**Algorithm**	**Program**	**Conclusion**	**Viva**	**Total**
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

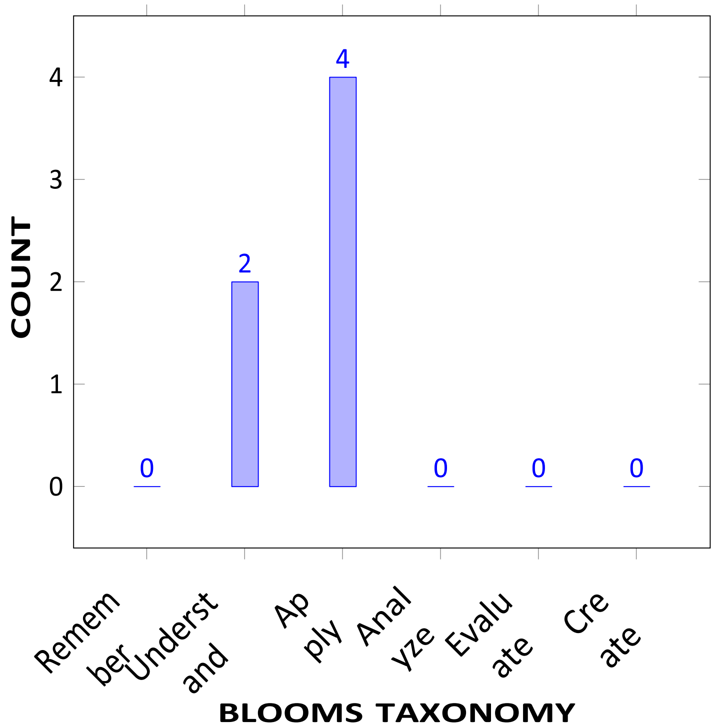
I	To familiarize with the lab facilities, equipment, standard operating procedures.
II	About the different kinds of functional electric and magnetic materials which paves a way for them to use in various technical and engineering applications.
III	The analytical techniques and graphical analysis to study the experimental data for optoelectronic devices.
IV	The applications of variation in the intensity of light due to natural phenomena like interference and diffraction.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Identify** the type of semiconductor using the principle of Hall Effect and alsodetermine the energy gap of a semiconductor diode.	Apply
CO 2	**Illustrate** principle, working and application of wave propagation and compare results with theoretical harmonics and overtones.	Understand
CO 3	**Investigate** the energy losses associated with a given Ferro magnetic material andalso magnetic field induction produced at various points along the axis of current carrying coil.	Apply
CO 4	**Examine** launching of light through optical fiberfrom the concept of light gathering capacity of numerical aperture.	Understand
CO 5	**Utilize** ththe phenomena of interference and diffraction for the determination of various parameterslike radius of curvature of convex lens, wavelength of laser light and width of single slit.	Apply
CO 6	**Investigate** V-I/L-I characteristics of various optoelectronic deviceslike Light Emitting Diode, Photodiode to understand their basic principle of functioning as well as to infer the value of Planck's constant.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Laboratory experiments, internal and external lab examinations.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	2	Laboratory experiments, internal and external lab examinations.
PO 4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	1	Laboratory experiments, internal and external lab examinations.

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	1	Laboratory experi-ments and Surveys

3 = High; 2 = Medium; 1 = Low

X JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 1	Identify basic principle of Hall effect and make use of mathematical expression for Hall coefficient to deduce the type of semiconductor.	2
	PO 2	Understand the given problem statement of identification of type of semiconductor and formulate Hall coefficient from experimental collection of information and data in reaching substantial conclusions by the interpretation of results.	4
	PO 1	Determine the energy gap of a semiconductor diode by making use of graphical analysis of current versus temperature curve.	2

CO 2	PO 1	Recall the theory of propagation of longitudinal and transverse waves and make use of number of loops formation in string to determine frequency of an electronically maintained tuning fork.	2
	PO 2	Understand the given problem statement of stationary wave propagation and formulate harmonics and overtones of fundamental frequency from experimental collection of information and data in reaching substantial conclusions by the interpretation of results.	4
CO 3	PO 1	Explain the variation of magnetic field at various points along the axis of current carrying coil and make use of mathematical expression of Tangent's law using Stewart Gee's apparatus.	2
	PO 2	Understand the given problem statement of current loop and formulate magnetic field induction at various points along the axis of current loop from experimental collection of information and data in reaching substantial conclusions by the interpretation of results.	4
	PO 1	Investigate the energy losses associated with a given ferromagnetic material and make use of graphical representation of hysteresis loop exhibited by magnetic material.	2
	PO 2	Understand the given problem statement of energy losses associated with a given ferromagnetic material and formulate hysteresis loop from experimental collection of information and data in reaching substantial conclusions by the interpretation of results.	4
	PO 4	Apply simulation tool to get hysteresis curve of a ferromagnetic material and understand energy losses associated with material.	1
	PSO 3	Make use of modern simulation tool to get information about energy losses associated with a ferromagnetic material.	1
CO 4	PO 1	Interpret launching of light through optical fiber and make use of mathematical expression for analyzing light gathering capacity through numerical aperture.	2
	PO 4	Make use of optical fiber trainer kit and understand conversion of electrical to light energy..	1
CO 5	PO 1	Explain the concept of interference in Newton's rings and make use of it to determine the radius of curvature of convex lens.	2
	PO 4	Make use of microscope to get Newton's rings and understand the phenomenon of interference in reflected light.	1
	PO 1	Recollect the phenomena of diffraction from N-slits and make use of it for the determination of wavelength of a given laser.	1

	PO 1	Understand the phenomenon of single slit diffraction and make use of it to determine the slit width by using laser light as monochromatic source.	1
CO 6	PO 1	Explain the V-I characteristics of light emitting diode and infer the value of planck's constant by plotting temperature versus current curve.	2
	PO 1	Understand the phenomenon of recombination of electron-hole pair and determine the value of threshold voltage of a given LED.	2
	PO 1	Illustrate the variation of photo current with light intensity in a photo diode.	1

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

COURSE OUTCOMES	PROGRAM OUTCOMES			PSO'S
	PO 1	PO 2	PO 4	PSO 3
CO 1	3	2	-	-
CO 2	3	2	1	-
CO 3	3	-	-	1
CO 4	3	2	1	-
CO 5	3	-	1	-
CO 6	3	2	1	-

3 = High; 2 = Medium; 1 = Low

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	√	SEE Exams	√	Seminars	-
Laboratory Practices	√	Student Viva	√	Certification	-
Assignments	-				

XIII ASSESSMENT METHODOLOGY INDIRECT:

√	Early Semester Feedback	√	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK 1	**HAL LEFFECT (LORENTZFORCE)**
	Determination of charge carrier density.
WEEK 2	**MELDE'S EXPERIMENT**
	Determination of frequency of a given tuning fork
WEEK 3	**STEWART GEE'S APPARATUS**
	Magnetic field along the axis of current carrying coil – Stewart and Gee's method.
WEEK 4	**B-H CURVE WITH CRO**
	To determine the value of retentivity and coercivity of a given magnetic material.
WEEK 5	**ENERGY GAP OF A SEMICONDUCTOR DIODE**
	Determination of energy gap of a semiconductor diode.
WEEK 6	**PHOTO DIODE**
	Studying V-I characteristics of Photo Diode.
WEEK 7	**OPTICAL FIBER**
	Evaluation of numerical aperture of a given optical fiber.
WEEK 8	**WAVELENGTH OF LASER LIGHT**
	Determination of wavelength of a given laser light using diffraction grating.
WEEK 9	**PLANK'S CONSTANT**
	Determination of Plank's constant using LED.
WEEK 10	**LIGHT EMITTING DIODE**
	Studying V-I Characteristics of LED.
WEEK 11	**NEWTONS RINGS**
	Determination of radius of curvature of a given plano - convex lens.
WEEK 12	**SINGLE SLIT DIFFRACTION**
	Determination of width of a given single slit.

TEXTBOOKS

1.1 CL Arora, "Practical Physics", S Chand and Co.,New Delhi, 3rd Edition,2012.

2.2 Vijay Kumar, Dr. T. Radha krishna, "Practical Physics for Engineering Students", S M Enterprises, 2nd Edition, 2014.

REFERENCE BOOKS:

1.1 CF Coombs,"Basic Electronic Instrument Handbook", McGraw - HillBookCo.,1972.

2.2 CH Bernardand CD Epp, John Wiley and Sons, " Laboratory Experiments in College Physics" Inc.,NewYork,1995.

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Determination of charge carrier density.	CO 1	T1:13.5
2	Determination of frequency of a given tuning fork.	CO 2	T1:13.5
3	Determination of Magnetic field along the axis of current carrying coil – Stewart and Gee's method.	CO 3, CO 4	TT1:14.7
4	Determination of the energy loss per unit volume of a given magnetic material per cycle by tracing the Hysteresis loop.	CO 3	T1:15.7
5	Determination of energy gap of a semiconductor diode.	CO 1	T1:16.8
6	Studying V-I Characteristics of Photo Diode.	CO 6	T1:16.9
7	Evaluation of numerical aperture of a given optical fiber.	CO 4	T1:17.9
8	Determination of wavelength of a given laser light using diffraction grating.	CO 5	T1:18.10
9	Determination of Plank's constant using LED.	CO 6	T1:19.10
10	Studying V-I characteristics of LED	CO 6	T1:19.9
11	Determination of radius of curvature of a given Plano-convex lens.	CO 5	T1:23.10
12	Determination of width of a given single slit.	CO 5	T1:23.10

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	To determine the wavelength of different colored light using white light source by Newton's ring method
2	To study the bending losses and transmission losses of an optical Fiber
3	To observe the dispersion of prism by using spectrometer.
4	Study the characteristics of Laser diode.
5	To illustrate the interference pattern produced from the air wedge.
6	To determine the voltage current characteristics of solar cell

Signature of Course Coordinator **HOD,IT**
Ms. S.Charavani, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	INFORMATION TECHNOLOGY
Course Title	**SEMICONDUCTOR PHYSICS**
Course Code	**AHSB13**
Program	**B. Tech.**
Semester	**II**
Course Type	**FOUNDATION**
Regulation	R-18

Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	4	3	1.5

Course Coordinator	Ms. S.Charavani, Assistant Professor.

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
10+2	-	-	Basic Principles of Semiconductors

II COURSE OVERVIEW:

This course is structured specifically to make the students understand some of the core topics in physics essential for further studies in engineering. It focuses on illustrating and developing an understanding of the interplay between problem solving and their practical applications which include experimental techniques and modern equipment. The topics include quantum mechanics, semiconductors, opto-electronic devices, magnetism, dielectrics, LASER and fiber optics. At the end, this course helps students to appreciate the diverse real-time applications in technological fields in respective branches.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Applied Physics	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	x	Assignments	x	MOOC
✓	Open Ended Experiments	x	Seminars	x	Mini Project	✓	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in Table: 1.

Percentage of Cognitive Level	Blooms Taxonomy Level
0 %	Remember
60 %	Understand
40 %	Apply
0 %	Analyze

Table 1: The expected percentage of cognitive level of questions in SEE

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 2), with 20 marks for Continuous Internal Examination (CIE), 10 marks for Alternative Assessment Tool (AAT) (Table 3).

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (Mid-term)	10	
	AAT-1	5	
	AAT-2	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			100

Table 2: Assessment pattern for CIA

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT):
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table 3.

Concept Video	Tech-talk	Complex Problem Solving
50%	50%	-

Table 3: Assessment pattern for CIA

VI COURSE OBJECTIVES:

The students will try to learn:

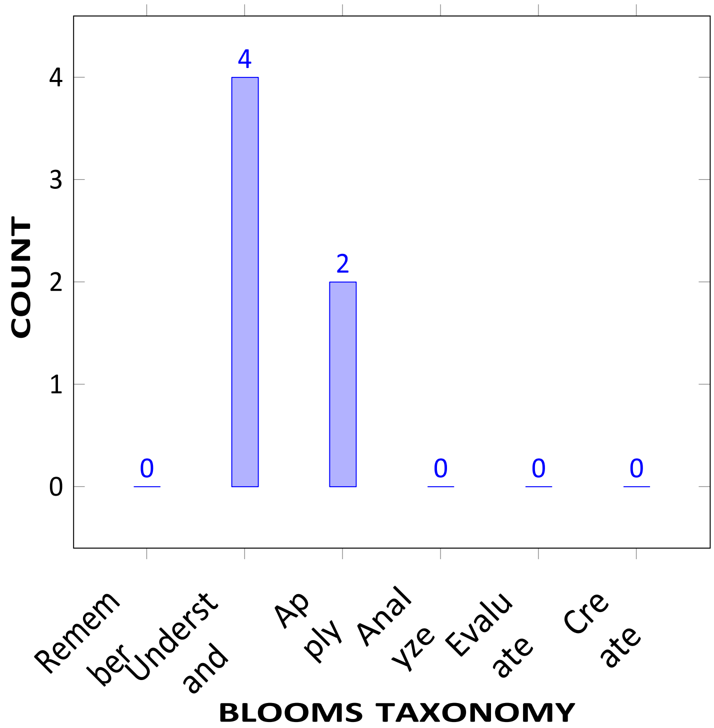
I	Basic formulations in wave mechanics for the evolution of energy levels and quantization of energies for a particle in a potential box with the help of mathematical description.
II	Fundamental properties of semiconductors including the band gap, charge carrier concentration, doping and transport mechanisms.
III	The metrics of optoelectronic components, LASER, optical fiber communication and be able to incorporate them into systems for optimal performance.
IV	The appropriate magnetic and dielectric materials required for various engineering applications.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Apply** the concepts of dual nature of matter and Schrodinger wave equation to a particle enclosed in simple systems.	Apply
CO 2	**Demonstrate** the classification of Solids and important aspects of semi-conductors in terms of carrier concentration and Fermi level.	Understand
CO 3	**Make use of** the key concepts of semiconductors to explain the ba- sic working mechanism of optoelectronic device characteristics of light-emitting diodes, photodetectors and solar cells.	Apply
CO 4	**Illustrate** the properties of dielectric and magnetic materials suitable for engineering applications.	Understand
CO 5	**Compare** the concepts of LASER and normal light in terms of mecha-nism and working principles for applications in different fields and sci-entific practices.	Understand
CO 6	**Explain** functionality of components in optical fiber communication system by using the basics of signal propagation, attenuation and dis-persion.	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engi- neering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first princi- ples of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowl- edge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Program Outcomes	
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to com- prehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understandingof the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems..	3	CIE/SEE/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	CIE/SEE/AAT
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	2	CIE/SEE/AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools	-	-
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges	-	-
PSO3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry..	1	AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH POs, PSOs:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	√	√	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	√	√	-	√	-	-	-	-	-	-	-	-	-	-	-
CO 3	√	√	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	√	√	-	√	-	-	-	-	-	-	-	-	-	-	√
CO 5	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	√	√	-	-	-	-	-	-	-	-	-	-	-	-	-

XII JUSTIFICATIONS FOR CO – (PO/PSO) MAPPING -DIRECT:

Course Outcomes	POs PSOs	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	**Outline** drawbacks of classical mechanics, basic principles **dual nature** of matter wave, **derive** mathematical wave equation of matter waves and come to **conclusion** of quantization of energy used in quantum dots.	3
	PO 2	**Explain** the given **problem statement** and formulate quantum confinement problems related to particle enclosed in small dimension from the provided **information** and **data** in reaching substantial conclusions by the **interpretation of results**.	4
CO 2	PO 1	**Illustrate** the charge transport mechanism in intrinsic and extrinsic semiconductors using energy level diagrams, calculate their charge carrier concentration and use those expressions to integrate with other engineering disciplines .	3

Course Outcomes	POs PSOs	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 4	**Identify** the use of these semiconductors under study and their conduction mechanism for the **research based knowledge** and **technological development**.	2
	PO 2	**Explain** the given **problem statement** and formulate mobility and conductivity aspects of a material from the provided **information** and **data** in reaching substantial conclusions by the **interpretation of Hall coefficient value**.	4
CO 3	PO 1	**Acquire** detailed **knowledge** of fundamental and applied aspects of optoelectronic device physics, **analyze** key parameters and **apply** them to the functioning of electronic devices.	3
	PO 2	**Illustrate** the given **problem statement** and **formulate** light interaction aspects of direct band gap materials from the provided **information** and **data** by the **interpretation of carrier generation and recombination** in opto-electronic devices	4
CO 4	PO 1	**Relate** principles of different types of polarization mechanism and expression for polarizability to the properties of functional materials and for solving engineering problems by applying these principles of science.	3
	PO 2	**Explain** the given **problem statement** and **formulate** polarization versus applied electric field related to ferroelectric materials from the provided **information** and **data** by the **interpretation of hysteresis loop**.	4
	PO 1	**Utilize** spin and orbital motion of electrons in determining **magnetic moment** of materials in terms of Bohr magneton materials having specific **engineering applications**.	3
	PO 4	**Identify** the use of magnetic materials and their magnetization values for the **research based knowledge** and **technological development.**	2
	PSO 3	**Make use of** modern computer tools to determine remnant magnetization and coercivity values from B-H curve and gain knowledge helpful for **higher studies**.	1
CO 5	PO 1	**Compare** the concepts of LASER and normal light in terms of mechanism and **working principle** for applications in different fields and scientific practices.	3
CO 6	PO 1	**Explain** functionality of components in optical fiber communication **system** by using the **basics** of signal propagation, attenuation and dispersion.	3
	PO 2	**Identify the given problem** and **formulate** expressions for acceptance angle and numerical aperture with the given **information** and **data** by applying principles of information propagation through optical waveguides.	4

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – (PO/PSO) MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	4	-	2	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	4	-	-	-	-	-	-	-	-	-		-	-	-
CO 4	3	4	-	2	-	-	-	-	-	-	-	-	-	-	1
CO 5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – (PO/PSO):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	100	40	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	100	40	-	20	-	-	-	-	-	-	-	-	-	-	-
CO 3	100	40	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	100	40	-	20	-	-	-	-	-	-	-	-	-	-	30
CO 5	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	100	40	-	-	-	-	-	-	-	-	-	-	-	-	-

XV COURSE ARTICULATION MATRIX (CO-PO/PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - 0≤ C≤ 5% – No correlation
1-5 <C≤ 40% – Low/ Slight
2 - 40 % <C < 60% –Moderate
3 - 60% ≤ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	2	-	1		-	-	-	-	-	-		-	-	-
CO 3	3	2	-	-	-	-	-	-	-	-	-		-	-	-
CO 4	3	2	-	1	-	-	-	-	-	-	-	-	-	-	1
CO 5	3		-	-	-	-	-	-	-	-	-	-	-	-	-

COURSE OUTCOMES	PROGRAM OUTCOMES												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 6	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	18	10	-	2	-		-	-	-	-	-	-	-	-	-
AVERAGE	3	2	-	1	-		-	-	-	-	-	-	-	-	1

XVI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	Open Ended Experiments	-
Assignments	-				

XVII ASSESSMENT METHODOLOGY-INDIRECT:

x	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	QUANTUM MECHANICS
	Introduction to quantum physics,black body radiation,planck's law,photo-electric effect,compton effect, de broglie hypothesis, Wave-particle duality, Davisson and Germer's experiment, Time-independent Schrödinger equation for wave function, born's interpretation of the wave function, Schrödinger equation for one dimensional problems - particle in a box.
MODULE II	ELECTRONIC MATERIALS AND SEMICONDUCTORS
	free electron theory, Bloch's theorem for particles in a periodic potential , Kronig-Penney model (Qualitative treatment),Origin of energy bands,types of electronic materials : metals, semiconductors, and insulators. Intrinsic and extrinsic semiconductors, Carrier concentration, Dependence of Fermi level on carrier-concentration and temperature, Hall effect.
MODULE III	LIGHT-SEMICONDUCTOR INTERACTION
	Carrier generation and recombination,carrier transport:diffusion and drift, Direct and indirect band gaps, p-n junction, V-I characteristics, Energy Band diagram, Biasing of a junction.Photo voltaic effecct Zener diode. Construction and working of LED, Photo detectors, PIN, Avalanche photodiode, Solar cell.
MODULE IV	ENGINEERED ELECTRIC AND MAGNETIC MATERIALS
	Polarisation, Permittivity, Dielectric constant, Internal field in solids, Clausius Mosotti equation, Ferroelectricity ,piezo electricity,pyroelectricity;Magnetisation, Permeability, Susceptibility, Classification of dia, para and ferro magnetic materials on the basis of magnetic moment,Domain theory of ferro magnetism on the basis of Hysteresis curve.

MODULE V	LASERS AND FIBER OPTICS
	Characteristics of LASER, Spontaneous and stimulated emission of radiation, Metastable state, Population inversion, Lasing action, Ruby LASER, semi-conductor diode laser and applications of LASER.Principle and construction of an optical fibre, Acceptance angle, Numerical aperture, Types of optical fibers (Single mode, multimode, step index, graded index),Attenuation in optical fibers, Optical fibre communication system with block diagram .

TEXTBOOKS

1. Dr. K Vijay Kumar and Dr. S Chandralingam — Modern Engineering Physics‖ Volume-1 & 2, S Chand. Co, 2018.
2. Dr. M. N. Avadhanulu, Dr. P. G. Kshirsagar —A Text Book of Engineering Physics‖, S. Chand.
3. B. K Pandey and S. Chaturvedi —Engineering physics‖, Cengage learning.

REFERENCE BOOKS:

1. J. Singh, —Semiconductor Optoelectronics: Physics and Technology‖, McGraw-Hill Inc. (1995).
2. P. Bhattacharya, —Semiconductor Optoelectronic Devices‖, Prentice Hall of India (1997).
3. Monica Katiyar and Deepak Gupta on NPTEL.Online course: ”Optoelectronic Materials and Devices”.

WEB REFERENCES

1. http://link.springer.com/book
2. http://www.thpys.physics.ox.ac.uk
3. http://sciencedirect.com/science
4. http://www.e-booksdirectory.com

COURSE WEB PAGE:

1. https://lms.iare.ac.in/index?route=course/details & course_id=17

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO’s	Reference
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO-PO Mapping		
CONTENT THEORY(DELIVERY)			
2	Introduction to Quantum Physics	CO 1	T2:5.15; R1:1.16

3	Black body radiation	CO 1	T2:5.17; R1:1.13.1
4	planck's law	CO 1	T2:5.17; R1:1.13.1
5	Photo-electric effect	CO 1	T2:5.17; R1:1.13.1
6	Compton effect	CO 1	T2:5.18; R1:1.13.2
7	De-broglie hypothesis and de-broglie wavcelength	CO 1	T2:5.18; R1:1.13.2
8	Wave particle duality	CO 1	T2:5.18; R1:1.13.2
9	Davisson and Germer's experiment	CO 1	T2:5.19 R1:1.13.3,
10	Schrödinger time independent wave equation	CO 1	T2:5.24; R1:1.17.3
11	Born's interpretation of the wavefunction	CO 1	T2:6.1; R1:2.3
12	Schrodinger equation for Particle in a one dimensional problems - Particle in a box	CO 1	T2:6.3; R1:2.6.1
13	Free electron theory	CO 2	T2:6.5; R1:2.6.2
14	Bloch's theorem for particle in a periodic potential	CO 2	T2:6.5; R1:2.6.2
15	Kronig-Penney model	CO 2	T2:7.3; R1:2.8
16	Origin of energy bands in solids	CO 2	T2:7.5,7.6; R1:2.9.2
17	Types of electronic materials : insulators, conductors and semi-conductors	CO 2	T2:7.5,7.6; R1:2.9.2
18	intrinsic and extrinsic semiconductors	CO 2	T2:7.7; R1:2.10
19	Carrier concentration	CO 2	T2:7.7; R1:2.10
20	Depends of Fermi level on Carrier concentration and tempera-ture	CO 2	T2:7.11; R2:2.10.2
21	Hall effect	CO 2	T2:7.11; R2:2.32
22	carrier generation and recombination	CO 3	T2:7.11; R2:2.10
23	carrier transport: diffusion and drift	CO 3	T2:7.11; R2:2.10
24	Direct and indirect band gaps	CO 3	T2:7.11; R2:2.10
25	p-n junction, V-I characteristics	CO 3	T2:7.12; R2:2.10.3

26	Energy Band diagram of PN Junction	CO 3	T2:7.12; R2:2.10.3
27	Biasing of PN junction	CO 3	T2:7.13; R1:2.10.4
28	photo voltaic effect	CO 3	T2:7.14 R1:2.10.6
29	Construction and working of LED	CO 3	T2:7.15; R1:2.10.7
30	photo detectors	CO 3	T2:7.15; R1:2.10.7
31	Construction and working of Photodiode, PIN and Avalanche Photodiode	CO 3	T1:7.15; R2:2.10.7
32	Construction and working of Solar cell	CO 3	T1:7.15; R2:2.10.7
33	Introduction to dielectric materials, Polarization, Permittivity, Dielectric constant	CO 4	T1:7.15; R2:2.10.7
34	Internal fields in solids	CO 4	T1:16.9 R2:8.11.1
35	Clausius – Mosotti equation	CO 4	T1:16.9; R2:8.11.2
36	piezo electricity	CO 4	T1:15.2; R4:8.2
37	pyro electricity	CO 4	T1:15.2; R4:8.2
38	Ferroelectricity	CO 4	T2:15.7; R4:8.3.3
39	Magnetic materials, Magnetization, Permeability, Susceptibil-ity	CO 4	T2:15.13 R4:8.7.2
40	classification of Diamagnetic and Paramagnetic and ferromag-netic on the basis of magnetic moment	CO 4	T2:15.13; R4:8.7.2
41	domain theory of ferro magnetism on the basis of Hysteresis curve	CO 4	T1:11.9; R2:12.24
42	Characteristics of LASER, Spontaneous and Stimulated emis-sion of radiation	CO 5	T1:11.9; R3:12.25
43	Metastable state, Population inversion, Lasing action	CO 5	T1:3.2; R3:3.2
44	Ruby LASER	CO 5	T1:3.3.1; R3:3.2
45	semi-conductor diode LASER and Applications of LASER	CO 5	T2:16.5; R3:8.10
46	Principle and construction of optical fibers	CO 6	T2:16.5; R3:8.10
47	Acceptance angle, Numerical Aperture	CO 6	T1:3.3.1; R3:3.2
48	Types of optical fibers	CO 6	T2:16.5; R3:8.10

49	Attenuation in optical fibers	CO 6	T2:16.5; R3:8.10
50	Optical fiber communication systemwith block diagram	CO 6	T2:16.5; R3:8.10
PROBLEM SOLVING			
1	De-broglie wavelength	CO 1	T1:3.3.1; R3:3.2
2	Energies associated with one dimensional potential box	CO 1	T2:16.5; R3:8.10
3	Intrinsic carrier concentration, Fermi level in semiconductors	CO 2	T2:16.5; R3:8.10
4	Carrier concentration based on Hall coefficient	CO 2	T1:3.3.1; R3:3.2
5	Mobility and conductivity based on Hall coefficient	CO 2	T2:16.5; R3:8.10
6	Diffusion and drift	CO 3	T2:16.5; R3:8.10
7	Energy gap in indirect bandgap semiconductors	CO 3	T1:3.3.1; R3:3.2
8	Dielectric constant, capacitance, permittivity	CO 4	T2:16.5; R3:8.10
9	Electric susceptibility, Polarization vector	CO 4	T2:16.5; R3:8.10
10	Polarizability	CO 4	T1:3.3.1; R3:3.2
11	Magnetic moment, Magnetic induction, Permeability	CO 4	T2:16.5; R3:8.10
12	Intensity of magnetization, Magnetic susceptibility	CO 4	T2:16.5; R3:8.10
13	Wavelength and Energy bandgap, Divergence	CO 5	T2:16.5; R3:8.10
14	Relative population of two states, Number of photons emitted	CO 5	T1:3.3.1; R3:3.2
15	Acceptance angle and Numerical Aperture	CO 6	T2:16.5; R3:8.10
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Quantum Mechanics	CO 1	T2:16.5; R3:8.10
2	Electronic materials and Semiconductors	CO 2	T1:3.3.1; R3:3.2
3	light Semiconductor interaction	CO 3	T2:16.5; R3:8.10
4	Engineered electric and magnetic materials	CO 4	T2:16.5; R3:8.10
5	LASER, Fiber optics	CO 5, CO 6	T2:16.5; R3:8.10

DISCUSSION OF QUESTION BANK			
1	Quantum Mechanics	CO 1	T1:3.3.1; R3:3.2
2	Electronic materials and Semiconductors	CO 2	T2:16.5; R3:8.10
3	Light Semiconductor interaction	CO 3	T2:16.5; R3:8.10
4	Engineered electric and magnetic materials	CO 4	T1:3.3.1; R3:3.2
5	LASER, Fiber optics	CO 5, CO 6	T2:16.5; R3:8.10

Signature of Course Coordinator **HOD, IT**

Ms. S.Charavani,, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**INFORMATION TECHNOLOGY**				
Course Title	**DATA STRUCTURES**				
Course Code	ACSB03				
Program	B.Tech				
Semester	III				
Course Type	Core				
Regulation	R-18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	3	1.5
Course Coordinator	Mr.CH.Suresh Kumar Raju, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSB01	II	Programming for Problem Solving

II COURSE OVERVIEW:

The course covers some of the general-purpose data structures and algorithms, and software devel- opment. Topics covered include managing complexity, analysis, static data structures, dynamic data structures and hashing mechanisms. The main objective of the course is to teach the students how toselect and design data structures and algorithms that are appropriate for problems that they might encounter in real life. This course reaches to student by power point presentations, lecture notes, andlab which involve the problem solving in mathematical and engineering areas.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Data Structures	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	whiteboard		Assignments	x	MOOC
✓	Open Ended Experiments	x	Seminars	x	Mini Project	✓	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIE examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into five modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with ”either” or ”choice” will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
60%	Understand
20%	Apply
10%	Analyze

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks, with 25 marks for Continuous Internal Examination (CIE) and 05 marks for Quiz \Alternative Assessment Tool (AAT).

Component	Theory		Total Marks
Type of Assessment	CIE Exam	Quiz \AAT	
CIA Marks	25	05	30

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8^{th} and 17^{th} week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to be answered where, each question carries 5 marks. Marks are awardedby taking average of marks scored in two CIE exams.

Quiz - Online Examination

Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the averageof two quiz examinations for every course.

Alternative Assessment Tool (AAT)

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table.

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

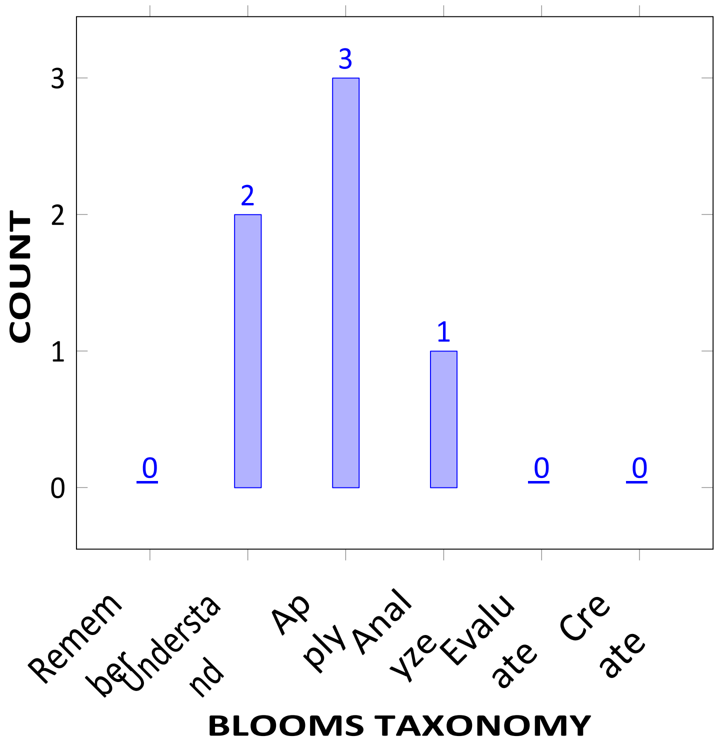
I	The skills needed to understand and analyze performance trade-offs of different algorithms implementations and asymptotic analysis of their running time and memory usage.
II	The knowledge of basic abstract data types (ADT) and associated algorithms: stacks, queues, lists, tree, graphs, hashing and sorting, selection and searching.
III	The fundamentals of Non-linear Data structure to store, retrieve, and process data efficiently.
IV	The implementing these data structures and algorithms and Understand essential for future programming and software engineering courses.
V	Analyze and choose appropriate data structure to solve problems in real world.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Interpret** the complexity of algorithmusing the asymptotic notations.	Understand
CO 2	**Select** appropriate searching and sorting techniquefor a given problem.	Apply
CO 3	**Construct** programs on performing operations on linear and nonlinear data structuresfor organization of a data	Apply
CO 4	**Make use of** linear data structures and nonlinear data structuressolving real time applications.	Apply
CO 5	**Describe** hashing techniques and collision resolution methods for efficiently accessing data with respect to performance.	Understand
CO 6	**Compare** various types of data structures ;in terms of implementation, operations and performance.	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Program Outcomes	
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	2	CIA/SEE
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	CIA/SEE
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	1	CIA/SEE
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	1	CIA/SEE

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	3	CIA/SEE/Open ended Experiments
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	1	Tech Talk/Concept Videos/Open ended Experiments
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	1	Tech Talk/Concept Videos/Open ended Experiments

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools	3	CIA/ SEE/ Tech Talk/ Concept Videos
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges	2	CIA/ SEE/ Tech Talk/ Concept Videos
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry..	2	CIA/ SEE/ Tech Talk/ Concept Videos

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	√	√	√	-	-	-	-	-	-	√	-	-	√	-	√
CO 2	√	√	√	-	√	-	-	-	-	√	-	√	√	√	√
CO 3	√	√	√	√	√	-	-	-	-	√	-	√	√	√	√
CO 4	√	√	√	√	√	-	-	-	-	√	-	√	√	√	√
CO 5	√	-	√	-	√	-	-	-	-	√	-	-	√	√	√
CO 6	√	√	√	√	√	-	-	-	-	√	-	√	√	√	√

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO1	PO 1	**Understand** (knowledge) the concept of conventional digital communication system and (understand) various types of pulse analog modulation techniques for signals analysis by applying the principles of **mathematics, science,** and **engineering fundamentals**.	3
	PO 2	**Problem Analysis** on different types of algorithms to analyze space and time complexities.	4
	PO 3	**Design the Solutions** for finding space and time complexities of a complex algorithm and representing it by asymptotic notations	2
	PO 10	**Subject matter and speaking style** assessed in explanation of various algorithms, algorithm complexity.	2
	PSO1	**Design and analyze** complex algorithms and specify its space and time complexities and representing it by asymptotic notations for faster processing of data.	3
	PSO3	**Make use of modern** computer tools for finding space and time complexities of a complex algorithm	1
CO 2	PO 1	**Make use** of broad knowledge of searching and sorting techniques for an efficient search from a data structure and optimize the efficiency of other algorithms by applying the knowledge of mathematics, science, Engineering fundamentals.	1
	PO 2	**Problem Analysis** on different types of search sort algorithms to analyze space and time complexities.	5

	PO 3	**Design/Development of Solutions** using appropriate searching and sorting techniques for designing a solution for complex Engineering problems.	2
	PO 5	**Implementation of** different sorting and searching techniques for given problem with the help of computer software	1
	PO 10	**Subject matter and speaking style** assessed in explanation of searching and sorting along with efficiency of searching and sorting techniques in terms of space and time complexity	2
	PO 12	**Keeping current in CSE and advanced engineering concepts** of various searching , sorting and respective time and space complexity by tech talk, concept videos and open ended experiments.	3
	PSO1	**Understand**complex problems and analyzing it and apply appropriate sorting and searching techniques for data processing.	4
	PSO2	**Applying**various selecting and sorting techniques while designing and developing information retrieval systems and its applications	2
	PSO3	**Make use of** various selecting and sorting techniques and extend the knowledge for advance frame works and platforms which are necessary for engineering practices and higher studies or become an entrepreneur.	1
CO 3	PO 1	**Make use of** linear and nonlinear data structures to organize the data in a particular way so to use them in the most effective way by applying the basic knowledge of mathematics, science, engineering fundamentals	2
	PO 2	**Problem analysis:** Organizing the given data in particular way by performing the operations on linear and nonlinear data structures to use the data in the most effective way.	7
	PO 3	**Recognize the** need of linear and nonlinear data structures such as linked list, array, stack and queue by Designing solutions for complex Engineering.	5
	PO 4	**Conduct Investigations** Conduct Investigations of Complex Problems: Ability to apply operations on linear and nonlinear data structures in order to organize the given data in a particular way	4
	PO 5	**Implementation of** Implementation of different operations on linear and nonlinear data structures for given problem with the help of computer software	1
	PO 10	**Subject matter and speaking style** assessed in explanation of linear and nonlinear data structures like linked lists, stacks and queues	2

	PO 12	**Keeping current in** CSE and advanced engineering concepts of linear and nonlinear data structures like linked lists, stacks and queues by tech talk, concept videos and open-ended experiments	3
	PSO1	**Understand** complex problems and analyzing it and apply appropriate operations on linear or nonlinear data structures for Developing the solution.	5
	PSO2	**Applying** various linear or nonlinear data structures while designing and developing information retrieval systems and its applications	2
	PSO3	**Make use of** various linear or nonlinear data structures and extend the knowledge for advance frame works and platforms which are necessary for engineering practices and higher studies or become an entrepreneur.	1
CO 4	PO 1	**Make use of** linear and nonlinear data structures for solving real time applications by applying the basic knowledge of mathematics, science, engineering fundamentals	3
	PO 2	**Problem analysis:**Solving real time applications by performing the operations on linear or nonlinear data structures.	7
	PO 3	**Recognize the** need of linear and nonlinear data structures such as linked list, array, stack and queue for Designing real time applications.	2
	PO 4	**Conduct Investigations of Complex Problems:** Ability to apply operations on linear or nonlinear data structures in order to solve real time applications.	4
	PO 5	**Implementation of** different operations on linear and nonlinear data structures for solving real time applications with the help of computer software	1
	PO 10	**Subject matter and speaking style** assessed in explanation of linear and nonlinear data structures like linked lists, stacks, queues, trees and graphs	2
	PO 12	**Keeping current** in CSE and advanced engineering concepts of linear and nonlinear data structures like linked lists, stacks, queues, trees and graphs by tech talk, concept videos and open-ended experiments for solving real time applications.	3
	PSO1	**Understand** complex problems and analyzing it and apply appropriate operations on linear or nonlinear data structures for solving real time applications.	5
	PSO2	**Applying** various linear or nonlinear data structures while designing and developing information retrieval systems and its applications	1

	PSO3	**Make use of** various linear or nonlinear data structures and extend the knowledge for advance frame works and platforms which are necessary for engineering practices and higher studies or become an entrepreneur.	1
CO 5	PO 1	**Understand** the knowledge of hashing techniques and collision resolution methods and implementing for specified problem domain using knowledge of mathematics, science and engineering fundamentals	1
	PO 3	**Design the Solution** for efficiently accessing data with respect to performance by using hashing techniques and collision resolution methods	2
	PO 5	**Implementation of** hashing techniques and collision resolution methods for efficiently accessing data with respect to performance with the help of computer software	1
	PO 10	**Subject matter and speaking style** assessed in explanation of Hashing, Collision techniques	2
	PSO1	**Understand** complex problems and analyzing it and apply appropriate hashing techniques and collision resolution methods for efficiently accessing data with respect to performance.	4
	PSO2	**Applying** various hashing techniques and collision resolution methods while designing and developing information retrieval systems and its applications	1
	PSO3	**Build** sufficient knowledge hashing techniques and collision resolution methods so that new product can be developed, which leads to become successful entrepreneur in the present market.	1
CO 6	PO 1	**Understand** various types of data structures in terms of implementations and choose appropriate data structure for specified problem domain using knowledge of mathematics, science and engineering fundamentals	3
	PO 2	**Problem Analysis:** Recognize the importance of suitable data structures in checking the efficiency of algorithms used for complex engineering problems.	7
	PO 3	**Design the Solution** complex problems or efficiently accessing data with respect to performance by using hashing techniques and collision resolution methods	5
	PO 4	**Conduct Investigations of Complex Problems:** Ability to apply operations on linear or nonlinear data structures in order to solve real time applications.	4
	PO 5	**Understand** the Implementation of various types of data structures with the help of computer software	1
	PO 10	**Subject matter and speaking** style assessed in explanation of Implementation of various types of data structures.	2

	PO 12	**Keeping current in CSE** and advanced engineering concepts of Implementation of various types of data structures by tech talk, concept videos and open ended experiments	3
	PSO 1	**Understand** complex problems and analyzing it and apply Implementation of various types of data structures.	5
	PSO 2	**Applying** Implementation of various types of data structures while designing and developing information retrieval systems and its applications	1
	PSO 3	**Build** sufficient knowledge Implementation of various types of data structures so that new product can be developed, which leads to become successful entrepreneur in the present market.	1

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – (PO, PSO) MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	3	10	10	11	1	5	3	3	12	5	12	12	6	2	2
CO 1	1	4	2	-	-	-	-	-	-	2	-	-	3	-	1
CO 2	1	5	2	-	1	-	-	-	-	2	-	3	4	2	1
CO 3	2	7	5	4	1	-	-	-	-	2	-	3	5	2	1
CO 4	3	7	2	4	1	-	-	-	-	2	-	3	5	1	1
CO 5	1	-	2	-	1	-	-	-	-	2	-	-	4	1	1
CO 6	3	7	5	4	1	-	-	-	-	2	-	3	5	1	1

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – (PO, PSO):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	3	10	10	11	1	5	3	3	12	5	12	12	2	2	2
CO 1	33.3	40	20	-	-	-	-	-	-	40	-	-	50	-	50
CO 2	33.3	50	20	-	100	-	-	-	-	40	-	25	66.6	100	50
CO 3	66.6	70	50	36.3	100	-	-	-	-	40	-	25	83.3	100	50
CO 4	100	70	20	36.3	100	-	-	-	-	40	-	-	66.6	50	50
CO 5	33.3	-	20	-	100	-	-	-	-	40	-	-	66.6	50	50
CO 6	100	70	50	36.3	100	-	-	-	-	40	-	25	83.3	50	50

XV COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, **0** being **no correlation**, **1** being the **low correlation**, **2** being **medium correlation** and **3** being **high correlation**.

0 - 0 ≤ ⋞ 5% – No correlation
1 -5 <C≤ 40% – Low/ Slight
2 - 40 % <C < 60% –Moderate
3 - 60% ≤ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	1	1	-	-	-	-	-	-	1	-	-	2	-	2
CO 2	1	2	1	-	3	-	-	-	-	1	-	1	3	3	2
CO 3	3	3	2	1	3	-	-	-	-	1	-	1	3	3	2
CO 4	3	3	1	1	3	-	-	-	-	1	-	1	3	2	2
CO 5	1	-	1	-	3	-	-	-	-	1	-	-	3	2	2
CO 6	3	3	2	1	3	-	-	-	-	1	-	1	3	2	2
TOTAL	**12**	**12**	**8**	**3**	**15**	**-**	**-**	**-**	**-**	**6**	**-**	**4**	**17**	**12**	**12**
AVERAGE	**2.0**	**2.4**	**1.3**	**1.0**	**3.0**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**2.8**	**2.4**	**2.0**

XVI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	√	SEE Exams	√	Assignments	√
Seminars	-	Student Viva	-	Certification	-
Laboratory Practices	-	5 Minutes Video	-	Open Ended Experiments	-
Term Paper	-	-	-	-	-

XVII ASSESSMENT METHODOLOGY INDIRECT:

√	Early Semester Feedback	√	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	**INTRODUCTION TO DATA STRUCTURES, SEARCHING AND SORTING**
	Basic concepts: Introduction to data structures, classification of data structures, operations on data structures; Algorithms Specification ,Recursive algorithms ,Data Abstraction, Performance analysis-time complexity and space complexity, Asymptotic Notation-Big O ,Omega and Theta notations. Introduction to Linear and Non Linear data structures, Searching techniques: Linear search, Binary search; Sorting techniques: Bubble, Selection, Insertion, Quick and Merge Sort and comparison of sorting algorithms
MODULE II	**LINEAR DATA STRUCTURES**
	Stacks: Stack ADT, definition and operations, Implementations of stacks using array, applications of stacks, Arithmetic expression conversion and evaluation; Queues: Primitive operations; Implementation of queues using Arrays, applications of linear queue, circular queue and double ended queue (deque).
MODULE III	**LINKED LISTS**
	Linked lists: Introduction, singly linked list, representation of a linked list in memory, operations on a single linked list; Applications of linked lists: Polynomial representation and sparse matrix manipulation. Types of linked lists: Circular linked lists, doubly linked lists; Linked list representation and operations of Stack, linked list representation and operations of queue
MODULE IV	**NON LINEAR DATA STRUCTURES**
	Trees: Basic concept, binary tree, binary tree representation, array and linked representations, binary tree traversal, binary tree variants, application of trees; Graphs: Basic concept, graph terminology, Graph representations-Adjacency matrix, Adjacency lists, graph implementation, Graph traversals-BFS,DFS, Application of graphs, Minimum spanning trees-Prims and Kruskal algorithms
MODULE V	**BINARY TREES AND HASHING**
	Binary search trees: Binary search trees, properties and operations; Balanced search trees: AVL trees; Introduction to M-Way search trees, B trees; Hashing and collision: Introduction, hash tables, hash functions, collisions, applications of hashing.

TEXTBOOKS

1. Rance D. Necaise, —Data Structures and Algorithms using Python, Wiley Student Edition.
2. Benjamin Baka, David Julian, —Python Data Structures and Algorithms, Packt Publishers, 2017.

REFERENCE BOOKS:

1.S. Lipschutz, —Data Structures , Tata McGraw Hill Education, 1st Edition, 2008.

2.D. Samanta, —Classic Data Structures, PHI Learning, 2nd Edition, 2004.

WEB REFERENCES:

1.http://www.tutorialspoint.com/data-structures-algorithms

2.https://www.geeksforgeeks.org/data-structures/

3.https://www.studytonight.com/data-structures/

4.https://www.coursera.org/specializations/data-structures-algorithms

COURSE WEB PAGE:

1.https://www.iare.ac.in/?q=courses/computer-science-and-engineering-autonomous/datastructures

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
	OBE DISCUSSION		
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO - PO Mapping	-	https: //www.iare.ac.in ? q=courses /computer-science-and-engineering-autonomous/data structures
	CONTENT DELIVERY (THEORY)		
1	Basic concepts: Introduction to Data Structures	CO 3	T1:1.1.3 R2 : 1.2
2	Classification of data structures	CO 3	T1:1.1.3 R2 : 1.4
3	Operations on data Structures	CO 3	T1:1.2
4	Recursive algorithm, Performance Analysis	CO 1	T1:1.2 T1:5.1
5	Searching techniques: Linear search and binary search	CO 2, CO 6	T1:5.1
6	Searching techniques: Fibonacci search and comparison	CO 2, CO 6	T1:5.1
8	Sorting techniques: Bubble sort, selection sort and companding	CO 2 CO 6	R1:14.5

9	Sorting techniques: Insertion sort, Quick sort	CO 2, CO 6,	T1:5.2 R2 : 10.2
10	Merge sort ,comparison of sorting algorithms	CO 4, CO 6	T1:5.2 R2 : 10.2
13	Stacks: Primitive operations, implementation of stacks using Arrays	CO 3, CO 4	T1:7.1
14	Applications of stacks arithmetic expression conversion and evaluation	CO 4, CO 6	T1:7.2
16	Queues: Primitive operations; Implementation of queues using Array	CO 3, CO 4	T1:8.1
17	Applications of linear queue, circular queue	CO 3, CO 4	T1:8.4
18	Double ended queue (deque)l	CO 3, CO 4	R2 : 5.4
19	Linked lists: Introduction, singly linked list, representation of a linked list in memory	CO 3, CO 4	T1:9.1
20	Operations on a single linked list :creation, insertion and deletion	CO 3, CO 4	T1:9.2
21	Applications of linked lists	CO 4,	T1:9.3
22	Operations on a double linked lists :creation, insertion and deletion	CO 3, CO 4	T1:9.4
23	Operations on a double linked lists : deletion ,traversal.	CO 3, CO 4	T1:9.4
24	single linked list :polynomial expression	CO 3, CO 4	T1:9.3
25	single linked list :Sparse matrix manipulation.	CO 3, CO 4	T1:9.3
26	Operations on a Circular linked lists: creation, insertion and deletion	CO 3, CO 4	T1:9
30	Operations on a Circular linked lists: deletion, traversal	CO 3, CO 4	T1:9
31	Linked list representation and operations of Stack	CO 3, CO 4	T1:9.7
32	Linked list representation and operations of queue	CO 3, CO 4	T1:9.8
37	Trees: Basic concept, Tree terminology	CO 3	T1:13.1

CONTENT DELIVERY (THEORY)			
38	Binary tree :Binary Tree properties	CO 3, CO 4	T1:13.1
39	Binary tree representation using array	CO 3, CO 4	T1:13.2
40	Binary tree representation using linked list	CO 3, CO 4	T1:13.2
41	Binary tree traversal, binary tree variants	CO 3, CO 4	T1:13.2
42	Application of trees	CO 4	T1:13.2.3
44	Graphs: Basic concept, graph terminology	CO 3	R2 : 8.2
45	Types of graphs, Representation of graph	CO 3	R2 : 8.2
46	Graph traversals :DFS and BFS, Application of graphs	CO 3	T2:6.2
48	Minimum Spanning Trees-Prims and Kruskal algorithms	CO 4	T1:6.1 T2:5.6
50	Binary search trees, properties	CO 3	T1:13.2.3
51	Binary search trees operations	CO 3	T1:13.2.3
52	AVL trees	CO 3	T1:14.3
53	M- Way search trees, B trees	CO 3	T1:14.3
54	Hashing, Collision	CO 5	R2 : 6.4
7	Problems on linear search, binary search and Fibonacci search.	CO 2	T1:5.1
11	Problems on bubble sort, selection and insertion sort	CO 3, CO 4	T1:5.2 R2 : 10.2
12	Problems on quick and merge sort	CO 3, CO 4	T1:5.2 R2 : 10.2
15	Problems on Arithmetic expression conversion and evaluation	CO 3, CO 4	T1:7.2
27	Problems on single linked list to add, delete element	CO 3, CO 4	T1:9.8
28	Problems on double linked list to add, delete element	CO 3, CO 4	T1:9.8
33	Problems on circular linked list to add, delete element	CO 3, CO 4	T1:9.4
34	Problems on double linked list to add, delete element	CO 3, CO 4	T1:9.3
35	Problems on stack using linked list	CO 3, CO 4	T1:9.7
36	Problems on queue using linked list	CO 3, CO 4	T1:9.8
43	Problems on Binary tree :creation ,insertion and deletion of a node	CO 3, CO 4	T1:13.2
47	Problems on Graph Traversal: DFS and BFS	CO 3, CO 4	T2:6.2

49	Problems on MST: Prim's and Kruskal's	CO 3, CO 4	T1:6.1 T2:5.6
55	Problems on Binary search tree	CO 4	T1:14.3
56	Problems oh hashing	CO 5	R2 : 6.4
DISCUSSION ON DEFINITION AND TERMINOLOGY			
57	Definitions on Data Structures, searching and sorting	CO 1,CO2,CO 3	T1:1 R1:14
58	Definitions on Linear Data Structures	CO 3	T1:7,.T1:8
59	Definitions on Linked Lists	CO 3	T1:9
60	Definitions on Non Linear data Structures	CO 3	T1:7.5
61	Definitions on Binary Trees and Hashing	CO 3 CO 5	T1:14
DISCUSSION ON QUESTION BANK			
62	Module I	CO 1, CO2,CO6	T1:1 R1:14
63	Module II	CO 3,CO 4,CO 6	T1:9
64	Module III	CO 3,CO 4,CO 6	T1:2.5
65	Module IV	CO 3,CO 4,CO 6	T1: 4.1
66	Module V	CO 3,CO 5,CO 6	T1: 5.1

Course Coordinator **HOD,IT**
Mr.CH.Suresh Kumar Raju, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**INFORMATION TECHNOLOGY**
Course Title	**BUSINESS ECONOMICS AND FINANCIAL ANALYSIS**
Course Code	AHSB14
Program	B.Tech
Semester	III
Course Type	Core
Regulation	R-18

<table>
<tr><td rowspan="3">Course Structure</td><td colspan="3">Theory</td><td colspan="2">Practical</td></tr>
<tr><td>Lecture</td><td>Tutorials</td><td>Credits</td><td>Laboratory</td><td>Credits</td></tr>
<tr><td>3</td><td>-</td><td>3</td><td>-</td><td>-</td></tr>
<tr><td>Course Coordinator</td><td colspan="5">Dr. T.Vara Laxmi, Associate Professor</td></tr>
</table>

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
-	-	-	-

II COURSE OVERVIEW:

The present course is designed in such a way that it gives an overview of concepts of Economics. Managerial Economics enables students to understand micro environment in which markets operate how price determination is done under different kinds of competitions. Financial Analysis gives clear idea about concepts, conventions and accounting procedures along with introducing students to fundamentals of ratio analysis and interpretation of financial statements. Break Even Analysis is very helpful to the Business Concern for Decision Making, controlling and forward Strategic Planning.Ratio analysis gives an idea about financial forecasting, financial planning, controlling the businessand decision making.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
BEFA	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	✓	Seminars	x	Mini Project	✓	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with ”either” or ”choice” will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
16%	Remember
17%	Understand
17%	Apply
50%	Analyze
0%	Evaluate
0%	Create

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Quiz	AAT	
CIA Marks	20	05	05	30

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination

Two Quiz exams shall be online examination consisting of 50 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the averageof two quiz examinations for every course.

Alternative Assessment Tool (AAT)

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

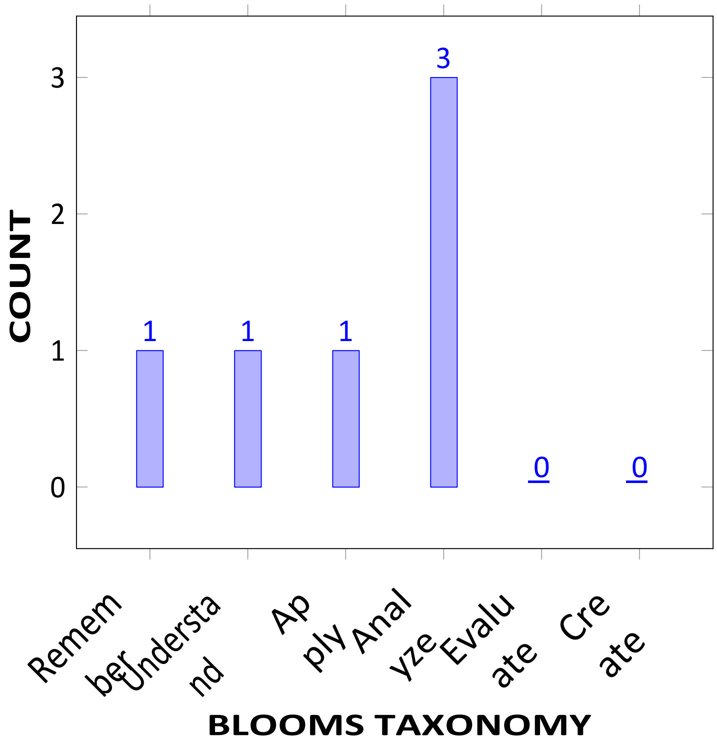
I	The concepts of business economics and demand analysis helps in optimal decision making in business environment
II	The functional relationship between Production and factors of production and able to compute breakeven point to illustrate the various uses of breakeven analysis.
III	The features, merits and demerits of different forms of business organizations existing in the modern business environment and market structures.
IV	The concept of capital budgeting and allocations of the resources through capital budgeting methods and compute simple problems for project management.
V	Various accounting concepts and different types of financial ratios for knowing financial positions of business concern.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**List** the basic concepts of managerial economics and analysis, measurement of demand and its forecasting to know the current status of goods and services.	Remember
CO 2	**Examine** to know the current status of goods and services. to know the economies and diseconomies of scale in manufacturing sector.	Analyze
CO 3	**Summarize** the four basic market models like perfect competition, monopoly, monopolistic competition, and oligopoly to know the price and quantity are determined in each model.	Understand
CO 4	**Compare** various types of business organizations and discuss their implications for resource allocation to strengthen the market environment.	Analyze
CO 5	**Analyze** different project proposals by applying capital budgeting techniques to interpret the solutions for real time problems in various business projects.	Analyze
CO 6	**Develop** the ability to use a basic accounting system along with the application of ratios to create (record, classify, and summarize) the data needed to know the financial position of the organization.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Program Outcomes	
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	-	-
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	-	-
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	-	-

3 = High; 2 = Medium; 1 = Low

X MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	✓	-	-	-	-	-	✓	✓	-	✓	-	-	-	-
CO 2	✓	✓	-	-	-	-	-	✓	✓	-	✓	-	-	-	-
CO 3	-	-	-	-	-	-	-	✓	✓	-	-	-	-	-	-
CO 4	-	-	-	-	-	-	-	✓	✓	-	-	-	-	-	-
CO 5	✓	-	-	-	-	-	-	-	-	-	✓	-	-	-	-
CO 6	-	✓	-	-	-	-	-	-	-	-	✓	-	-	-	-

XI JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	**Recall** (knowledge) the scientific fundamentals of economic activities performed by the businessmen in the business for profit earning.	2
	PO 2	**Interpret** and identify the demand and its analysis with the mathematical and natural principles of demand forecasting methods.	6
	PO 8	**Define** (knowledge) the responsibilities of the engineering practices by knowing the best economical practices.	1
	PO 9	**Match** (knowledge) the economical implication to effectively function as a team member, and as a member or leader in diverse teams.	5
	PO 11	**Relate** (knowledge) the knowledge and understanding of the economic principles and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	6
CO 2	PO 1	**Recall** (Knowledge) the knowledge of mathematics, science in the production function through Different Combination of variable inputs with Economies of Scale.	2
	PO 2	**Demonstrate** the different cost concepts and determine the significance of Break Even Analysis.	5
	PO 8	**Relate** (Knowledge) (Knowledge) the ethical principles and commit to professional ethics and responsibilities and norms of the production management	2
	PO 9	**Show** (Fundamentals) the production function implications for effective implementation of gang compositions in a team work and in multidisciplinary settings.	6
	PO 11	**Define** the economies of scale in production function and Break Even Analysis knowledge applied in one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	5
CO 3	PO 8	**List** (Knowledge) (Knowledge) different structures of market and how price is determined under different market structures commit to professional ethics and responsibilities and norms of the engineering practice.	2
	PO 9	**Match** the market structures and the market entry strategies as an individual, and as a member in diverse teams.	6
CO 4	PO 8	**Categorize** the ethical principles and commit to professional ethics and responsibilities belongs to different forms of business organizations existing in the modern business.	2

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 9	**Classify** various business organizations and their functioning as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	6
CO 5	PO 1	**Explain** the ethical issues involved in the allocation of funds under the concept of capital budgeting.	1
	PO 11	**Summarize** the concept of capital budgeting and allocations of the resources through capital budgeting methods of the management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	8
CO 6	PO 2	**Explain** the GAAP principles and ratios to analyse complex engineering problems reaching substantiated conclusions using first principles of accounts and profitability and efficiency of the organization.	6
	PO 11	**Illustrate**the accounting methods and procedures and accounting principles to manage the financial aspects in a project.	8

XII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	6	-	-	-	-	-	1	5	-	6	-	-	-	-
CO 2	2	5	-	-	-	-	-	2	6	-	5	-	-	-	-
CO 3	-	-	-	-	-	-	-	2	6	-	-	-	-	-	-
CO 4	-	-	-	-	-	-	-	2	6	-	-	-	-	-	-
CO 5	1	-	-	-	-	-	-	-	-	-	8	-	-	-	-
CO 6	-	2	-	-	-	-	-	-	-	-	8	-	-	-	-

XIII PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	66.7	60.0	-	-	-	-	-	33.3	41.6	-	50.0	-	-	-	-
CO 2	66.7	50.0	-	-	-	-	-	66.7	50.0	-	41.6	-	-	-	-
CO 3	-	-	-	-	-	-	-	66.7	50.0	-	-	-	-	-	-
CO 4	-	-	-	-	-	-	-	66.7	50.0	-	-	-	-	-	-
CO 5	33.3	-	-	-	-	-	-	-	-	-	75.0	-	-	-	-
CO 6	-	20.0	-	-	-	-	-	-	-	-	75.0	-	-	-	-

XIV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - 0 ≤ C ≤ 5% – No correlation

1 -5 <C≤ 40% – Low/ Slight

2 - 40 % <C < 60% –Moderate

3 - 60% ≤ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	-	-	-	-	-	1	2	-	2	-	-	-	-
CO 2	3	2	-	-	-	-	-	3	2	-	2	-	-	-	-
CO 3	-	-	-	-	-	-	-	3	2	-	-	-	-	-	-
CO 4	-	-	-	-	-	-	-	3	2	-	-	-	-	-	-
CO 5	1	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO 6	-	1	-	-	-	-	-	-	-	-	3	-	-	-	-
TOTAL	7	7	-	-	-	-	-	10	8	-	-	-	-	-	-
AVERAGE	2.3	2.3	-	-	-	-	-	2.5	2	-	2.5	-	-	-	-

XV ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	PO 1, PO 2, PO 8,PO 9 PO 11	SEE Exams	PO 1, PO 2, PO 8,PO 9 PO 11	Seminars	PO8
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	PO 1, PO 2, PO 8,PO 9 PO 11	Open Ended Experiments	-
Assignments	PO 9				

XVI ASSESSMENT METHODOLOGY-INDIRECT:

X	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVII SYLLABUS:

MODULE I	**INTRODUCTION&DEMAND ANALYSIS**
	Introduction to Business Economics: Definition, Nature and Scope of Managerial Economics – Demand Analysis: Demand Determinants, Law of Demand and its exceptions. Elasticity of Demand: Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting

MODULE II	**PRODUCTION & COST ANALYSIS**
	Theory of Production and Cost Analysis: Production Function – Iso-quants and Iso-costs, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale. Cost Analysis: Cost concepts; Break-even analysis, Determination of Break – Even point (Simple Problems) , Managerial Significance of BEA.
MODULE III	**MARKETS & NEW ECONOMIC ENVIRONMENT**
	LMarket structures: Types of competition, Features of perfect competition, Monopoly and monopolistic competition. Price determination & Price Statistics: Price Output determination in case of perfect competition and monopoly. Features and evaluation of different forms of Business organization: Sole proprietorship, partnership, Joint Stock Company, public enterprises andtheir types.
MODULE IV	**CAPITAL BUDGETING**
	Capital and its significance, types of capital, estimation of fixed and working capital requirements, methods and sources of raising capital- Trading Forecast, Capital budget, Cash Budget. Features of capital budgeting proposals, methods of capital budgeting – payback method, Accounting rate of return(ARR), Net Present Value Method (simple problems).
MODULE V	**INTRODUCTION TO FINANCIAL ACCOUNTING AND FINANCIAL ANALYSIS**
	Financial accounting objectives, functions, importance; Accounting concepts and accounting conventions - double-entry book keeping, journal, ledger, trial balance; Final accounts: Trading account, profit and loss account and balance sheet with simple adjustments; Financial analysis: Analysis and interpretation of liquidity ratios, activity ratios, capital structure ratios and profitability ratios (simple problems), Du Pont chart.

TEXTBOOKS

1. Aryasri, “Managerial Economics and Financial Analysis”, TMH publications, 4thEdition,2012.
2. M. KasiReddy, Saraswathi, “Managerial Economics and Financial Analysis”, PHI Publications, New Delhi, 2ndEdition,2012.
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COURSE WEB PAGE:

https://lms.iare.ac.in/index?route=publicprofile&id=5201

XVIII COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Discussion on Course Outcomes and how these COs mapped with POs and PSOs.		
CONTENT DELIVERY (THEORY)			
2-3	Explain about managerial economics according to the business	CO 1	T1- 1.3-1.8 R1-1.5-1.7
4-5	Describe about demand analysis, the Law of Demand and Demand Function.	CO 1	T1-2.2-2.11 R1-3.3-3.20
6-7	Understand elasticity of the demand of the product, different types, Measurement of Elasticity of Demand and Factors influencing on Elasticity of Demand.	CO 1	T1-3.3-3.20 R1- 5.29-6.8
8	State different methods of Demand Forecasting and the factors governing Demand Forecasting.	CO 1	T1-4.6-4.19
9-10	Demonstrate the Production function, features of Iso-Quants and Iso-Costs, different types of Internal Economies, External Economies and Law of Returns.	CO 2	T1- 5.3-5.18 R1- 5.29-6.8
11-13	Different types of Internal Economies, External Economies ad Law of Returns with appropriate examples.	CO 2	T1- 5.3-5.18
14-15	Illustrate different types of costs	CO 2	T1- 5.29-6.8
16-17	Explain the Significance and Limitations of Break-Even Analysis	CO 2	T1- 7.13-7.14
18-19	Calculate Break-Even Point (Simple Problems)	CO 2	T1- 7.1-7.12

20-21	Illustrate the features, price-output determination under Perfect Competition, Monopoly and Monopolistic competition Markets.	CO 3	T1- 8.4-8.16 R2- 5.29-6.8
22-24	Demonstrate the Objectives, Policies and Methods of Pricing Strategies and Price Methods.	CO 3	T1- 8.21-8.25
25-26	Describe Features of business, Definitions of Various forms of Business Units.	CO 4	T1-9.3-9.15
27-30	State the Merits & Demerits of Different types of Public Enterprises and Changing Business Environment to Post Liberalization Scenario.	CO 4	T1-9.2-10.23 R1- 8.21-8.25
31-32	Explain the significance and classification of capital, Methods and Sources of Raising Finance.	CO 6	T1-9.2-10.23
33-34	Demonstrate the concept of capital budgeting and allocations of the resources through capital budgeting methods and compute simple problems.	CO 6	T1-11.3-11.5 R2-12.3-12.5
35-37	Illustrate the Significance of Financial Accounting, Double Entry, Accounts, Accounting Concepts and Conventions	CO 6	T1-12.1-12.26
38-40	Explain the meaning, advantages and Limitations of the Journal, Ledger and Trial Balance and Final Accounts and Solve simple Problems.	CO 6	T1-13.4-13.15 R2-11.3-11.5
41-42	Describe Meaning, Definitions and Limitations of Ratio Analysis	CO 6	T1-13.4-13.15 R2-11.7-11.8
43-45	Compute different types of Financial Ratios (Problems)	CO 6	T1-13.5-13.68
PROBLEM SOLVING/ CASE STUDIES			
46	Problems relating to Demand elasticty measurement and Forecasting	CO 1	T1: 1.1 - 2.8, R1:2.1
47	Problems relation to Break Even Point	CO 2	T2: 3.0 to 3.6, 5.0 to5.5 , R2:4.4
48	Problems in determining the price in different types of markets	CO 3,4	T3: 6.0 to 6.4, R1:5.1
49	Problems relating to Capital Budgeting Decisions	CO 5	R2:7.5
50	Problems relating to Final Accounts and Calculation of Ratios	CO 6	R3: 4.1
DISCUSSION OF DEFINITION AND TERMINOLOGY			
51	Introduction and Demand Analysis	CO 1	T1: 1.1 - 2.8, R1:2.1
52	Production and Cost Analysis	CO 2	T2: 3.0 to 3.6, 5.0 to5.5 , R2:4.4
53	Markets and New Environment	CO 3,4	T3: 6.0 to 6.4, R1:5.1
54	Capital Budgeting	CO 5	R2:7.5
55	Introduciton to Financial Accounting and Financial Analysis	CO 6	R3: 4.1

DISCUSSION OF QUESTION BANK			
56	Introduction and Demand Analysis	CO 1	T1: 1.1 - 2.8, R1:2.1
57	Production and Cost Analysis	CO 2	T2: 3.0 to 3.6, 5.0 to5.5 , R2:4.4
58	Markets and New Environment	CO 3,4	T3: 6.0 to 6.4, R1:5.1
59	Capital Budgeting	CO 5	R2:7.5
60	Introduciton to Financial Accounting and Financial Analysis	CO 6	R3: 4.1

Signature of Course Coordinator **HOD IT**
Dr. T.Vara Laxmi, Associate Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**Information Technology**				
Course Title	**DATABASE MANAGEMENT SYSTEMS**				
Course Code	ACSB08				
Program	B.Tech				
Semester	FOUR				
Course Type	Core				
Regulation	R-18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	1	4	3	2
Course Coordinator	Ms.Akula Rajitha				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AHS001	I	Computer Programming
B.Tech	AHS002	II	Data Structures

II COURSE OVERVIEW:

Database management system is intended to provide a clear understanding of fundamentals with emphasis on their applications to create and manage large data sets. It emphasizes on technical overview of database software to retrieve data from database. This includes database design principles, normalization, concurrent transaction processing, security, recovery and file organization techniques. This will provide adequate knowledge to understand future evolutions of data technologies.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Database Managment Systems	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	White Board	✓	Assignments	x	MOOC
✓	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIE examinations or the marks scored in the make-up examination.

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50%	Apply
0%	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 25 marks for Continuous Internal Examination (CIE) and 05 marks for Quiz \Alternative Assessment Tool (AAT).

Component	Theory		Total Marks
Type of Assessment	CIE Exam	Quiz \AAT	
CIA Marks	25	05	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 17^{th} week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination
Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table.

Five Minutes Video	METE	Complex Problem Solving

40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

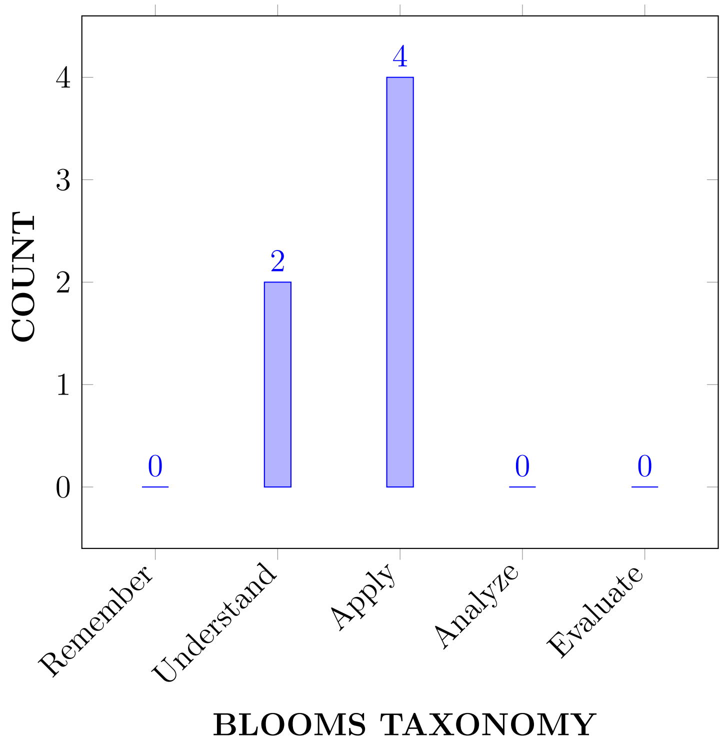
I	Efficient ways of designing database by encapsulating data requirements for business and organizational scenarios
II	Analysing and developing sophisticated queries in database language SQL for extracting information from large datasets
III	Enhancing skills in developing and managing data efficiently in related engineering problems.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Outline** the importance of database system, RDBMS and its functionalities for voluminous data storage and management..	Understand
CO 2	**Model** the real world database systems using Entity Relationship Diagrams from the requirement specification.	Apply
CO 3	**Construct** queries in Relational Algebra, Relational Calculus and SQL to retrieve desired information.	Apply
CO 4	**Identify** appropriate normalization technique using dependencies for controlling the redundancy of data in database.	Apply
CO 5	**Demonstrate** ACID properties of Transaction processing, currency control protocols and recovery to preserve the database in a consistent state.	Understand
CO 6	**Organize** data storage and file organization techniques using tree and hash indices for effective query processing..	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	2.6	SEE / CIE / AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2.16	SEE / CIE / AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	2	SEE / CIE / AAT
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	1.5	SEE / CIE / AAT
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	3	SEE / CIE / AAT
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	1	SEE / CIE / AAT

PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	1	SEE / CIE / AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	**Design** next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	3	Quiz/AAT
PSO 2	**Focus** on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	2	Quiz/AAT
PSO 3	**Practical** experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	3	Quiz/AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	✓	✓								✓					
CO 2		✓	✓	✓						✓		✓	✓	✓	✓
CO 3	✓	✓	✓	✓	✓					✓		✓	✓	✓	✓
CO 4	✓	✓	✓	✓						✓			✓	✓	✓
CO 5	✓	✓	✓	✓						✓					✓
CO 6	✓	✓	✓							✓				✓	✓

XII JUSTIFICATIONS FOR CO – PO / PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Demonstrate basics of databases, functions of database management system and types of users to describe large sets of data with knowledge of mathematics, Science and Engineering Fundamentals.	3
	PO 2	Define the relational data model, constraints and keys to maintain integrity of data with the Problem statement and system definition, Problem formulation and abstraction , Information and data collection, Model translation	3

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 2	PO 10	Understand and Outline fundamental concepts of databases with clarity .	1
	PO 2	Model the real world database systems using Entity Relationship Diagrams from the requirement specification with the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation	5
	PO 3	Model the real world database systems using Entity Relationship Diagrams from the requirement specification with the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation.	5
	PO 4	Model the real world database systems using Entity Relationship Diagrams from the requirement specification with the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation.	6
	PO 10	Develop logical model for real time applications to get clarity on requirements.	1
	PO 12	Choose appropriate techniques to model Database project using advanced concepts of CSE to meet industry trends..	3
	PSO 1	Model the real world database systems using Entity Relationship Diagrams from the requirement specification by using sequence of steps.	2
	PSO 2	Design ER model for efficient any data retrieval to develop database projects	2
	PSO 3	Develop a model for real time database application for any Enterprise.	1
CO 3	PO 1	Outline the use of relational algebra, relational calculus and SQL for creation and management of database with knowledge on fundamentals of mathematics such as set theory and engineering basics.	2
	PO 2	Build queries in Relational Algebra , Relational Calculus and SQL to retrieve desired information with detail Problem statement and system definition, Problem formulation and abstraction , Information and data collection, Model translation and validation	5
	PO 3	Illustrate the use of Relational Algebra , Relational Calculus and SQL for database creation and querying with the help of Investigate and define a problem , Identify constraints ,find creative solution , Manage the design process and evaluate outcomes	7
	PO 4	Develop RA, RC and SQL queries for database creation and maintenance by Understanding of contexts in which engineering knowledge can be applied, Understanding use of technical literature , appropriate codes of practice , industry standards and apply system approach to output qualitative output	6

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 5	Select appropriate techniques to retrieve information using modern tools such as SQL	1
	PO 10	Develop queries in SQL , RA and RC for retrieving information in real time applications with clear understanding of needs	1
	PO 12	Choose appropriate techniques to model Database project using advanced concepts of CSE to meet industry trends..	3
	PSO 1	Demonstrate RA, RC and SQL queries for database creation and maintenance by using a set of instructions.	2
	PSO 2	Identify clauses and verbs of SQL for retrieving Information from database	2
	PSO 3	Selectl for real time database application for any Enterprise.	1
CO 4	PO 1	Illustrate the definition of Functional Dependencies, Inference rules and minimal sets of FD's to maintain data integrity basic fundamentals of mathematics and engineering fundamentals.	2
	PO 2	Illustrate the definition of Functional Dependencies, Inference rules and minimal sets of FD's to maintain data integrity with the Problem statement and system definition, Problem formulation and abstraction , Information and data collection, Model translation.	7
	PO 3	Make use of normalization techniques for reducing redundancy of database to Investigate and define a problem and identify constraints ,Understand customer and user needs, for creating and Managing the design process and evaluate outcomes.	5
	PO 4	Apply normalization techniques to normalize a database by Understanding of contexts in which engineering knowledge can be applied, Understanding use of technical literature , Understanding of appropriate codes of practice and industry standards.	2
	PO 10	Develop efficient logical model of database using normalization for real time database applications with clear understanding of enterprise needs.	1
	PSO 1	Make use of normalization to identify the need of constraints and design appropriate techniques to develop data centric applications .	3
	PSO 2	Apply normalization to design efficient information retrieval system .	1
	PSO 3	Apply dependencies for normalization and extend the study for advanced frameworks and platforms of data storage.	1
CO 5	PO 1	Demonstrate the concepts of transaction ACID properties and recovery techniques in data manipulation with basic engineering fundamentals.	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 2	Outline concurrent transaction processing, recovery techniques in transaction failure by formulating and stating the problem with constraints using Information management and data collection .	5
	PO 3	Make use of concurrency control protocols to preserve the database in a consistent state by Investigate and define a problem and identify constraints ,Understand customer and user needs, Manage the design process and evaluate outcomes	3
	PO 4	Utilize concurrency control protocols to preserve the database in a consistent state by Understanding of contexts in which engineering knowledge can be applied, Understanding use of technical literature.	2
	PO 10	Build a database which will always in a consistent state during concurrent transaction processing with reference to security and integrity.	1
	PSO 3	Extend concurrent transactions and recovery processing to manage large data sets by using innovative technical tools and advanced frameworks	1
CO 6	PO 1	Describe disk storage devices, file organization to select efficient data storage with basic fundamentals of mathematics and engineering fundamentals	2
	PO 2	Apply indexing ,hashing techniques to access the records from the file effectively through problem statement and formulation with data collection and validation in designing experiment and developing effective data retrieval system	7
	PO 3	Apply indexing techniques to access the records from the file effectively by Investigate and define a problem and identify constraints ,Understand customer and user needs, Manage the design process and evaluate outcomes,.	5
	PO 10	Make use of efficient data storage devices to implement effective retrieval techniques with clear understanding of data structures	1
	PSO 2	Outline the indexing and hashing techniques for efficient and secure retrieval of data in query processing .	2
	PSO 3	Extend storage devices characteristics and organization of data with innovative technical tools and advanced frameworks	2

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO / PSO MAPPING:

COURSE OUTCOMES	Program Outcomes/ No. of Key Competencies Matched											PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	3								1					
CO 2		5	5	6						1		2	2	2	1

CO 3	2	5	7	6						1		2	2	2	1
CO 4	2	7	5	2						1			3	1	1
CO 5	1	5	3	2						1					1
CO 6	2	7	5							1				1	1

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO / PSO:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	3	10	10	11	1	5	3	3	12	5	12	12	6	2	2
CO 1	100.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0
CO 2	0.0	50.0	50.0	54.54	0.0	0.0	0.0	0.0	0.0	20.0	0.0	37.5	33.3	100.0	50.0
CO 3	66.66	50.0	70.0	54.4	100.0	0.0	0.0	0.0	0.0	20.0	0.0	25.5	33.3	100.0	50.0
CO 4	66.66	70.0	50.0	27.3	0.0	0.0	0.0	0.0	0.0	20.0	0.0	00.0	50.0	50.0	50.0
CO 5	33.33	50.0	30.0	27.3	0.0	0.0	0.0	0.0	0.0	20.0	0.0	0.0	0.0	0.0	50.0
CO 6	66.66	70.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0	0.0	0.0	50.0	50.0

XV COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.
0 - $0 \leq$ C$\leq$ 5% – No correlation
2 - 40 % <C < 60% –Moderate
1-5 <C$\leq$ 40% – Low/ Slight
3 - 60% $\leq$ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	1	-	-	-	-	-	-	-	1	-	-	-	-	-
CO 2	0	2	2	2	-	-	-	-	-	1	-	1	1	3	2
CO 3	3	2	3	2	3	-	-	-	-	1	-	1	1	3	2
CO 4	3	3	2	1	-	-	-	-	-	1	-	-	2	2	2
CO 5	1	2	1	1	-	-	-	-	-	1	-	-	-	-	2
CO 6	3	3	2	-	-	-	-	-	-	1	-	-	-	2	2
TOTAL	13	13	10	6	3	-	-	-	-	6	-	2	4	10	8
AVERAGE	2.6	2.16	2	3	-	-	-	-	-	1	-	1	1.33	2.5	1.6

XVI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	PO1, PO2, PO3, PO4	SEE Exams	PO1, PO2, PO3 ,PO4	Assignments	PO1,PO2
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	PO1, PO2, PO3,	Open Ended Experiments	-

XVII ASSESSMENT METHODOLOGY INDIRECT:

X	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**CONCEPTUAL MODELING INTRODUCTION**
	Introduction to Data bases: Purpose of Database Systems, View of Data, Data Models, Database Languages, Database Users, Various Components of overall DBS architecture, Various Concepts of ER Model, Basics of Relational Model. .
MODULE II	**RELATIONAL APPROACH**
	Relational algebra and calculus: Relational algebra, selection and projection, set operations, renaming, joins,division, examples of algebra queries, relational calculus: Tuple relational calculus, Domain relationalcalculus, expressive power of algebra and calculus.
MODULE III	**SQL QUERY - BASICS, RDBMS - NORMALIZATION**
	SQL – Data Definition commands, Queries with various options, Mata manipulation commands, Views,Joins, views, integrity and security; Relational database design: Pitfalls of RDBD, Lossless joindecomposition, Functional dependencies , Armstrong Axioms, Normalization for relational databases 1st 2nd and 3rd normal forms, Basic definitions of MVDs and JDs, 4th and 5th normal forms Theory of games: Introduction, terminology, solution of games with saddle points and without saddle points, 2 x 2 games, dominance principle, m x 2 and 2 x n games, graphical method.
MODULE IV	**TRANSACTION MANAGEMENT**
	Transaction processing: Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability. Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols,Multiple Granularity, Multiversion Schemes, Deadlock Handling. Recovery: Failure Classification, Storage Structure ,Recovery and Atomicity, Log-Based Recovery, Shadow Paging, Recovery With Concurrent Transactions Buffer Management .
MODULE V	**DATA STORAGE AND QUERY PROCESSING**
	Data storage: Overview of Physical Storage Media, Magnetic Disks, Storage Access, File Organization, Organization of Records in Files. Indexing and Hashing: Basic Concepts: Ordered Indices, B+-Tree Index Files, B-Tree Index Files, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing.Query Processing: Overview, Measures of Query Cost.

TEXT BOOKS

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill 6th Edition, 2017.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamental Database Systems", Pearson Education, 6th Edition, 2014. 2. Raghu Ramakrishnan, "Database Management System", Tata McGraw

REFERENCE BOOKS:

1. Raghu Ramakrishnan, "Database Management System", Tata McGraw-Hill Publishing Company, 3rd Edition, 2007.
2. Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, "Database System Implementation", Pearson Education, United States, 1st Edition, 2000.

3. Peter Rob, Corlos Coronel, "Database System, Design, Implementation and Management", Thompson Learning Course Technology, 5th Edition, 2003.

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COURSE WEB PAGE:

https://nptel.ac.in/courses/112105171/1

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	CD based on OBE for DBMS course		
CONTENT DELIVERY (THEORY)			
1	Introduction to Databases	CO 1	T2:1.1-1.5
2	File System vs. Database system	CO 1	T2: 1.6-1.8 T1.2.1
3	Data Models and Levels of Abstraction	CO 1	T2:1.1 - 1.5
4	Database users and Database languages, DBS architecture	CO 1	T1:1.5, 1.4.2,1.4.3
5	Basics of ER Model	CO 2	T1:2.2
6	Extended ER Model	CO 2	T1:3.1
7	Basics of Relational Model	CO 1	T1:3.1,3.2 R1:6.2-6.8
8	Logical Database design.	CO 1	T1: 3.1
9	Relational database languages	CO 3	T1:4.1
10	Basic operations of Relational algebra	CO 3	T1:4.1
11	Derived operations of Relational algebra, Extended operations of Relational algebra	CO 3	T1: 4.1
12	Queries in Relational algebra	CO 3	T1:4.1,4.2.2
13	Tuple Relational Calculus	CO 3	T1:4.3
14	Domain Relational calculus	CO 3	T1:4.3
15	Intiegrity constraints – RDB Design	CO 4	T1: 3.1
16	Pitfalls of RDBD	CO 4	T1:3.1
17	Lossless join decomposition	CO 4	T1: 9.1,19.1.3
18	Functional dependencies Armstrong Axioms	CO 4	T2: 19.4
19	Closure of set of FDs and Attribute Closure, Canonical Cover	CO 4	T2: 19.4
20	Purpose of Normalization – RDBD.	CO 4	T1: 9.1
21	1st, and 2nd normal forms.	CO 4	T1: 9.1
22	3rd and BCNF normal forms.	CO 4	T1: 9.1
23	4NF, 5NF Normal forms and Other Dependencies.	CO 4	T2: 19.8-19..9
24	Transaction Concept, Transaction State	CO 4	T2:15.1
25	Implementation of Atomicity and Durability.	CO 5	T2:15.1
26	Serial Vs. Nonserial Transactions.	CO 5	T2:15.1
27	Serializability – Conflict Serializability.	CO 5	T2: 16.1
28	View Serializability.	CO 5	T2: 16.3
29	Lock-Based Protocols.	CO 5	T2: 16.1
30	Deadlock Handling – Concurrent Transactions	CO 5	T2: 16.3

31	Implementation of locks and Multiple Granularity.	CO 5	T2: 16.1
32	Timestamp-Based and Validation-Based Protocols	CO 5	T2: 16.3
33	Transaction Recovery and LogBbased Recovery techniques	CO 5	T2:17.1
34	Recovery Algorithms – Buffer Management	CO 5	T2:17.1
35	Physical Storage Media	CO 6	T1: 8.1
36	Data Access and File Organization Techniques	CO 6	T1: 8.1
37	B+ Tree index File Organization	CO 6	T1: 8.3- 8.4
38	B-Tree and Bit Index File Organization	CO 6	T1: 10 10.2
39	Static and Dynamic Hashing Techniques	CO 6	T1: 8.3- 8.4
40	Query Processing : Overview	CO 6	T1: 10 10.2
PROBLEM SOLVING/ CASE STUDIES			
1	SQL – DDL Statements	CO 3	R1.5
2	SQL – DML Statements.	CO 3	R1.5.1
3	SQL – Builtn funcions	CO 3	R1.5.2
4	SQL – SELECT Statement	CO 3	R1.5.3
5	SQL - Join operation .	CO 3	R1.5.4
6	SQL – Subqueries.	CO 3	R1.5.5
7	SQl – Views	CO 3	R1.5.6
8	SQL – Stored Programs and stored Functions	CO 3	R1.5.7
9	SQL - Triggers	CO 3	R1.5.8
10	Problems on Rlational algebra and Relational Calculus	CO 3	R1.4
11	Problems on ER Model	CO 2	R1.2
12	Problems on Concurrent Transactions and Recovery	CO 5	R1.3
13	Problems on Normalization.	CO 4	R1.3
14	Problems on Functional dependencies.	CO 4	R1.3
15	Problems on B-trees and hashing	CO 6	R1.9, R1.10
DISCUSSION ON DEFINITION AND TERMINOLOGY			
1	Module I	CO 1, CO 2	T1.1, R1.1,2
2	Module II	CO 3	R1.4
3	Module III	CO 3,CO 4	R1.5
4	Module IV	CO 5	R1.18, 19,20
5	Module V	CO 6	R1.7, 8, 9,10
DISCUSSION ON QUESTION BANK			
1	Module I	CO 1, CO 2	T1.1, R1.1,2
2	Module II	CO 3	R1.4

3	Module III	CO 3,CO 4	R1.5
4	Module IV	CO 5	R1.18, 19,20
5	Module V	CO 6	R1.7, 8, 9,10

Signature of Course Coordinator **HOD,CSE**

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION

Course Title	**DATABASE MANAGEMENT SYSTEMS LABORATORY**				
Course Code	ACSB09				
Program	B.Tech				
Semester	IV	CSE/IT			
Course Type	Core				
Regulation	IARE - R18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	3	1.5
Course Coordinator	Ms B Geetavani, Assistant Professor				

I COURSE OVERVIEW:

This Laboratory course introduces the query language for design and development of a database by using various software's such as SQL, ORACLE, and MS – Access etc. It provides practice on built-in SQL functions using languages like DDL, DCL, DML and TCL to create and manage database systems and perform Set operations, Sub Queries, Joins; and PL/SQL programs to implement Exceptions, Cursors, Stored Functions, Views, Sequences, Locks and Triggers. This is essential for mobile and web application development for business, scientific and engineering applications.

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSB03	III	Data Structures

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Database Management Systems Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Demo Video	✓	Lab Worksheets	✓	Viva Questions	✓	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component			Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
-	-	-	-	-	-

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

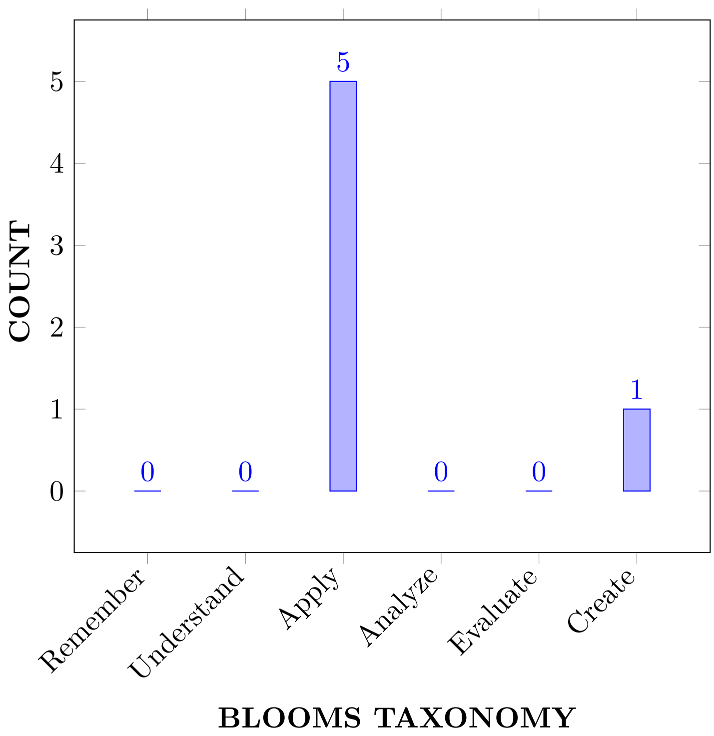
I	The SQL commands for data definition, manipulation, control and perform transactions in database systems.
II	The procedural language for implementation of functions, procedures, cursors and triggers using PL/SQL programs.
III	The logical design of a real time database system with the help of Entity Relationship diagrams.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Demonstrate** database creation and manipulation concepts with the help of SQL queries. .	Apply
CO 2	**Make use of** inbuilt functions of SQL queries to perform data aggregations, subqueries, embedded queries and views.	Apply
CO 3	**Apply** key constraints on database for maintaining integrity and quality of data.	Apply
CO 4	**Demonstrate** normalization by using referential key constraint.	Apply
CO 5	**Implement** PL/SQL programs on procedures, cursors and triggers for enhancing the features of database system to handle exceptions.	Apply
CO 6	**Design** database model with the help of Entity Relationship diagrams for a real time system or scenario.	Create

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	Lab Exercises,CIE,SEE
PO 3	**Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations	3	Lab Exercises,CIE,SEE
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	3	Lab Exercises,CIE,SEE
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	3	Lab Exercises,CIE,SEE
PO 12	**Life-long learning:**Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	2	Lab Exercises,CIE,SEE

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 2	**Problem-Solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.	3	Lab Exercises

3 = High; 2 = Medium; 1 = Low

X JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 2	Demonstrate the use of SQL for database creation and maintenance with **the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation**	3
	PO 3	Demonstrate the use of SQL for database creation and maintenance with the help **of Investigate and define a problem and identify constraints Manage the design process and evaluate outcomes,**	4
	PO 5	Demonstrate the use of SQL for database creation and maintenance **by Understanding of contexts in which engineering knowledge can be applied, understanding use of technical literature, Understanding of appropriate codes of practice and industry standards.**	3
	PSO 2	Demonstrate the use of SQL for database creation and maintenance **by using a set of instructions**	1
CO 2	PO 2	Make Use of SQL queries for data aggregation, calculations, views, sub-queries, embedded queries manipulation with **the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation**	4
	PO 3	Make Use of SQL queries for data aggregation, calculations, views, sub-queries, embedded queries manipulation with the help of **Investigate and define a problem and identify constraints, Manage the design process and evaluate outcomes.**	3
	PO 5	Make Use of SQL queries for data aggregation, calculations, views, sub-queries, embedded queries manipulation **by Understanding of contexts in which engineering knowledge can be applied, understanding use of technical literature, Understanding of appropriate codes of practice and industry standards.**	3
	PO 10	Build strong foundation on SQL queries for career building **by communicating effectively with engineering community.**	2
	PSO 2	Make Use of SQL queries for data aggregation, calculations, views, sub-queries, embedded queries manipulation **by using a set of steps.**	3
CO 3	PO 2	Define the relational data model, its constraints and keys to maintain integrity of data with **the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation**	4

	PO 10	Build strong foundation on relational model and keys **for career building by communicating effectively with engineering community.**	2
CO 4	PO 2	Apply normalization techniques to normalize a database with the **Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation**	4
	PO 3	Apply normalization techniques to normalize a database Investigate and define a problem and identify constraints, understand customer and user needs, Manage the design process and evaluate outcomes, **Investigate and define a problem and identify constraints, understand customer and user needs**Manage the design process and evaluate outcomes	4
	PO 5	Apply normalization techniques to normalize a database **by Understanding of contexts in which engineering knowledge can be applied, Understanding use of technical literature, Understanding of appropriate codes of practice and industry standards.**	3
	PSO 2	Apply normalization techniques to normalize a database **by using sequence of steps**	1
CO 5	PO 2	Define PL/SQL programs on procedures, cursors and triggers for enhancing the features of database system to handle exceptions. **with the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation**	4
CO 6	PO 2	Model the real-world database systems using Entity Relationship Diagrams from the requirement specification **with the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation**	4
	PO 3	Model the real-world database systems using Entity Relationship Diagrams from the requirement specification through **Investigate and define a problem and identify constraints, Understand customer and user needs, Manage the design process and evaluate outcomes.**	4
	PO 5	Model the real- world database systems using Entity Relationship Diagrams from the requirement specification **Understanding of contexts in which engineering knowledge can be applied, Understanding use of technical literature, Understanding of appropriate codes of practice and industry standards.**	3
	PO 12	Build strong foundation on SQL and ER diagrams **for career building by communicating effectively with engineering community.**	2
	PSO 2	Model the real-world database systems using Entity Relationship Diagrams from the requirement specification **by using sequence of steps**	1

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Table 10:

Course Outcomes	Program Outcomes					Program Specific Outcomes
	PO2	PO3	PO5	PO10	PO12	PSO2
CO1	2	3	3			3
CO2	2	3	3	2		3
CO3	2			3		
CO4	2	3	3			2
CO5	2					
CO6	2	3	3		2	3

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	PO 2, PO 3, PO 5	SEE Exams	PO 2,PO 3, PO 5, PO 10,PO 12	Seminars	-
Laboratory Practices	PO 2,PO 3, PO 5	Student Viva	PO 2, PO 3,PO 10	Certification	-
Assignments	-				

XIII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK I	CREATION OF TABLES
	1. Create a table called Employee with the following structure. Name Type Emp no Number E name Varchar2(20) Job Varchar2(20) Mgr Number Sal Number

- Add a column commission with domain to the Employee table
- Insert any five records into the table.
- Update the column details of job
- Rename the column of Employ table using alter command.
- Delete the employee whose empno is19.

2.Create department table with the following structure.

Name Type
Dept no Number
Dept name Varchar2(20)
location Varchar2(20)

- Add column designation to the department table.
- Insert values into the table.
- List the records of emp table grouped by dept no. Update the record where dept no is 9.
- Delete any column data from the table.

3. Create a table called Customer table

Name Type
Cust Name Varchar2(20)
Cust city Varchar2(20)
Cust city Varchar2(20)

- Insert records into the table.
- Add salary column to the table.
- Alter the table column domain.
- Drop salary column of the customer table.
- Delete the rows of customer table whose cust city is hyd.

4. Create a table called branch table.

Name Type
Branch Name Varchar2(20)
Branch city Varchar2(20)
Asserts Number

- Increase the size of data type for asserts to the branch.
- Add and drop a column to the branch table.
- Insert values to the table.
- Update the branch name column
- Delete any two columns from the table

5. Create a table called sailor table

Name Type
S Name Varchar2(20)
Rating Varchar2(20)
Sid Number

- Add column age to the sailor table.
- Insert values into the sailor table.
- Delete the row with rating>8.
- Update the column details of sailor.
- Insert null values into the table.

6. Create a table called reserves table.

Name Type
Boat Id Number
Day Number
Sid Number

- Insert values into the reserves table.
- Add column time to the reserves table.
- Alter the column day data type to date.
- Drop the column time in the table.
- Delete the row of the table with some condition.

WEEK II	**QUERIES USING DDL AND DML**
	1. a. Create a user and grant all permissions to the user. b. Insert the any three records in the employee table and use rollback. Check the result. c. Add primary key constraint and not null constraint to the employee table. d. Insert null values to the employee table and verify the result. **2.** a. Create a user and grant all permissions to the user. b. Insert values in the department table and use commit. c. Add constraints like unique and not null to the department table. d. Insert repeated values and null values into the table. **3.** a. Create a user and grant all permissions to the user. b. Insert values into the table and use commit. c. Delete any three records in the department table and use rollback. d. Add constraint primary key and foreign key to the table. **4.** a. Create a user and grant all permissions to the user. b. Insert records in the sailor table and use commit. c. Add save point after insertion of records and verify savepoint. d. Add constraints not null and primary key to the sailor table. **5.** a. Create a user and grant all permissions to the user. b. Use revoke command to remove user permissions. c. Change password of the user created. d. Add constraint foreign key and not null. **6.** a. Create a user and grant all permissions to the user. b. Update the table reserves and use savepoint and rollback. c. Add constraint primary key , foreign key and not null to the reserves table
WEEK III	**QUERIES USING AGGREGATE FUNCTIONS**
	1. a. By using the group by clause, display the enames who belongs to deptno 10 , whose salary is same as respective departments average salary. b. Display lowest paid employee details under each department. c. Display number of employees working in each department and their department number. d. Using builtin functions, display number of employees working in each department and their department name from dept table. Insert deptname to dept table and insert deptname for each row, do the required thing specified above. e. List all employees which start with either B or C. f. Display only these ename of employees where the maximum salary is greater than or equal to 5000.

	2. a. Calculate the average salary for each different job. b. Show the average salary of each job excluding manager. c. Show the average salary for all departments employing more than three people. d. Display employees who earn more than the lowest salary in department 30 e. Show that value returned by sign (n)function. f. How many days between day of birth to current date. **3.** a. Show that two substring as single string. b. List all employee names, salary and 15% rise in salary. c. Display lowest paid emp details under each manager d. Display the average monthly salary bill for each deptno. e. Show the average salary for all departments employing more than two people. f. By using the group by clause, display the eid who belongs to deptno 05 along with average salary. **4.** a. Count the number of employees in department20 b. Find the minimum salary earned by clerk. c. Find minimum, maximum, average salary of all employees. d. List the minimum and maximum salaries for each job type. e. List the employee names in descending order. f. List the employee id, names in ascending order by empid. **5.** a. Find the sids ,names of sailors who have reserved all boats called "INTERLAKE Find the age of youngest sailor who is eligible to vote for each rating level with at least two such sailors. b. Find the sname , bid and reservation date for each reservation. c. Find the ages of sailors whose name begin and end with B and has at least 3 characters. d. List in alphabetic order all sailors who have reserved red boat. e. Find the age of youngest sailor for each rating level. **6.** a. List the Vendors who have delivered products within 6 months from order date. b. Display the Vendor details who have supplied both Assembled and Subparts. c. Display the Sub parts by grouping the Vendor type (Local or NonLocal). d. Display the Vendor details in ascending order.
WEEK IV	**PROGRAMS ON PL/SQL**
	1. a. Write a PL/SQL program to swap two numbers. b. Write a PL/SQL program to find the largest of three numbers. **2.** a. Write a PL/SQL program to find the total and average of 6 subjects and display the grade. b. Write a PL/SQL program to find the sum of digits in a given number.

	3. a. Write a PL/SQL program to display the number in reverse order. b. Write a PL / SQL program to check whether the given number is prime or not. **4.** a. Write a PL/SQL program to find the factorial of a given number. b. Write a PL/SQL code block to calculate the area of a circle for a value of radius varying from 3 to 7. Store the radius and the corresponding values of calculated area in an empty table named areas, consisting of two columns radius and area. **5.** a. Write a PL/SQL program to accept a string and remove the vowels from the string. (When „hello passed to the program it should display „Hll removing e and o from the world Hello). b. Write a PL/SQL program to accept a number and a divisor. Make sure the divisor is less than or equal to 10. Else display an error message. Otherwise Display the remainder in words.
WEEK V	**PROCEDURES AND FUNCTIONS**
	1. Write a function to accept employee number as parameter and return Basic +HRA together as single column. **2. Accept year as parameter and write a Function to return the total net salary spent for a given year.** **3. Create a function to find the factorial of a given number and hence find NCR.** **4. Write a PL/SQL block o pint prime Fibonacci series using local functions.** **5. Create a procedure to find the lucky number of a given birthdate.** **6. Create function to the reverse of given number.**
WEEK VI	**TRIGGERS**
	1. Create a row level trigger for the customers table that would fire for INSERT or UPDATE or DELETE operations performed on the CUSTOMERS table. This trigger will display the salary difference between the old values and new values: CUSTOMERS table. **2. Creation of insert trigger, delete trigger, update trigger practice triggers using the passenger database. Passenger (Passport id INTEGER PRIMARY KEY, Name VARCHAR (50) Not NULL, Age Integer Not NULL, Sex Char, Address VARCHAR (50) Not NULL);** a. Write a Insert Trigger to check the Passport id is exactly six digits or not. b. Write a trigger on passenger to display messages „1 Record is inserted , „1 record is deleted , „1 record is updated when insertion, deletion and updation are done on passenger respectively.

	3. Insert row in employee table using Triggers. Every trigger is created with name any trigger have same name must be replaced by new name. These triggers can raised before insert, update or delete rows on data base. The main difference between a trigger and a stored procedure is that the former is attached to a table and is only fired when an INSERT, UPDATE or DELETE occurs. **4. Convert employee name into uppercase whenever an employee record is inserted or updated. Trigger to fire before the insert or update.** **5. Trigger before deleting a record from emp table. Trigger will insert the row to be deleted into table called delete emp and also record user who has deleted the record and date and time of delete.** **6. Create a transparent audit system for a table CUST MSTR. The system must keep track of the records that are being deleted or updated**
WEEK VII	**PROCEDURES**
	1. Create the procedure for palindrome of given number. **2. Create the procedure for GCD: Program should load two registers with two Numbers and then apply the logic for GCD of two numbers. GCD of two numbers is performed by dividing the greater number by the smaller number till the remainder is zero. If it is zero, the divisor is the GCD if not the remainder and the divisors of the previous division are the new set of two numbers. The process is repeated by dividing greater of the two numbers by the smaller number till the remainder is zero and GCD is found.** **3. Write the PL/SQL programs to create the procedure for factorial of given number.** **4. Write the PL/SQL programs to create the procedure to find sum of N natural number.** **5. Write the PL/SQL programs to create the procedure to find Fibonacci series.** **6. Write the PL/SQL programs to create the procedure to check the given number is perfect or not.**
WEEK VIII	**CURSORS**
	1. Write a PL/SQL block that will display the name, dept no, salary of fist highest paid employees. **2. Update the balance stock in the item master table each time a transaction takes place in the item transaction table. The change in item master table depends on the item id is already present in the item master then update operation is performed to decrease the balance stock by the quantity specified in the item transaction in case the item id is not present in the item master table then the record is inserted in the item master table.** **3. Write a PL/SQL block that will display the employee details along with salary using cursors.** **4. To write a Cursor to display the list of employees who are working as a Managers or Analyst.**

	5. To write a Cursor to find employee with given job and deptno. **6. Write a PL/SQL block using implicit cursor that will display message, the salaries of all the employees in the „employee table are updated. If none of the employee s salary are updated we get a message 'None of the salaries were updated'. Else we get a message like for example, 'Salaries for 1000 employees are updated' if there are 1000 rows in "employee table.**
WEEK IX	**CASE STUDY: BOOK PUBLISHING COMPANY**
	A publishing company produces scientific books on various subjects. The books are written by authors who specialize in one particular subject. The company employs editors who, not necessarily being specialists in a particular area, each take sole responsibility for editing one or more publications. A publication covers essentially one of the specialist subjects and is normally written by a single author. When writing a particular book, each author works with on editor, but may submit another work for publication to be supervised by other editors. To improve their competitiveness, the company tries to employ a variety of authors, more than one author being a specialist in a particular subject for the above case study, do the following: 1. Analyze the data required. 2. Normalize the attributes. Create the logical data model using E-R diagrams.
WEEK X	**CASE STUDY GENERAL HOSPITAL**
	A General Hospital consists of a number of specialized wards (such as Maternity, Pediatric, Oncology, etc). Each ward hosts a number of patients, who were admitted on the recommendation of their own GP and confirmed by a consultant employed by the Hospital. On admission, the personal details of every patient are recorded. A separate register is to be held to store the information of the tests undertaken and the results of a prescribed treatment. A number of tests may be conducted for each patient. Each patient is assigned to one leading consultant but may be examined by another doctor, if required. Doctors are specialists in some branch of medicine and may be leading consultants for a number of patients, not necessarily from the same ward. For the above case study, do the following. 1. Analyze the data required. 2. Normalize the attributes. 3. Create the logical data model using E-R diagrams.
WEEK XI	**CASE STUDY: CAR RENTAL COMPANY**

	A database is to be designed for a car rental company. The information required includes a description of cars, subcontractors (i.e. garages), company expenditures, company revenues and customers. Cars are to be described by such data as: make, model, year of production, engine size, fuel type, number of passengers, registration number, purchase price, purchase date, rent price and insurance details. It is the company policy not to keep any car for a period exceeding one year. All major repairs and maintenance are done by subcontractors (i.e. franchised garages), with whom CRC has long-term agreements. Therefore the data about garages to be kept in the database includes garage names, addresses, range of services and the like. Some garages require payments immediately after a repair has been made; with others CRC has made arrangements for credit facilities. Company expenditures are to be registered for all outgoings connected with purchases, repairs, maintenance, insurance etc. Similarly the cash inflow coming from all sources: Car hire, car sales, insurance claims must be kept of file. CRC maintains a reasonably stable client base. For this privileged category of customers special credit card facilities are provided. These customers may also book in advance a particular car. These reservations can be made for any period of time up to one month. Casual customers must pay a deposit for an estimated time of rental, unless they wish to pay by credit card. All major credit cards are accepted. Personal details such as name, address, telephone number, driving license, number about each customer are kept in the database. For the above case study, do the following: 1. Analyze the data required. 2. Normalize the attributes.
WEEK XII	**CASE STUDY: STUDENT PROGRESS MONITORING SYSTEM**
	A database is to be designed for a college to monitor students' progress throughout their course of study. The students are reading for a degree (such as BA, BA (Hons) M.Sc., etc) within the framework of the modular system. The college provides a number of modules, each being characterized by its code, title, credit value, module leader, teaching staff and the department they come from. A module is coordinated by a module leader who shares teaching duties with one or more lecturers. A lecturer may teach (and be a module leader for) more than one module. Students are free to choose any module they wish but the following rules must be observed: Some modules require pre- requisites modules and some degree programme have compulsory modules. The database is also to contain some information about students including their numbers, names, addresses, degrees they read for, and their past performance i.e. modules taken and examination results. For the above case study, do the following:

	1. Analyze the data required. 2. Normalize the attributes. 3. Create the logical data model i.e., ER diagrams. 4. Comprehend the data given in the case study by creating respective tables with primary keys and foreign keys wherever required. 5. Insert values into the tables created (Be vigilant about Master- Slave tables). 6. Display the Students who have taken M.Sc course. 7. Display the Module code and Number of Modules taught by each Lecturer. 8. Retrieve the Lecturer names who are not Module Leaders. 9. Display the Department name which offers "English" module. 10. Retrieve the Prerequisite Courses offered by every Department(with department names). 11. Present the Lecturer ID and Name who teaches "Mathematics . 12. Discover the number of years a Module is taught. 13. List out all the Faculties who work for „Statistics Department. 14. List out the number of Modules taught by each Module Leader. 15. List out the number of Modules taught by a particular Lecturer. 16. Create a view which contains the fields of both Department and Module tables. (Hint The fields like Module code, title, credit, Department code and its name). 17. Update the credits of all the prerequisite courses to 5. Delete the Module ":History from the Module table.

TEXTBOOKS

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", Mc raw-Hill, 4th Edition,2002.

2. Ivan Bayross, "SQL, PL/SQL The programming language of oracle", BPB publications, 4th Revised Edition, 2010.

REFERENCE BOOKS:

1. Ramez Elmasri, Shamkant, B. Navathe, "Database Systems", Pearson Education, 6th Edition, 2013.

2. Peter Rob, Carles Coronel, "Database System Concepts", Cengage Learning, 7th Edition, 2008.

3. M L Gillenson, "Introduction to Database Management", Wiley Student Edition,2012.

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Introduction to database management system environments	CO 1	T1:4.1, T2:1.1
2	Creation of tables using DDL and DML commands.	CO 2	T1:4.9,4.11, T2:7
3	Working with integrity constraints	CO 3,CO 4	T1:3, T2:8
4	Working with DCL and TCL commands	CO 1,CO 2	T1:6.6, T2:12
5	Queries using aggregate functions.	CO 3	T1:4.4, T2:10

6	Nested queries using comparison keywords and logical operators.	CO 3	T1:4.6, T2:10
7	Working with Programs on pl/sql.	CO 6	T2:15
8	Working with Procedures.	CO 3,CO 6	T2:18
9	Working with Triggers.	CO 6	T2:18
10	Working with functions.	CO 5	T2:18
11	Working with Cursors.	CO 6	T2:10
12	Case study	CO 7	T1:2, T2:1

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	Implementation of views using SQL.
2	Practical Implementation of assertions using PL/SQL.

Signature of Course Coordinator **HOD,CSE**
Ms B Geetavani, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

INFORMATION TECHNOLOGY

COURSE DESCRIPTION

Course Title	**COMPUTER ORGNANIZATION AND ARCHITECTURE**				
Course Code	**ACSC07**				
Program	B.Tech				
Semester	IV	IT			
Course Type	CORE				
Regulation	IARE - UG-18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Mr. A PRAVEEN, Assistant Professor.				

I COURSE OVERVIEW:

This course intended to provide the structure, internal working and implementation of a computer system. The fundamentals of various functional units of computer, computer instructions, addressing modes, computer arithmetic and logic unit, registers, data transfer, memory and input output system. It focuses on analysis of computer performance and functioning in modern computers.

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AAEB08	II	Programming for Problem Solving
B.Tech	AAEB10	III	Digital System Design

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Computer Architecture	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

C	Power Point Presentations	x	Chalk & Talk	C	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	C	Quiz
C	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with ”either” or ”choice” will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The expected percentage of cognitive level of the questions is broadly based on the criteria given in Table: 1.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
70 %	Understand
20 %	Apply
0 %	Analyze
0 %	Evaluate
0 %	Create

VI COURSE OBJECTIVES:

The students will try to learn:

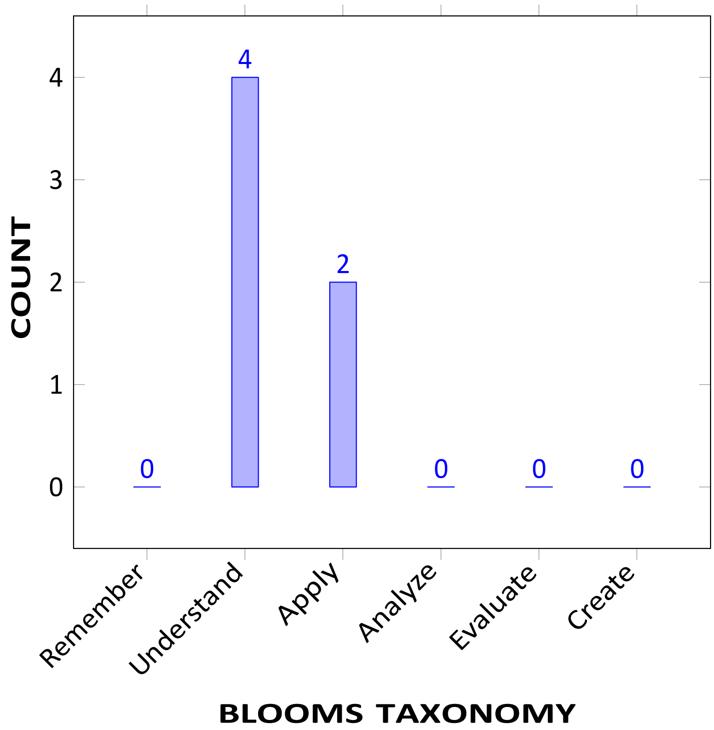
I	The basic concepts of the various functional units and characteristics of computer systems.
II	The concepts of central processing unit design and perform basic operations with signedand unsigned integers in decimal and binary number systems.
III	The function of each element of a memory hierarchy and compare the different methods for computer input and output.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Illustrate** interaction of components in a computer system with functional units and levels of programming languages.	Understand
CO 2	**Demonstrate** the implementation of micro-operations with the help of register transfer language and electronic circuits.	Understand
CO 3	**Identify** appropriate addressing modes for specifying the location of an operand.	Apply
CO 4	**Make use of** number system for data representation and binary arithmetic in digital computers.	Apply
CO 5	**Interpret** the design of hardwired and micro-programmed control unit for execution of micro programs.	Understand
CO 6	**Summarize** the concepts of pipelining and inter process communication for advanced processor design..	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Program Outcomes	
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/Quiz
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	CIE/Quiz
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety,and the cultural, societal, and Environmental considerations	3	CIE/Quiz
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	2	Assignments/ SEE /CIE, QUIZ
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	3	Assignments
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	2	SEE/ CIE, AAT, QUIZ

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	3	CIE/Quiz
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges	2	CIE/Quiz
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in it industry	3	CIE/Quiz

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	C	C	C	-	-	-	-	-	-	-	-		C	C	-
CO 2	C	-	-	-	-	-	-	-	-	-	-	-	C	C	-
CO 3	C	C	C	C	-	-	-	-	-	C	-	-	C	-	-
CO 4	C	C	-	C	-	-	-	-	-	C	-	C	C	-	-
CO 5	C	-	-	-	-	-	-	-	-	C	-	C	C	-	-
CO 6	C	C	-	-	-	-	-	-	-	C	-	C	C	-	-

XII JUSTIFICATIONS FOR CO (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 1	**Demostrate** interaction of components in a computer system with functional units using **knowledge of mathematics, science, engineering fundamentals, and to the solution of complex engineering problems**.	1
	PO 2	**Ilustrate** interaction of components in a computer system with functional units and levels of programming languages by **Identifying complex engineering problems of mathematics, natural sciences, and engineering sciences**	2
	PO 3	**Understand** the interaction of components in a computer system with respect to various functional units **Design solutions for complex Engineering problems that meet the specified needs with appropriate consideration** for the public health and safety,and the cultural, societal, and Environmental considerations	4
	PSO 1	**Make use** components in a computer system in designing next-generation computer systems, **networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools**	1
	PSO 2	**Exibit** interaction of components which enables **Focus on mobile and web applications development and learn the emerging technologies and frameworks** in demand with contemporary challenges.	1
CO 2	PO 1	**Demonstrate** the implementation of micro-operations by using knowledge of mathematics, science, engineering fundamentals, and **provide solution to complex engineering problems**	2
	PSO 1	**Illustrate** the implementation of micro-operations in Designing next-generation computer systems, **networking devices, search engines, soft computing and intelligent systems**, web browsers, and knowledge discovery tools.	1
	PSO 2	**Compare** the implementation of micro-operations with the help of register **transfer language and electronic circuits in development of emerging technologies** and frameworks.	2
CO 3	PO 1	**Explain** various appropriate addressing modes for specifying the location of an operand which uses of **knowledge of mathematics, science, engineering fundamentals, and an engineering specialization** to the solution of complex engineering problems.	2

	PO 2	**Describe** modes for specifying the location of an operand which **analyze complex engineering problems reaching principles of mathematics, natural sciences, and engineering sciences**	2
	PO 3	**Recognize** addressing modes for complex Engineering problems and design system components or processes that meet the specified needs with **appropriate consideration for the public health and safety**,and the cultural, societal, and Environmental consideration.	1
	PO 4	**Summarize** modes for specifying the location of an operand in analysis and interpretation of data, and **synthesis of the information to provide valid conclusions**.	3
	PO 10	**Describe** Addressing modes in effective activities with the engineering community and with society at large, and **make effective presentations, and give and receive clear instructions**	2
	PSO 1	**Define** appropriate addressing modes which are capable for next-generation computer systems, **soft computing and intelligent systems**, web browsers, and knowledge discovery tools.	1
CO 4	PO 1	**Make** use of number system for data representation and binary arithmetic in digital computers by **using knowledge of mathematics, science, engineering fundamentals**, to the solution of complex engineering problems.	3
	PO 12	**Identification** of effective data representation and **binary arithmetic in independent computers and life-long learning** in the broadest context of technological change .	1
	PSO 1	**Explain** number system for data representation next-generation computer systems, **networking devices, search engines, soft computing and intelligent systems**, web browsers, and knowledge discovery tools.	1
CO 5	PO 1	**Illustrate** the design of hardwired and micro-programmed control unit for mathematics, science, **engineering fundamentals, to provide solutions** to complex engineering problems	3
	PO 10	**Design** of hardwired and micro-programmed control unit for execution of micro **programs engineering community in writing effective reports and design documentation, make effective presentations**, and give and receive clear instructions.	2
	PO 12	**Recognize** the need for having the preparation and ability to design of hardwired and micro-programmed control unit for **execution of micro programs which are independent** and life-long learning in the broadest context of technological change	2
	PSO 1	**Illustrate**thedesign of next-generation computer systems, networking devices, search engines,soft computing and intelligent systems, web browsers, and knowledge discovery tools	2

CO 6	PO 1	**Apply** the knowledge of mathematics, science, engineering fundamentals, and an **engineering specialization to the solution of complex engineering problems**	2
	PO 2	**Focus** on mobile and web applications development and learn the emerging technologies and **frameworks in demand with employers and contemporary challenges**	2
	PO 10	**Communicate** effectively on complex engineering activities with the engineering community and with society at large, such as, **being able to comprehend and write effective reports and design documentation, make effective presentations**, and give and receive clear instructions.	2
	PO 12	**Recognize** the need for and having the preparation and ability to engage in**independent and life-long learning in the broadest context** of technological change	2
	PSO 1	**Design** next-generation computer systems, networking devices, search engines, **soft computing and intelligent systems, web browsers, and knowledge discovery tools**	2

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO (PO, PSO) MAPPING:

COURSE OUTCOMES	Program Outcomes/ No. of Key Competencies Matched												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	3	10	10	11	1	5	3	3	12	5	12	12	6	2	2
CO 1	1	2	4	-	-	-	-	-	-	-	-	-	1	1	-
CO 2	2	-	-	-	-	-	-	-	-	-	-	-	1	2	-
CO 3	2	2	1	3	-	-	-	-	-	2	-	2	1	-	-
CO 4	3	6	-	4	-	-	-	-	-	2	-	3	1	-	-
CO 5	1	2	3	3	-	-	-	-	-	2	-	4	1	-	1
CO 6	2	-	-	-	-	-	-	-	-	2	-	4	1	-	1

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO (PO, PSO):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	3	10	10	11	1	5	3	3	12	5	12	12	6	2	2
CO 1	33.4	20	40	-	-	-	-	-	-	-	-	-	16.6	50 -	-
CO 2	66.6	-	-	-	-	-	-	-	-	-	-	-	16.6	100	-

CO 3	66.6	20	10	27.3	-	-	-	-	-	20	-	16.6	16.6	-	-
CO 4	100	60	-	36.4	-	-	-	-	-	20	-	25	16.6	-	-
CO 5	33.4	20	30	27.3	-	-	-	-	-	20	-	33.4	16.6	-	50
CO 6	66.6	-	-	-	-	-	-	-	-	20	-	33.4	16.6	-	50

XV COURSE ARTICULATION MATRIX (PO PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - 0≤ C≤ 5% No correlation
2 - 40 % <C < 60% Moderate
1-5 <C≤ 40% Low/ Slight
3 - 60% ≤ C < 100% Substantial /High

COURSE OUTCOMES	**PROGRAM OUTCOMES**												**PSO'S**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	1	1	2	-	-	-	-	-	-	-	-	-	1	3	-
CO 2	3	-	-	-	-	-	-	-	-	-	-	-	1	3	-
CO 3	3	1	1	1	-	-	-	-	-	1	-	1	1	-	-
CO 4	3	3	-	1	-	-	-	-	-	1	-	1	3	-	-
CO 5	1	1	1	1	-	-	-	-	-	1	-	1	1	-	3
CO 6	3	-	-	-	-	-	-	-	-	1	-	1	1	-	3
TOTAL	14	6	4	3	-	-	-	-	-	4	-	4	7	6	6
AVERAGE	2.3	1.5	2.6	1	-	-	-	-	-	1	-	1	1.17	3	3

XVI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	PO 1,PO 2	SEE Exams	PO 1,PO 2	Seminars	PO 1, PO 2, PO5
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	PO 1, PO 2, PO5	5 Minutes Video	PO 10	Open Ended Experiments	-
Assignments	PO 1, PO 2				

XVII ASSESSMENT METHODOLOGY INDIRECT:

C	Early Semester Feedback	C	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	**INTRODUCTION TO COMPUTER ORGANIZATION**
	Basic computer organization, CPU organization, memory subsystem organization and interfacing, input or output subsystem organization and interfacing, simple computer levels of programming languages, assembly language instructions and a simple instruction set architecture.
MODULE II	**ORGANIZATION OF A COMPUTER**
	Register transfer: Register transfer language, register transfer, bus and memory transfers, arithmetic micro operations, logic micro operations and shift micro operations; Control memory.
MODULE III	**CPU AND COMPUTER ARITHMETIC**
	CPU design: Instruction cycle, data representation, memory reference instructions, input- output, and interrupt, addressing modes, data transfer and manipulation, program control. Computer arithmetic: Addition and subtraction, floating point arithmetic operations, decimal arithmetic unit.
MODULE IV	**INPUT-OUTPUT ORGANIZATION AND MEMORY ORGANIZATION**
	Memory organization: Memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory; Input or output organization: Input or output Interface, asynchronous data transfer, modes of transfer, priority interrupt, direct memory access.
MODULE V	**MULTIPROCESSORS**
	Pipeline: Parallel processing, pipelining-arithmetic pipeline, instruction pipeline; Multiprocessors: Characteristics of multiprocessors, inter connection structures, inter processor arbitration, inter processor communication and synchronization.

TEXTBOOKS

1. M. Morris Mano,Computer Systems Architecture, Pearson, 3rd Edition, 2015.
2. Patterson, Hennessy, Computer Organization and Design- The Hardware Software Interface, Morgan Kaufmann, 5th Edition, 2013.

REFERENCE BOOKS:

1. John. P. Hayes, Computer System Architecture, McGraw-Hill, 3rd Edition, 1998.
2. Carl Hamacher, Zvonko G Vranesic, Safwat G Zaky, Computer Organization, McGraw-Hill, 5th Edition, 2002.
3. William Stallings,Computer Organization and Architecture, Pearson Edition, 8th Edition,2010.

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO - PO Mapping	-	-
CONTENT DELIVERY (THEORY)			
1	Outline the basic computer organization	CO 1	R1:1.1
2	Understand the CPU organization, memory subsystem organization and interfacing	CO 1	R1:1.1
3	Analyze the input or output subsystem organization and interfacing	CO 2	T1:1.2
4	Understand a simple computer levels of programming languages	CO 2	T1:1.2
5	Explain assembly language instructions	CO 3	T1:1.3
6	Determine the simple instruction set architecture	CO 3	T1:1.3
7	Understand the register transfer language, register transfer	CO 4	R1:1.5
8	Analyze bus and memory transfers	CO 4	R1:1.5
9	Explain the arithmetic micro-operations, logic micro-operations, shift micro-operations	CO 4	R1:1.5
10	Understand the control memory	CO 5	T1:3.2
11	Explain the instruction cycle	CO 5	T1:3.2
12	Outline the data representation, memory reference instructions	CO 3	T1:3.5
13	Analyze input-output, and interrupt, addressing modes	CO 3	T1:3.5
14	Discuss the data transfer and manipulation, program control	CO 3	T1:4.3
15	Determine the Addition and subtraction, floating point arithmetic operations, decimal arithmetic unit	CO 3	T1:4.3
16	Need of Input or output organization	CO 8	T1:5.2
17	Discuss the Input or output Interface	CO 3	T1:5.2
18	Understand the asynchronous data transfer, modes of transfer	CO 3	T1:5.2
19	Analyze the priority interrupt, direct memory access	CO 3	T1:5.2
20	internal commerce, supply chain management	CO 3	T1:5.2
21	Understand the memory organization	CO 4	T1:6.2

22	Discuss Memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory	CO 4	T1:6.2
23	Understand the Pipeline: Parallel processing, Instruction pipeline	CO 6	T1:6.5
24	Characteristics of multiprocessors	CO6	T1:6.5
25	Inter connection structures	CO 5	T1:10.2
26	Inter processor arbitration	CO 5	T1:10.2
27	Inter processor communication and synchronization	CO 2	T1:10.2
28	auxiliary memory	CO 2	T1:10.2
29	associative memory	CO 3	T1:10.4
30	cache memory	CO 3	T1:10.4
31	modes of transfer	CO 3	T1:10.4
32	Instruction pipeline	CO 3	T1:10.4
PROBLEM SOLVING/ CASE STUDIES			
1	Perform of particle in cell methods on highly concurrent computational architectures	CO 1	R1:1.5
2	Computer architecture fundamentals and principles of computer design	CO 1	R1:1.5
3	Programmable architecture for quantum computing	CO 1	R1:1.5
4	The new landscape of parallel computer architecture	CO 1	T1:3.2
5	A task-based parallelism and vectorized approach to 3D method of characteristics (MOC) reactor simulation for high performance computing architecture	CO 4	T1:3.2
6	A Heterogeneous Quantum Computer Architecture.	CO 4	T1:3.2
7	Computer aid in solar architecture	CO 4	T1:4.3
8	Electromagnetic physics models for parallel computing architecture.	CO 5	T1:4.3
9	Layered architecture for quantum computing	CO 1	T1:4.3
10	Fault Tolerant Computer Architecture	CO 3	T1:6.2
11	Spatial computing in interactive architecture	CO 1	T1:6.2
12	Self-timed circuitry for global clocking	CO 1	T1:6.2
13	Globally-Asynchronous Locally-Synchronous (GALS) systems	CO 5	T1:6.5
14	Asynchronous circuit and processor design	CO 5	T1:6.5
15	The new landscape of parallel computer architecture	CO 5	T1:6.5
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Define computer.and Define register transfer language.	CO 1	R1:1.5
2	What is data representation?	CO 2	T1:3.2
3	What are second generation computers?	CO 3	T1:5.2
4	What are the characteristics of a system bus?	CO 4,5	T1:6.2,6.5
5	Define the data Processing instruction.	CO 5,6	T1:10.2,4
DISCUSSION OF QUESTION BANK			
1	Define data moment instructions.	CO 1	R1:1.5
2	Explain the micro program control with diagram and give with an example	CO 2	T1:3.2
3	Explain the rules in arithmetic operation on floating point numbers.	CO3	T1:5.2

4	How the mapping process in address sequencing	CO 4,5	T1:6.2,6.5
5	What is data hazard? Explain the methods for dealing with data hazard?	CO 5,6	T1:10.2,4

Signature of Course Coordinator **HOD,IT**
Mr. A PRAVEEN, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**INFORMATION TECHNOLOGY**					
Course Title	**DESIGN AND ANALYSIS OF ALGORITHMS**					
Course Code	AITB05					
Program	B.Tech					
Semester	IV					
Course Type	Core					
Regulation	R-18					
Course Structure	Theory			Practical		
	Lecture	Tutorials	Credits	Laboratory	Credits	
	3	1	4	3	1.5	
Course Coordinator	Dr. M Purushotham Reddy, Associate Professor , IT					

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACS001	I	Computer Programming
B.Tech	ACS002	II	Data Structures

II COURSE OVERVIEW:

The primary objective of this course is to introduce the concept of algorithm as a precise mathematical concept, and study how to design algorithms, establish their correctness, study their efficiency and memory needs. The course consists of a strong mathematical component in addition to the design of various algorithms.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Design And Analysis Of Algorithms	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	x	Chalk & Talk	x	Assignments	x	MOOC
✓	Open Ended Experiments	x	Seminars	x	Mini Project	✓	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIE examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with ”either” or ”choice” will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
70%	Understand
10%	Remember
20%	Apply
0%	Analyze
0%	Evaluate
0%	Create

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 25 marks for Continuous Internal Examination (CIE) and 05 marks for Alternative Assessment Tool (AAT).

Component	Theory		Total Marks
Type of Assessment	CIE Exam	AAT	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 17^{th} week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

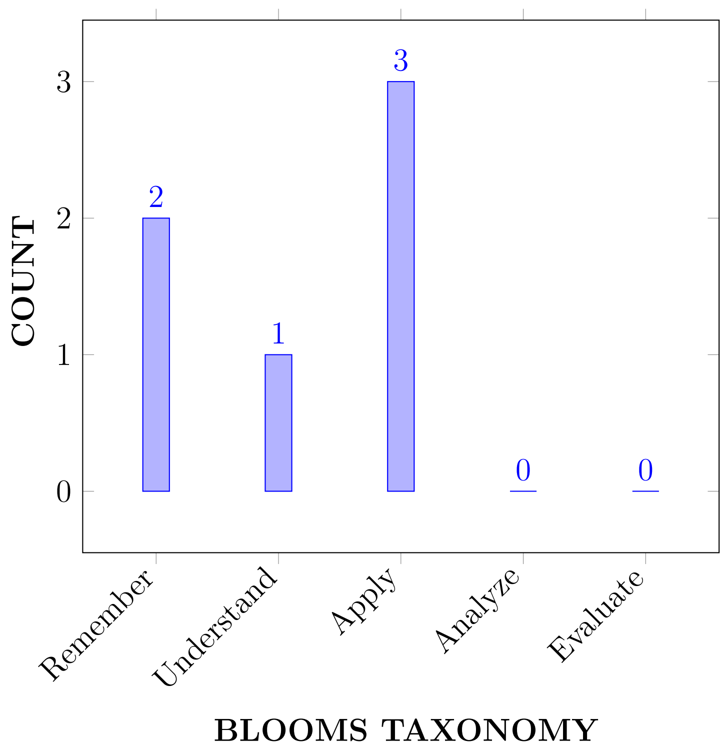
I	Calculate performance of algorithms with respect to time and space complexity.
II	Illustrate the graph traversals and tree traversals to solve the problems
III	Demonstrate the concepts greedy method and dynamic programming for several applications like knapsack problem, job sequencing with deadlines, and optimal binary search tree, TSP.
IV	Illustrating the methods of backtracking and branch bound techniques to solve the problems like n-queens problem, graph colouring and TSP respectively

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Find** the (worst case, randomized, amortized) running time and space complexity of given algorithms using techniques such as recurrences and properties of probability.	Remember
CO 2	**Apply** divide and conquer algorithms for solving sorting, searching and matrix multiplication.	Apply
CO 3	**Make Use of** appropriate tree traversal techniques for finding shortest path.	Apply
CO 4	**Identify** suitable problem solving techniques for a given problem and finding optimized solutions using Greedy and Dynamic Programming techniques	Remember
CO 5	**Utilize** backtracking and branch and bound techniques to deal with traceable and in-traceable problems.	Apply
CO 6	**Describe** the classes P, NP, NP-Hard, NP-complete for solving deterministic and non deterministic problems.	Under-stand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations

Program Outcomes	
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/SEE
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	1	SEE/AAT

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	1	CIE/SEE/AAT
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	1	AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools	2	SEE/AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	-	-	-	-	-	-	-		✓	-	-
CO 2	✓	✓	-	-	-	-	-	-	-	-	-	-	✓	-	-
CO 3	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	✓	✓	✓	-	-	-	-	-	-	-	-	✓	-	-	-
CO 5	✓	-	-	✓	-	-	-	-	-	-	-	✓	-	-	-
CO 6	✓	-	-	✓	-	-	-	-	-	-	-	✓	✓	-	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Analyze the running time and space complexity of given algorithms using techniques such as recurrences, potential functions, properties of probability by applying the **mathematical principles, engineering principles and scientific principles**	3

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO1	Understand the basic properties of asymptotic notations, probability analysis for designing **algorithms, system software and Networking.**	3
CO 2	PO 1	Apply divide and conquer algorithms for solving sorting, searching and matrix multiplication problems to integrate **mathematical principles, engineering Principles,** and **Scientific Principles.**	3
	PO 2	Understand the given **problem** and **develop the solution** for solving sorting, searching and matrix multiplication problems **complex engineering problems** and **Interpretation of results.**	4
	PSO1	Build divide and conquer algorithms for solving sorting, searching, **Big data** analysis and matrix multiplication problems through **system software.**	2
CO 3	PO 1	Utilize appropriate tree traversal techniques for solving graph problems to integrate **mathematical principles, scientific Methodology, and engineering principles.**	3
	PO 2	Understand the given **problem** traversal techniques to **develop the solution** for graph problems **complex engineering problems and interpretation of results.**	4
CO 4	PO 1	Choose (Pick) greedy algorithms for finding solutions of minimization and maximization problems to support study of their own **engineering discipline and methodologies.**	2
	PO 2	Understand the given **problem** and **develop the solution** using greedy methods in reaching substantiated conclusions from the provided **problem identification, information, interpret of results, complex engineering problems** and **Experimental design.**	7
	PO 3	Select appropriate technique from the greedy techniques for given problem and **apply** chosen method for finding the solutions of given problem **define problem, Evaluate outcomes, innovative solutions, engineering activities** and**engineering processes**	7
	PO 12	make use of greedy and dynamic programming techniques for **beginning works on advances degree, current trends in computer science, efforts for personal continue education** ,personal development and **on going learning.**	4

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 5	PO 1	Identify backtracking and branch and bound techniques to compact with traceable and in -traceable problems by applying the knowledge of **mathematics, Engineering fundamentals** and to find the solution of **complex engineering problems.**	3
	PO 4	Understand the given set of problems from the **provided information, to identify, classify** and describe the **performance of systems** approach and textbfengineering problems and principles.	6
	PO 12	Utilize branch and bound techniques to learn for solving problems in**current trends of computer science, on going learning, continuum education,** beginning works for **advance degree** and personal development.	4
CO 6	PO 1	Understanding the concepts of classes P, NP, NP-Hard, NP- complete for solving deterministic and non-deterministic problems in attainment of mathematical **principles, engineering methodologies and scientific principles.**	3
	PO 4	Identify the given complex problem and choose the deterministic algorithms for solving the given decision problems from the **provided information** in accomplishment of **engineering problems, performance of systems, to identify , classify and principles.**	6
	PO 12	Describe P,NP,NP-Hard, NP-complete for solving deterministic and non deterministic problems which are useful for **personal development**, on going learning ,**continuum education** and **current trends in computer science.**	3
	PSO 1	Understand the basic properties of deterministic algorithms in the areas related to **computer programs, Big data, Machine Learning and Networking.**	3

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO 2	3	4	-	-	-	-	-	-	-	-	-	-	2	-	-
CO 3	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	2	7	7	-		-	-	-	-	-	-	4	-	-	-

CO 5	3	-	-	6	-	-	-	-	-	-	-	4	-	-	-
CO 6	3	-	-	6	-	-	-	-	-	-	-	3	3	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	100	-	-	-	-	-	-	-	-	-	-		50.0	-	-
CO 2	100	40	-	-	-	-	-	-	-	-	-	-	33.33	-	-
CO 3	100	40	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	100	70	70	-		-	-	-	-	-	-	50.0	100	100	-
CO 5	100	-	-	54.54	-	-	-	-	-	-	-	50.0	-	-	-
CO 6	100	-	-	54.54	-	-	-	-	-	-	-	37.5	50.0	-	-

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation

1 -5 $<C \leq 40\%$ – Low/ Slight

2 - 40 % $<C < 60\%$ –Moderate

3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO 2	3	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO 3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	3	3	3	-	-	-	-	-	-	-	-	2	-	-	-
CO 5	3	-	-	2	-	-	-	-	-	-	-	2	-	-	-
CO 6	3	-	-	2	-	-	-	-	-	-	-	1	2	-	-
TOTAL	18	7	3	4	-	-	-	-	-	-	-	5	5	-	-
AVER- AGE	3.0	2.3	1.0	1.0	-	-	-	-	-	-	-	1.7	1.7	-	-

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	PO 1, PO 2, PO 3,PO 4	SEE Exams	PO 1, PO 2, PO 3,PO 4	Seminars	PO 2
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	PO 4	Open Ended Experiments	-
Assignments	PO1				

XVII ASSESSMENT METHODOLOGY-INDIRECT:

x	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**INTRODUCTION**
	Algorithm: Pseudo code for expressing algorithms; Performance analysis: Space complexity, time complexity; Asymptotic notations: Big O notation, omega notation, theta notation and little o notation, amortized complexity; Divide and Conquer: General method, binary search, quick sort, merge sort, Strassen's matrix multiplication.
MODULE II	**SEARCHING AND TRAVERSAL TECHNIQUES**
	Disjoint set operations, union and find algorithms; Efficient non recursive binary tree traversal algorithms, spanning trees; Graph traversals: Breadth first search, depth first search, connected components, bi-connected components.
MODULE III	**GREEDY METHOD AND DYNAMIC PROGRAMMING**
	Greedy method: The general method, job sequencing with deadlines, knapsack problem, minimum cost spanning trees, single source shortest paths. Dynamic programming: The general method, matrix chain multiplication optimal binary search trees, 0/1 knapsack problem, single source shortest paths, all pairs shortest paths problem, the travelling salesperson problem.
MODULE IV	**BACKTRACKING AND BRANCH AND BOUND**
	Backtracking: The general method, the 8 queens problem, sum of subsets problem, graph coloring, Hamiltonian cycles; Branch and bound: The general method, 0/1 knapsack problem, least cost branch and bound solution, first in first out branch and bound solution, travelling salesperson problem.
MODULE V	**NP-HARD AND NP-COMPLETE PROBLEM**
	Basic concepts: Non-deterministic algorithms, the classes NP - Hard and NP, NP Hard problems, clique decision problem, chromatic number decision problem, Cook's theorem.

TEXTBOOKS

1. Ellis Horowitz, Satraj Sahni, Sanguthevar Rajasekharan, Fundamentals of Computer Algorithms, Universities Press, 2nd Edition, 2015.
2. Alfred V. Aho, John E. Hopcroft, Jeffrey D, The Design And Analysis Of Computer Algorithms, Pearson India, 1st Edition, 2013.

REFERENCE BOOKS:

1. Levitin A, Introduction to the Design and Analysis of Algorithms, Pearson Education, 3rd Edition, 2012.
2. Goodrich, M. T. R Tamassia, Algorithm Design Foundations Analysis and Internet Examples, John Wileyn and Sons, 1st Edition, 2001.
3. Base Sara Allen Vangelder, Computer Algorithms Introduction to Design and Analysis, Pearson, 3rd Edition, 1999.

WEB REFERENCES:

1. https://www.coursera.org/learn/algorithm-design-analysis

2. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms
3. http://www.facweb.iitkgp.ernet.in/sourav/daa.html

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO - PO Mapping	-	
CONTENT DELIVERY (THEORY)			
2	Introduction: Algorithm, Pseudo code for expressing algorithms, Performance Analysis- Space complexity, Time complexity.	CO 1	T1:1.1-1.3.2
3	Asymptotic Notation-Big oh notation, Omega notation, Theta notation and Little oh notation	CO 1	T1:1.3.3
4	Amortized complexity.	CO 1	T2:2.3
5	Divide and conquer: General method.	CO 2	T1:3.1
6	Divide and conquer: Binary search, Quick sort	CO 2	T1:3.2-3.5
7	Divide and conquer: Merge sort, Strassen'smatrix multiplication.	CO 2	T1:3.4-3.7
8	Disjoint set operations.,	CO 3	T1:2.5
9	Union and find algorithms.	CO 1	T1:2.5.2
10	Non-recursive binary tree traversal algorithms,	CO 3	T1:6.1
11	Spanning tree.	CO 3	T1:6.3
12	Graph traversals: Breadth first search.	CO 3	T1:6.2.1
13	Graph traversals:Depth first search.	CO 3	T1:62.2
14	Connected components, Bi-connected components.	CO 3	T1:6.3-6.4
15	Greedy general method.	CO 4	T1:4.1
16	Greedy method: Job sequencing with deadlines.	CO 4	T1:4.4
17	Greedy method: 0/1 knapsack problem, Minimum cost spanning trees.	CO 4	T1:4.2-4.5
18	Greedy method: Single source shortest path problem	CO 4	T1:4.8
19	Dynamic Programming: General method.	CO 4	T1:5.1
20	Dynamic Programming: Matrix chain multiplication.	CO 4	T1:5.2
21	aDynamic Programming: Optimal binary search trees.	CO 4	T1:5.5
22	Dynamic Programming:0/1 knapsack problem.	CO 4	T1:5.7
23	Dynamic Programming:All pairs shortest path problem.	CO 4	T1:5.5
24	Dynamic Programming: Single source shortest path problem.	CO 4	T1:5.4

25	Dynamic Programming: Travelling sales person problem.	CO 4	T1:5.9
26	Backtracking: General method.	CO 5	T1:7.1
27	Backtracking: 8-queens problem.	CO 5	T1:7.2
28	Backtracking: Sum of subsets problem.,	CO 5	T1:7.3
29	Backtracking: Graph coloring	CO 5	T1:7.4
30	Backtracking :Hamiltonian cycles	CO 5	T1:7.5
31	Branch and Bound: General method.	CO 5	T1:8.1
32	Branch and Bound :0/1 knapsack problem	CO 5	T1:8.2
33	Branch and Bound: Least Cost Branch and Bound.	CO 5	T1:8.2.1
34	Branch and Bound: FIFO Branch and Bound.	CO 5	T1:8.2.2
35	Branch and Bound :Travelling sales person problem	CO 5	T1:8.3
36	NP-Hard and NP-Complete problems: Basic concepts.	CO 6	T1:11.1
37	Non-deterministic algorithms.	CO 6	T1:11.1.1
38	The classes NP -Hard and NP, NP Hard	CO 6	T1:11.1.2
39	Clique decision problem	CO 6	T1:11.3.1
40	Chromatic number decision problem.	CO 6	T1:11.3.3
41	Cook's theorem.	CO 6	T1:11.2
PROBLEM SOLVING/ CASE STUDIES			
42	Write a program to implement quick sort.	CO 2	T1:3.5
43	Write a program to implement Merge sort	CO 2	T1:3.4
44	Write a program to implement Warshall's algorithm	CO 3	t1:3.5.5
45	Write a program to implement Knapsack Problem	CO 4	T1:4.2
46	Write a program to implement Graph Traversals	CO 4	T1:6.2
47	Write a program to implement Shortest Paths Algorithm	CO 4	T1:5.3
47	Write a program to implement Minimum Cost Spanning Tree	CO 4	T1:4.5
48	Write a program to implement Tree Travesrsals	CO 4	T1:6.1
49	Write a program to implement Sum Of Sub Sets Problem	CO 5	T1:7.3
50	Write a program to implement Travelling Sales Person Problem	CO 5	T1:5.9
51	Write a program to implement Minimum Cost Spanning Tree	CO 5	T1:4.5
52	Write a program to implement All Pairs Shortest Paths	CO 5	T1:5.3
53	Write a program to implement N Queens Problem	CO 5	T1:7.2
DISCUSSION OF DEFINITION AND TERMINOLOGY			
54	Discuss definitions and terminology on introduction to algorithms, divide and conquer.	CO 1,2	T1:3.0
55	Discuss definitions and terminology on greedy method.	CO 1,2, 3	T:4.0
56	Discuss definitions and terminology on dynamic programming.	CO 4	T:5.0
57	Discuss definitions and terminology on bracktracking, branch and bound.	CO 5	T1:7-8
58	Discuss definitions and terminology on NP-Hard and NP-Complete.	CO 6	T1:11.0

DISCUSSION OF QUESTION BANK			
59	Discuss questions on introduction to algorithms, divide and conquer.	CO 1,2	T1:3.0
60	Discuss questions on greedy algorithm, dynamic programming.	CO 4	T1:3,4
61	Discuss questions on bracktracking, branch and bound and NP-hard and NP-Complete.	CO 5,6	T1:7,8,11

Signature of Course Coordinator **HOD,IT**

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

INFORMATION TECHNOLOGY
COURSE DESCRIPTION

<table>
<tr><td>Course Title</td><td colspan="5">DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY</td></tr>
<tr><td>Course Code</td><td colspan="5">AITB07</td></tr>
<tr><td>Program</td><td colspan="5">B.Tech</td></tr>
<tr><td>Semester</td><td>IV</td><td colspan="4">IT</td></tr>
<tr><td>Course Type</td><td>Core</td><td colspan="4"></td></tr>
<tr><td>Regulation</td><td>IARE - R18</td><td colspan="4"></td></tr>
<tr><td rowspan="3">Course Structure</td><td colspan="3">Theory</td><td colspan="2">Practical</td></tr>
<tr><td>Lecture</td><td>Tutorials</td><td>Credits</td><td>Laboratory</td><td>Credits</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>3</td><td>2</td></tr>
<tr><td>Course Coordinator</td><td colspan="5">Dr. M Purushotham Reddy, Associate Professor , IT</td></tr>
</table>

I COURSE OVERVIEW:

Design and analysis of algorithm lab provides hands on experience in implementing different algorithmic paradigms and develops competence in choosing appropriate data structure to improve efficiency of technique used. This laboratory implements sorting techniques using divide and conquer strategy, shortest distance algorithms based on Greedy, Dynamic programming techniques, Minimum spanning tree construction and applications of Back tracking , Branch and Bound. This is essential for developing software in areas Information storage and retrieval, Transportation through networks, Graph theory and Optimization problems.

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSB01	II	Programming for Problem Solving
B.Tech	ACSB03	IV	Data Structures

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Design And Analysis Of Algorithms Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Demo Video	✓	Lab Worksheets	✓	Viva Questions	✓	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component			Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
-	-	-	-	-	-

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

I	The selection of Algorithmic technique and Data structures required for efficient development of technical and engineering applications.
II	The algorithmic design paradigms and methods for identifying solutions of optimization problems..

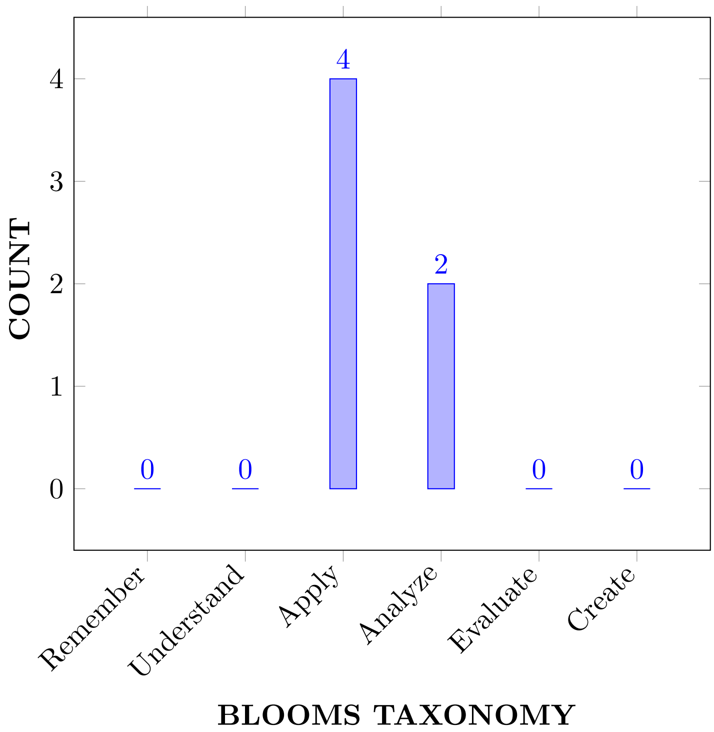
III	Implementation of different algorithms for the similar problems to compare their performance.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Apply** Divide and conquer strategy to organize the data in ascending or descending order. .	Apply
CO 2	**Make use of** Algorithmic Design paradigms to determine shortest distance and transitive closure of Directed or Undirected Graphs.	Apply
CO 3	**Utilize** Greedy Technique or principle of Optimality for finding solutions to optimization problems.	Analyze
CO 4	**Compare** the efficiencies of traversal problems using different Tree and Graph traversal algorithms.	Apply
CO 5	**Utilize** Backtracking method for solving Puzzles involving building solutions incrementally.	Analyze
CO 6	**Examine** Branch and Bound Approach for solving Combinatorial optimization problems.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	Lab Exercises,CIE,SEE
PO 3	**Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations	2	Lab Exercises,CIE,SEE
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	3	Lab Exercises,CIE,SEE
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	3	Lab Exercises,CIE,SEE
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	3	Lab Exercises,CIE,SEE
PO 8	**Ethics** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	3	Lab Exercises,CIE,SEE
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	1	Lab Exercises,CIE,SEE
PO 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	1	Lab Exercises,CIE,SEE

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	3	Lab Exercises
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	3	Lab Exercises
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	3	Lab Exercises

3 = High; 2 = Medium; 1 = Low

X JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 2	Demonstrate the use of divide and conquer strategy for arranging data in sorted order with the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation and interpret the results.	4
	PO 3	Demonstrate the use of sorting techniques and analyze time and space complexities with the help of Investigate and define a problem and identify constraints Manage the design process and evaluate outcomes and use in engineering application.	1
	PO 5	Translate the algorithm into python code by using its Libraries and modules	1
	PO 6	Apply Divide and conquer strategy to organize the data in ascending or descending order,Knowledge and understanding of commercial and economic context of engineering processes	1
	PO 7	Apply Divide and conquer strategy to organize the data in ascending or descending order,impact of the professional Engineering solutions	1
	PO 8	Apply Divide and conquer strategy to organize the data in ascending or descending order,evaluates the ethical dimensions of professional practice,	1

	PO 10	Apply Divide and conquer strategy to organize the data in ascending or descending order	1
	PO 12	Apply Divide and conquer strategy to organize the data in ascending or descending order	1
	PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools	2
CO 2	PO 2	Make Use of Dynamic programming for solving shortest distance problems with the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation and solution development.	4
	PO 3	Make Use of Dynamic Programming for shortest distance problems and substructure generation with the help of Investigate and define a problem and identify constraints, Manage the design process and evaluate outcomes and find innovative solutions	4
	PO 5	Make Use of DP for implementing Shortest distance algorithms and optimal substructure identifications by Understanding of contexts in which engineering knowledge can be applied, understanding use of technical literature, Understanding of appropriate codes of practice and industry standards.	1
	PO 6	Make use of Algorithmic Design paradigms to determine shortest distance and transitive closure of Directed or Undirected Graphs,Knowledge and understanding of commercial	1
	PO 7	Make use of Algorithmic Design paradigms to determine shortest distance and transitive closure of Directed or Undirected Graphs,Impact of the professional Engineering solutions	1
	PO 8	Make use of Algorithmic Design paradigms to determine shortest distance and transitive closure of Directed or Undirected Graphs, knowledge of professional codes of ethics	1
	PO 10	Build strong foundation on Dynamic Programming for career building by communicating effectively with engineering community about optimal solutions.	4
	PO 12	Make use of Algorithmic Design paradigms to determine shortest distance and transitive closure of Directed or Undirected Graphs,Personal continuing education efforts,Continued personal development.	3
	PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools	3

CO 3	PO 2	Make Use Greedy Technique or principle of Optimality for for finding solutions to optimization problems with the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation and solution development.	4
	PO 3	Make Use of Greedy Technique or principle of Optimality for for finding solutions to optimization problems with the help of Investigate and define a problem and identify constraints, Manage the design process and evaluate outcomes and find innovative solutions	7
	PO 4	Utilize Greedy Technique,technical uncertainty, industry standards, principle of Optimality for finding solutions to optimization problems,Understanding of appropriate codes	6
	PO 5	Make Use of Greedy Technique or principle of Optimality for for finding solutions to optimization problem identifications by Understanding of contexts in which engineering knowledge can be applied, understanding use of technical literature, Understanding of appropriate codes of practice and industry standards.	1
	PO 6	Utilize Greedy Technique or principle of Optimality for finding solutions to optimization problems,knowledge and understanding of commercial	1
	PO 7	Utilize Greedy Technique or principle of Optimality for finding solutions to optimization problems,impact of the professional Engineering solutions	1
	PO 8	Utilize Greedy Technique or principle of Optimality for finding solutions to optimization problems,knowledge of professional codes of ethics	1
	PO 10	Utilize Greedy Technique or principle of Optimality for finding solutions to optimization problems,Clarity,Grammar,Subject Matter,References	4
	PO 12	Utilize Greedy Technique or principle of Optimality for finding solutions to optimization problems,Personal continuing education ,efforts Ongoing learning,Continued personal development.	3
	PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools	4
	PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	1
	PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	2

CO 4	PO 2	Make Use of recursive and non recursive algorithms for comparing traversal techniques of graph and tree with the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation and solution development.	4
	PO 3	Make Use recursive and non recursive algorithms for comparing tree and graph traversal techniques with the help of Investigate and define a problem and identify constraints, Manage the design process and evaluate outcomes and find innovative solutions	7
	PO 5	Compare the efficiencies of traversal problems using different Tree and Graph traversal algorithms	1
	PO 6	Compare the efficiencies of traversal problems using different Tree and Graph traversal algorithms	1
	PO 7	Compare the efficiencies of traversal problems using different Tree and Graph traversal algorithms	1
	PO 8	Compare the efficiencies of traversal problems using different Tree and Graph traversal algorithms	1
	PO 10	Compare the efficiencies of traversal problems using different Tree and Graph traversal algorithms	4
	PO 12	Compare the efficiencies of traversal problems using different Tree and Graph traversal algorithms	3
	PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers,and knowledge discovery tools	3
	PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	1
CO 5	PO 2	Apply Back Tracking for developing solutions to puzzles with the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation and solution development.	4
	PO 3	Apply Back Tracking for developing solutions to puzzles with the help of Investigate and define a problem and identify constraints, Manage the design process and evaluate outcomes and find innovative solutions	7
	PO 4	Utilize Backtracking method,technical uncertainty, industry standards, principle of Optimality involving building solutions incrementally to optimization problems,Understanding of appropriate codes	6
	PO 5	Apply Back Tracking for developing solutions to puzzles by Understanding of contexts in which engineering knowledge can be applied, understanding use of technical literature, Understanding of appropriate codes of practice and industry standards.	1

	PO 6	Utilize Backtracking method for solving Puzzles involving building solutions incrementally,Knowledge and understanding of commercial	1
	PO 7	Utilize Backtracking method for solving Puzzles involving building solutions incrementally,impact of the professional Engineering solutions	1
	PO 8	Utilize Backtracking method for solving Puzzles involving building solutions incrementally, evaluates the ethical dimensions of professional practice	1
	PO 10	Build strong foundation on Back tracking for by communicating effectively with engineering community about games development.	4
	PO 12	Build strong foundation on Back tracking for career building in software development for games and puzzles	3
	PSO1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers,and knowledge discovery tools	4
	PSO2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	1
	PSO3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	2
CO 6	PO 2	Make Use of Branch and Bound for solving Optimal problems with the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation and solution development.	4
	PO 3	Make Use of Branch and Bound for solving Optimal problems with the help of Investigate and define a problem and identify constraints, Manage the design process and evaluate outcomes and find innovative solutions	7
	PO 4	Examine Branch and Bound Approach,technical uncertainty, industry standards, principle of Optimality for finding solutions to optimization problems,Understanding of appropriate codes	6
	PO 5	Make Use of Branch and Bound for solving Optimal problems by Understanding of contexts in which engineering knowledge can be applied, understanding use of technical literature, Understanding of appropriate codes of practice and industry standards.	1
	PO 6	Utilize Greedy Technique or principle of Optimality for finding solutions to optimization problems,Knowledge and understanding of commercial	1
	PO 7	Utilize Greedy Technique or principle of Optimality for finding solutions to optimization problems	1

	PO 8	Utilize Greedy Technique or principle of Optimality for finding solutions to optimization problems, evaluates the ethical dimensions of professional practice	1
	PO 10	Build strong foundation on Branch and bound for career building by communicating effectively with engineering community about optimal solutions related to state space.	4
	PO 12	Utilize Greedy Technique for career building in software development for games and puzzles and optimal solutions	3
	PSO1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers,and knowledge discovery tools	4
	PSO3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	1

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	2	1	-	1	1	2	2	-	3	-	2	1	-	-
CO 2	-	2	2	-	2	1	2	2	-	3	-	2	2	-	-
CO 3	-	2	3	2	3	1	2	2	-	3	-	2	3	2	2
CO 4	-	2	3	-	2	1	2	2	-	3	-	2	2	2	-
CO 5	-	2	3	2	3	1	2	2	-	3	-	2	3	2	2
CO 6	-	2	3	2	3	1	2	2	-	3	-	2	3	-	1

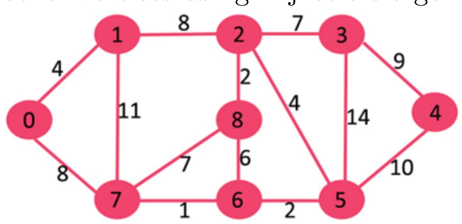
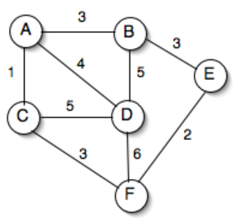
XII ASSESSMENT METHODOLOGY DIRECT:

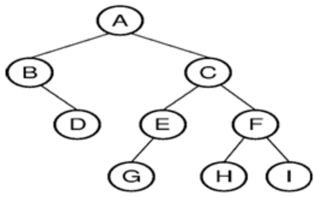
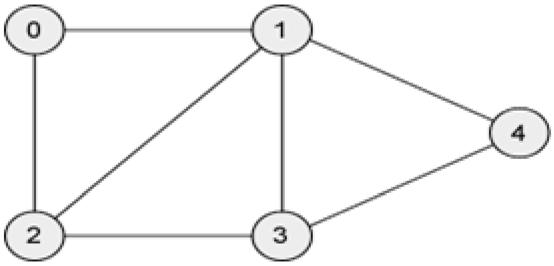
CIE Exams	PO 2, PO 3, PO 5	SEE Exams	PO 2,PO 3, PO 5	Seminars	-
Laboratory Practices	PO 2,PO 3, PO 5	Student Viva	PO 2, PO 3	Certification	-
Assignments	-				

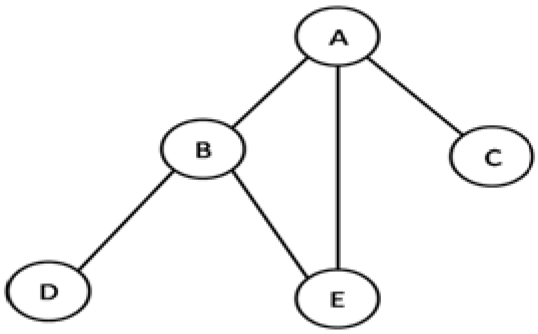
XIII ASSESSMENT METHODOLOGY INDIRECT:

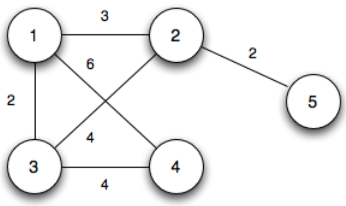
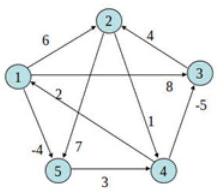
✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK I	**QUICK SORT**
	Sort a given set of elements using the quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the 1st to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
WEEK II	**MERGE SORT**
	Implement merge sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
WEEK III	**KNAPSACK PROBLEM**
	Implement 0/1 Knapsack problem using Dynamic Programming
WEEK IV	**SHORTEST PATHS ALGORITHM**
	From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm. 2. 
WEEK V	**MINIMUM COST SPANNING TREE**
	Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm. 
WEEK VI	**TREE TRAVESRSALS**

<table>
<tr><td></td><td>Perform various tree traversal algorithms for a given tree

</td></tr>
<tr><td>WEEK VII</td><td>GRAPH TRAVERSALS</td></tr>
<tr><td></td><td>a. Print all the nodes reachable from a given starting node in a digraph using BFS method.


b. Check whether a given graph is connected or not using DFS method

</td></tr>
<tr><td>WEEK VIII</td><td>SUM OF SUB SETS PROBLEM</td></tr>
<tr><td></td><td>Find a subset of a given set S = sl, s2,.....,sn of n positive integers whose sum is equal to a given positive integer d. For example, if S= 1, 2, 5, 6, 8 and d = 9 there are two solutions 1, 2, 6 and 1,8.A suitable message is to be displayed if the given problem instance doesn't have a solution.</td></tr>
</table>

WEEK IX	**TRAVELLING SALES PERSON PROBLEM**
	Implement any scheme to find the optimal solution for the Traveling Sales Person problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.
WEEK X	**MINIMUM COST SPANNING TREE**
	Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm 
WEEK XI	**ALL PAIRS SHORTEST PATHS**
	Implement All-Pairs Shortest Paths Problem using Floyd's algorithm.  $\begin{array}{c\|ccccc} & 1 & 2 & 3 & 4 & 5 \\ \hline 1 & 0 & 6 & 8 & \infty & -4 \\ 2 & \infty & 0 & \infty & 1 & 7 \\ 3 & \infty & 4 & 0 & \infty & \infty \\ 4 & 2 & \infty & -5 & 0 & \infty \\ 5 & \infty & \infty & \infty & 3 & 0 \end{array}$
WEEK XII	**N QUEENS PROBLEM**
	Implement N Queen's problem using Back Tracking.

REFERENCE BOOKS

1. 1. Levitin A, "Introduction to the Design and Analysis of Algorithms", Pearson Education, 2008.

2. Goodrich, M.T. R Tomassia, "Algorithm Design foundations Analysis and Internet Examples", John Wiley and Sons, 2006.

3. Base Sara, Allen Van Gelder, "Computer Algorithms Introduction to Design and Analysis", Pearson, 3rd Edition, 1999

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

Week No.	Topics to be covered	Course Out-comes	Reference
1. 1	Quick Sort	CO 1	T1:4.1, T2:1.1
2. 2	Merge Sort	CO 1	T1:4.9,4.11, T2:7
3.	KnapSack Problems	CO 3	T1:6.6, T2:12
4.	Shortest distance using Dijkstra's algorithm	CO 3	T1:4.4, T2:10
5.	Minimum spanning tree using Kruskal's algorithm	CO 3	T1:4.6, T2:10
6.	Tree Traversal Techniques using Non recursive techniques	CO 4	T2:15
7.	Graph Traversal Techniques	CO 4	T2:18
8.	Sum of Subsets using DP	CO 3	T2:18
9.	Travelling salesman Problem	CO 3	T2:18
10.	Minimum spanning tree using Prims algorithm	CO 3	T2:10
11.	All Pairs Shortest Paths – Floyd Algorithms	CO 6	T1:2, T2:1
12.	N Queen Problem	CO 5	T1:2, T2:1

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	Implementation of Optimization problems using Branch and Bound.
2	Practical Implementation of Games and Puzzles using Back Tracking

Signature of Course Coordinator **HOD,IT**
Dr. M Purushotham Reddy, Associate Professor , IT

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

INFORMATION TECHNOLOGY

COURSE DESCRIPTION

Course Title	**DATABASE MANAGEMENT SYSTEMS LABORATORY**					
Course Code	ACSB09					
Program	B.Tech					
Semester	IV	IT				
Course Type	Core					
Regulation	IARE - R18					
Course Structure	Theory			Practical		
	Lecture	Tutorials	Credits	Laboratory	Credits	
	-	-	-	3	1.5	
Course Coordinator	Mr.U.Shivaji, Assistant Professor					

I COURSE OVERVIEW:

This Laboratory course introduces the query language for design and development of a database by using various software's such as SQL, ORACLE, and MS – Access etc. It provides practice on built-in SQL functions using languages like DDL, DCL, DML and TCL to create and manage database systems and perform Set operations, Sub Queries, Joins; and PL/SQL programs to implement Exceptions, Cursors, Stored Functions, Views, Sequences, Locks and Triggers. This is essential for mobile and web application development for business, scientific and engineering applications.

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSB03	III	Data Structures

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Database Management Systems Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

C	Demo Video	C	Lab Worksheets	C	Viva Questions	C	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component			Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. Experiment Based

Objective	Analysis	Design	Conclusion	Viva	Total
-	-	-	-	-	-

2. Programming Based

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

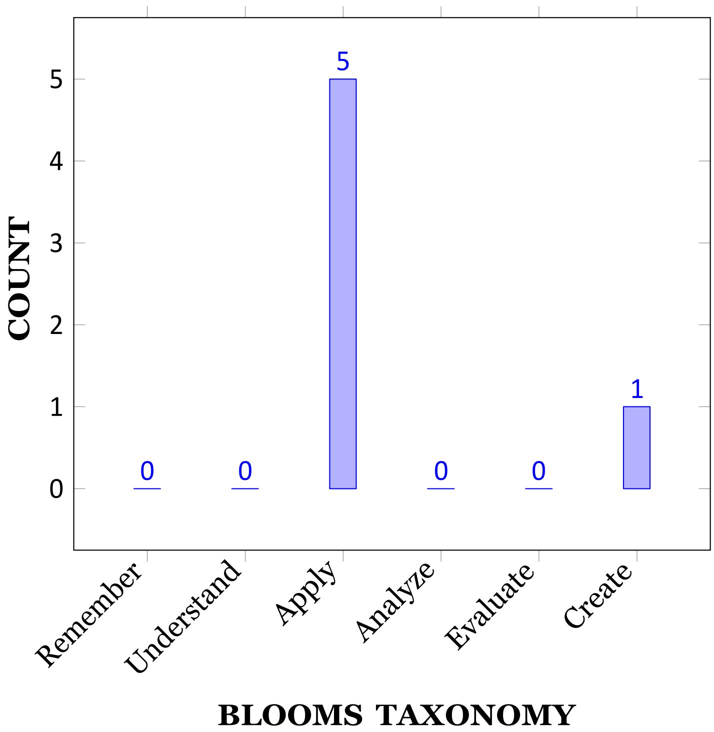
I	The SQL commands for data definition, manipulation, control and perform transactions in database systems.
II	The procedural language for implementation of functions, procedures, cursors and triggers using PL/SQL programs.
III	The logical design of a real time database system with the help of Entity Relationship diagrams.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Demonstrate** database creation and manipulation concepts with the help of SQL queries. .	Apply
CO 2	**Make use of** inbuilt functions of SQL queries to perform data aggregations, subqueries, embedded queries and views.	Apply
CO 3	**Apply** key constraints on database for maintaining integrity and quality of data.	Apply
CO 4	**Demonstrate** normalization by using referential key constraint.	Apply
CO 5	**Implement** PL/SQL programs on procedures, cursors and triggers for enhancing the features of database system to handle exceptions.	Apply
CO 6	**Design** database model with the help of Entity Relationship diagrams for a real time system or scenario.	Create

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	Lab Exercises,CIE,SEE
PO 3	**Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations	3	Lab Exercises,CIE,SEE
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	3	Lab Exercises,CIE,SEE
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	3	Lab Exercises,CIE,SEE
PO 12	**Life-long learning:**Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	2	Lab Exercises,CIE,SEE

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 2	**Problem-Solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.	3	Lab Exercises

3 = High; 2 = Medium; 1 = Low

X JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 2	Demonstrate the use of SQL for database creation and maintenance with **the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation**	3
	PO 3	Demonstrate the use of SQL for database creation and maintenance with the help **of Investigate and define a problem and identify constraints Manage the design process and evaluate outcomes,**	4
	PO 5	Demonstrate the use of SQL for database creation and maintenance **by Understanding of contexts in which engineering knowledge can be applied, understanding use of technical literature, Understanding of appropriate codes of practice and industry standards.**	3
	PSO 2	Demonstrate the use of SQL for database creation and maintenance **by using a set of instructions**	1
CO 2	PO 2	Make Use of SQL queries for data aggregation, calculations, views, sub-queries, embedded queries manipulation with **the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation**	4
	PO 3	Make Use of SQL queries for data aggregation, calculations, views, sub-queries, embedded queries manipulation with the help of **Investigate and define a problem and identify constraints, Manage the design process and evaluate outcomes.**	3
	PO 5	Make Use of SQL queries for data aggregation, calculations, views, sub-queries, embedded queries manipulation **by Understanding of contexts in which engineering knowledge can be applied, understanding use of technical literature, Understanding of appropriate codes of practice and industry standards.**	3
	PO 10	Build strong foundation on SQL queries for career building **by communicating effectively with engineering community.**	2
	PSO 2	Make Use of SQL queries for data aggregation, calculations, views, sub-queries, embedded queries manipulation **by using a set of steps.**	3
CO 3	PO 2	Define the relational data model, its constraints and keys to maintain integrity of data with **the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation**	4

	PO 10	Build strong foundation on relational model and keys **for career building by communicating effectively with engineering community.**	2
CO 4	PO 2	Apply normalization techniques to normalize a database with the **Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation**	4
	PO 3	Apply normalization techniques to normalize a database Investigate and define a problem and identify constraints, understand customer and user needs, Manage the design process and evaluate outcomes, **Investigate and define a problem and identify constraints, understand customer and user needs**Manage the design process and evaluate outcomes	4
	PO 5	Apply normalization techniques to normalize a database **by Understanding of contexts in which engineering knowledge can be applied, Understanding use of technical literature, Understanding of appropriate codes of practice and industry standards.**	3
	PSO 2	Apply normalization techniques to normalize a database **by using sequence of steps**	1
CO 5	PO 2	Define PL/SQL programs on procedures, cursors and triggers for enhancing the features of database system to handle exceptions. **with the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation**	4
CO 6	PO 2	Model the real-world database systems using Entity Relationship Diagrams from the requirement specification **with the Problem statement and system definition, Problem formulation and abstraction, Information and data collection, Model translation**	4
	PO 3	Model the real-world database systems using Entity Relationship Diagrams from the requirement specification through **Investigate and define a problem and identify constraints, Understand customer and user needs, Manage the design process and evaluate outcomes.**	4
	PO 5	Model the real- world database systems using Entity Relationship Diagrams from the requirement specification **Understanding of contexts in which engineering knowledge can be applied, Understanding use of technical literature, Understanding of appropriate codes of practice and industry standards.**	3
	PO 12	Build strong foundation on SQL and ER diagrams **for career building by communicating effectively with engineering community.**	2
	PSO 2	Model the real-world database systems using Entity Relationship Diagrams from the requirement specification **by using sequence of steps**	1

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Table 10:

Course Outcomes	Program Outcomes					Program Specific Outcomes
	PO2	PO3	PO5	PO10	PO12	PSO2
CO1	2	3	3			3
CO2	2	3	3	2		3
CO3	2			3		
CO4	2	3	3			2
CO5	2					
CO6	2	3	3		2	3

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	PO 2, PO 3, PO 5	SEE Exams	PO 2,PO 3, PO 5, PO 10,PO 12	Seminars	-
Laboratory Practices	PO 2,PO 3, PO 5	Student Viva	PO 2, PO 3,PO 10	Certification	-
Assignments	-				

XIII ASSESSMENT METHODOLOGY INDIRECT:

C	Early Semester Feedback	C	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK I	CREATION OF TABLES
	1. Create a table called Employee with the following structure. Name Type Emp no Number E name Varchar2(20) Job Varchar2(20) Mgr Number Sal Number

- Add a column commission with domain to the Employee table
- Insert any five records into the table.
- Update the column details of job
- Rename the column of Employ table using alter command.
- Delete the employee whose empno is19.

2.Create department table with the following structure.

Name Type
Dept no Number
Dept name Varchar2(20)
location Varchar2(20)

- Add column designation to the department table.
- Insert values into the table.
- List the records of emp table grouped by dept no. Update the record where dept no is 9.
- Delete any column data from the table.

3. Create a table called Customer table

Name Type
Cust Name Varchar2(20)
Cust city Varchar2(20)
Cust city Varchar2(20)

- Insert records into the table.
- Add salary column to the table.
- Alter the table column domain.
- Drop salary column of the customer table.
- Delete the rows of customer table whose cust city is hyd.

4. Create a table called branch table.

Name Type
Branch Name Varchar2(20)
Branch city Varchar2(20)
Asserts Number

- Increase the size of data type for asserts to the branch.
- Add and drop a column to the branch table.
- Insert values to the table.
- Update the branch name column
- Delete any two columns from the table

5. Create a table called sailor table

Name Type
S Name Varchar2(20)
Rating Varchar2(20)
Sid Number

- Add column age to the sailor table.
- Insert values into the sailor table.
- Delete the row with rating>8.
- Update the column details of sailor.
- Insert null values into the table.

6. Create a table called reserves table.

Name Type
Boat Id Number
Day Number
Sid Number

- Insert values into the reserves table.
- Add column time to the reserves table.
- Alter the column day data type to date.
- Drop the column time in the table.
- Delete the row of the table with some condition.

WEEK II	**QUERIES USING DDL AND DML**
	1. a. Create a user and grant all permissions to the user. b. Insert the any three records in the employee table and use rollback. Check the result. c. Add primary key constraint and not null constraint to the employee table. d. Insert null values to the employee table and verify the result. **2.** a. Create a user and grant all permissions to the user. b. Insert values in the department table and use commit. c. Add constraints like unique and not null to the department table. d. Insert repeated values and null values into the table. **3.** a. Create a user and grant all permissions to the user. b. Insert values into the table and use commit. c. Delete any three records in the department table and use rollback. d. Add constraint primary key and foreign key to the table. **4.** a. Create a user and grant all permissions to the user. b. Insert records in the sailor table and use commit. c. Add save point after insertion of records and verify savepoint. d. Add constraints not null and primary key to the sailor table. **5.** a. Create a user and grant all permissions to the user. b. Use revoke command to remove user permissions. c. Change password of the user created. d. Add constraint foreign key and not null. **6.** a. Create a user and grant all permissions to the user. b. Update the table reserves and use savepoint and rollback. c. Add constraint primary key , foreign key and not null to the reserves table
WEEK III	**QUERIES USING AGGREGATE FUNCTIONS**
	1. a. By using the group by clause, display the enames who belongs to deptno 10 , whose salary is same as respective departments average salary. b. Display lowest paid employee details under each department. c. Display number of employees working in each department and their department number. d. Using builtin functions, display number of employees working in each department and their department name from dept table. Insert deptname to dept table and insert deptname for each row, do the required thing specified above. e. List all employees which start with either B or C. f. Display only these ename of employees where the maximum salary is greater than or equal to 5000.

	2. a. Calculate the average salary for each different job. b. Show the average salary of each job excluding manager. c. Show the average salary for all departments employing more than three people. d. Display employees who earn more than the lowest salary in department 30 e. Show that value returned by sign (n)function. f. How many days between day of birth to current date. **3.** a. Show that two substring as single string. b. List all employee names, salary and 15% rise in salary. c. Display lowest paid emp details under each manager d. Display the average monthly salary bill for each deptno. e. Show the average salary for all departments employing more than two people. f. By using the group by clause, display the eid who belongs to deptno 05 along with average salary. **4.** a. Count the number of employees in department20 b. Find the minimum salary earned by clerk. c. Find minimum, maximum, average salary of all employees. d. List the minimum and maximum salaries for each job type. e. List the employee names in descending order. f. List the employee id, names in ascending order by empid. **5.** a. Find the sids ,names of sailors who have reserved all boats called “INTERLAKE Find the age of youngest sailor who is eligible to vote for each rating level with at least two such sailors. b. Find the sname , bid and reservation date for each reservation. c. Find the ages of sailors whose name begin and end with B and has at least 3 characters. d. List in alphabetic order all sailors who have reserved red boat. e. Find the age of youngest sailor for each rating level. **6.** a. List the Vendors who have delivered products within 6 months from order date. b. Display the Vendor details who have supplied both Assembled and Subparts. c. Display the Sub parts by grouping the Vendor type (Local or NonLocal). d. Display the Vendor details in ascending order.
WEEK IV	**PROGRAMS ON PL/SQL**
	1. a. Write a PL/SQL program to swap two numbers. b. Write a PL/SQL program to find the largest of three numbers. **2.** a. Write a PL/SQL program to find the total and average of 6 subjects and display the grade. b. Write a PL/SQL program to find the sum of digits in a given number.

	3. a. Write a PL/SQL program to display the number in reverse order. b. Write a PL / SQL program to check whether the given number is prime or not. **4.** a. Write a PL/SQL program to find the factorial of a given number. b. Write a PL/SQL code block to calculate the area of a circle for a value of radius varying from 3 to 7. Store the radius and the corresponding values of calculated area in an empty table named areas, consisting of two columns radius and area. **5.** a. Write a PL/SQL program to accept a string and remove the vowels from the string. (When „hello passed to the program it should display „Hll removing e and o from the world Hello). b. Write a PL/SQL program to accept a number and a divisor. Make sure the divisor is less than or equal to 10. Else display an error message. Otherwise Display the remainder in words.
WEEK V	**PROCEDURES AND FUNCTIONS**
	1. Write a function to accept employee number as parameter and return Basic +HRA together as single column. **2. Accept year as parameter and write a Function to return the total net salary spent for a given year.** **3. Create a function to find the factorial of a given number and hence find NCR.** **4. Write a PL/SQL block o pint prime Fibonacci series using local functions.** **5. Create a procedure to find the lucky number of a given birthdate.** **6. Create function to the reverse of given number.**
WEEK VI	**TRIGGERS**
	1. Create a row level trigger for the customers table that would fire for INSERT or UPDATE or DELETE operations performed on the CUSTOMERS table. This trigger will display the salary difference between the old values and new values: CUSTOMERS table. **2. Creation of insert trigger, delete trigger, update trigger practice triggers using the passenger database. Passenger (Passport id INTEGER PRIMARY KEY, Name VARCHAR (50) Not NULL, Age Integer Not NULL, Sex Char, Address VARCHAR (50) Not NULL);** a. Write a Insert Trigger to check the Passport id is exactly six digits or not. b. Write a trigger on passenger to display messages „1 Record is inserted , „1 record is deleted , „1 record is updated when insertion, deletion and updation are done on passenger respectively.

	3. Insert row in employee table using Triggers. Every trigger is created with name any trigger have same name must be replaced by new name. These triggers can raised before insert, update or delete rows on data base. The main difference between a trigger and a stored procedure is that the former is attached to a table and is only fired when an INSERT, UPDATE or DELETE occurs. **4. Convert employee name into uppercase whenever an employee record is inserted or updated. Trigger to fire before the insert or update.** **5. Trigger before deleting a record from emp table. Trigger will insert the row to be deleted into table called delete emp and also record user who has deleted the record and date and time of delete.** **6. Create a transparent audit system for a table CUST MSTR. The system must keep track of the records that are being deleted or updated**
WEEK VII	**PROCEDURES**
	1. Create the procedure for palindrome of given number. **2. Create the procedure for GCD: Program should load two registers with two Numbers and then apply the logic for GCD of two numbers. GCD of two numbers is performed by dividing the greater number by the smaller number till the remainder is zero. If it is zero, the divisor is the GCD if not the remainder and the divisors of the previous division are the new set of two numbers. The process is repeated by dividing greater of the two numbers by the smaller number till the remainder is zero and GCD is found.** **3. Write the PL/SQL programs to create the procedure for factorial of given number.** **4. Write the PL/SQL programs to create the procedure to find sum of N natural number.** **5. Write the PL/SQL programs to create the procedure to find Fibonacci series.** **6. Write the PL/SQL programs to create the procedure to check the given number is perfect or not.**
WEEK VIII	**CURSORS**
	1. Write a PL/SQL block that will display the name, dept no, salary of fist highest paid employees. **2. Update the balance stock in the item master table each time a transaction takes place in the item transaction table. The change in item master table depends on the item id is already present in the item master then update operation is performed to decrease the balance stock by the quantity specified in the item transaction in case the item id is not present in the item master table then the record is inserted in the item master table.** **3. Write a PL/SQL block that will display the employee details along with salary using cursors.** **4. To write a Cursor to display the list of employees who are working as a Managers or Analyst.**

	5. To write a Cursor to find employee with given job and deptno. **6. Write a PL/SQL block using implicit cursor that will display message, the salaries of all the employees in the „employee table are updated. If none of the employee s salary are updated we get a message 'None of the salaries were updated'. Else we get a message like for example, 'Salaries for 1000 employees are updated' if there are 1000 rows in "employee table.**
WEEK IX	**CASE STUDY: BOOK PUBLISHING COMPANY**
	A publishing company produces scientific books on various subjects. The books are written by authors who specialize in one particular subject. The company employs editors who, not necessarily being specialists in a particular area, each take sole responsibility for editing one or more publications. A publication covers essentially one of the specialist subjects and is normally written by a single author. When writing a particular book, each author works with on editor, but may submit another work for publication to be supervised by other editors. To improve their competitiveness, the company tries to employ a variety of authors, more than one author being a specialist in a particular subject for the above case study, do the following: 1. Analyze the data required. 2. Normalize the attributes. Create the logical data model using E-R diagrams.
WEEK X	**CASE STUDY GENERAL HOSPITAL**
	A General Hospital consists of a number of specialized wards (such as Maternity, Pediatric, Oncology, etc). Each ward hosts a number of patients, who were admitted on the recommendation of their own GP and confirmed by a consultant employed by the Hospital. On admission, the personal details of every patient are recorded. A separate register is to be held to store the information of the tests undertaken and the results of a prescribed treatment. A number of tests may be conducted for each patient. Each patient is assigned to one leading consultant but may be examined by another doctor, if required. Doctors are specialists in some branch of medicine and may be leading consultants for a number of patients, not necessarily from the same ward. For the above case study, do the following. 1. Analyze the data required. 2. Normalize the attributes. 3. Create the logical data model using E-R diagrams.
WEEK XI	**CASE STUDY: CAR RENTAL COMPANY**

	A database is to be designed for a car rental company. The information required includes a description of cars, subcontractors (i.e. garages), company expenditures, company revenues and customers. Cars are to be described by such data as: make, model, year of production, engine size, fuel type, number of passengers, registration number, purchase price, purchase date, rent price and insurance details. It is the company policy not to keep any car for a period exceeding one year. All major repairs and maintenance are done by subcontractors (i.e. franchised garages), with whom CRC has long-term agreements. Therefore the data about garages to be kept in the database includes garage names, addresses, range of services and the like. Some garages require payments immediately after a repair has been made; with others CRC has made arrangements for credit facilities. Company expenditures are to be registered for all outgoings connected with purchases, repairs, maintenance, insurance etc. Similarly the cash inflow coming from all sources: Car hire, car sales, insurance claims must be kept of file. CRC maintains a reasonably stable client base. For this privileged category of customers special credit card facilities are provided. These customers may also book in advance a particular car. These reservations can be made for any period of time up to one month. Casual customers must pay a deposit for an estimated time of rental, unless they wish to pay by credit card. All major credit cards are accepted. Personal details such as name, address, telephone number, driving license, number about each customer are kept in the database. For the above case study, do the following: 1. Analyze the data required. 2. Normalize the attributes.
WEEK XII	**CASE STUDY: STUDENT PROGRESS MONITORING SYSTEM**
	A database is to be designed for a college to monitor students' progress throughout their course of study. The students are reading for a degree (such as BA, BA (Hons) M.Sc., etc) within the framework of the modular system. The college provides a number of modules, each being characterized by its code, title, credit value, module leader, teaching staff and the department they come from. A module is coordinated by a module leader who shares teaching duties with one or more lecturers. A lecturer may teach (and be a module leader for) more than one module. Students are free to choose any module they wish but the following rules must be observed: Some modules require pre- requisites modules and some degree programme have compulsory modules. The database is also to contain some information about students including their numbers, names, addresses, degrees they read for, and their past performance i.e. modules taken and examination results. For the above case study, do the following:

	1. Analyze the data required. 2. Normalize the attributes. 3. Create the logical data model i.e., ER diagrams. 4. Comprehend the data given in the case study by creating respective tables with primary keys and foreign keys wherever required. 5. Insert values into the tables created (Be vigilant about Master- Slave tables). 6. Display the Students who have taken M.Sc course. 7. Display the Module code and Number of Modules taught by each Lecturer. 8. Retrieve the Lecturer names who are not Module Leaders. 9. Display the Department name which offers "English" module. 10. Retrieve the Prerequisite Courses offered by every Department(with department names). 11. Present the Lecturer ID and Name who teaches "Mathematics . 12. Discover the number of years a Module is taught. 13. List out all the Faculties who work for „Statistics Department. 14. List out the number of Modules taught by each Module Leader. 15. List out the number of Modules taught by a particular Lecturer. 16. Create a view which contains the fields of both Department and Module tables. (Hint The fields like Module code, title, credit, Department code and its name). 17. Update the credits of all the prerequisite courses to 5. Delete the Module ":History from the Module table.

TEXTBOOKS

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", Mc raw-Hill, 4th Edition,2002.

2. Ivan Bayross, "SQL, PL/SQL The programming language of oracle", BPB publications, 4th Revised Edition, 2010.

REFERENCE BOOKS:

1. Ramez Elmasri, Shamkant, B. Navathe, "Database Systems", Pearson Education, 6th Edition, 2013.

2. Peter Rob, Carles Coronel, "Database System Concepts", Cengage Learning, 7th Edition, 2008.

3. M L Gillenson, "Introduction to Database Management", Wiley Student Edition,2012.

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Introduction to database management system environments	CO 1	T1:4.1, T2:1.1
2	Creation of tables using DDL and DML commands.	CO 2	T1:4.9,4.11, T2:7
3	Working with integrity constraints	CO 3,CO 4	T1:3, T2:8
4	Working with DCL and TCL commands	CO 1,CO 2	T1:6.6, T2:12
5	Queries using aggregate functions.	CO 3	T1:4.4, T2:10

6	Nested queries using comparison keywords and logical operators.	CO 3	T1:4.6, T2:10
7	Working with Programs on pl/sql.	CO 6	T2:15
8	Working with Procedures.	CO 3,CO 6	T2:18
9	Working with Triggers.	CO 6	T2:18
10	Working with functions.	CO 5	T2:18
11	Working with Cursors.	CO 6	T2:10
12	Case study	CO 7	T1:2, T2:1

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	Implementation of views using SQL.
2	Practical Implementation of assertions using PL/SQL.

Signature of Course Coordinator **HOD,IT**
Mr.U.Shivaji, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**INFORMATION TECHNOLOGY**				
Course Title	**OPERATING SYSTEMS**				
Course Code	AITB04				
Program	B.Tech				
Semester	IV				
Course Type	Core				
Regulation	R18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	**Mr. B.Pravallika, Assistant Professor**				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSB01	II	Programming for Problem Solving
B.Tech	ACSB03	III	Data Structures

II COURSE OVERVIEW:

This course emphasizes on basic knowledge of various types of operating systems, effective resource utilization by using systems and applications software. It is designed to provide in-depth critique on the problems of resource management, scheduling, concurrency, synchronization, memory management, file management, protection and security of used system. Learned knowledge will be implemented in design and development of hybrid operating systems, command control systems, and in real time environments.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Operating Systems	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), and 10 marks for Alternative Assessment Tool (AAT).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with ”either” or ”choice” will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
45 %	Understand
18 %	Apply
27 %	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for continuous internal examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

<table>
<tr><th colspan="2">Component</th><th>Marks</th><th>Total Marks</th></tr>
<tr><td rowspan="4">CIA</td><td>Continuous Internal Examination – 1 (Mid-term)</td><td>10</td><td rowspan="4">30</td></tr>
<tr><td>Continuous Internal Examination – 2 (Mid-term)</td><td>10</td></tr>
<tr><td>AAT-1</td><td>5</td></tr>
<tr><td>AAT-2</td><td>5</td></tr>
<tr><td>SEE</td><td>Semester End Examination (SEE)</td><td>70</td><td>70</td></tr>
<tr><td colspan="3">Total Marks</td><td>100</td></tr>
</table>

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

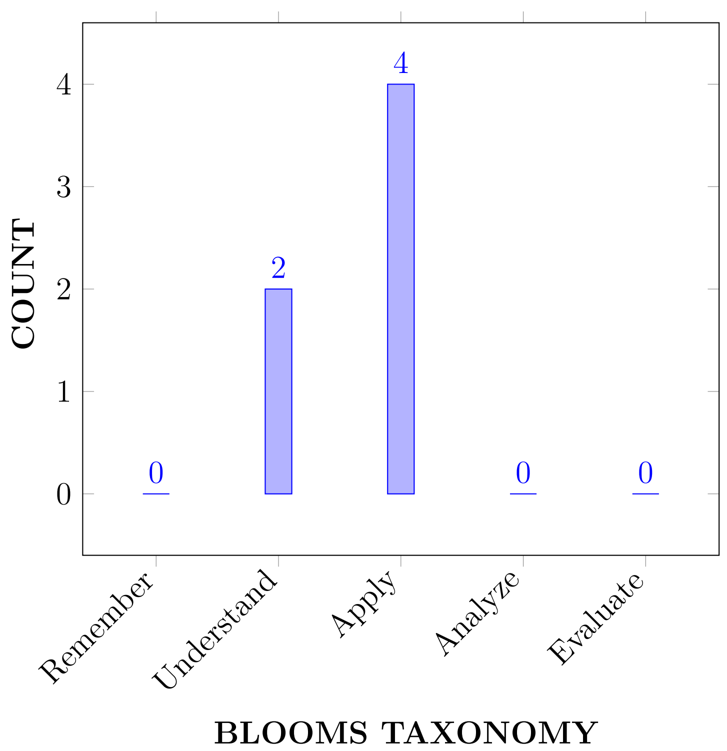
I	The principles of operating systems, services and functionalities with its evolution.
II	The structures, functions and components of modern operating systems
III	The conventional hardware at different OS abstraction levels.
IV	The essential skills to examine issues and methods employed in design of operating systems with identification of various functionalities.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Illustrate** different architectures used in design of modern operating systems.	Understand
CO 2	**Solve** problems related to process scheduling, synchronization and deadlock handling in uni and multi-processing systems.	Apply
CO 3	**Choose** memory allocation algorithms for effective utilization of resources.	Apply
CO 4	**Select** various page replacement algorithms applied for allocation of frames.	Apply
CO 5	**Make use of** different file allocation and disk scheduling algorithms applied for efficient utilization of storage.	Apply
CO 6	**Outline** mechanisms used in protection of resources in real time environment	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	SEE / CIE / AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	SEE / CIE / AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	2	SEE / CIE / AAT
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	2	SEE / CIE / AAT
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2	SEE / CIE / AAT
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	1	SEE / CIE / AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools	2	SEE/AAT
PSO 2	Focus on improving software reliability, network security / information retrieval systems.	3	SEE/AAT
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure .	3	SEE/AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	$\checkmark$	-	-	-	-	-	-	-	-	$\checkmark$	-	$\checkmark$	$\checkmark$	-	$\checkmark$
CO 2	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	-	-	-	-	-	$\checkmark$	-	$\checkmark$	$\checkmark$	$\checkmark$	-
CO 3	$\checkmark$	$\checkmark$	$\checkmark$	-	-	-	-	-	-	$\checkmark$	-	-	$\checkmark$	-	-
CO 4	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	-	-	-	-	-	$\checkmark$	-	-	$\checkmark$	-	-
CO 5	$\checkmark$	$\checkmark$	$\checkmark$	-	-	-	-	-	-	$\checkmark$	-	$\checkmark$	$\checkmark$	-	-
CO 6	$\checkmark$	-	-	-	-	-	-	-	-	$\checkmark$	-	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Understand the structure and evolution of operating system by understanding fundamentals of Computer engineering specialization and mathematical and scientific principles.	3
	PO 10	Communicate effectively on evolution of operating systems including deep subject knowledge.	1
	PO 12	By understanding different operating system architectures, one can personally continue understanding of different operating systems developed by the companies to stay up with new technology and for personal development.	2
	PSO 1	Identify the need, key issues and applications of the operating system in various real time environments.	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO 3	By understanding different operating system architectures, one can acquire knowledge on advanced operating systems for engineering practice and higher education and even can extend the knowledge to become an entrepreneur.	2
CO 2	PO 1	Understand the concept of Process, process scheduling, issues and their solutions related to process synchronization by using mathematical principles, fundamental of Computer engineering specialization and scientific principles.	3
	PO 2	Identify synchronization problem and understand the problem statement of classical synchronization problems collect the data needed for solving the problem then analyze different models of solutions for classical synchronization problems by semaphores and monitors and interpret the solutions	6
	PO 3	Define the process synchronization problem, understand the user needs then identify the resources required next manage the design process using banker's algorithm and evaluate outcomes.	4
	PO 4	By having the knowledge of characteristics of process and understanding the context in classical synchronization problems and the solutions provided using the technical constructs like semaphores and monitors with their working strategies, these can be applied for understanding of other synchronization problems.	5
	PO 10	Communicate effectively on process communication using process communication techniques and explaining each technique.	2
	PO 12	By understanding process management, one can personally continue understanding internal functioning of operating systems developed by the companies to stay up with new technology and for personal development.	2
	PSO 1	Identify the need for process scheduling and apply appropriate algorithms for scheduling of process arriving at various time intervals.	4
	PSO 2	By acquiring knowledge of process management one can design software applications with reliability and applications with fast information retrieval.	2
CO 3	PO 1	Describe the need and various techniques for memory management by understanding the limits of contiguous memory allocation through applying mathematical principles, fundamental of Computer engineering specialization and scientific principles	3

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 2	Identify problem of memory management and understand the problem statement of contiguous memory management then analyze different models of non-contiguous memory management.	3
	PO 3	Define the problem related to contiguous memory management, understand the user needs then identify the memory requirements of each process next manage the design process by using non-contiguous memory management techniques and evaluate outcomes.	4
	PO 10	Communicate effectively on memory management techniques with clarity on contiguous and varied strategies and explaining each technique with appropriate terminology.	2
'	PSO 1	Identify the need of efficient utilization of main memory and apply various contiguous and non-contiguous memory allocation techniques of memory management.	4
CO 4	PO 1	Understand the concept of virtual memory and various algorithms for effective usage of memory by applying the knowledge of computer engineering fundamentals, mathematical and scientific principles.	3
	PO 2	Identify the need for page replacement, understand the problem statement of allocation of pages to frames, then collect the data related to available pages and frames then analyze various models for solving problem based on the given sequence of pages and interpret their results accordingly.	6
	PO 3	Define the problem of mapping of large virtual memory to the existing physical memory, understand the user needs then manage the design process using page replacement algorithms and evaluate outcomes by identifying the number of page faults incurred.	4
	PO 4	By understanding characteristics of process, understanding the context in virtual memory management using demand paging and segmentation, this knowledge can be applied for virtualizing engineering process.	4
	PO 10	Communicate on utilization of main memory using pictorial representation of demand paging and segmentation and explaining them in detail.	2
	PSO 1	Identify the need of separation of logical memory from physical memory and apply appropriate algorithms for allocating given sequence of pages to frames.	4
CO 5	PO 1	Understand the concept of file system and analyze various file allocation methods by using the knowledge of computer engineering fundamentals, mathematical and scientific principles.	3

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 2	Identify the need for disk scheduling, understand the problem statement of disk scheduling, then collect the data related to location of data to be accessed in the disk structure then analyze different scheduling algorithm models used for solving problems related to finding total head movements and interpret their results.	6
	PO 3	Define the problem of file allocation to disk block, understand the user needs then identify the free disk space available next manage the design process by using appropriate file allocation methods.	4
	PO 10	Communicate on effective utilization of mass storage structures clearly using pictorial representation of disk structure.	2
	PO 12	By understanding mass storage structure, one can personally continue understanding of different storage devices developed by the companies to stay up with new technology.	2
	PSO 1	Identify the need of scheduling the service of disk I/O requests and apply appropriate algorithms for processing I/O requests.	4
CO 6	PO 1	Explain the importance of protection of objects and the protection provided for them by using domain concept in terms of access matrix implementation by applying knowledge of computer science fundamentals.	1
	PO 10	Communicate on protection of computer system components using protection strategies in detail.	1
	PO 12	By understanding the concept of protection, one can study and analyze various protection mechanisms developed recently for personal development.	2
	PSO 1	Identify the need of protection provided to the hardware and software components of the computer system and analyze the techniques provided for their protection.	1
	PSO 2	By acquiring knowledge of protection one can design software applications with high security and reliability.	1
	PSO 3	By understanding the concept of protection, one can acquire knowledge on advanced protection mechanisms for engineering practice and higher education and even can extend the knowledge to become an entrepreneur.	2

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	1	-	2	1	-	2
CO 2	3	6	4	5	-	-	-	-	-	2	-	2	4	2	-
CO 3	3	3	4	-	-	-	-	-	-	2	-	-	4	-	-
CO 4	3	6	4	4	-	-	-	-	-	2	-	-	4	-	-
CO 5	3	6	4	-	-	-	-	-	-	2	-	2	4	-	-
CO 6	1	-	-	-	-	-	-	-	-	1	-	2	1	1	2

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	100	-	-	-	-	-	-	-	-	20	-	25	17		100
CO 2	100	60	40	45	-	-	-	-	-	40	-	25	67	100	-
CO 3	100	30	40	-	-	-	-	-	-	40	-	-	67	-	-
CO 4	100	60	40	36	-	-	-	-	-	40	-	-	67	-	-
CO 5	100	60	40	-	-	-	-	-	-	40	-	25	67	-	-
CO 6	33	-	-	-	-	-	-	-	-	20	-	25	17	50	100

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation

1 -$5 < C \leq 40\%$ – Low/ Slight

2 - $40\ \% < C < 60\%$ –Moderate

3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	1	-	1	1	-	3
CO 2	3	3	2	2	-	-	-	-	-	2	-	1	3	3	-
CO 3	3	1	2	-	-	-	-	-	-	2	-	-	3	-	-
CO 4	3	3	2	2	-	-	-	-	-	2	-	-	3	-	-
CO 5	3	3	2	-	-	-	-	-	-	2	-	1	3	-	-
CO 6	1	-	-	-	-	-	-	-	-	1	-	1	1	2	3
TOTAL	16	10	8	4	-	-	-	-	-	10	-	4	14	5	6
AVERAGE	2.7	2.5	2	2	-	-	-	-	-	1.7	-	1	2.3	2.5	3

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	✓
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	Open Ended Experiments	-
Assignments	-	-	-	-	-

XVII ASSESSMENT METHODOLOGY-INDIRECT:

	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**INTRODUCTION**
	Operating systems objectives and functions: Computer system architecture, operating systems structure, operating systems operations; Evolution of operating systems: Simple batch, multi programmed, time shared, personal computer, parallel distributed systems, real time systems, special purpose systems, operating system services, user operating systems interface; Systems calls: Types of systems calls, system programs, protection and security, operating system design and implementation, operating systems structure, virtual machines.
MODULE II	**PROCESS AND CPU SCHEDULING, PROCESS COORDINATION**
	Process concepts: The process, process state, process control block, threads; Process scheduling: Scheduling queues, schedulers, context switch, preemptive scheduling, dispatcher, scheduling criteria, scheduling algorithms, multiple processor scheduling; Real time scheduling; Thread scheduling; Case studies Linux windows; Process synchronization, the critical section problem; Peterson‘s solution, synchronization hardware, semaphores and classic problems of synchronization, monitors.
MODULE III	**MEMORY MANAGEMENT AND VIRTUAL MEMORY**
	Logical and physical address space: Swapping, contiguous memory allocation, paging, structure of page table. Segmentation: Segmentation with paging, virtual memory, demand paging; Performance of demand paging: Page replacement, page replacement algorithms, allocation of frames, thrashing
MODULE IV	**FILE SYSTEM INTERFACE, MASS-STORAGE STRUCTURE**
	The concept of a file, access methods, directory structure, file system mounting, file sharing, protection, file system structure, file system implementation, allocation methods, free space management, directory implementation, efficiency and performance; Overview of mass storage structure: Disk structure, disk attachment, disk scheduling, disk management, swap space management; Dynamic memory allocation: Basic concepts; Library functions.

MODULE V	**DEADLOCKS, PROTECTION**
	System model: Deadlock characterization, methods of handling deadlocks, deadlock prevention, dead lock avoidance, dead lock detection and recovery form deadlock system protection, goals of protection, principles of protection, domain of protection, access matrix, implementation of access matrix, access control, revocation of access rights, capability based systems, language based protection.

TEXTBOOKS

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Operating System Principles‖, Wiley Student Edition, 8th Edition, 2010.
2. . William Stallings, Operating System- Internals and Design Principles‖, Pearson Education, 6th Edition, 2002.

REFERENCE BOOKS:

1. Andrew S Tanenbaum, Modern Operating Systems‖, PHI, 3rd Edition, 2007.
2. D. M. Dhamdhere, Operating Systems a Concept based Approach, Tata McGraw-Hill, 2nd Edition, 2006.

WEB REFERENCES:

1. www.smartzworld.com/notes/operatingsystems
2. www.scoopworld.in
3. www.sxecw.edu.in
4. www.technofest2u.blogspot.com

COURSE WEB PAGE:

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Refer-ence
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO - PO Mapping	-	-
CONTENT DELIVERY (THEORY)			
2	Computer system architecture, operating systems structure	CO 1	T1:1.1-1.4
3	operating systems operations	CO 1	T1:1.5
4	Evolution of operating systems: Simple batch, multi programmed, time shared, personal computer	CO 1	T2:2.2
5	parallel distributed systems, real time systems, special purpose systems,	CO 1	T2:2.2

6	operating system services, user operating systems interface	CO 1	T2:2.1-2.2
7	Systems calls: Types of systems calls, system programs	CO 1	T2:2.3-2.5
8	protection and security, operating system design and implementation	CO 1	T1:2.6
9	operating systems structure, virtual machines.	CO 1	T1:2.7-2.8
10	Process concepts: The process, process state	CO 2	T1:3.1-3.2
11	process control block, threads;	CO 2	T1:3.2-3.4
12	Process scheduling: Scheduling queues, schedulers, context switch	CO 2	T1:5.2
13	preemptive scheduling, dispatcher, scheduling criteria	CO 2	T1:5.3
14	scheduling algorithms	CO 2	T1:5.3
15	multiple processor scheduling	CO 2	T1:5.3
17	Real time scheduling; Thread scheduling;	CO 2	T1:5.4-5.5
18	Case studies Linux windows	CO 2	T1:5.6, 21.4
19	Process synchronization, the critical section problem	CO 2	T1:6.1
20	Peterson‘s solution	CO 2	T1:6.2-6.3
21	synchronization hardware	CO 2	T1:6.4
22	semaphores	CO 2	T1:6.5
23	classic problems of synchronization, monitors.	CO 2	T1:6.6-6.7
24	Logical and physical address space: Swapping, contiguous memory allocation	CO 3	T1:8.1
26	paging, structure of page table	CO 3	T1:8.2
27	Segmentation: Segmentation with paging	CO 3	T1:8.3
29	virtual memory, demand paging	CO 3	T1:8.4-8.5
30	Performance of demand paging	CO 3	T1:8.6
31	Page replacement, page replacement algorithms,	CO 4	T1:8.6
33	allocation of frames	CO 4	T1:9.5
34	Thrashing	CO 4	T1:9.6
35	The concept of a file, access methods	CO 4	T1:10.1-10.2
36	directory structure	CO 4	T1:10.3
37	file system mounting	CO 4	T1:10.5
38	file sharing, protection	CO 4	T1:10.6
39	file system structure	CO 4	T1:10.6
40	file system implementation	CO 4	T1:11.3
41	allocation methods	CO 4	T1:11.4

43	free space management	CO 4	T1:11.5
44	directory implementation, efficiency and performance	CO 4	T1:11.6
45	Overview of mass storage structure: Disk structure, disk attachment	CO 5	T1:12.1-12.3
46	disk scheduling, disk management, swap space management	CO 5	T1:12.4-12.6
48	Dynamic memory allocation: Basic concepts; Library functions.	CO 5	T1:12.7-12.8
49	System model: Deadlock characterization, methods of handling deadlocks	CO 2	T1:7.1-7.2
50	deadlock prevention	CO 2	T1:8.1
51	deadlock avoidance	CO 2	T1:8.2
52	dead lock detection and recovery form deadlock system protection	CO 2	T1:8.3
55	goals of protection, principles of protection, domain of protection	CO 6	T2:27.8
56	access matrix, implementation of access matrix, access control, revocation of access rights	CO 6	T2:27.9
57	capability based systems, language based protection	CO 6	T1:8.2-8.3
PROBLEM SOLVING/ CASE STUDIES			
16	Problems on CPU scheduling algorithms	CO 2	T1:5.3-5.3
25	Problems on contiguous memory allocation	CO 3	T1:8.1-8.3
28	Problems on paging and segmentation	CO 3	T1:8.4-8.6 T1:9.1-9.2
32	Problems on page replacement algorithms	CO 4	T1:9.4-9.6
42	Problems on file allocation methods	CO 5	T1:11.3-11.6
47	Problems on disk scheduling	CO 5	T1:12.1-12.6
53	Problems on deadlock avoidance	CO 2	T1:8.1-8.3
54	Problems on recovery from deadlocks	CO 2	T1:8.1-8.3
DISCUSSION OF DEFINITION AND TERMINOLOGY			
58	Definitions on operating systems fundamentals	CO 1	T1:1.2
59	Definitions on process, CPU scheduling and process coordination	CO 2	T1:1.5
60	Definitions on memory management and virtual memory	CO 3, CO 4	T1:8,9

61	Definitions on file system interface and mass storage structure	CO 5	T1:10,11
62	Definitions on deadlocks and protection	CO 2, CO 6	T1:9.1
DISCUSSION OF QUESTION BANK			
1	Introduction	CO 1	T1:1.2
2	Process and CPU Scheduling, Process Coordination	CO 2	T1:1.5
3	Memory Management and Virtual Memory	CO 3,4	T1:8,9
4	File System Interface, Mass Storage Structure	CO 5	T1:10,11
5	Deadlocks, Protection	CO 2,6	T1: 9.1

Signature of Course Coordinator **HOD, IT**
Mr. B.Pravallika, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
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Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**INFORMATION TECHNOLOGY**				
Course Title	**THEORY OF COMPUTATION**				
Course Code	AITB03				
Program	B.Tech				
Semester	IV				
Course Type	Core				
Regulation	R-18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	1	4	-	-
Course Coordinator	Mr. U Sivaji, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
UG	AHSC010	II	Probability and Statistics.
UG	ACS002	II	Data Structures
UG	AHS013	III	Discrete Mathematical Structures

II COURSE OVERVIEW:

This course focuses on infinite languages in finite ways, and classifies machines by their power to recognize. It includes finite automata, regular grammar, push down automata, context free grammars, and Turing machines It is applicable in designing phrasing and lexical analysis of a compiler, genetic programming and recursively enumerable languages

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Theory of Computation	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	x	Assignments	x	MOOC
✓	Open Ended Experiments	x	Seminars	x	Mini Project	✓	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
60%	Understand
20%	Apply
10 %	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Quiz	AAT	
CIA Marks	20	05	05	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination
Two Quiz exams shall be online examination consisting of 50 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

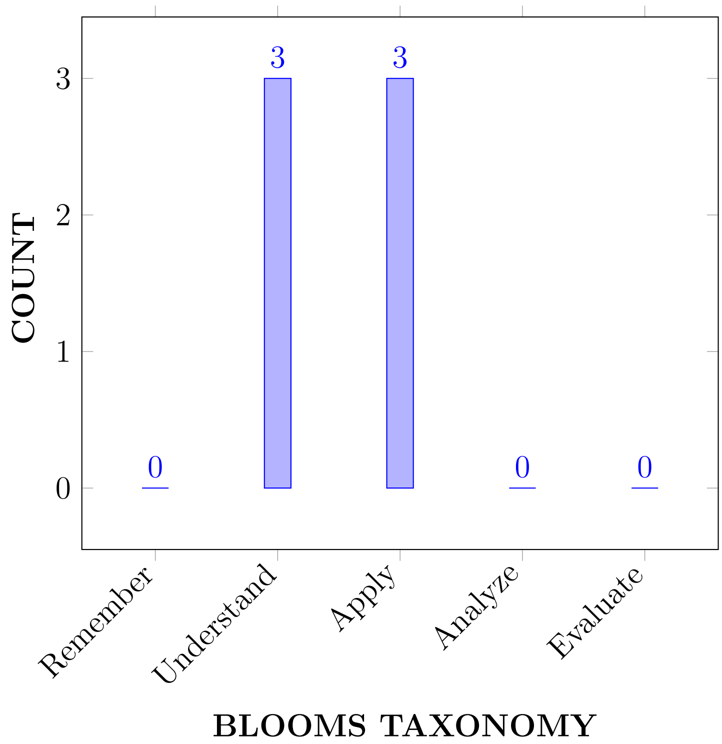
I	The fundamental knowledge of automata theory which is used to solve computational problems
II	The reorganization of context free language for processing infinite information using push down automata.
III	The computer based algorithms with the help of an abstract machine to solve recursively Enumerable problems

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Make use of** deterministic finite automata and non deterministic finite automata for modeling lexical analysis and text editors.	Apply
CO 2	**Extend** regular expressions and regular grammars for parsing and designing programming languages.	Understand
CO 3	**Illusrate** the pumping lemma on regular and context free languages for perform negative test .	Understand
CO 4	**Demonstarte** context free grammars, normal forms for generating patterns of strings and minimize the ambiguity in parsing the given strings.	Understand
CO 5	**Construct** push down automata for context free languages for developing parsing phase of a compiler.	Apply
CO 6	**Apply** Turing machines and Linear bounded automata for recognizing the languages,complex problems.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations

Program Outcomes	
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering commMODULEy and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE / SEE
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2.5	AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	2.5	SEE / AAT

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	2	CIE / Quiz / AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	2.3	Group discussion/ Short term courses
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	2.0	Research papers/ Industry exposure

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	-	-	-	-	-	-	-		-	-	✓
CO 2	✓	-	-	-	-	-	-	-	-	-	-	-	✓	-	-
CO 3	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	✓	✓	-	-	-	-	-	-	-	-	-	-	✓	-	-
CO 5	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	✓
CO 6	✓	✓	✓	✓		-	-	-	-	-	-	-	✓	-	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Solve the lexical analysis and text editor's using deterministic finite automata and non- deterministic finite automata using the principles of mathematical principles and scientific principles.	2
	PSO 3	Demonstrate the basic text editors in real world software, using industry standard tools and collaboration techniques in the field of computational programming.	1
CO 2	PO 1	Understand the basics of regular expressions and regular grammars, its types and properties for applying mathematical principles and scientific principles.	2
	PSO 1	Make use of the concept of regular expressions and regular grammars for developing algorithms of machine learning and networking concepts.	3
CO 3	PO 1	Find an optimized solution for the given problem using pumping lemma by applying the knowledge of mathematical principles and computer engineering methodologies.	2
	PO 2	Understand the given problem and develop the solution using pumping lemma from the provided information and interpret of results for validation.	5
	PO 3	Explain and demonstrate the pumping lemma, by investigate and define a problem and identify constraints ,Understand customer and user needs, Manage the design process and evaluate outcomes.	5
CO 4	PO 1	Describe the role of Ambiguity in construction of context free grammars by understanding mathematical principles and scientific principles.	2
	PO 2	Understand the given problem and analyze the grammar and eliminate ambiguity using derivation trees by model,design,document the results for interpretation.	6
	PSO 1	Understand the normalization techniques in the area related to parsing desire for higher studies in field of compiler design, machine Learning and data science.	3
CO 5	PO 1	Describe acceptance of context free language by final state and by empty stack problems by understanding mathematical principles, engineering methodologies and scientific principles.	3
	PO 2	Understand equivalence of context free language and pushdown automata for validation , model, design of inter conversion for solving the given problem related to engineering from the provided information , data and documentation.	6

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO 3	Understand the principle of languages , grammars for computational programming to achieve engineering objectives.	1
CO 6	PO 1	Describe the recursively enumerable languages and churchs hypothesis using mathematical principles and scientific principles.	3
	PO 2	Understand the given problem statement and formulate the (complex) engineering problems in the Design and Model of Turing machine in reaching substantiated conclusions by the interpretation of results.	5
	PO 3	Make Use of Turing machines to develop programs (define problem)for identify the solution (innovative) of complex engineering problems which satisfy the user constraints.	6
	PO 4	Ability to identify ,classify and describe the performance of turing machine by using analytical methods and modeling techniques.	4
	PSO 1	Analyze computable functions in the areas related to simulation of Turing machine, software testing, high performance computing, machine learning, software engineering and computer networks	6

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	-	-	-	-	-	-	-	-	-	-		-	-	1
CO 2	2	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO 3	2	5	5	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	2	6	-	-		-	-	-	-	-	-	-	3	-	-
CO 5	3	6	-	-	-	-	-	-	-	-	-	-	-	-	1
CO 6	3	5	6	5	-	-	-	-	-	-	-		6	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO / PSO:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	66.7	-	-	-	-	-	-	-	-	-	-		-	-	50.0
CO 2	66.7	-	-	-	-	-	-	-	-	-	-	-	50.0	-	-
CO 3	66.7	50.0	50.0	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	66.7	60.0	-	-		-	-	-	-	-	-	-	50.0	-	-
CO 5	100.0	60.0	-	-	-	-	-	-	-	-	-	-	-	-	50.0
CO 6	100.0	50.0	60.0	55.0		-	-	-	-	-	-		100.0	-	-

XV COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.
0 - 0≤ C≤ 5% – No correlation
2 - 40 % <C < 60% –Moderate
1-5 <C≤ 40% – Low/ Slight
3 - 60% ≤ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	2
CO 2	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO 3	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO 5	3	3	-	-	-	-	-	-	-	-	-	-	-	-	2
CO 6	3	2	3	2	-	-	-	-	-	-	-	-	3	-	-
TOTAL	18	10	5	2	-	-	-	-	-	-	-	-	7	-	4
AVERAGE	3.0	2.5	2.5	2.0	-	-	-	-	-	-	-	-	2.3	0	2.0

XVI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	Open Ended Experiments	✓
Assignments	-				

XVII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	**FINITE AUTOMATA**
	Fundamentals: Alphabet, strings, language, operations; Introduction to finite automata: The central concepts of automata theory, deterministic finite automata, nondeterministic finite automata, an application of finite automata, finite automata with and without epsilon transitions, Conversion of NFA to DFA Machines.
MODULE II	**REGULAR LANGUAGES**
	Regular sets, regular expressions, identity rules, constructing finite automata for a given regular expressions, conversion of finite automata to regular expressions, pumping lemma of regular sets, closure properties of regular sets (proofs not required), regular grammars-right linear and left linear grammars, equivalence between regular linear grammar and finite automata, inter conversion.

MODULE III	**CONTEXT FREE GRAMMARS**
	Context free grammars and languages: Context free grammar, derivation trees, sentential forms, right most and leftmost derivation of strings, applications. Ambiguity in context free grammars, minimization of context free grammars, Chomsky normal form, Greibach normal form, pumping lemma for context free languages, enumeration of properties of context free language (proofs omitted)
MODULE IV	**PUSHDOWN AUTOMATA**
	Pushdown automata, definition, model, acceptance of context free language, acceptance by final state and acceptance by empty stack and its equivalence, equivalence of context free language and pushdown automata, inter conversion;(Proofs not required); Introduction to deterministic context free languages and deterministic pushdown automata.
MODULE V	**TURING MACHINE**
	Turing machine: Turing machine, definition, model, design of Turing machine, computable functions, recursivey enumerable languages, Church's hypothesis, counter machine, types of Turing machines (proofs not required), linear bounded automata and context sensitive language, Chomsky hierarchy of languages.

TEXT BOOKS

1. John E. Hopcroft , Rajeev Motwani, Jeffrey D. Ullman, —Introduction to Automata, Theory, Languages and Computation, Pearson Education, 3rd Edition, 2007.

REFERENCE BOOKS:

1. John C Martin, —Introduction to Languages and Automata Theory, Tata McGraw Hill, 3rd Edition, 2017
2. Daniel I.A. Cohen, Introduction to Computer Theory, John Wiley Sons, 2nd Edition, 2004.

COURSE WEB PAGE:

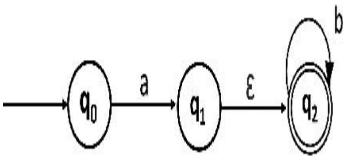
https://nptel.ac.in/courses/106103070

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	In Outcome-Based Education (OBE), we discussed about course delivery assessment that are planned to achieve stated objectives and outcomes. We will focuses on measuring student performance i.e. outcomes at different levels. Course outcomes(CO),Program Outcomes(PO)and Program Specific Outcomes(PSO) and also mapping of CO's to PO's PSO's and their attainments are discussed.		
CONTENT DELIVERY (THEORY)			
1	Alphabet, strings, language and operations	CO1	T1:1.5-1.6
2	finite automata and concepts of automata theory	CO1	T1:2.1-2.2, R2:38-64

3	Demonstrate the behavior of deterministic finite automata	CO 1	T1:2.2-2.3
4-6	Understand the functionality of non-deterministic finite automata and Finite automata with epsilon transitions.	CO 1	T1:2.3-2.4, R1:3.1-3.3, R2:142-148
7	application of finite automata,Conversion of NFA to DFA, Moore and Melay Machines.	CO 1	T1:2.3-2.4, R1:3.1-3.3, R2:142-148
8-10	understand the Regular sets, regular expressions, identity rules	CO 2	T1: 3.1-3.2
11-13	finite automata for a given regular expressions, finite automata to regular expressions	CO 2	T1: 3.1-3.2
14-15	find the pumping lemma of regular sets, regular grammars, right linear and left linear grammars	CO 3	T1: 4.1-4.2
16-19	Regular grammars-right linear and left linear grammars	CO 4	T1: 4.4-4.5
20-22	regular linear grammar and finite automata, inter conversion.	CO 2	T1: 4.4-4.5
23-24	Apply Context free grammar on derivation trees	CO 4	T1: 5.1-5.5, R1:4.2-4.4
25-27	sentential forms, right most and leftmost derivation of strings	CO 4	T1: 5.1-5.5, R1:4.2-4.4
28-29	Ambiguity in context free grammars	CO 4	T1: 5.1-5.5, R1:4.2-4.4
30-32	Understand Minimization of context free grammars, Chomsky normal form, Greibach normal form	CO 4	T1: 7.4-7.5, R1:6.1-6.2
33-34	Pumping lemma for context free languages, properties	CO 3	T1: 7.4-7.5, R1:6.1-6.2
35-37	Apply the push down automata for acceptance of context free Languages	CO 5	T1: 6.1-6.2, R1:5.2-5.4
38-41	push down automata for given context free languages	CO 5	T1: 6.1-6.2, R1:5.2-5.4
42-43	acceptance by empty stack and its Equivalence.	CO 5	T1: 6.1-6.2, R1:5.2-5.4
44-45	Describe Equivalence of context free language and pushdown automata	CO 5	T1: 6.3-6.4
46-47	inter conversion, deterministic push down automata.	CO 5	T1: 6.3-6.4
48-53	Describe Turing machine, definition, model, computable functions	CO 6	T1: 8.1-8.2, R1:7.2-7.4
54-56	Apply Recursively enumerable languages	CO 6	T1: 8.2-8.6, R1:7.5-7.6
57-58	Types of Turing machines and Church's hypothesis.	CO 6	T1: 8.2-8.6, R1:7.5-7.6
59-60	Linear bounded automata and context sensitive language.	CO 6	T1:9.1-9.8, R2:551-560
61-62	Chomsky hierarchy of languages.	CO 6	T1:9.1-9.8, R2:551-560

PROBLEM SOLVING/ CASE STUDIES			
1	Describe a DFA for the following language L={w/|w | mod5=0,w belongs to (a,b)*} L={w/|w | mod5=1,w belongs to (a,b)*}	CO 1	T1:2.3-2.4, R1:3.1-3.3
2	Convert NFA with ϵ to equivalent NFA M=({q0,q1,q2},{0,1,2}, δ, q0, {q2}) where δ is given by [δ (q0,0)={q0}, δ (q0,1)=ϕ, δ (q0,2)=ϕ, δ(q0, ϵ)=q1] [δ (q1,0)=ϕ, δ (q1,1)=q1 , δ (q1,2)=ϕ ,δ (q1, ϵ)=q2] [δ (q2,0)=ϕ, δ (q2,1)= ϕ , δ (q2,2)= {q2},δ (q2, ϵ)= ϕ]	CO1	T1:2.3-2.4, R1:3.1-3.3
3	Convert NFA with ϵ to equivalent DFA 	CO 1	T1:2.3-2.4, R1:3.1-3.3
4	Describe Pumping Lemma for Regular Languages. Prove that the language L = {a^n/ n is a n^5} is not regular	CO 3	T1: 7.4-7.5, R1:6.1-6.2
5	Convert the following automata into Regular expression M=({q1,q2,q3},{0,1}, δ, q1, {q2,q3}) where δ is given by [δ (q1,0)={q2}, δ (q1,1)={q3}] [δ (q2,0)={q1}, δ (q2,1)={q3}] [δ (q3,0)={q2}, δ (q3,1)= {q2}]	CO 2	T1: 3.1-3.2
6	Describe the DFA Transition diagram for equivalent Regular expression (ab+a) *(aa+b)	CO 1	T1:3.1-3.2
7	Convert the following grammar into GNF S→ABA/AB/BA/AA/B A→aA/a, B→bB/b	CO 4	T1: 7.4-7.5, R1:6.1-6.2
8	Describe the context free grammars in the four tuple form.(V,T,P,S) for the given languages on $\sum$={a,b} i. All strings having at least two a's ii. All possible strings not containing triple b's	CO 4	T1: 7.4-7.5, R1:6.1-6.2
9	Describe the steps to show the following is not CFG. { $a^m b^n c^p$ | m< n or n< p}	CO 4	T1: 7.4-7.5, R1:6.1-6.2
10	Construct PDA for equal number of x's and y's. eg: xyyxxy	CO 5	T1: 6.1-6.2, R1:5.2-5.4
11	Construct NDPDA for L = { W$\neq W^R$ /W$\in (X+Y)^*$}	CO 5	T1: 6.1-6.2, R1:5.2-5.4
12	Construct DPDA for L = { W$\neq W^R$ /W$\in (X+Y)^*$}	CO 5	T1: 6.1-6.2, R1:5.2-5.4

13	Construct a Turing Machine that accepts the language L = { $a^{2n}b^n$ |n≥0}.Give the transition diagram for the Turing Machine obtained.	CO 6	T1: 8.2-8.6, R1:7.5-7.6
14	Construct a Turing Machine to accept the following languages L = $\{w^n x^n y^n z^n \mid n \geq 1\}$	CO 6	T1:8.2-8.6, R1:7.5-7.6
15	Design a Turing Machine that accepts the language denoted by regular expression (000)*	CO 6	T1:8.2-8.6, R1:7.5-7.6
DISCUSSION ON DEFINITION AND TERMINOLOGY			
1	Alphabet, strings, language and operations	CO 1	T1:1.5-1.6
2	understand the Regular sets, regular expressions, identity rules	CO 2	T1:3.1-3.2
3	Understand Minimization of context free grammars, Chomsky normal form, Greibach normal form	CO 4	T1:7.4-7.5, R1:6.1-6.2
4	push down automata for given context free languages	CO 5	T1:6.1-6.2, R1:5.2-5.4
5	Types of Turing machines and Church's hypothesis.	CO 6	T1:8.2-8.6, R1:7.5-7.6
DISCUSSION ON QUESTION BANK			
1	Describe the DFA with the set of strings having "aaa as a substring over an alphabet $\sum$ ={a,b}.	CO 1	T1:1.5-1.6
2	Convert Regular Expression (11+0)*(00+1)* to Finite Automata.	CO 2	T1:3.1-3.2
3	Describe a CFG for the languages L={$a^i b^j$ | i≤2j}	CO 4	T1:7.4-7.5, R1:6.1-6.2
4	Define the NPDA(Nondeterministic PDA) and DPDA(deterministic PDA) equivalent? Illustrate with an example.	CO 5	T1:6.1-6.2, R1:5.2-5.4
5	Describe a Turing Machine. With a neat diagram explain the working of a Turing Machine.	CO 6	T1: 8.2-8.6, R1:7.5-7.6

Signature of Course Coordinator **HOD,IT**

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

INFORMATION TECHNOLOGY

COURSE DESCRIPTION

Course Title	**OBJECT ORIENTED ANALYSIS AND DESIGN**				
Course Code	ACSB10				
Program	B.Tech				
Semester	V	IT			
Course Type	CORE				
Regulation	IARE - R18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Mr R.suvarna Rao, Assistant Professor				

I COURSE OVERVIEW:

This course is intended to provide an in depth understanding of object-oriented approaches to software development, in particular to the analysis and design phase of the software life cycle. Topic include notation, methods, competing methodologies, issues in object-oriented development, and recent advancements which complement traditional object-oriented methodologies.

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AITB01	III	Object Oriented Programming through Python

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Object Oriented Analysis and Design	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	PPT	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with ”either” or ”choice” will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The expected percentage of cognitive level of the questions is broadly based on the criteria given in Table: 1.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
70 %	Understand
20 %	Apply
0 %	Analyze
0 %	Evaluate
0 %	Create

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 2), with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool in table

Component	Theory			Total Marks
Type of Assessment	**CIE Exam**	**Quiz**	**AAT**	
CIA Marks	20	05	05	30

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8th and 16th week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination

Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course. **Alternative Assessment Tool (AAT)**

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	**Tech-talk**	**Open Ended Experiment**
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

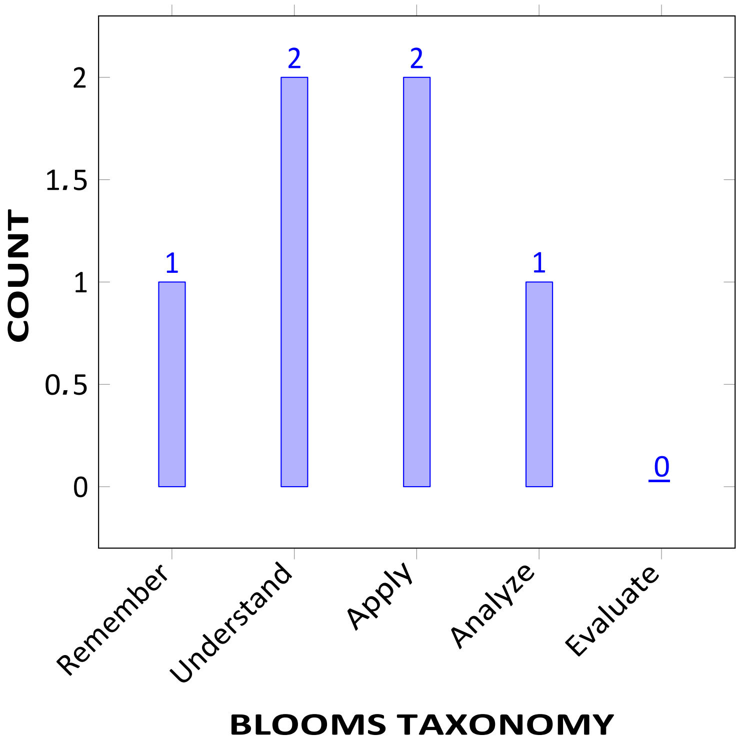
I	Develop the skills to analyze and design object-oriented problems.
II	Specify, analyze and design the use case driven requirements for a particular system.
III	Understand the various processes and techniques for building object-oriented software systems.
IV	Identify and analyze the subsystems for various components and collaborate them interchangeably.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**List** the importance and use of basic principles in object oriented modeling for appropriate analysis and design of given scenarios.	Remember
CO 2	**Make use of** building blocks and different views for creating conceptual model architectural view of system in unified software development life cycle.	Apply
CO 3	**Demonstrate** static and dynamic aspects of the system through UML diagrams static and dynamic aspects of the system through UML diagrams.	Understand
CO 4	**Identify** basic building blocks for visualizing objects of an object-orientedsystem.	Apply
CO 5	**Summarize** building blocks in structural and behavioral modeling of a software system for visualizing the relationships.	Understand
CO 6	**Categorize** behavioral modeling for visualizing flow control of objects and activities of specified case study like next gen POS system,for documenting static and dynamic aspects of a system software application like Unified Library with the help of UML diagrams	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIA/SEE/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	CIA/SEE/AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	2	CIA/SEE/AAT
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	1	Assignments/ CIA/SEE/AAT

PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	3	CIA/SEE/AAT
PO 9	**Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	2	AAT / Projects
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2	AAT
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	1	Projects

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		**Strength**	**Proficiency Assessed by**
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	1	CIA/SEE/AAT
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	3	CIA/SEE/AAT

3 = High; 2 = Medium; 1 = Low

X MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	**PROGRAM OUTCOMES**												**PSO'S**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	-	-	-	-	√	-	-	-	-	-	-	-	√	-	-
CO 2	√	-	√	√	√	-	-	-	-	√	-	-	-	-	√
CO 3	-	√	-	√	√	-	-	-	-	√	-	√	-	-	-
CO 4	√	-	√	√	√	-	-	-	-	√	-	√	√	-	√
CO 5	-	√	-	√	√	-	-	-	-	-	-	-	√	-	√
CO 6	-	-	-	√	-	-	-	-	-	√	-		√	-	√

XI JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 5	Usage of **CASE tool** for modelling simple to complex engineering activities with understanding requirements and limitations of user.	1
	PSO 1	**Formulate** and **Evaluate engineering concepts** to Design next-generation computer systems for modelling simple to complex engineering activities with understanding requirements and limitations of user.	2
CO 2	PO 1	Apply **Engineering knowledge** and **modelling principles,** building blocks and architectural views of the system with support of UML.	2
	PO 3	**Design solutions** for simple and complex problems by **Defining** and **understanding** customer requirements, identifying various static and dynamic functions, **managing design process and evaluate the outcomes** as UML diagrams.	6
	PO 4	**Conduct investigation of complex problems** for visualizing artefacts by using basic and advanced building blocks with **knowledge of process, laboratory skills, understanding knowledge and ability to apply a systems approach** to engineering problems.	5
	PO 5	Usage of **CASE tool** ffor modelling simple to complex engineering activities with understanding requirements and limitations of user for architectural view of system.	1
	PO 10	Make use of building blocks for creating architectural view of system using UML by **by communicating effectively to engineering community .**	3
	PSO 3	Make use of **computational and advanced CASE tools** tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2
CO 3	PO 2	**Understand** the given problem and **system definition,problem formulation, collecting data, modelling, solution development** and **documentation** by using diagrams for static and dynamic aspects of the system.	6
	PO 4	**Conduct investigation of complex problems** for visualizing diagrams of static and dynamic aspects by using basic and advanced building blocks **blocks knowledge of process, laboratory skills, understanding knowledge** and **ability to apply a systems approach** to engineering problems.	5
	PO 5	Usage of **CASE tool** for modelling simple to complex engineering activities with understanding requirements and limitations of user.	1

	PO 10	**Communicate** static and dynamic aspects of the **system using UML diagrams** for specifying structure and interaction of objects during runtime.	5
	PO 12	Recognize the need and develop suitable building blocks using UML diagrams for **future advancement and lifelong learning.**	5
CO 4	PO 1	Apply **Engineering knowledge and modelling principles,** , in identifying basic building blocks for visualizing artefacts of system.	2
	PO 3	**Design solutions** for simple and complex problems by **defining problem, understand customer requirements, identifying** basic building blocks to draw UML diagrams.	3
	PO 4	Conduct investigation of complex problems for visualizing artefacts by using basic building blocks with **knowledge** and **system approach** of process.	2
	PO 5	Usage of **CASE tool** for modelling simple to complex engineering activities with understanding requirements and limitations of user.	1
	PO 10	**Communicate** static and dynamic aspects of the **system using UML diagrams** for specifying structure and interaction of objects during runtime.	4
	PO 12	Recognize the need and develop suitable building blocks using UML diagrams for **future advancement and lifelong learning.**	6
	PSO 1	**Formulate** and **Evaluate engineering concepts** to Design next-generation computer systems for modelling simple to complex engineering activities with understanding requirements and limitations of user.	2
	PSO 3	Make use of **computational and advanced CASE tools** tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2
CO 5	PO 2	**Understand** the given problem and **system definition,problem formulation, collecting data, modelling, solution development** and **documentation** by using diagrams for static and dynamic aspects of the system.	6
	PO 4	**Conduct investigation of complex problems** for visualizing diagrams of static and dynamic aspects by using basic and advanced building blocks **blocks knowledge of process, laboratory skills, understanding knowledge** and **ability to apply a systems approach** to engineering problems.	2
	PO 5	Usage of **CASE tool** for modelling simple to complex engineering activities with understanding requirements and limitations of user.	1
	PSO 1	**Formulate** and **Evaluate engineering concepts** to Design next-generation computer systems for modelling simple to complex engineering activities with understanding requirements and limitations of user.	2

	PSO 3	Make use of **computational and advanced CASE tools** tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2
CO 6	PO 4	**Conduct investigation of complex problems** for structural modelling with**knowledge and system approach** of process.	2
	PO 10	**Make effective presentation** and better understanding of the scenario, use structural modelling framework with **knowledge and system approach.**	5
	PSO 1	**Formulate** and **Evaluate engineering concepts** to Design next-generation computer systems for modelling .	2
	PSO 3	Make use of **computational and advanced CASE tools** tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2

XII TOTAL COUNT OF KEY COMPETENCIES FOR CO – (PO, PSO) MAPPING:

COURSE OUTCOMES	Program Outcomes/ No. of Key Competencies Matched											PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	-	-	-	-	1	-	-	-	-	-	-	-	2	-	-
CO 2	2	-	6	5	1	-	-	-	-	3	-	-	-	-	2
CO 3	-	6	-	5	1	-	-	-	-	5	-	5	-	-	-
CO 4	2	-	3	2	1	-	-	-	-	4	-	6	2	-	2
CO 5	-	6	-	5	1	-	-	-	-	-	-	-	2	-	2
CO 6	-	-	-	2	-	-	-	-	-	5	-	-	2	-	2

XIII PERCENTAGE OF KEY COMPETENCIES FOR CO – (PO, PSO):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	-	-	-	100	-	-	-	-	-	-	-	-	33	-	-
CO 2	66	-	60	45	100	-	-	-	-	60	-	-	-	-	100
CO 3	-	60	-	45	100	-	-	-	-	100	-	41	-	-	-
CO 4	66	-	30	18	100	-	-	-	-	80	-	50	33	-	100
CO 5	-	60	-	18	100	-	-	-	-	-	-	-	33	-	100
CO 6	-	-	-	18	-	-	-	-	-	100	-	33	-	-	100

XIV COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

CO’S and PO’S and CO’S and PSO’S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - 0≤ C≤ 5% – No correlation ***2*** - 40 % <C < 60% –Moderate ***1-5*** <C≤ 40% – Low/ Slight

3 - 60% ≤ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO’S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	-	-	-	-	3	-	-	-	-	-	-	-	1	-	-
CO 2	3	-	3	2	3	-	-	-	-	2	-	-	-	-	3
CO 3	-	3	-	2	3	-	-	-	-	2	-	1	-	-	-
CO 4	3	-	1	1	3	-	-	-	-	2	-	2	1	-	3
CO 5	-	3	-	1	3	-	-	-	-	-	-	-	1	-	3
CO 6	-	-	-	1	-	-	-	-	-	2	-	-	1	-	3 -
Total	18	11	12	15	27				2	18		6	10		33
Average	3	3	2	1.1	3				2	2		2	1		3

XV ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	PO 1,PO 2, PO 3, PO 4,PO 5,PSO 1,PSO 3	SEE Exams	PO 1,PO 2,PO 3,PO 4,PO 5,PSO 1,PSO 3	Seminars	PO 1,PO 2,PO 3,PO 4,PO 5,PSO 1,PSO 3
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	PO 10	Open Ended Experiments	-
Assignments	PO 1,PO 2,PO 3,PO 4,PO 5,PSO 1,PSO 3	Tech talk	PO 10		

XVI ASSESSMENT METHODOLOGY INDIRECT:

√	Early Semester Feedback	√	End Semester OBE Feedback
√	Assessment of Mini Projects / Case Studies by Experts		

XVII SYLLABUS:

MODULE I	**INTRODUCTION TO UML**
	Introduction to UML: Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, architecture, software development life cycle; Classes, relationships, common mechanisms and diagrams.
MODULE II	**ADVANCED BEHAVIORAL MODELING**
	Advanced classes, advanced relationships, interfaces, types and roles, packages, terms, concepts; Class and Object Diagrams: Terms, concepts, common modeling techniques for class and object diagrams.
MODULE III	**ARCHITECTURAL MODELING**
	Basic Behavioral Modeling - I: Interactions, Interaction diagrams. Basic Behavioral Modeling-II: Use cases, Use case Diagrams, Activity Diagrams.
MODULE IV	**ADVANCED BEHAVIORAL MODELING**
	Events and signals, state machines, processes and threads, time and space, state chart and state chart diagrams. Case study: The next gen POS system.
MODULE V	**ARCHITECTURAL MODELING**
	Component, Component diagrams, Deployment, Deployment diagrams; Case Study: The Unified Library Application.

TEXTBOOKS

1. Grady Booch, James Rumbaugh, Ivar Jacobson, “The Unified Modeling Language User Guide”, Pearson Education, 2nd Edition, 2004.
2. 2. Craig Larman, “Applying UML and Patterns: An Introduction to Object Oriented Analysis and Design and Iterative Development”, Pearson Education, 3rd Edition, 2005.

REFERENCE BOOKS:

1. MeilirPage-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education, 1st Edition, 2006.
2. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, “UML 2 Toolkit”, WILEY-Dreamtech India Pvt. Ltd., Pearson Education, 3rd Edition, 2005.

XVII COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	**Topics to be covered**	**CO’s**	**Reference T1: 4.1**
1	Introduction to UML: Importance of Modeling, Things, Principles of Modeling.	CO 1	T1:1.1
2	Object Oriented Modeling, Structural things, Structural diagrams.	CO 1	T1:1.2

3	Conceptual model of the UML, Structural diagrams	CO 2	T1:1.3-1.4
4	Behavioral diagrams.	CO 2	T1:2.3
5	UML architecture, Software Development Life Cycle.	CO 2	T1:2.4
6	Basic class diagram symbols and notations.	CO 2	T1:2.5
7-8	Class diagram: Purpose, Benefits with example.	CO 3,CO 4	T1:4.1
9-10	Relationships: Dependencies, Generalizations, Associations with example	CO 3,CO 4	T1:5.1
11	Aggregation vs. Composition, Common mechanisms.	CO 3,CO 4	T1:6.1
12-13	Advanced classes: scope, multiplicity, operations, examples.	CO 3,CO 4	T1:7.1.1
14-16	Common modeling techniques for class diagram, Advanced relationships: dependency, generalization,association, realization, common modeling techniques	CO 5	T1:8.1.1
17	ThPackages: Key elements of package diagram, visibility of packages, import and access.	CO 5	T1:11.4
18	Terms and Concepts: common uses, common modeling techniques, forward and reverse engineering.	CO 5	T1:12.5
19	Class Diagrams- Terms, concepts and common modeling techniques.	CO 6,CO 5	T1:13.1
20	Object Diagrams: Terms, concepts and common modeling techniques.	CO 6,CO 5	T1:13.1
21	OInteractions: Interactions, concepts and common modeling techniques.	CO 3,CO 5	T1:14.1
22-23	Interaction Diagrams: Terms, concepts, uses and common modeling techniques.	CO 3,CO 5	T2: 5.2
24-25	Use cases: Use case diagrams Terms, concepts, uses and common modeling techniques.	CO 3,CO 6	T1:16.1
26-27	Activity Diagrams: Terms, concepts, uses and common modeling techniques.	CO 3,CO 5	T1:16.4
28	Events and signals, State machines.	CO 4	T1:20.5
29	Processes and threads, Time and space.	CO 4	T1:21.4
30-31	State Chart: Terms, concepts, uses and common modeling techniques.	CO 5,CO 5	T1:22.1
32-33	State chart diagrams: Terms, concepts, uses and common modeling techniques.	CO 4,CO 5	T1:22.4
34	Case study: The next gen POS system.	CO 6	T1:22.7
35	Component: Terms and concepts.	CO 5	T1:29.1
36-37	Component diagrams: Terms, concepts, uses and common modeling techniques.	CO 5	T1:29.3
38	Deployment: Terms and concepts.	CO 5	T1:30.1
39-40	Deployment diagrams: Terms, concepts, uses and common modeling techniques.	CO 5	T1:30.5
41-43	Case Study: The Unified Library Application.	CO 6	T1:30.9

44-45	Case Study: Real-Time applications.	CO 6	T1:30.9

Signature of Course Coordinator **HOD,IT**
Mr.R.Suvarna Rao, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**INFORMATION TECHNOLOGY**				
Course Title	**WEB TECHNOLOGIES**				
Course Code	AITB09				
Program	B.Tech				
Semester	FIVE				
Course Type	Core				
Regulation	R-18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	2	1	3	-	-
Course Coordinator	Mr.A.Krishna Chaitanya, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSB01	II	Programming For Problem Solving
B.Tech	AITB06	IV	Object Oriented Programming Through Java Laboratory

II COURSE OVERVIEW:

This course emphasize on website development, build dynamic and database driven web applications. using tools. Content of this course covers an insight into HTTP communication protocol, the markup languages HTML, DHTML , XML and the CSS for formatting and transforming web content, interactive graphics and multimedia content on the web. It also enriches client-side and server side programming using servlets JSP, PHP and connects with Data bases . There is a growing need for management and decision makers to gain a clearer understanding of the application development process, from planning through to deployment and maintenance. It will also give you how you can analyze requirements, plan, design, implement and test arrange of web applications.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Web Technologies	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIE examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
20%	Remember
40%	Understand
25%	Apply
15%	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Quiz	AAT	
CIA Marks	20	05	05	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination
Two Quiz exams shall be online examination consisting of 50 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

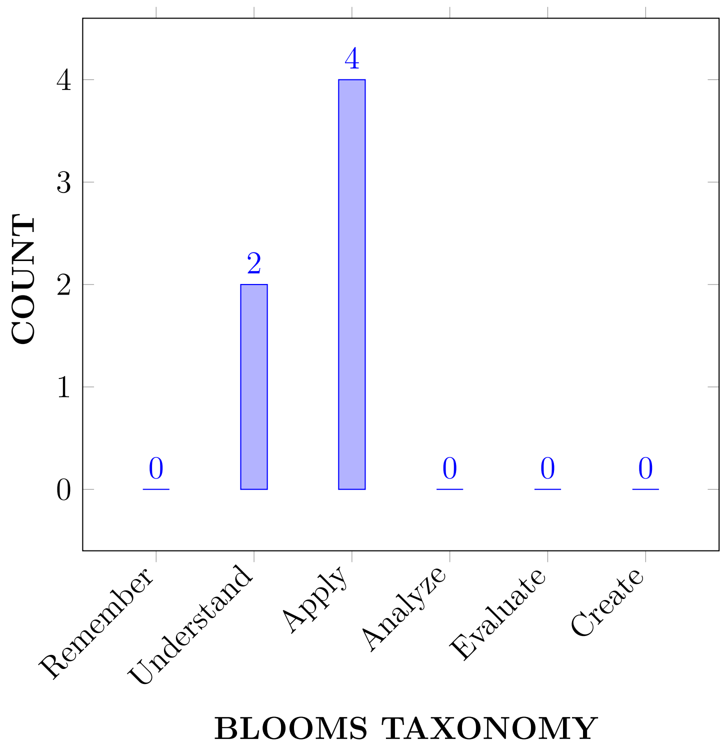
I	The fundamentals of designing static and dynamic web pages using HTML and DHTML for creation of websites..
II	The concepts of client - server programming with JavaScript, XML, Servlets, JSP and PHP..
III	The project-based experience needed for designing real time web based client-server applications..

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Demonstrate** basic elements of HTML and CSS for designing static web pages.	Understand
CO 2	**Develop** effective and interactive web pages using dynamic HTML with javascript and XML for client/server based applications.	Apply
CO 3	**Make use of** Servlets and Java Server Pages for server side programming with Model View Control architecture.	Apply
CO 4	**Summarize** basic concepts of PHP for designing static and dynamic web pages.	Understand
CO 5	**Build** dynamic web pages using XML and PHP with database connectivity to perform CRUD operations and validate using AJAX and Java Script.	Apply
CO 6	**Construct** website by using front end and backend end programming.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/Quiz/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	CIE/Quiz/AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	2	CIE/Quiz/AAT
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	3	CIE/Quiz/AAT
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	3	CIE/Quiz/AAT
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	1	Assignments
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	1	SEE/ CIE, AAT, QUIZ

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	Professional Skills: Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	2	CIA/SEE/AAT
PSO 2	Problem-Solving Skills: Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	2	CIA/SEE/AAT
PSO 3	Successful Career and Entrepreneurship: Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry. .	3	CIA/SEE/AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	✓	-	✓	-	✓	-	-	-	-	✓	-	✓	✓	-	✓
CO 2	✓	✓	✓	-	✓	-	-	-	-	✓	-	✓	✓	-	✓
CO 3	✓	✓	✓	-	✓	-	-	-	-	✓	-	✓	✓	-	✓
CO 4	✓	-	✓	-	✓	-	-	-	-	✓	-	✓	✓	-	✓
CO 5	✓	✓	✓	-	✓	-	-	-	-	✓	-	✓	✓	✓	✓
CO 6	✓	✓	✓	✓	✓	-	-	-	-	✓	-	✓	✓	✓	✓

XII JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 1	Identify(knowledge) the structure of web page using HTML elements with their importance in webpage designing by applying basic principles of mathematics and engineering Fundamentals of programming.	2
	PO 3	Understand the customer needs of static and dynamic webpages and use creativity to provide innovative solutions in designing attractive webpages using various mark-up languages ,scripting languages by considering all aspects of the problem by managing the design process cost effectively and evaluate the outcomes to achieve engineering objectives to provide sustainable development.	5

	PO 5	Apply appropriate techniques, modern Engineering and IT tools to design a web page with HTML and CSS and use search tools such as browsers to produce the view of webpage.	1
	PO 10	Communicate effectively on complex Engineering activities with the Engineering community related to web development and with society at large, to design web pages and write effective Programming by using the elements of HTML and CSS.	2
	PO 12	Recognize the need for advanced concepts related to HTML and CSS for understanding and developingweb applications through continuing education efforts with ongoing learning – stays up with industry trends.	2
	PSO 1	Identify the Customer needs and problem specific constraints in designing web pages related to the basic concepts of HTML and CSS.	2
	PSO 3	Make use of modern computer tool in designing Web applications by applying the technical skills and Knowledge on advanced frameworks and platforms and desire for higher studies.	1
CO 2	PO 1	Apply the knowledge of client side and server-side scripting, mark-up languages to develop effective web pages by applying principles of mathematics and engineering fundamentals.	2
	PO 2	Understand the problem statement and formulate (complex)specific engineering problems related to the concepts of HTML, Javascript and XML by considering the information and data provided by the customer to provide sustained conclusions by using model translation and validate the implementation of webpage byinterpretation of results .	8
	PO 3	Design solution for effective webpage by considering the customer requirementsand use creativity and to ensure sustainable development in design processof web application toensure fitness of the problemby using HTML,Javascript,XML. .	5
	PO 5	Effective web pages are developed by using computer software related to web development with concepts related to Dynamic HTML ,XML and Java script for client/server based web applications.	1
	PO 10	Communicate effectively on complex Engineering activities related to web development with the customer to take the specific needs in designing client/server based web applications by using HTML ,XML and Java script concepts.	2

	PO 12	Recognize the need for advanced concepts in developing web applicationsand through continuing education efforts with ongoing learning – stays up with industry trends/ new technology related to the concepts of HTML,Javascript,XML.	2
	PSO 1	Understand the need and constraints related to programming concepts of dynamic HTML, Java Script and XML languages in designing web pages.	2
	PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2
CO 3	PO 1	Illustrate the use of servlets and JSP for server-side programming by applying principles of programming engineering fundamentals and mathematics.	2
	PO 2	Understand the given problem statement and formulate (complex)specific engineering problems related to Servlets ,and JSPs by appliying MVC architecture from the information and data collection.	2
	PO 3	Design solution for effective webpage by considering the customer requirementsand use creativity and to ensure sustainable development in design process of web application to ensure fitness of the problem by using servlets and jsp with MVC architecture.	5
	PO 5	Effective server side web pages are developed by using computer software related to web development with concepts related to Servlets and JSP,s by using MVC architecture.	1
	PO 10	Communicate effectively on complex Engineering activities related to web development with the customer to take the specific needs in designing web pages by using Servlets and JSP with MVC architecture	2
	PO 12	Recognize the need for advanced concepts in developing web applications and through continuing education efforts with ongoing learning –stays up with industry trends/ new technology related to the concepts of Servlets , JSP with MVC architecture.	2
	PSO 1	Understand the need and constraints related to programming concepts of servlets, and JSP in designing web pages.	2
	PSO 3	Make use of modern computer tool in designing Web applications it desire for higher studies andto be an entrepreneur .	2
CO 4	PO 1	Understand the basic concepts of PHP in designing webpages by applying the principles of programming Engineering fundamentals and mathematics.	2

	PO 3	Understand the customer needsin designing static and dynamic web pages to ensure fitness of the problem by managing all the aspects under design process and to provide sustainable development.	4
	PO 5	Effective web pages are developed by using computer software related to web development with concepts related to PHP for designing static and dynamic web pages.	1
	PO 10	Communicate effectively on complex Engineering activities related to web development with the customer to take the specific needs in designing static and dynamic web pages by using PHP .	2
	PO 12	Recognize the need for advanced concepts in developing web applications through continuing education efforts with ongoing learning – stays up with industry trends/ new technology related to the concepts of PHP.	2
	PSO 1	Understand the need and constraints related to programming concepts of PHP in designing web pages.	2
	PSO 3	Make use of modern computer tool in designing Web applications by applying the technical skills and Knowledge on advanced frameworks and platforms .	1
CO 5	PO 1	Illustrate the use of XML.PHP,AJAX and data base connectivity in designing web pages by applying the principles of mathematics and engineering fundamentals	2
	PO 2	Understand the given problem statement and formulate the(complex) engineering problems of creating dynamic webpages using XML,PHP,AJAX and Javascriptby considering all the specifications by the information provided by the user and use model translations if required and validate the conclusion of the problem by the Interpretation of results by implementing the webpages.	8
	PO 3	Design dynamic webpages using XML,PHP,AJAX and database connectivity by considering the customer requirementsand use creativity to ensure sustainable development in design process of web pages to ensure fitness of the problemand to manage cost drivers.	6
	PO 5	Design web pages by using the computer software related to programming by using the concepts of PHP interaction with the database to perform CRUD and by using XML and AJAX.	1
	PO 10	Communicate effectively with the customer to take the specific needs in designing dynamic web pages by using the concepts of PHP with data base connectivity and AJAX.	2

	PO 12	Build web applications according to technological changes done in software environment trelated to the concepts of PHP,XML,AJAX with database connectivity through continuing education efforts with ongoing learning.	2
	PSO 1	Understand the need and constraints of the customers related to the web design by using the concepts of PHP,XML and AJAX.	2
	PSO 2	Understand and develop web applications using PHP for Improving software reliability.	1
	PSO 3	Make use of modern computer tool in designing Web applications for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2
CO 6	PO 1	Apply the knowledge of front end and back end programming in designing website by applying principles of mathematics and engineering fundamentals	2
	PO 2	Understand the given problem statement and formulate the(complex) engineering problems of creating dynamic webpages using XML,PHP,AJAX and Javascriptby considering all the specifications by the information provided by the user and use model translations if required and validate the conclusion of the problem by the Interpretation of results by implementing the webpages.	9
	PO 3	Create dynamic website using front end and backend programminglanguages by considering the customer requirementsand use creativity to ensure sustainable development in design process of web pages to ensure fitness of the problem and to manage cost drivers.	6
	PO 4	Design website by conducting investigations on complex requirements of the user including design process,technologies,analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	7
	PO 5	Create web site by using front end and backend technologies in developing web application by using Computer software .	1
	PO 10	Communicate effectively in designing website with the customer to take the requirements related to the designing of web pages by using front end and back end programming.	2
	PO 12	Construct web site according to technological changes done in software environment related to front end and backend programming through continuing education efforts with ongoing learning – stays up with industry trends/ new technology.	2

	PSO 1	Design the web applications by considered all the constraints of the customer in designing web pages by using front end and backend programming languages.	2
	PSO 2	Understand and develop web applications for Improving software reliability.	1
	PSO 3	Make use of modern computer tool in designing Web applications for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – (PO, PSO) MAPPING:

COURSE	PROGRAM OUTCOMES												PSO'S		
OUTCOMES	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2	-	5	-	1	-	-	-	-	2	-	2	2	-	1
CO 2	2	8	5	-	1	-	-	-	-	2	-	2	2	-	1
CO 3	2	2	5	-	1	-	-	-	-	2	-	2	2	-	2
CO 4	2	-	4	-	1	-	-	-	-	2	-	2	2	-	1
CO 5	2	8	6	-	1	-	-	-	-	2	-	2	2	1	2
CO 6	2	9	6	7	1	-	-	-	-	2	-	2	2	1	2

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – (PO, PSO):

COURSE	PROGRAM OUTCOMES												PSO'S		
OUTCOMES	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	66.7	-	50	-	100	-	-	-	-	40	-	25	33.3	-	50
CO 2	66.7	80	50	-	100	-	-	-	-	40	-	25	33.3	-	50
CO 3	66.7	20	50	-	100	-	-	-	-	40	-	25	33.3	-	100
CO 4	66.7	-	40	-	100	-	-	-	-	40	-	25	33.3	-	50
CO 5	66.7	80	60	-	100	-	-	-	-	40	-	25	33.3	50	100
CO 6	66.7	90	60	63.6	100	-	-	-	-	40	-	25	33.3	50	100

XV COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, **0** being **no correlation**, **1** being the **low correlation**, **2** being **medium correlation** and **3** being **high correlation**.

0 - $0 \leq C \leq 5\%$ – No correlation
1 -$5 < C \leq 40\%$ – Low/ Slight
2 - $40\% < C < 60\%$ –Moderate
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE	PROGRAM OUTCOMES												PSO'S		
OUTCOMES	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	-	2	-	3	-	-	-	-	1	-	1	2	-	2
CO 2	3	3	2	-	3	-	-	-	-	1	-	1	2	-	2

CO 3	3	1	2	-	3	-	-	-	-	1	-	1	2	-	3
CO 4	3	-	1	-	3	-	-	-	-	1	-	1	2	-	2
CO 5	3	3	3	-	3	-	-	-	-	1	-	1	2	2	3
CO 6	3	3	3	-	3	-	-	-	-	1	-	1	2	2	3
TOTAL	18	10	13	3	18	-	-	-	-	6	-	6	6	4	15
AVERAGE	3	2.5	2.1	3	3	-	-	-	-	1	-	1	2	2	2.5

XVI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Assignments	✓
Seminars	-	Student Viva	-	Certification	-
Laboratory Practices	-	5 Minutes Video	-	Open Ended Experiments	-
Term Paper	-	-	-	-	-

XVII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	**INRODUCTION TO HTML AND JAVA SCRIPT**
	Introduction to html: fundamentals of HTML elements, Document body, text, hyperlink, lists, tables, color and images, frames; Cascading Style Sheets: Introduction, defining your own styles, properties and values in styles, style sheets, formatting blocks, and layers. JavaScript: JavaScript basics, variables, string manipulation, mathematical functions, statements, operators, arrays and functions.
MODULE II	**OBJECTS IN JAVASCRIPT AND XML**
	Objects in JavaScript: Data and objects in JavaScript, regular expressions, exception handling, built- in objects, events; Dynamic HTML with JavaScript: Data validation, opening a new window, Rollover buttons, moving images, multiple pages in a single download, floating logos. XML: Basics XML, document type definition, xml schemas, Document Object Model, presenting XML.
MODULE III	**SERVLETS AND JSP**
	Servlet: Lifecycle of a Servlet, a simple Servlet, the Servlet API, the Javax. Servlet package, reading Servlet parameters, the javax.Servlet.HTTP package, Handling HTTP requests and responses, using cookies and sessions. JSP: The anatomy of a JSP page, JSP processing, declarations, directives, expressions, code snippets, implicit objects, using beans in JSP pages, connecting to database inJSP.

MODULE IV	**INTRODUCTION TO PHP**
	Basics of PHP: downloading, installing, configuring PHP, programming in a web environment and the anatomy of a PHP page; Overview of PHP data types and concepts: Variables and data types, operators, expressions and statements, strings, arrays and functions
MODULE V	**PHP AND DATABASE ACCESS**
	PHP and database access: Basic database concepts, connecting to a My SQL database, retrieving and displaying results, modifying, updating and deleting data; MVC architecture: PHP and AJAX other web technologies: PHP and XML.

TEXTBOOKS

1. Chris Bates, "Web Programming: Building Internet Applications", Wiley Dream Tech, 2nd Edition, 2002.
2. Jeffrey C K Jackson, "Web Technologies", Pearson Education, 1st Edition, 2006
3. Steven Holzner, "The Complete reference PHP", Tata McGraw-Hill, 1st Edition, 2007.

REFERENCE BOOKS:

1. WHans Bergsten, "Java Server Pages", O Reilly, 3rd Edition, 2003.
2. D. Flanagan, "Java Script", O Reilly, 6th Edition, 2011.
3. Jon Duckett, "Beginning Web Programming", WROX, 2nd Edition, 2008.

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO - PO Mapping	-	https://lms.iare.ac.in/index?route=course/details&course_id=177
CONTENT DELIVERY (THEORY)			
1	Basic concepts: Introduction to HTML	CO 1	T1:1.1 T1:2.1
2	Fundamentals of HTML elements, Document body	CO 1	T1:2.1 R2 : 1.4
3	Text,Hyperlink, Lists,Tables,color and images,Frames	CO 1	T1:2.2-2.8
4	Introduction to CascadingStyleSheets,Defining your own styles	CO1	T1:4.1-4.4.3

5	Properties and values in styles	CO 3	T1:4.4
6	Stylesheets,Formattingblocks,Layers	CO 1,	T1:4.5
7	JavaScript basics,variables,	CO 2,	T1:5.1 -5.4
8	String manipulation	CO 2	T1:5.5
9	Mathematicalfunctions,statements, operators	CO 2	T1:5.6-5.8
10	Arrays and Functions.	CO 2	T1:5.9-5.10
11	Data and objects in JavaScript, built-in objects.	CO 2	T1:6.1,6.4
12	Regular expressions.	CO 2	T1:6.2
13	Exception handling	CO 2	T1:6.3
14	Events	CO 2	T1:6.5
15	HTML with JavaScript: Data validation	CO 2	T1:7.1
16	Opening a window, Roll over buttons	CO 2	T1:7.2,7.6
17	Moving images, multiple pages in a single download, floating logos	CO 2	T1:7.7-7.10
18	Basics XML, document type definition	CO 2	T1: 14.1,14.2
19	Xml schemas.	CO 2	T1: 14.3
20	Document Object Model	CO 2	T1: 14.4
21	Presenting XML	CO 2	T1: 14.5
22	Life cycle of a Servlet, a simple Servlet	CO 3	T2: 6.1-6.4
23	The servlet API, the Javax. servlet package.	CO 3	T2: 6.1-6.4
24	Reading Servlet parameters	CO 3	T1:6.5
25	Handling HTTP requests and responses,Packages.	CO 3	T1:6.5
26	Cookies and sessions	CO 3	T2: 6.6-6.7
27	The anatomy of a JSP page, JSP processing, declarations	CO 3	T2: 8.1-8.2
28	Directives,Eexpressions, Code snippets	CO 3	T2: 8.3-8.4
29	Implicit objects, using beans in JSP pages, connecting to database in JSP.	CO 3	T2: 8.5
30	Basics of PHP, downloading, installing, configuring PHP	CO4	T3:1.1
31	Programming in a web environment and the anatomy of a PHP page	CO4	T3:1.1
32	Overview of PHP datatypes and concepts:Variables,datatypes,operators,expressionsand statements	CO 4	T3:1. 2
33	Complex structures, structures and functions	CO 4	T3:2.1
34	Passing structures through pointers, self-referential structures	CO 4	T3:3.4
35	Strings, arrays, Functions	CO 4	T3: 3.10
36	PHP and data base access :Basic database concepts, connecting to a My SQL	CO 5	T3:3.10

37	Retrieving and displaying results,modifying,updating and deleting data	CO 5	T3: 3.18
38	MVC Architecture	CO 5	T3: 3.12
39	PHP and other web technologies: PHP and XML	CO 5	T3: 3.13
40	PHP and AJAX.	CO 5	T3: 3.14
PROBLEM SOLVING			
41	Create a table to show your class timetable.	CO 1	T1:2.7
42	Build a HTML document that has the form with the following controls: (a) A text box to collect the customer's name. (b) Four checkboxes, one each for the following items: i. Four HTML textbooks for Rs.1000. ii. Eight XML textbooks for Rs.2000. iii. Four Javabeans books for Rs.2500. iv. Eight UML textbooks for Rs.1500.	CO 1	T1:2.6
43	Build a script that inputs three integers from the user and displays sum, average, product, smallest and largest of these numbers in an alert dialog	CO 2	T1:6.3
44	Write an HTML page that has one input, which can take multi-line text and a submit button. Once the user clicks the submit button should show the number of characters, words and lines in the entered using an alert message. Words are separated with space and lines are separated with new line character.	CO 2	T1: 2.1-2.9
45	Build the page(s) for accepting the values of name and marks in a table then display them in the descending order of the marks.	CO 2	T1:2.5
46	Build web page for a library system, page should be in such a way that it should contain all book details- details include fields like Book name, Author name, ISBN and no. of copies available. Design webpage using CSS.	CO 6	T1: 2.1-2.9
47	Construct HTML page for any company home page and explain.	CO 6	T1: 2.4
48	Write a Java Script function to print an integer with commas as thousands separators.	CO 2	T1:4.8
49	Write a Java Script program to test the first character of a string is uppercase or not. Write a pattern that matches e-mail addresses.	CO 2	T1:2.2
50	Write a Java Script program to sort a list of elements using quick sort.	CO 2	T2: 4.1-4.5
51	Write a Java Script function which will take an array of numbers stored and find the second lowest and second greatest numbers, respectively.	CO 2	T2: 4.2-4.6

52	Write a Java Script program which compute, the average marks of the following students then determine the corresponding grade.	CO 2	T2: 4.1-4.6
53	To design the scientific calculator and make event for each button using java script.	CO 2	T1: 4.1
54	A simple calculator web application	CO 6	T1: 4.4
55	Write php program how to send mail using PHP.	CO 4	T3:9.5
56	Write php program to upload image to the server using html and PHP.	CO 4	T3: 4.4
57	Write php program to upload registration form into database	CO 5	T3: 5.5
58	Write php program to display the registration form from the database.	CO 5	T3: 6.5
59	Write php program to delete the registration form from database	CO 5	T3: 6.7
DISCUSSION ON DEFINITION AND TERMINOLOGY			
60	HTML, Java script, CSS, arrays, functions, string manipulation	CO 1,CO 2	T1:1.1 T1:2.1
61	Data validation, regular expressions, exception handling	CO 2	T1:2.1
62	Servlet, cookies and sessions, JSP page	CO 3	T2:6.2-6.8
63	PHP	CO 4	T3 :2.1
64	My SQL database, retrieving MVC architecture	CO 5	T3:10,11,12
DISCUSSION ON QUESTION BANK			
65	A simple calculator web application that takes two numbers and an operator (+, -,/,*) from an HTML page and returns the result page with the operation performed on the operands	CO 2	T1: 2.1-2.9
66	State the order of evaluation of the operators in the following JavaScript statements and show the value of x after each statement is performed. X=2/2+2*2- 2/2; X=(3*9*(3+(9*3/(3)))));	CO 2	T1:5.1-5.9
67	The MVC architecture in PHP with a neat diagram?	CO 5	T2:8.7
68	create a database using PHP and My SQL	CO 5	T3: 5,10
69	Write a PHP Script to validate username and password by reading values from html form and validate the form using XML file?	CO 5	T3:10,11,12
70	My SQL database, retrieving MVC architecture	CO 5	T3:10

Signature of Course Coordinator **HOD,IT**
Mr.A.Krishna Chaitanya, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	INFORMATION TECHNOLOGY					
Course Title	**COMPILER DESIGN**					
Course Code	AIT004					
Program	B.Tech					
Semester	V					
Course Type	Core					
Regulation	R16					
Course Structure	Theory			Practical		
	Lecture	Tutorials	Credits	Laboratory	Credits	
	2	1	3	-	-	
Course Coordinator	Mr. U Sivaji , Assistant Professor					

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
UG	ACS01	I	Computer Programming
UG	ACS02	II	Data Structures
UG	AHS013	III	Discrete Mathematical Structures
UG	AIT002	IV	Theory of Computation

II COURSE OVERVIEW:

This course describes the basic techniques for compiler construction and tools that can be used to perform syntax-directed translation of a high-level programming language into an executable code. It will provide deeper insights into the more advanced semantics aspects of programming languages, machine independent optimizations and code generation.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Compiler Design	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Chalk & Talk	✓	Quiz	✓	Assignments	x	MOOCs
✓	PPT	✓	Seminars	x	Mini Project	✓	Videos
x	open Ended Experiments						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The expected percentage of cognitive level of the questions is broadly based on the criteria given in Table: 1.

Percentage of Cognitive Level	Blooms Taxonomy Level
7.69%	Remember
53.84 %	Understand
38.46 %	Apply
0 %	Analyze
0 %	Evaluate
0 %	Create

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Quiz	AAT	
CIA Marks	20	05	05	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination
Two Quiz exams shall be online examination consisting of 50 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

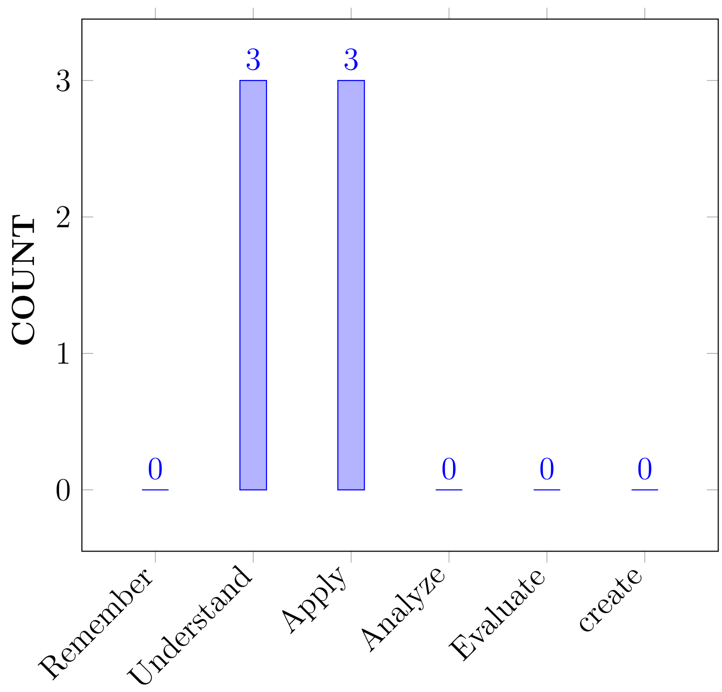
I	The process of translating a high-level language to machine code required for compiler construction.
II	The Software tools and techniques used in compiler construction such as lexical analyser and parser generators.
III	The data structures used in compiler construction such as abstract syntax trees, symbol tables, three-address code, and stack machines.
IV	The deeper insights into the syntax and semantic aspects of programming languages, dynamic memory allocation and code generation.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Summarize** phases of a compiler in the construction of language processors.	Understand
CO 2	**Make use of** finite automata for designing a lexical analyzer for a specific programming language constructs.	Apply
CO 3	**Choose** top down, bottom up parsing methods for developing a parser with representation of a parse table or tree.	Apply
CO 4	**Outline** syntax directed translations, intermediate forms for performing semantic analysis along with code generation.	Understand
CO 5	**Relate** symbol table, type checking and storage allocation strategies used in run-time environment.	Understand
CO 6	**Select** code optimization techniques on intermediate code form for generating target code.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

Program Outcomes	
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	Engineering knowledge: Apply the knowledge of mathematics, science, engineeringfundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE / Quiz / AAT
PO 2	Problem analysis: Identify, formulate, review research literature, and analyze complexengineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	1	CIE / Quiz / AAT
PO 3	Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	1	CIE / Quiz / AAT
PO 5	Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings	3	CIE / Quiz / AAT

PO 10	Communication: Communicate effectively on complex Engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2	CIE / Quiz / AAT/Tech-Talk

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		**Strength**	**Proficiency Assessed by**
PSO 1	Understand, design and analyse computer programs in the areas related to Algorithms, System Software, Web design, Bigdata, Artificial Intelligence, Machine Learning and Networking.	3	Group discussion/ Short term courses
PSO 2	Focus on improving software reliability, network security and information retrieval systems.	3	Industry exposure/AAT
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2	Group discussion/ Short term courses/AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	**PROGRAM OUTCOMES**												**PSO'S**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	✓	-	-	-	-	-	-	-	✓	-	-
CO 2	✓	-	-	-	-	-	-	-	-	-	-	-	✓	-	-
CO 3	✓	✓	-	-	-	-	-	-	-	-	-	-	-	✓	-
CO 4	✓	-	✓	-	✓	-	-	-	-	-	-	-	-	-	-
CO 5	-	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	✓	✓	-	-	✓	-	-	-	-	✓	-	-	-	-	✓

XII JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 1	Describe the role of lexical analyzer and recognition of tokens, from regular expressions to finite automataby applying engineering fundamentals and provide solutions to engineering problems.	2
	PO 5	Understand the phases of compiler in optimizing regular Expressions by using the mathematical principles and computer science methodologies.	1
	PSO 1	Understand pass and phases of translation for specific problems with lexical analyzer generator.	1
CO2	PO 1	Understand the significant phases of translation, bootstrapping, LEX-lexical analyzer generator in lexical analysis using mathematical principles, fundamental of Computer engineering specialization and scientific principles.	3
	PSO 1	Understand the finite automata, regular Expressions in the area related to lexical analysis.	1
CO 3	PO 1	Understand the different types of parsing methods including the backtracking by apply the knowledge of computer engineering fundamentals and mathematical principles	2
	PO 2	Understand the problem statement and choose appropriate techniques by analyzing various grammars including stack implementation of parser by the interpretation of results.	3
	PSO 2	Understand the basic difference between top down parsing and bottom up parsing with reference to grammars and parser generator.	2
CO 4	PO 1	Describe Intermediate forms using syntax tree and three address code using mathematical principles and scientific principles.	2
	PO 3	Explain and demonstrate the translation of simple statements, Boolean expression and flow of control statements with three address code.	2
	PO 5	Understand the concepts of three address statements and its implementation in the intermediate code generation.	1
CO 5	PO 2	Analyze the process of symbol tables in runtime environment.	1
	PO 3	Understand the concepts of runtime environment evaluate the Source languageissues.	2

CO 6	PO 1	Demonstrate the code optimization by applying the principles of mathematics and engineering fundamentals.	2
	PO 2	Understand the given problem statement and formulate the (complex) engineering problems in the Design of a Code Generator and addresses in the target Code in reaching substantiated conclusions by the interpretation of results.	3
	PO 5	Create the addresses for Design of a Code Generator (complex) Engineering activities in Computer software.	1
	PO 10	Understand code optimization techniques on intermediate code forms such as syntax trees and design documentation, for improving the performance of a program.	1
	PSO 3	Demonstrate the basic optimization in real world software, using industry standard tools and collaboration techniques in the field of application programming.	1

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – (PO, PSO) MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2				1								1		
CO 2	3												1		
CO 3	2	3												2	
CO 4	2		2		1										
CO 5		1	2												
CO6	2	3			1					1					1

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – (PO, PSO):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	66.7	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0
CO 2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0
CO 3	66.7	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0
CO 4	66.7	0.0	20.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO 5	0.0	10.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 6	66.7	30.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	20.0	0.0	0.0	0.0	0.0	50.0

XV COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.
0 - 0$\leq$ C$\leq$ 5% – No correlation
2 - 40 % <C < 60% –Moderate
1-5 <C$\leq$ 40% – Low/ Slight
3 - 60% $\leq$ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	3	-	-	-	-	-	-	-	3	-	-
CO 2	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO 3	3	1	-	-	-	-	-	-	-	-	-	-	-	3	-
CO 4	3	-	1	-	3	-	-	-	-	-	-	-	-	-	-
CO 5	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	3	1	-	-	3	-	-	-	-	2	-	-	-	-	2
TOTAL	15	3	2		9					2			6	3	2
AVERAGE	3	1	1		3					2			3	3	2

XVI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	-	Open Ended Experiments	-
Assignments	✓				

XVII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	**INTRODUCTION TO COMPILERS AND PARSING**
	Introduction to compilers: Definition of compiler, interpreter and its differences, the phases of a compiler; Lexical Analysis: Role of lexical analyzer, input buffering, recognition of tokens, finite automata, regular Expressions, from regular expressions to finite automata, pass and phases of translation, bootstrapping, LEX-lexical analyzer generator. Parsing: Parsing, role of parser, context free grammar, derivations, parse trees, ambiguity, elimination of left recursion, left factoring, eliminating ambiguity from dangling-else grammar, classes of parsing, topdown parsing: backtracking, recursive-descent parsing, predictive parsers, LL(1) grammars.
MODULE II	**BOTTOM-UP PARSING**
	Bottom-up parsing: Definition of bottom-up parsing, handles, handle pruning, stack implementation of shift- reduce parsing, conflicts during shift-reduce parsing, LR grammars, LR parsers-simple LR, canonical LR and Look Ahead LR parsers, error recovery in parsing, parsing ambiguous grammars,YACC-automatic parser generator.
MODULE III	**SYNTAX-DIRECTED TRANSLATION AND INTERMEDIATE CODE GENERATION**
	Syntax-directed translation: Syntax directed definition, construction of syntax trees, S-attributed and L- attributed definitions, translation schemes, emitting a translation. Intermediate code generation: Intermediate forms of source programs– abstract syntax tree, polish notation and three address code, types of three address statements and its implementation, syntax directed translation into three-address code, translation of simple statements, Boolean expressions and flow-of control statements
MODULE IV	**TYPE CHECKING ANDRUN TIME ENVIRONMENT**
	Type checking: Definition of type checking, type expressions, type systems, static and dynamic checking of types, specification of a simple type checker, equivalence of type expressions, type conversions, overloading of functions and operators; Run time environments: Source language issues, Storage organization, storage- allocation strategies, access to nonlocal names, parameter passing, symbol tables, and language facilities for dynamic storage allocation.
MODULE V	**CODE OPTIMIZATION AND CODE GENERATION**
	Code optimization: The principle sources of optimization, optimization of basic blocks, loops in flow graphs, peephole optimization; Code generator: Issues in the design of a code generator, the target machine, runtime storage management, basic blocks and flow graphs, a simple code generator, register allocation and assignment, DAG representation of basic blocks.

TEXTBOOKS

1. Alfred V.Aho, RaviSethi,JeffreyD, Ullman, —Compilers–Principles,TechniquesandTools, Pearson Education, 2nd Edition, 2006.

REFERENCE BOOKS:

1. Kenneth C.Louden,Thomson, —CompilerConstruction–PrinciplesandPractice, PWS Publishing, 1st Edition,1997.
2. Andrew W. Appel, —Modern Compiler Implementation C, Cambridge University Press, Revised Edition, 2004.

COURSE WEB PAGE:

1. http://csenote.weebly.com/principles-of-compiler-design.html
2. http://www.faadooengineers.com/threads/32857-Compiler-Design-Notes-full-book-pdf-download
3. http://www.e-booksdirectory.com/details.php?ebook=10166
4. http://www.e-booksdirectory.com/details.php?ebook=7400re

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	In Outcome-Based Education (OBE), we discussed about course delivery assessment that are planned to achieve stated objectives and outcomes. We will focuses on measuring student performance i.e. outcomes at different levels. Course outcomes(CO),Program Outcomes(PO)and Program Specific Outcomes(PSO) and also mapping of CO's to PO's PSO's and their attainments are discussed.		
CONTENT DELIVERY (THEORY)			
1	Introduction to compilers: Definition of compiler, interpreter and its differences	CO 1	T1:1.1-1.5 R1:1.1
2	The phases of a compiler	CO 1	T1:3.6-3.7 R1:2.2-2.4
3	Lexical Analysis: Role of lexical analyzer, input buffering	CO 1	T1: 1.5
4	recognition of tokens, finite automata.	CO 2	T1:1.1 R1:1.6
5	regular Expressions	CO 2	T1:3.8-4.3 R1:3.1-3.3
6	from regular expressions to finite automata.	CO 2	T1: 4.3-4.4 R1:4.1
7-8	pass and phases of translation, bootstrapping, LEX-lexical analyzer generator.	CO 2	T1:4.5-4.7 R1:4.3-4.5
9	Syntax Analysis: Parsing, role of parser, context free grammar.	CO 3	T1:4.5-4.7 R1:5.1-5.2
10	derivations, parse trees, ambiguity	CO 3	T1:4.7 R1:5.3
11	elimination of left recursion, left factoring	CO 3	T1: 4.7 R1:5.4-5.5
12	eliminating ambiguity from dangling-else grammar	CO 3	T1:4.7 R1:5.6
13	Types of parsing: Top-down parsing	CO 3	T1:4.9 R1:5.5

14	backtracking, recursive-descent parsing, predictive parsers,	CO 3	T1: 4.9
15	LL (1) grammars	CO 3	T1: 5.1-5.4 R1:6.1
16	Bottom-up parsing: Definition of bottom-up parsing,.	CO 3	T1:8.4-8.6
17	handles, handle pruning, stack implementation of shift-reduce parsing,	CO 3	T1: 6.1 R1:6.4-6.5
18	conflicts during shift-reduce parsing,	CO 3	T1: 7.1-7.5 R1:7.1
19	LR grammars, LR parsers-simple LR,	CO 3	T1: 7.6-7.7
20	canonical LR and Look Ahead LR parsers,	CO 3	T1: 10.2
21	YACC-automatic parser generator.	CO 3	T1:10.1-10.2 T1:10.4,9.9
22	Syntax-Directed Translation: Syntax directed definitions, construction of syntax trees	CO 4	T1: 9.1-9.2
23	S-attributed and L- attributed definitions; Syntax Directed Translation schemes.	CO 4	T1: 9.3 R1:7.6
24	Intermediate code generation: Intermediate forms of source	CO 4	T1: 9.4
25	programs– abstract syntax tree, polish notation and three address code,	CO 4	T1:9.6-9.7 R1:8.1-8.8
26	Types of three address statements and its implementation	CO 4	T1: 9.8
27	syntax directed translation into three-address code	CO 4	T1: 9.1-9.2
28	translation of simple statements, Boolean expressions	CO 4	T1: 9.1-9.2
29	Flow-of- Control statements.	CO 4	R1:8.1-8.8
30	Type checking: Definition of type checking,	CO 5	R1:8.1-8.8
31	type expressions, type systems, static and dynamic checking of	CO 5	T1: 9.4
32	specification of a simple type checker	CO 5	T1: 9.1-9.2
33	Run time environments: Source language issues,	CO 5	T1: 9.1-9.2
34	Types Storage organization	CO 5	T1: 9.1-9.2
35	storage-allocation strategies,	CO 5	T1: 9.1-9.2
36	access to nonlocal data on the stack,	CO 5	T1: 9.1-9.2
37	Garbage collection, symbol tables.	CO 5	T1: 9.1-9.2
38	Code optimization: The principle sources of optimization	CO 6	T1: 9.1-9.2
39	optimization of blocks	CO 6	T1:10.1-10.2 T1:10.4,9.9
40	loops in flow graphs	CO 6	T1: 10.2
41	peephole optimization	CO 6	T1: 9.1-9.2

42	Code Generation: Issues in the Design of a Code Generator	CO 6	T1: 9.1-9.2
43-44	The Target Language, addresses in the Target Code,	CO 6	T1:10.1-10.4
45-46	Basic Blocks and Flow Graphs	CO 6	T1: 9.1-9.2
47	Optimization of Basic Blocks	CO 6	T1: 9.1-9.2
48	A Simple Code Generator	CO 6	T1:9.6-9.7 R1:8.1-8.8
49	register allocation and assignment	CO 6	T1:9.6-9.7
50-52	DAG representation of basic blocks.	CO 6	R1:8.1-8.8
PROBLEM SOLVING/ CASE STUDIES			
1	Consider the following fragment of C code: float i, j; i = i*70+j+2; Construct the output at all phases of the compiler for above C code	CO 1	T1:1.1-1.5 R1:1.1
2	For the following expression total = count + rate * 5 Construct the output after each phase of compiler?	CO 1	T1:1.1-1.5 R1:1.1
3	Convert NFA with ϵ to equivalent NFA M=({q0,q1,q2},{0,1,2}, δ, q0, {q2}) where δ is given by [δ (q0,0)={q0}, δ (q0,1)=ϕ, δ (q0,2)=ϕ, δ(q0, ϵ)=q1] [δ (q1,0)=ϕ, δ (q1,1)=q1 , δ (q1,2)=ϕ ,δ (q1, ϵ)=q2] [δ (q2,0)=ϕ, δ (q2,1)= ϕ , δ (q2,2)= {q2},δ (q2, ϵ)= ϕ]	CO 2	T1:1.1 R1:1.6
4	Describe a DFA for the following language L={w/|w | mod5=0,w belongs to (a,b)*} L={w/|w | mod5=1,w belongs to (a,b)*}	CO 2	T1:1.1 R1:1.6
5	Describe the DFA Transition diagram for equivalent Regular expression (ab+a) *(aa+b)	CO 2	T1:3.8-4.3 R1:3.1-3.3
6	Construct the FIRST and FOLLOW sets for following grammar S$\rightarrow$ aBDh , B $\rightarrow$ cC , C $\rightarrow$ bC / ϵ , D $\rightarrow$ EF , E $\rightarrow$ g / ϵ , F $\rightarrow$ f / ϵ	CO 3	T1: 4.9
7	Construct SLR parsing table for the below grammar? E $\rightarrow$ E+T |T T $\rightarrow$ T*F | F F$\rightarrow$ (E) |id.	CO 3	T1: 7.6-7.7
8	Outline the CLR Parsing model and write the CLR parsing algorithm for constructing the parsing table	CO 3	T1: 10.2

9	Construct production rules and semantic actions for the following grammar along with annotated parse tree for the expression: "int a, b, c"? D →T L T →int T → float; L→ L1,id L → id	CO 4	T1: 9.1-9.2
10	Construct the three address code and draw the abstract tree for the following expressions? a) (x-y)*z+m-n b) a+(b-c)+(b+c)*(a*e)	CO 4	T1: 9.1-9.2
11	Translate the expression – (a + b) * (c + d) + (a + b +c) into a) quadruples b) triples	CO 4	T1: 9.8
12	Explain briefly about Activation record with block diagram	CO 5	T1: 9.1-9.2
13	Explain the specification of a simple type checker	CO 5	R1:8.1-8.8
14	Construct the code sequence generated by the simple code generation algorithm for x*y+(m-k)-(g+b)	CO 6	T1:9.6-9.7 R1:8.1-8.8
15	Explain the concept of Function-Preserving Transformations	CO 6	T1:10.1-10.2 T1:10.4,9.9
DISCUSSION ON DEFINITION AND TERMINOLOGY			
1	Definition of compiler, interpreter and its differences, the phases of a compiler	CO 1	T1:1.1-1.5 R1:1.1
2	LR grammars, LR parsers-simple LR,CLR ,LALR	CO 3	T1: 7.6-7.7
3	Syntax directed definition, construction of syntax trees, S-attributed and L- attributed definitions	CO 4	T1: 9.1-9.2
4	Storage organization, storage- allocation strategies, access to nonlocal names	CO 5	T1: 9.1-9.2
5	optimization of basic blocks, loops in flow graphs, peephole optimization; Code generator	CO 6	T1:10.1-10.2 T1:10.4,9.9
DISCUSSION ON QUESTION BANK			
1	Describe how various phases could be combined as a pass in compiler	CO 1	T1:1.1-1.5 R1:1.1
2	Identify whether the following grammar is CLR or not with reasons? S→ AA , A →aA | b	CO 3	T1: 7.6-7.7

3	Construct production rules and semantic actions for S-attributed grammar for the following grammar along with syntax tree and annotated parse tree for the given string a*b-c/d+e? L→E E→ E+T | E-T|T T→ T*F | T/F |F F→ P-F | P P→(E) P→ID	CO 4	T1: 9.1-9.2
4	Explain briefly about stack storage allocation with block diagram.	CO 5	T1: 9.1-9.2
5	Identify the register descriptor target code for the source language Statement and its cost. (a-b) + (a-c) + (a-c)	CO 6	T1:10.1-10.2 T1:10.4,9.9

Prepared by **HOD,CSE**
Mr. U Sivaji, Assistant Professor

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Dundigal, Hyderabad - 500 043

INFORMATION TECHNOLOGY
COURSE DESCRIPTION

Department	**INFORMATION TECHNOLOGY**				
Course Title	**COMPUTER NETWORKS**				
Course Code	AITC06				
Program	B.Tech				
Semester	V				
Course Type	Core				
Regulation	R 18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	3
Course Coordinator	Mr. S Vinod Kumar , Assistant Professor				

I COURSE OVERVIEW:

The main emphasis of this course is on the organization and management of local area networks (LANs) wide area networks (WANs). The course includes learning about computer network organization and implementation, obtaining a theoretical understanding of data communication and computer networks. Topics include layered network architectures, addressing, naming, forwarding, routing, communication reliability, the client-server model, and web and email protocols. The applications of this course are to design, implement and maintain a basic computer networks.

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSB07	IV	Computer Organization and Architecture

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Computer Networks	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	x	Chalk & Talk	x	Assignments	x	MOOC
✓	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
60 %	Understand
20 %	Apply
10 %	Analyze

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Quiz	AAT	
CIA Marks	20	**x**	10	30

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Alternative Assessment Tool (AAT)

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

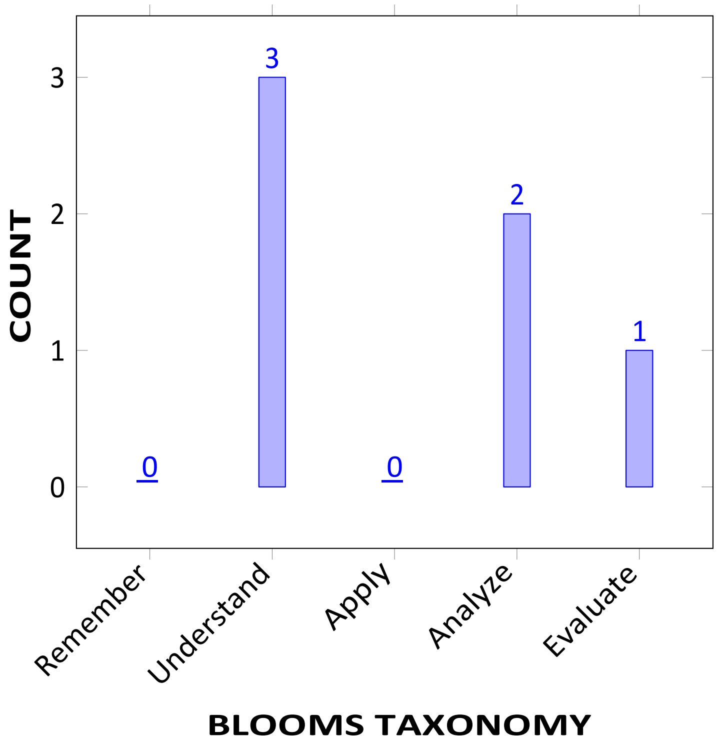
I	How computer network hardware and software operate
II	Investigate the fundamental issues driving network design
III	The data transmission through protocols across the network in wired and wireless using routing algorithms.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Outline** the basic concepts of data communications including the key aspects of networking and their interrelationship, packet, circuit and cell switching as internal and external operations, physical structures, types, models, and internetworking	Understand
CO 2	**Make use of** different types of of bit errors and the concept of bit redundancy for error detection and error correction.	Understand
CO 3	**Identify** the suitable design parameters and algorithms for assuring quality of service and internetworking in various internet protocols	Understand
CO 4	**Interpret** transport protocols (TCP,UDP) for measuring the network performance	Evaluate
CO 5	**Illustrate** the various protocols (FTP, SMTP,TELNET, EMAIL,WWW) and standards (DNS) in data communications among network.	Analyze
CO 6	**Compare** various networking models (OSI, TCP/IP) in terms of design parameters and communication modes.	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/Quiz/AAT

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	CIE/Quiz/AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	2	CIE/Quiz/AAT
PO 10	**Communication:** Communicate effectively on complex Engineering activities with the Engineering .community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions..	2	Discussion on Innovations / Presentation
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	1	Short term courses

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	2	Research papers / Group discussion / Short term courses
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	1	Research papers / Industry exposure

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	✓	✓	-	-	-	-	-	-	-	✓	-	✓	-	-	-
CO 3	✓	✓	✓	-	-	-	-	-	-	✓	-	-	✓	-	-
CO 4	✓	-	✓	✓	-	-	-	-	-	✓	-		✓	-	✓
CO 5	✓	✓	✓	-	-	-	-	-	-	-	-	✓	✓	-	✓
CO 6	✓	-	✓	-	-	-	-	-	-	-	-		-	-	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Understand the importance of network types, suitable transmission medium, devices and the Internet in supporting business communications and everyday activities by understanding **fundamentals of Computer engineering specialization** and **scientific principles.**	1
CO 2	PO 1	Understand the importance of network types, suitable transmission medium, devices and the Internet in supporting business communications and everyday activities by understanding **fundamentals of Computer engineering specialization** and **scientific principles.**	2
	PO 2	Understand the **problem** statement and **choose appropriate techniques** by **analyzing** the importance of data hiding **interpretation of results.**	4
	PO 10	Recognize the importance of error detection and correction techniques for optimizing the efficiency of the networks by **communicating effectively** with **engineering community.**	2
	PO 12	Build strong foundation of the performance of a single link, logical process-to-process (end-to-end) channel, and a network as a whole (latency, bandwidth, and throughput) for career **building** by **communicating effectively** with **engineering community.**	4
CO 3	PO 1	Explain the concept of Hamming distance, and the significance of the minimum Hamming Distance and its relationship to errors by **understanding mathematical principles** and **scientific principles.**	3
	PO 2	Understand the **problem** statement and **choose appropriate techniques** by **analyzing**the importance of data hiding **interpretation of results.**	4

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 3	**Understand the concepts** E-mail, telnet, secure shell for **innovative solutions, evaluate the solution of the complex issues.**	3
	PO 10	Recognize the importance of error detection and correction techniques for optimizing the efficiency of the networks by **communicating effectively** with **engineering community.**	2
	PSO 1	Design **next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers,** and **knowledge discovery tools.**	6
CO 4	PO 1	Describe the relationship between data and signals, their types, behavior, properties, characterization and transmission through the physical layer by **understanding mathematical principles** and **scientific principles.**	2
	PO 3	**Understand the concepts** E-mail, telnet, secure shell for **innovative solutions, evaluate the solution of the complex issues.**	3
	PO 4	Evaluate the performance of a single link, logical process-to-process (end-to-end) channel, a and **a network as a whole (latency, bandwidth, and throughput).**	2
	PO 10	Recognize the importance of error detection and correction techniques for optimizing the efficiency of the networks by **communicating effectively with engineering community.**	2
	PSO 1	Design **next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers,** and **knowledge discovery tools.**	6
	PSO 3	Practical experience in **shipping real world software,using industry standard tools** and **collaboration techniques** will equip to secure and succeed in first job upon graduation in IT industry.	3
CO 5	PO 1	Understand the basic design problems of data communications including the checksum, flow control, error control, reliability by apply the **knowledge of computer engineering fundamentals and mathematical principles.**	2
	PO 2	Understand the **problem** statement and **choose appropriate techniques by analyzing**analyzing the importance of data hiding **interpretation of results.**	3
	PO 3	**Understand the concepts** E-mail, telnet, secure shell for **innovative solutions, evaluate the solution of the complex issues.**	3

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 12	Build strong foundation of the performance of a single link, logical process-to-process (end-to-end) channel, and a network as a whole (latency, bandwidth, and throughput) for career **building by communicating effectively with engineering community.**	2
	PSO 1	Design **next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers,** and **knowledge discovery tools.**	6
	PSO 3	Practical experience in **shipping real world software,using industry standard tools** and **collaboration techniques** will equip to secure and succeed in first job upon graduation in IT industry.	3
CO 6	PO 1	Describe the reliable inter-node transmission of chunks and congestion control methods for reliable data transmission across the network by apply the**knowledge of computer engineering fundamentals and mathematical principles.**	2
	PO 3	**Understand the concepts** E-mail, telnet, secure shell for **innovative solutions, evaluate the solution of the complex issues.**	3

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	2	4	-	-	-	-	-	-	-	2	-	4	-	-	-
CO 3	3	4	3	-	-	-	-	-	-	2	-	-	6	-	-
CO 4	2	-	3	2	-	-	-	-	-	2	-	-	6	-	3
CO 5	2	3	3	-	-	-	-	-	-	-	-	2	6	-	3
CO 6	2	-	3	-	-	-	-	-	-	-	-	-	-	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	33.3	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	66.7	40	-	-	-	-	-	-	-	40	-	33.3	-	-	-
CO 3	100	40	30	-	-	-	-	-	-	40	-	-	100	-	-
CO 4	66.7	-	30	18	-	-	-	-	-	40	-	-	100	100	-
CO 5	66.7	30	30	-	-	-	-	-	-	-	-	17	100	100	-
CO 6	66.7	30	-	-	-	-	-	-	-	-	-	-	-	-	-

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - 0 ≤ C≤ 5% – No correlation

1 -5 <C≤ 40% – Low/ Slight

2 - 40 % <C < 60% –Moderate

3 - 60% ≤ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	2	-	-	-	-	-	-	-	2	-	1	-	-	-
CO 3	3	2	1	-	-	-	-	-	-	1	-	-	3	-	-
CO 4	3	-	1	1	-	-	-	-	-	1	-	-	3	3	-
CO 5	3	1	1	-	-	-	-	-	-	-	-	1	3	-	3
CO 6	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	15	5	4	1	-	-	-	-	-	4	-	2	9	3	3
AVERAGE	2.5	1.6	1.3	1.0	-	-	-	-	-	1.3	-	1.0	3.0	1.0	1.0

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	PO 1,PO 2, PO 3, PO 10, PO 12	SEE Exams	PO 1,PO 2, PO 3, PO 10, PO 12	Seminars	PO 2
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	-	Open Ended Experiments	-
Assignments	PO 1				

XVII ASSESSMENT METHODOLOGY-INDIRECT:

X	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	**INTRODUCTION**
	Introduction: Networks, network types, internet history, standards and administration; Network models: Protocol layering, TCP/IP protocol suite, the OSI model Transmission media: Introduction, guided media, unguided media; Switching: Introduction, circuit switched networks, packet switching.
MODULE II	**DATA LINK LAYER**
	Introduction: Link layer addressing; Error detection and correction: Cyclic codes, checksum, forward error correction; Data link control: DLC services, data link layer protocols, media access control: Random access, virtual LAN.

MODULE III	**NETWORK LAYER**
	Network layer design issues, routing algorithms, congestion control algorithms, quality of service, and internetworking. The network layer in the internet: IPv4 addresses, IPv6, internet control protocols, OSPF(Open Shortest Path First), IP (Internet Protocol)
MODULE IV	**TRANSPORT LAYER**
	The transport service, elements of transport protocols, congestion control; The internet transport protocols: UDP (User Datagram Protocol), TCP (Transport Control Protocol), performance problems in computer networks, network performance measurement.
MODULE V	**APPLICATION LAYER**
	Introduction, client server programming, WWW (World Wide Web) and HTTP (Hyper Text Transfer Protocol), FTP (File Transfer Protocol), E-mail, telnet, DNS (Domain Naming System), SNMP (Simple Network Management Protocol).

TEXTBOOKS

1. Behrouz A. Forouzan, "Data Communications and Networking", Tata McGraw-Hill, 5th Edition, 2012.
2. Andrew S. Tanenbaum, David.j.Wetherall, "Computer Networks", Prentice-Hall, 5th Edition, 2010.

REFERENCE BOOKS:

1. Douglas E. Comer, "Internetworking with TCP/IP", Prentice-Hall, 5th Edition, 2011
2. Peterson, Davie, Elsevier, "Computer Networks", 5th Edition,2011
3. Comer, "Computer Networks and Internets with Internet Applications", 4th Edition, 2004.
4. Chwan-Hwa Wu, Irwin, "Introduction to Computer Networks and Cyber Security", CRC publications, 2014.

WEB REFERENCES:

1. https://www.geeksforgeeks.org/computer-network-tutorials/

COURSE WEB PAGE:

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
OBE DISCUSSION			
1			
CONTENT DELIVERY (THEORY)			

2	40 topics		T2: 1.1-1.5, T1: 4.1
PROBLEM SOLVING/ CASE STUDIES			
1	15 problem solving classes	CO 1	R2:7.5
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	5 classes	CO 1,2, 3	R4:2.1
DISCUSSION OF QUESTION BANK			
1	Understand and explore the basics of computer networks and various network Types	CO 1	T2:2.1
2	Recognize knowledge on previous versions of internet	CO 1	T2:2.3
3	Understands on the various standards and administrations	CO 1	T2:2.3.1
4-5	Discuss on networks models and understand layering scenarios and protocols	CO 1	T2:7.2,7.3
6-9	Demonstrate on TCP/IP models	CO 1	T2:10.3.1
10-11	Demonstrate on Guided and Unguided medium.	CO 2	T2:13.3.2, 13.4.1
12	Understand the addressing mechanism of network layer	CO 3	T2:17.1.1, 17.1.3
13-15	Demonstrate on Error detection and correction Cyclic codes, checksum, and forward error correctionr	CO 3	T2:18.1, 18.2.1
23	Understand Network layer services provided to transport layer	CO 3	T2:18.4, 18.4.3
24-26	Discuss Static and Non static routing algorithms	CO 4	T2:19.2, 18.4.4
27-30	Demonstrate on various congestion control algorithms	CO 4	T2:23.1.1, 23.1.3
31-32	Understand quality service provided by network layer and discuss on internetworking	CO 3	T2:18.3.4, 18.3, 4.17
33-41	Explain IPv4 IPv6 IP addressing, OSPF, IP protocols	CO 4	T2:24.2,28.4
42-45	Discuss about TCP and UDP CO 10,	CO 5	T1: 276-296
46-47	Explain Performance problems in computer networks, network performance measurement	CO 5	T2:24.3.6, 24.3.9
48-51	Discuss about application layer and client server programming	CO 5	T2:25.1, 25.1.2
52-56	Discuss WWW, FTP, DNS, SNMP and HTTP protocols	CO 5	T2:26.1.2, 26.2, 26.3, 26.4,26.5

Signature of Course Coordinator **HOD,IT**

Mr. S Vinod Kumar , Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

INFORMATION TECHNOLOGY
COURSE DESCRIPTION

Course Title	**MACHINE LEARNING**				
Course Code	ACSB21				
Program	B.Tech				
Semester	V	IT			
Course Type	CORE				
Regulation	IARE-R18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Dr. RAVI KUMAR POLURU, Associate Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AHSB12	II	Probability and statistics

II COURSE OVERVIEW:

The main emphasis of this course is to provide systems the ability to automatically learn and improve from experience without being explicitly programmed.The course includes the fundamental concepts to build, train, and predict data models using machine learning (ML) algorithms. This course provides a clear understanding on concepts ofsupervised learning through decision trees, advanced techniques like neural networks, Naive Bayes and k-nearest neighbor algorithmandintroduction tounsupervised and reinforcement learning.Machine Learning has revolutionized industries like medicine, healthcare, manufacturing, banking, and several other industries.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Machine Learning	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	PPT	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	✓	Quiz
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

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The expected percentage of cognitive level of the questions is broadly based on the criteria given in Table: 1.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
70 %	Understand
20 %	Apply
0 %	Analyze
0 %	Evaluate
0 %	Create

VI COURSE OBJECTIVES:

The students will try to learn:

I	The fundamental concepts, issues and challenges of machine learning associated to data for model selection.
II	The supervised learning methods such as decision trees, Naïve Bayes classifier, k-nearest neighbor learning for building data models and basics of unsupervised learning methods.
III	The knowledge used for making predictions or decisions without human intervention on real-world problems.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Demonstrate** machine learning concepts with decision trees in data classification for smart and automated applications.	Understand
CO 2	**Make** use of support vector machine and multilayer perceptrons to control learning rate in high dimensionality data classification.	Apply
CO 3	**Select** probabilistic classifiers with Naivebayes and graphical models for temporal data classification.	Remember
CO 4	**Outline** evolutionary algorithms to solve optimization problems in stochastic manner in machine learning.	Remember

CO 5	**Utilize** data clustering algorithms to perform cluster analysis with large categorical datasets in real life data mining applications.	Apply
CO 6	**Identify** appropriate machine learning techniques and suitable computing environment for real time applications.	Remember

COURSE KNOWLEDGE COMPETENCY LEVEL

VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineeringfundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE / Quiz / AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complexengineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	CIE / Quiz / AAT
PO 3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	2	Seminar/ AAT
PO 10	**Communication:** Communicate effectively on complex Engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2	AAT
PO 12	**Life - Long Learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	2	AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	2	Research papers/ Group discussion
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	2	Research papers/ Group discussion / Short term courses

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	✓	✓	✓	-	-	-	-	-	-	✓	-	-	✓	-	✓
CO 2	✓	✓	✓	-	-	-	-	-	-	✓	-	-	✓	-	✓
CO 3	✓	✓	✓	-	-	-	-	-	-	✓	-	-	✓	-	✓
CO 4	✓	✓	✓	-	-	-	-	-	-	✓	-	-	✓	-	-
CO 5	✓	✓	✓	-	-	-	-	-	-	✓	-	-	✓	-	-
CO 6	✓	✓	✓	-	-	-	-	-	-	✓	-	-	✓	-	✓

XII JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO1	**Demonstrat**e machine learning concepts with decision trees in data classification for **smart and automated applications, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.**	4
	PO2	**Characteristics** of machine learning that make it useful to **identify** real-world data, **research, formulate** and **analyze complex engineering problems** using **principles of mathematics and engineering sciences.**	5
	PO3	**Design** machine learning concepts with decision trees in data classification for smart and automated applications and **design system components or processes and safety, and the cultural, societal, and environmental considerations.**	5
	PO10	**Determine** machine learning concepts with decision trees in data classification for being able to comprehend and **write effective reports and design documentation,** make effective presentations.	1
	PSO1	**Indicate** machine learning concepts with decision trees in data classification for **networking devices, search engines, soft computing and knowledge discovery tools.**	4
	PSO3	**Demonstrate** machine learning concepts with decision trees in data classification for **real world software, using industry standard tools and collaboration techniques.**	3
CO 2	PO1	**Make use** of support vector machine and multilayer perceptrons to control learning rate in high dimensionality data classification, **engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.**	3

	PO2	**Accept** support vector machine and multilayer perceptrons to control learning rate in high dimensionality to **Identify, formulate, review research literature, and analyze complex engineeringproblems in data classification .**	5
	PO3	**Apply** support vector machine and multilayer perceptrons to control learning rate for the specified needs with appropriate consideration for the **safety, cultural, societal, and environmental considerations**.	4
	PO10	**Exploit** of support vector machine and multilayer perceptrons to control learning rate in write effective reports.	5
	PSO1	**Utilize** the support vector machine and multilayer perceptrons to d esign next-generation computer systems, networking devices, and knowledge discovery tools	4
	PSO3	Make use of support vector machine and multilayer perceptrons to control learning rate in high dimensionality data classification using industry standard tools.	5
CO 3	PO1	Select probabilistic classifiers with Naïve bayes and graphical models to analyze the underlying mathematical relationships within and across machine learning algorithms to find solutions for complex engineering problems.	3
	PO2	Elect probabilistic classifiers with Naïve bayes and graphical models t o Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using engineering sciences	4
	PO3	Discriminate probabilistic classifiers with Naïve bayes and graphical models f o r the public health and safety, and the cultural, societal, and environmental considerations.	2
	PO10	Select probabilistic classifiers with Naïve bayes and graphical models for design documentation.	5
	PSO1	Discriminate probabilistic classifiers with Naivebayes and graphical models for networking devices, search engines, soft computing and knowledge discovery tools	5
	PSO3	Elect probabilistic classifiers with Naivebayes and graphical models for using industry standard tools	5
CO 4	PO 1	Outline evolutionary algorithms to solve optimization problems in science, engineering fundamentals to relate the hypothesis space using machine learning.	3

	PO 2	Layout evolutionary algorithms to solve optimization problems in machine learning to Identify, formulate, review research literature, and analyze complex engineeringproblems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3
	PO 3	D e f i ne evolutionary algorithms to solve optimization problems instochastic manner in machine learning for the public health and safety, cultural, societal, and environmental considerations.	1
	PO10	Summarize evolutionary algorithms to solve optimization problems instochastic manner in machine learning to communicate effectively on complex Engineering.	2
	PSO1	Brief evolutionary algorithms to solve optimization problems instochastic manner in machine learning to design next-generation computer systems, networking devices, and knowledge discovery tools.	5
CO 5	PO1	**Identify** best **models using algorithms** for reasoning with uncertainty as well as the use of unreliable information using **natural sciences and engineering sciences.**	5
	PO2	Use **research-based knowledge and methods for reasoning models** with uncertainty as well as the use of unreliable information.	3
	PO3	Characteristics of machine learning that make it useful to **identify** real-world data, **research, formulate** and **analyze complex engineering problems** using **principles of mathematics and engineering sciences.**	5
	PO10	**Communicate effectively** on real world problems reasoning with uncertainty as well as the use of unreliable information by **writing effective reports** discussing with the **engineering community.**	3
	PSO1	**Recognize** models for reasoning with uncertainty as well as the use of unreliable information used in **life-long learning in the broadest context of technological change.**	3
CO 6	PO1	Apply the **knowledge of mathematics** and engineering **fundamentals** to identify appropriate learning functions as activation function for **neural network design.**	3
	PO2	**Identify** appropriate activation function to solve **complex engineering problems** using single or multilayer **neural networks.**	3

	PO3	Characteristics of machine learning that make it useful to **identify** real-world data, **research, formulate** and **analyze complex engineering problems** using **principles of mathematics and engineering sciences.**	5
	PO10	Characteristics of machine learning that make it useful to **identify** real-world data, **research, formulate** and **analyze complex engineering problems** using **principles of mathematics and engineering sciences.**	5
	PSO1	Identify appropriate **learning functions** as activation function for **designing next generation computer systems, intelligent systems and knowledge discovery tools.**	4
	PSO3	Characteristics of machine learning that make it useful to **identify** real-world data, **research, formulate** and **analyze complex engineering problems** using **principles of mathematics and engineering sciences.**	5

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – (PO, PSO) MAPPING:

COURSE OUTCOMES	Program Outcomes/ No. of Key Competencies Matched												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	5	5	-	-	-	-	-	-	1	-	-	4	-	1
CO 2	3	5	4	-	-	-	-	-	-	1	-	-	3	-	1
CO 3	3	5	4	-	-	-	-	-	-	1	-	-	4	-	1
CO 4	3	7	4	-	-	-	-	-	-	1	-	-	3	-	-
CO 5	1	5	5	-	-	-	-	-	-	1	-	-	3	-	-
CO 6	3	7	7	-	-	-	-	-	-	1	-	-	4	-	2

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – (PO, PSO):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	100	50	50	-	-	-	-	-	-	20	-	-	66.6	-	43.3
CO 2	100	50	40	-	-	-	-	-	-	20	-	-	50	-	43.3
CO 3	100	50	40	-	-	-	-	-	-	20	-	-	66.6	-	43.3
CO 4	100	70	40	-	-	-	-	-	-	20	-	-	50	-	-

CO 5	66.6	50	50	-	-	-	-	-	-	20	-	-	50	-	-
CO 6	100	70	70	-	-	-	-	-	-	20	-	-	66.6	-	66.6

XV COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq$ C$\leq$ 5% – No correlation

2 - 40 % <C < 60% –Moderate

1-5 <C$\leq$ 40% – Low/ Slight

3 - 60% $\leq$ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	2	2	-	-	-	-	-	-	1	-	-	3	-	2
CO 2	3	2	1	-	-	-	-	-	-	1	-	-	2	-	2
CO 3	3	2	1	-	-	-	-	-	-	1	-	-	3	-	2
CO 4	3	2	1	-	-	-	-	-	-	1	-	-	2	-	-
CO 5	2	2	2	-	-	-	-	-	-	1	-	-	2	-	-
CO 6	3	2	3	-	-	-	-	-	-	1	-	-	3	-	3
TOTAL	17	14	10	-	-	-	-	-	-	6	-	-	15	-	9
AVERAGE	2.8	2.3	1.6	-	-	-	-	-	-	1	-	-	2.5	-	2.25

XVI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	PO1, PO2, PO4	SEE Exams	PO1, PO2, PO	Seminars	PO3, PO5
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	PO5	5 Minutes Video	PO1, PO2	Open Ended Experiments	-
Assignments	PO3, PO5				

XVII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	**TYPES OF MACHINE LEARNING**
	Introduction: Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning. Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.
MODULE II	**DECISION TREE LEARNINGS**
	Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.
MODULE III	**ARTIFICIAL NEURAL NETWORKS**
	Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptrons, Back propagation algorithm. Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, Generalapproach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms.
MODULE IV	**BAYESIAN LEARNING**
	Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks,EM algorithm.
MODULE V	**INSTANCE BASED AND REINFORMENT LEARNING**
	Instance Based Learning: Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning. Reinforcement Learning: Introduction, Learning Task, Q Learning.

TEXTBOOKS

1. Tom M. Mitchell, "Machine Learning ", McGraw-Hill, 1st Edition,2013.
2. Stephen Marsland, "Machine Learning - An Algorithmic Perspective ", CRC Press, 1st Edition,2009.

REFERENCE BOOKS:

1. RajjalShinghal, "Pattern Recognition and Machine Learning", Springer-Verlag, New York, 1st Edition, 2006..

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
1	Introduction to machine Learning	CO1	T1:1
2	Understanding Well posed learning problems	CO1, CO2	T1:1.1
3-4	Discuss the steps involved in Designing a Learning system	CO2	T1:1.2

5	Interpreting Issues in MachineLearning.	CO1	T1:1.3
6	Explain Concept learning task and Concept learning as search	CO3	T1:2.1,2.2,2.3
7	Explain Find-S algorithm	CO3	T1:2.4
8-9	Construct Version space using Candidate Elimination algorithm	CO3	T1:2.5,2.6
10	How to use Inductive Bias for different algorithms	CO1, CO3	T1:2.7
11	Decision tree representationusing attributes and values	CO4	T1:3.1,3.2
12	Appropriate problems for decision tree learning	CO4	T1:3.3
13	Basic decision tree learning algorithm advantages and disadvantages	CO4	T1:3.4
14-15	Construct decision tree by finding best attribute using ID3 Algorithm	CO4	T1:3.4
16	Explain how Hypothesis space search is used for prediction in decision tree learning	CO4	T1:3.5
17	How Inductive bias helps in reducing hypotheses space searching indecision tree learning	CO5	T1:3.6
18	Discussing Issues like overfitting in decision tree learning	CO5	T1:3.1
19	Introduction to Artificial Neural Networks	CO6	T1:4.1
20	Neural Network representation using inputs, output, weights and perceptron.	CO6	T1:4.2
21	Appropriate problems for neural network learning with different characteristics	CO6	T1:4.3
22-23	Representing single layer neural network and multilayer neural network using perceptrons	CO6	T1:4.4,4.5
24-25	Demonstration of Back propagation algorithm to update the weights.	CO7, CO8	T1:4.5,4.6
26	Evaluating accuracy of Hypothesis.	CO 3	T1:5.1
27	Finding sample error and true error to estimating hypothesis accuracy.	CO4, CO6	T1:5.2
28	Using basics of sampling theory to find the probability of predicting using binomial distribution.	CO4	T1:5.3
29	Understand the general approach for deriving confidence intervals used in finding true error.	CO4, CO7	T1:5.4
30	Observing the difference in error of two hypothesis so that prediction is accurate based on hypotheses.	CO4, CO7	T1:5.5
31	Comparing learning algorithms based on target functions considering the same training examples.	CO12	T1:5.6
32	Introduction to Bayesian Learning	CO9	T1:6.1
33	Design a concept learning algorithm based on Bayes theorem.	CO9	T1:6.2,6.3
34	Learning methods to minimize Least Squared error and maximize likelihood hypothesis.	CO9	T1:6.4

35	Using maximum likelihood hypotheses for predicting probabilities.	CO9	T1:6.5
36-37	Discussing Minimum Description Length principle and Bayesian learning method Naive Bayes classifier.	CO9	T1:6.6,6.7,6.9
38	Understand EM algorithm to train Bayesian belief networks used to describe the probability distribution.	CO9	T1:6.11,6.12
39	Introduction to Instance Based Learning	CO1	T1:8.1
40	k-nearest neighbor learning	CO5	T1:8.2
41	Locally weighted regression	CO12	T1:8.3
42	Radial basis function	CO12	T1:8.4
43	Cased-based reasoning	CO12	T1:8.5
44	Introduction to Reinforcement Learning	CO11	T1:13.1
45	Learning Task and Q Learning	CO11	T1:13.2,13.3

Signature of Course Coordinator **HOD, IT**
Dr. RAVI KUMAR POLURU, Associate Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	INFORMATION TECHNOLOGY					
Course Title	MICROPROCESSORS AND INTERFACING					
Course Code	AECB55					
Program	B.Tech					
Semester	V					
Course Type	Open Elective					
Regulation	R-18					
Course Structure	Theory			Practical		
	Lecture	Tutorials	Credits	Laboratory	Credits	
	3	-	3	-	-	
Course Coordinator	Ms. B. Lakshmi Prasanna, Assistant Professor					

I COURSE OVERVIEW:

This course introduces the architecture and signal description of Intel microprocessor and microcontrollers. The instruction set and assembly language programming along with input output and memory interfacing techniques are covered. The main applications of microprocessors are automatic testing of products, speed control of motors and software developement.

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Microprocessors and Interfacing	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	x	Assignments	x	MOOC
x	Open Ended Experiments	x	Tech talk	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into five modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with either or choice will be drawn from each module. Each question carries 14 marks. There could be a

maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
0%	Remember
50 %	Understand
33 %	Apply
17 %	Analyze
0 %	Evaluate
0 %	Create

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 10 marks for Alternative Assessment Tool (AAT).

Component	Theory		Total Marks
Type of Assessment	CIE Exam	AAT	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours / classes, techtalk, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), concept video, MOOCs etc. The AAT chosen for this course is given in table .

Concept Video	Tech-talk	Complex Problem Solving
50%	50%	-

VI COURSE OBJECTIVES:

The students will try to learn:

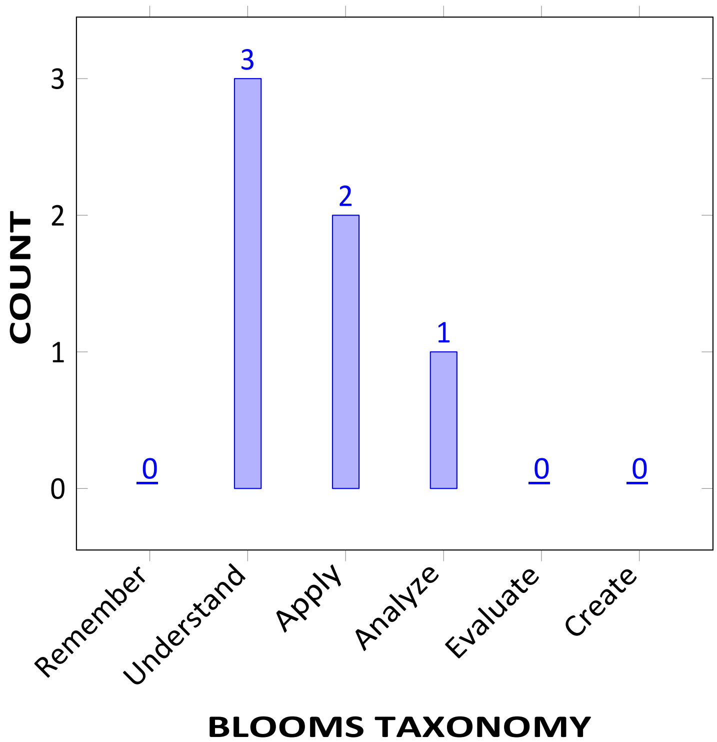
I	The signal descriptions along with functional architecture and hardware interfacing skills using microprocessors and microcontrollers.
II	The instruction set and logic to build assembly language programs for arithmetic, logic and automated electronic systems.
III	The essential concepts of development through a practical hands-on approach on advanced ARM processors and Internet of Things based systems.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Outline** the functional components of microprocessors and microcontrollers for understanding the operation of architectures.	Understand
CO 2	**Apply** the instruction set and addressing modes of a microprocessor to write an assembly language program.	Apply
CO 3	**Demonstrate** the internal architecture and modes of operation of peripheral devices for interfacing memory and I/O devices.	Understand
CO 4	**Illustrate** the interrupt handling mechanism in microprocessors and microcontrollers using interrupt controller.	Understand
CO 5	**Choose** an appropriate data transfer scheme and hardware for data transfer between the devices.	Apply
CO 6	**Analyze** the interfacing concept of programmable interfacing modules with microprocessors and microcontrollers for real time applications.	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Program Outcomes	
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	SEE, CIE, AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	SEE, CIE, AAT

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	2	SEE, CIE, AAT
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	1	SEE, CIE, AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	3	AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	3	10	10	11	1	5	3	3	12	5	12	8	2	2	2
CO 1	✓	-	-	-	-	-	-	-	-	✓	-		-	-	-
CO 2	✓	✓	✓	-	-	-	-	-	-	✓	-	-	✓	-	-
CO 3	✓	✓	✓	-	-	-	-	-	-	✓	-	-	-	-	-
CO 4	-	✓	✓	-	-	-	-	-	-	✓	-	-	-	-	-
CO 5	-	✓	✓	-	-	-	-	-	-	✓	-	-	-	-	-
CO 6	✓	✓	✓	-	-	-	-	-	-	✓	-	-	✓	-	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Describe the features and architectures of Intel 8086 processor and Intel 8051 microcontroller (knowledge) by applying the knowledge of **mathematics, Engineering fundamentals,**and electronics **engineering specialization** for understanding the operation.	3
	PO 10	Explain the functional components of microprocessors and microcontrollers by **giving effective presentations and receive clear instructions** for understanding the operation of architectures.	1
CO 2	PO 1	Illustrate instructions from the set library (knowledge) for efficient assembly level programming by applying the knowledge of **science, engineering fundamentals and mathematics.**	3
	PO 2	Select proper instructions from the instruction set by **Information and data collection** for **Solution development** by writing assembly language level programming efficient and **Interpretation of results**	3
	PO 3	**Manage the design process** and make use of **creativity to establish solutions** by selecting proper mnemonics to write the assembly language level programming by **Understanding of the requirement for engineering activities to promote sustainable development.**	3
	PO 10	Utilize addressing modes and instruction set of target microprocessors and microcontrollers microcontrollers by **giving effective presentations and receive clear instructions** for writing an assembly language programs to perform a task .	1
	PSO 1	Make use of addressing modes and instruction set of target microprocessors and microcontrollers microcontrollers and do **research towards digital manufacturing in Product development** by writing an assembly language programs to perform a task.	2
CO 3	PO 1	Illustrate the internal architecture and modes of operation of peripheral devices like PPI, DMA controller, PIC, USART by applying the principles of **mathematics, engineering fundamentals, electronics engineering specialization** for the solution of complex engineering problems.	3

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 2	Explain the **Problem statement and system definition** for interfacing devices with microprocessor and microcontroller by **Information and data collection** using peripheral devices like PPI, DMA controller, PIC, USART for **Solution development** and **Interpret the results**	4
	PO 3	**Manage the design process and evaluate outcomes** by interfacing devices with microprocessor and microcontroller using Programmable Peripheral Interface (PPI) and Interrupt Controllers **to establish innovative solutions** by**Understanding of the requirement for engineering activities to promote sustainable development**	3
	PO 10	Describe the internal architecture and modes of operation of peripheral devices by **giving effective presentations and receive clear instructions** for interfacing memory and I/O devices.	1
CO 4	PO 2	Explain the functionality of various types of interrupts and their structure with **Information and data collection** for controlling the processor or controller with program execution flow and**Interpret the results** for **solution development** using interrupt controller.	3
	PO 3	**Understand the requirement for engineering activities to promote sustainable development** in Interrupt handling and **use creativity to establish innovative solutions** using interrupt controller by **Managing the design process and evaluate outcomes**	3
	PO 10	Explain the interrupt handling mechanism in microprocessors and microcontrollers by **giving effective presentations and receive clear instructions** using interrupt controller.	1
CO 5	PO 2	Formulate and analyze (Problem analysis) **complex Engineering problems** by differentiating synchronous & asynchronous communication with **Information and data collection** for data transfer between the devices using first principles of **mathematics and Engineering sciences** and then **Interpret the results**	4
	PO 3	**understand the customer and user needs** and select an appropriate data transfer scheme and hardware by **Managing the design process and evaluate outcomes** to **promote sustainable development** for data transfer between the devices **using creativity to establish innovative solutions**	4
	PO 10	Select an appropriate data transfer scheme and hardware by **giving effective presentations and receive clear instructions** for data transfer between the devices.	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 6	PO 1	Build (Apply)necessary hardware and software interface using microcomputer based systems to provide solution for real world problems by applying **knowledge of mathematics, engineering fundamentals, engineering specialization.**	3
	PO 2	**Identify problem** and Choose necessary hardware and software interface **(information and data collection)** and conduct **experimental design** with **model translation** to provide **solution development** for real world problems **by interpreting results.**	6
	PO 3	Organize necessary hardware and software interface **based on user needs and importance of considerations** for **innovative solutions, of the problem including all aspects to manage design process ,** in microcomputer based systems **by applying different techniques, to achieve required sustained development, with legal requirements governing engineering activities, including personnel, health, safety, and risk issues.**	6
	PO 10	Build microprocessor and microcontroller based applications using necessary input and output devices and **give effective presentations and receive clear instructions.**	1
	PSO 1	**Focus on Ideation and Research towards Digital manufacturing in Product development** and develop microprocessor and microcontroller based applications using necessary input and output devices.	2

Note: For Key Attributes refer **Annexure - I**

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	3	10	10	11	1	5	3	3	12	5	12	8	2	2	2
CO 1	3	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CO 2	3	3	3	-	-	-	-	-	-	1		-	2	-	-
CO 3	3	4	3	-	-	-	-	-	-	1	-	-	-	-	-
CO 4	-	3	3	-	-	-	-	-	-	1	-	-	-	-	-
CO 5	-	4	4	-	-	-	-	-	-	1	-	-	-	-	-
CO 6	3	6	6	-	-	-	-	-	-	1	-	-	2	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	3	10	10	11	1	5	3	3	12	5	12	8	2	2	2
CO 1	100	-	-	-	-	-	-	-	-	20	-	-	-	-	-
CO 2	100	30	30	-	-	-	-	-	-	20	-	-	100	-	-
CO 3	100	40	30	-	-	-	-	-	-	20	-	-	-	-	-
CO 4	-	30	30	-	-	-	-	-	-	20	-	-	-	-	-
CO 5	-	40	40	-	-	-	-	-	-	20	-	-	-	-	-
CO 6	100	60	60	-	-	-	-	-	-	20	-	-	100	-	-

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - 0 ≤ C≤ 5% – No correlation
1 -5 <C≤ 40% – Low/ Slight
2 - 40 % <C < 60% –Moderate
3 - 60% ≤ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CO 2	3	1	1	-	-	-	-	-	-	1	-	-	3	-	-
CO 3	3	2	1	-	-	-	-	-	-	1	-	-	-	-	-
CO 4	-	1	1	-	-	-	-	-	-	1	-	-	-	-	-
CO 5	-	2	2	-	-	-	-	-	-	1	-	-	-	-	-
CO 6	3	3	3	-	-	-	-	-	-	1	-	-	3	-	-
TOTAL	**12**	**9**	**8**	-	-	-	-	-	-	**6**	-	-	**6**	-	-
AVERAGE	**3**	**1.8**	**1.6**	-	-	-	-	-	-	**1**	-	-	**3**	-	-

XVI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Assignments	-
Quiz	-	Tech - Talk	✓	Certification	-
Term Paper	-	Seminars	-	Student Viva	-
Laboratory Practices	-	5 Minutes Video / Concept Video	✓	Open Ended Experiments	-
Micro Projects	-	-	-	-	-

XVII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
✓	Assessment of activities / Modeling and Experimental Tools in Engineering by Experts		

XVIII SYLLABUS:

MODULE I	**INTRODUCTION TO 8 BIT AND 16 BIT MICROPROCESSOR**
	An over view of 8085, Architecture of 8086 Microprocessor, register organization of 8086, 8086 flag register. Addressing modes of 8086, Instruction set of 8086. Assembler directives, procedures, and macros. Assembly language programs involving logical, Branch & Call instructions, sorting, evaluation of arithmetic expressions, string manipulation.
MODULE II	**OPERATION OF 8086 AND INTERRUPTS**
	Pin diagram of 8086-Minimum mode and maximum mode of operation with Timing diagrams. Interrupt structure of 8086: Vector interrupt table, Interrupt service routines. Introduction to DOS and BIOS interrupts.
MODULE III	**INTERFACING WITH 8086**
	Memory interfacing to 8086 (Static RAM & EPROM). Need for DMA, DMA data transfer Method, Interfacing with 8237/8257. 8259 PIC Architecture and interfacing cascading of interrupt controller and its importance. Serial data transfer schemes: Asynchronous and Synchronous data transfer schemes. 8251 USART architecture and interfacing. TTL to RS 232C and RS232C to TTL conversion.
MODULE IV	**ADVANCED MICROPROCESSORS**
	Introduction to 80286, Salient Features of 80386, Real and Protected Mode Segmentation & Paging, Salient Features of Pentium, Branch Prediction, and Overview of RISC Processors.
MODULE V	**8051 MICROCONTROLLER ARCHITECTURE**
	Microcontroller Architecture, Register set of 8051, Modes of timer operation, Serial port operation, Interrupt structure of 8051, Memory and I/O interfacing with 8051.

TEXTBOOKS

1. A.K.Ray and K.M.Bhurchandi, —Advanced Microprocessor and Peripherals , TMH, 2000.
2. Deshmukh, Micro Controllers , Tata McGraw Hill Edition, TMH, 2000

REFERENCE BOOKS:

1. Douglas U, —Micro Processors & Interfacing , Hall, 2007.
2. By Liu, GA Gibson, —Micro Computer System 8086/8088 Family Architecture, Programming and Design , PHI, 2nd Edition, 2007.

WEB REFERENCES:

1. http://www.daenotes.com/electronics/digital-electronics/Intel-8085 8 bit microprocessor axzz2I9yUSe7I
2. https://www.smartzworld.com/notes/microprocessors-and-microcontrollers-mpmc/
3. http://www.iare.ac.in

COURSE WEB PAGE:

1. https://lms.iare.ac.in/index?route=course/details&course_id=135

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
0	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO-PO Mapping	-	https://lms.iare.ac.in/index?route=course/details&course id=135
CONTENT DELIVERY (THEORY)			
1	An over view of 8085 Microprocessor	CO 1	T1:1.1 R2:1.3
2	Architecture of 8086 Microprocessor	CO 1	T1:1.2 R2:1.2.2
3	Register organization of 8086 Microprocessor	CO 1	T1:1.1 R2:1.1,6.1
4	Flag Register of 8086 Microprocessor	CO 1	T1:1.1 R2:2.3
5	Addressing modes of 8086 Microprocessor	CO 2	T1:2.2,1.6,1.7
6	Instruction Set Of 8086 Microprocessor: Data transfer instructions	CO 2	T1:2.3 R2:6.3
7	Instruction Set Of 8086 Microprocessor: Arithmetic and Logical instructions	CO 2	T1:2.3 R2:6.4
8	Instruction Set Of 8086 Microprocessor: Program control transfer instructions	CO 2	T1:2.3 R2:3.1
9	Instruction Set Of 8086 Microprocessor: Machine Control Instructions and Flag manipulation instructions	CO 2	T1:2.3 R2:1.4
10	Instruction Set Of 8086 Microprocessor: Shift and rotate instructions	CO 2	T1:2.3 R2:3.2
11	Instruction Set Of 8086 Microprocessor: String instructions	CO 2	T1: 2.3 R2:3.4,3.5
12	Assembler Directives	CO 2	T1: 2.4 R2:3.3
18	Pin Diagram of 8086 Microprocessor	CO 1	T1: 1.3 R2:3.7
19	Operation of 8086 microprocessor in minimum mode with timing diagrams	CO 1	T1: 1.8 R2:3.6
20	Operation of 8086 microprocessor in maximum mode with timing diagrams	CO 1	T1: 1.9 R2:4.1
21	Interrupts and interrupt cycle of 8086	CO 4	T1:4.3, 4.4 R2:2.2
22	Vector interrupt table and interrupt service routines	CO 4	T1:4.3,3.2,3.3 R2:2.1

23	Introduction to DOS And BIOS Interrupts	CO 4	R2:4.1,4.2
26	Need for DMA and DMA data transfer method	CO 3	T1:7.1 R2:8.1
27	Pin Configuration of 8257 DMA Controller	CO 3	T1:7.1 R2:8.2
28	Block Diagram of 8257 DMA Controller	CO 3	T1:7.2
29	Pin Configuration Of 8259 PIC	CO 4	T1:6.2
30	Architecture Of 8259 PIC	CO 4	T1:6.2 R2:9.2
31	Serial Data Transfer Schemes, Asynchronous And Synchronous Data Transfer Schemes	CO 5	T1:6.4 R2:9.3
32	Pin Configuration Of 8251 USART	CO 5	T1:6.4 R2:9.8,9.9
33	8251 USART Architecture	CO 5	T1:6.4 R2:9.11
34	TTL To RS 232C And RS232C To TTL Conversion	CO 5	T1:6.4
35	80286 Microprocessor	CO 1	T1:9.1, 9.2, 9.3 R2:10.3
36	80386 Microprocessor	CO 1	T1:10.1, 10.2, 10.3 R2:10.3
37	Real mode and Protected mode	CO 1	T1:10.6, 10.7 R2:10.2
38	Segmentation	CO 1	T1:10.8 R2:11.3
39	Paging	CO 1	T1:10.9 R2:11.6
40	Salient features of Pentium processor, Branch Prediction	CO 1	T1:11.1 R2:20.1
41	overview of RISC processors	CO 1	T1:13
42	Introduction to 8051 Microcontroller	CO 1	T1:17.1 R2:19.9
43	8051 Microcontroller Architecture	CO 1	T1:17.2 R2:19.10
44	Pin Configuration Of 8051 Microcontroller	CO 1	T1:17.3 R2:20.3,20.4
45	I/O port structure of 8051 Microcontroller	CO 1	T1:17.6 R2:20.6
46	Register Set of 8051 Microcontroller	CO 1	T1:17.4 R2:20.5
47	Modes of Timer operation	CO 3	T1:18.2 R2:20.5
48	Serial Port Operation	CO 5	T1:18.4 R2:20.5
49	Interrupt Structure Of 8051 Microcontroller	CO 4	T1:18.3 R2:20.5

PROBLEM SOLVING/ CASE STUDIES			
50	Assembly Language Programs For Sorting Of Numbers using 8086 microprocessor	CO 2	T1:3.4 R2:1.1
51	Assembly Language Programs For Multibyte Addition and Subtraction, sum of squares using 8086 microprocessor	CO 2	T1:3.4 R2:4.7
52	Assembly Language Programs For String Manipulations using 8086 microprocessor	CO 2	T1:3.4 R2:4.7
53	Assembly Language Programs For Code Conversions using 8086 microprocessor	CO 2	T1:3.4 R2:4.1
54	Physical Address Calculation	CO 1	T1:1.2 R2:4.4,4.5
55	Memory Interfacing To 8086 (Static RAM)	CO 3	T1:5.1 R2:12.2,12.3
56	Memory Interfacing To 8086 (EPROM)	CO 3	T1:5.2 R2:12.4
57	Interfacing 8257 With 8086 Microprocessor	CO 3	T1:7.3 R2:9.8,9.9
58	Cascading Of Interrupt Controller And its Importance, Interfacing 8259 PIC With 8086 Microprocessor	CO 3	T1:6.2 R2:9.11
59	Interfacing 8251 USART With 8086 Microprocessor	CO 3	T1:6.4 R2:10.3,10.4
60	Memory And I/O Interfacing With 8051 Microcontroller	CO 3	T1:17.6 R2:10.2
61	Assembly language programming using data transfer, arithmetic, logical and branch instructions	CO 2	T1:17.10 R2:19.3
62	Real world interfacing of 8051 microcontroller with external memory	CO 6	T1:18.6 R2:20.2
63	Interfacing 8051 microcontroller with LCD	CO 6	T1:18.6 R2:21.3
64	Interfacing 8051 microcontroller with ADC and DAC	CO 6	T1:18.6 R2:21.1
DISCUSSION OF DEFINITION AND TERMINOLOGY			
65	Introduction to 8 and 16 bit microprocessors	CO 1, CO 2	T1, R2
66	Operation of 8086 microprocessor and Interrupts	CO 3, CO 4	T1, R2
67	Interfacing with 8086 microprocessor	CO 3, CO 4, CO 5, CO 6	T1, R2
68	Advanced Microprocessors	CO 1, CO 2, CO 3	T1, R2
69	8051 Microcontroller Architecture	CO 1, CO 3, CO 4, CO 5, CO 6	T1, R2

DISCUSSION OF QUESTION BANK			
70	Introduction to 8 and 16 bit microprocessors	CO 1, CO 2	T1, R2
71	Operation of 8086 microprocessor and Interrupts	CO 3, CO 4	T1, R2
72	Interfacing with 8086 microprocessor	CO 3, CO 4, CO 5, CO 6	T1, R2
73	Advanced Microprocessors	CO 1, CO 2, CO 3	T1, R2
74	8051 Microcontroller Architecture	CO 1, CO 3, CO 4, CO 5, CO 6	T1, R2

Signature of Course Coordinator
Ms. B. Lakshmi Prasanna, Assistant Professor **HOD, IT**

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

INFORMATION TECHNOLOGY

COURSE DESCRIPTION

Course Title	**CASE TOOLS LABORATORY**				
Course Code	ACSB12				
Program	B.Tech				
Semester	V	IT			
Course Type	CORE				
Regulation	IARE - R18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	3	1
Course Coordinator	Mr.Rajesh Kumar Bhavani, Assistant Professor				

I COURSE OVERVIEW:

This Laboratory course introduces the Unified Modeling language for visualizing, specifying, constructing and documenting in preparing blueprint of a software intensive system. This lab covers Static and Dynamic aspects of the System with illustrations of Class,Object,Component, Deployment Use case, State chart, sequence, activity, collaboration Diagrams. These diagrams are used to create low level and high level design documents of the software system.

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AITB06	IV	Object Oriented Programming through Java.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Case Tools Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Demo Video	✓	Lab Worksheets	✓	Viva Questions	✓	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component			Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
-	-	-	-	-	-

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

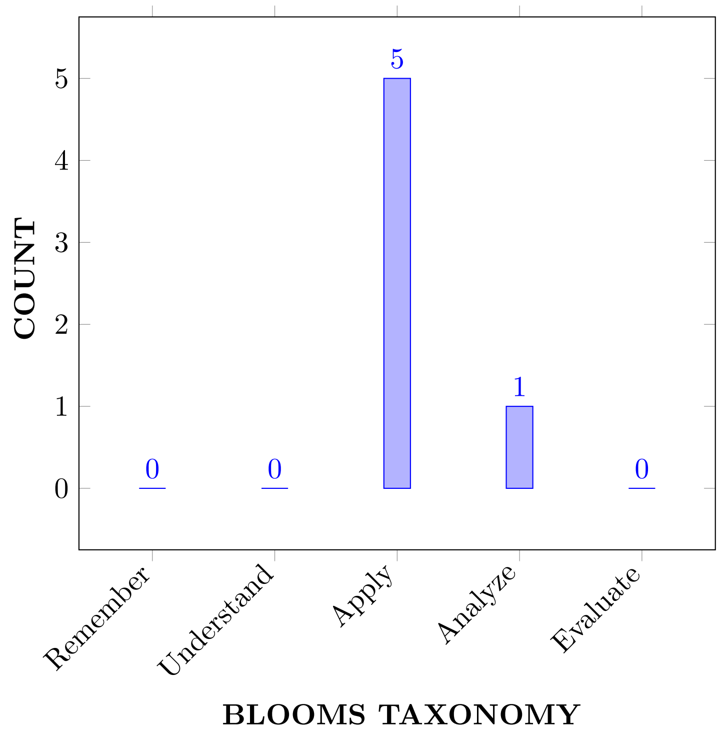
I	The Usage of CASE tools in modeling and designing of real time applications
II	The implementation of Architectural views for different case studies.
III	Applying common modeling techniques of forward and reverse engineering.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Demonstrate** Interlocking views of software intensive system for projection into the structure of system. .	Apply
CO 2	**Analyze** use case view for designing overall behavior of different systems.	Analyze
CO 3	**Apply** Design view for implementing vocabulary and functionality of various systems.	Apply
CO 4	**Apply** process view for improving performance and scalability in designing systems.	Apply
CO 5	**Apply** implementation view in system assembly and configuration management.	Apply
CO 6	**Apply** tdeployment view for designing system topology of various systems.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	Lab Exercise, CIE, SEE
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	3	Lab Exercise, CIE, SEE
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	3	Lab Exercise, CIE, SEE
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	3	Lab Exercise, CIE, SEE
PO 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	2	SEE

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	**Professional Skills:** Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	3	Lab Exercises
PSO 3	**Career and Entrepreneurship:** Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	2	Lab Exercises

3 = High; 2 = Medium; 1 = Low

X JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 5	Usage of **CASE tool** for modeling simple to complex engineering activities with understanding requirements and limitations of user.	1
	PSO 1	**Formulate** and **Evaluate engineering concepts** to Design next-generation computer systems for modeling simple to complex engineering activities with understanding requirements and limitations of user	2
CO 2	PO 3	**Design solutions** for simple and complex problems by **Defining** and **understanding** customer requirements, **identifying** various static and dynamic functions, **managing design process** and **evaluate the outcomes** as UML diagrams.	4
	PO 10	Make use of building blocks for creating architectural view of system using UML by **communicating effectively to engineering community.**	3
	PO 5	Usage of **CASE tool** for modeling simple to complex engineering activities with understanding requirements and limitations of user for architectural view of system.	1
	PSO 3	Make use of **computational and advanced CASE tools** for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2
CO 3	PO 2	**Understand** the given problem and **system definition, problem formulation, collecting data, modelling, solution development** and **documentation** by using diagrams for static and dynamic aspects of the system.	4
	PO 5	Usage of **CASE tool** for modeling simple to complex engineering activities with understanding requirements and limitations of user.	1
	PO 10	**Communicate** static and dynamic aspects of the **system using UML diagrams** for specifying structure and interaction of objects during runtime.	5
	PO 12	Recognize the need and develop suitable building blocks using UML diagrams for **future advancement and lifelong learning.**	5
CO 4	PO 3	R**Design solutions** for simple and complex problems by **Defining problem, understand customer requirements, identifying** basic building blocks to draw UML diagrams.	3
	PO 5	Usage of **CASE tool** for modelling simple to complex engineering activities with understanding requirements and limitations of user.	1
	PO 10	Recognize building blocks for **visualizing design requirements** of an **object-oriented System.**	4

	PO 12	Visualize objects based on the need, through identifying required design requirements and build architectural model using the object-oriented system for **future advancement and lifelong learning.**	5
	PSO 1	**Formulate** and **Evaluate engineering concepts** to Design next-generation computer systems in identifying basic building blocks for visualizing artifacts of system.	2
	PSO 3	Make use of **computational and advanced CASE tools** for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2
CO 5	PO 2	**Understand** the given problem and system **definition, problem formulation, collecting data, modelling, solution development** and **documentation** for design solution by using advanced building blocks of UML.	5
	PO 5	Usage of **CASE tool** for modelling simple to complex engineering activities with understanding requirements and limitations of user.	1
	PSO 1	**Formulate** and **Evaluate engineering concepts** to Design next-generation computer systems by using advanced building blocks of UML.	2
	PSO 3	Make use of **computational and advanced CASE tools** for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2
CO 6	PO 10	**Make effective presentation** and better understanding of the scenario, use structural modeling framework with **knowledge and system approach.**	5
	PSO 1	**Formulate** and **Evaluate engineering concepts** to Design next-generation computer systems for structural modeling.	2
	PSO 3	Make use of **computational and advanced CASE tools** for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Table 10:

Course Outcomes	Program Outcomes					Program Specific Outcomes	
	PO2	PO3	PO5	PO10	PO12	PSO1	PSO3
CO1			1			2	
CO2		4	1	3			2
CO3	4		1	5	5		
CO4		1	1	4	5	2	2
CO5	5		1			2	2
CO6				5		2	2

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	PO 2, PO 3, PO 5	SEE Exams	PO 2,PO 3, PO 5,PO 10, PO 12	Seminars	-
Laboratory Practices	PO 2,PO 3, PO 5	Student Viva	PO 2, PO 3, PO 10	Certification	-
Assignments	-				

XIII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK I	**INTRODUCTION TO UML**
	Study Of UML.
WEEK II	**ON LINE PURCHASE SYSTEM**
	Create a UML model for On line Purchase System
WEEK III	**LIBRARY MANAGEMENT SYSTEM**
	Create a UML model for Library Management System
WEEK IV	**E-TICKETING**
	Create a UML model for E-Ticketing
WEEK V	**QUIZ SYSTEM**
	Create a UML model for Quiz System.
WEEK VI	**STUDENT MARK ANALYZING SYSTEM**
	Create a UML model for Student Mark Analyzing System.
WEEK VII	**E-MAIL CLIENT SYSTEM**
	Create a UML model for E-Mail Client System.
WEEK VIII	**TELEPHONE PHONE DIALING**
	Create a UML model for Telephone Phone Dialing.
WEEK IX	**POINT OF SALE**
	Create a UML model for Point of sale.
WEEK X	**WORKING COMPANY**
	Create a UML model for a Working Company
WEEK XI	**ATM TRANSACTIONS**
	Create a system to design Bank ATM Transactions and generate code by using MS-Access as back end and VB as the front end.

WEEK XII	**STUDENT MARK ANALYSIS**
	Create a system to design Student mark analysis system and generate code by using MS-Access as back end and VB as the front end

TEXTBOOKS

1. Grady Booch, James Rumbaugh, Ivar Jacobson, —The Unified Modeling Language User Guide‖, Pearson Education, 2ndEdition, 2004.

REFERENCE BOOKS:

1. Craig Larman, —Applying UML and Patterns: An Introduction to Object Oriented Analysis and Design and Iterative Development‖, Pearson Education, 3rd Edition, 2005.

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Introduction To UML.	CO 1	R1: 1.1
2	On Line Purchase System.	CO 1, CO 2 ,CO 3, CO 4 ,CO 5 ,CO 6	R1: 2.3
3	Library Management System	CO 1, CO 2 ,CO 3, CO 4 ,CO 5 ,CO 6	R1: 4.1
4	E-Ticketing	CO 1, CO 2 ,CO 3, CO 4 ,CO 5 ,CO 6	R1: 5.1
5	Quiz System.	CO 1, CO 2 ,CO 3, CO 4 ,CO 5 ,CO 6	R2: 6.1
6	Student Mark Analyzing System.	CO 1, CO 2 ,CO 3, CO 4 ,CO 5 ,CO 6	R1: 7.1
7	E-Mail Client System.	CO 1, CO 2 ,CO 3, CO 4 ,CO 5 ,CO 6	R2: 11.4
8	Telephone Phone Dialing.	CO 1, CO 2 ,CO 3, CO 4 ,CO 5 ,CO 6	R1: 12.5
9	Telephone Phone Dialing.	CO 1, CO 2 ,CO 3, CO 4 ,CO 5 ,CO 6	R2: 14.3
10	Working Company.	CO 1, CO 2 ,CO 3, CO 4 ,CO 5 ,CO 6	R1: 15.1
11	ATM Transactions.	CO 1, CO 2 ,CO 3, CO 4 ,CO 5 ,CO 6	R2:16.4
12	Student Mark Analysis.	CO 1, CO 2 ,CO 3, CO 4 ,CO 5 ,CO 6	R1:20.5

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	**Real time Online Transform** for embedded Systems considering non-functional aspects with rate-monotonic analysis.
2	Implementation of **Advanced relationships** and common mechanisms in real time applications.
3	**Reverse engineering:** Encourage students to implement model from a given input of source code.

Course Coordinator **HOD,IT**
Mr. Rajesh Kumar Bhavani

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

INFORMATION TECHNOLOGY

COURSE DESCRIPTION

Course Title	**WEB TECHNOLOGIES LABORATORY**				
Course Code	AITB11				
Program	B.Tech				
Semester	V	IT			
Course Type	Core				
Regulation	IARE - R18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	3	2
Course Coordinator	Mr. A Krishna Chaitanya, Assistant Professor				

I COURSE OVERVIEW:

This Laboratory course provides a foundation for the development of a broad range of increasingly influential and strategic technologies, supporting a large variety of applications and services, both in the private and public sectors. There is a growing need for management and decision makers to gain a clearer understanding of the application development process, from planning through to deployment and maintenance. This module will give you an insight into architectures, protocols, standards, languages, tools and techniques; an understanding of approaches to more dynamic and mobile content; and demonstrate how you can analyze requirements, plan, design, implement and test arrange of web applications.

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSB01	II	Programming for Problem Solving
B.Tech	AITB06	IV	Object Oriented Programming Through Java

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Web Technologies Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

C	Demo Video	C	Lab Worksheets	C	Viva Questions	C	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component			Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
-	-	-	-	-	-

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

I	The fundamentals of designing static and dynamic web pages using HTML and DHTML for creation of websites.
II	The concepts of client - server programming with JavaScript, XML, Servlets, JSP and PHP.

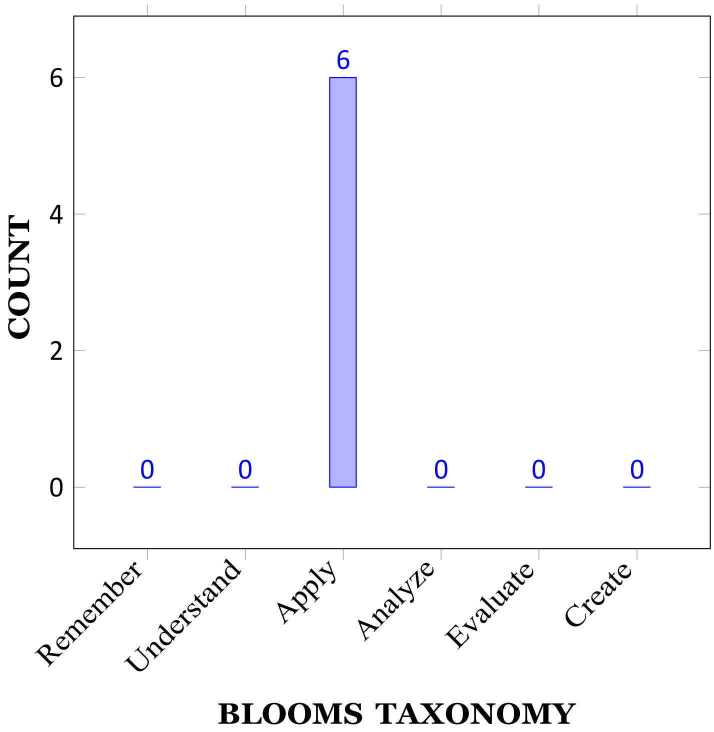
III	The project-based experience needed for designing real time web based client-server applications.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Develop** static web pages using HTML and CSS. .	Apply
CO 2	**Develop** effective and interactive web pages using elements and selectors in style sheets and dynamic HTML.	Apply
CO 3	**Make use of** functions in JavaScript and PHP for implementing data validations in web applications.	Apply
CO 4	**Develop** dynamic web site using server side PHP programming and database connectivity.	Apply
CO 5	**Build** dynamic web pages using XML and PHP with database connectivity to perform CRUD operations.	Apply
CO 6	**Construct** website by using front end and back end programming.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems..	2	Lab Exercises,CIE,SEE
PO 2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	Lab Exercises,CIE,SEE
PO 3	**Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations	3	Lab Exercises,CIE,SEE
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	3	Lab Exercises,CIE,SEE
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	1	Lab Exercises,CIE,SEE
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	2	Lab Exercises,CIE,SEE
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	2	Lab Exercises,CIE,SEE
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	2	Lab Exercises,CIE,SEE
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	3	Lab Exercises,CIE,SEE

PO 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	2	Lab Exer-cises,CIE,SEE

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		**Strength**	**Profi-ciency Assessed by**
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	2.5	Lab Exercises
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	2	Lab Exercises
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry	2	Lab Exercises

3 = High; 2 = Medium; 1 = Low

X JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	**PO'S PSO'S**	**Justification for mapping (Students will be able to)**	**No. of Key Competencies**
CO 1	PO 1	Identify(knowledge) the structure of web page using HTML elements with their importance in web page designing by applying basic principles of **mathematics and engineering fundamentals of programming.**	2
	PO 2	Understand the problem statement and formulate (complex) specific engineering problems related to the concepts of HTML and CSSL by considering the information and data provided by the customer to provide sustained conclusions by using model translation and validate the implementation of webpage by interpretation of results .	8

	PO 3	Understand the customer needs of static and dynamic web pages and use creativity to provide innovative solutions in designing attractive web pages using various mark-up languages, scripting languages by considering all aspects of the problem by managing the design process cost effectively and evaluate the outcomes to achieve engineering objectives to provide sustainable development.	7
	PO 5	Apply appropriate techniques, modern Engineering and IT tools to design a web page with HTML and CSS and use search tools such as browsers to produce the view of webpage.	1
	PO 6	Apply the contextual knowledge of HTML and CSS to assess societal, health and the consequent responsibilities relevant to the professional engineering practice.	2
	PO 7	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	2
	PO 8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	2
	PO 9	Design the webpages effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	7
	PO 10	**Communicate** effectively on complex Engineering activities with the Engineering community related to web development and with society at large, to design web pages and write effective Programming by using the elements of HTML and CSS.	3
	PO 12	Recognize the need for advanced concepts related to HTML and CSS for understanding and developing web applications through continuing education efforts **with ongoing learning – stays up with industry trends/ new technology .**	4
	PSO 1	**Identify the Customer needs and problem specific constraints** in designing web pages related to the basic concepts of HTML and CSS.	4
	PSO 2	Focus on improving software reliability and information retrieval systems using data validation.	2
	PSO 3	Make use of modern computer tool in designing Web applications **by applying the technical skills and Knowledge on advanced frameworks and platforms .**	2
CO 2	PO 1	Illustrate all variations of styling web pages such as internal, external and inline by applying principles of programming **engineering fundamentals and mathematics.**	2

	PO 2	Understand the problem statement and formulate (complex) specific engineering problems related to the concepts of HTML, Javascript and XML by considering the information and data provided by the customer to provide sustained conclusions by using model translation and validate the implementation of webpage by interpretation of results .	5
	PO 3	**Understand the customer needs** of developing interactive web pages identify the **cost limitations** of the web application and use creativity in applying style sheets and changing element's style object for **innovative solutions** by properly **managing design process.**	6
	PO 5	Effective web pages are developed by using computer software related to web development with concepts related to Dynamic HTML ,XML and Java script for client/server based web applications.	1
	PO 6	Apply the contextual knowledge of Javascript and XML to assess societal, health and the consequent responsibilities relevant to the professional engineering practice.	2
	PO 7	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	2
	PO 8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	2
	PO 9	Design the webpages effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	6
	PO 10	Communicate effectively on complex Engineering activities related to web development with the customer to take the specific needs in designing client/server based web applications by using HTML ,XML and Java script concepts.	3
	PO12	Recognize the need for advanced concepts in developing web applications through continuing education efforts with ongoing learning – stays up with industry trends/ new technology related to the concepts of HTML,Javascript,XML.	6
	PSO 1	Understand the need and constraints related to programming concepts of dynamic HTML, Java Script and XML languages in designing web pages.	4
	PSO 2	Focus on improving software reliability and information retrieval systems using data validation functions.	2
	PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2

CO 3	PO 1	Apply the knowledge of client side and server side scripting, mark-up languages to validate the information and data provided by the user by applying principles of **mathematics and engineering fundamentals.**	2
	PO 2	Understand the given problem statement and formulate (complex)specific engineering problems related to Servlets, and JSPs by appliying MVC architecture from the information and data collection.	5
	PO 3	**Understand the customer needs** of validating data; **identify the cost limitations** based on requirements and network traffic, **use creativity** in implementing validation functions for **innovative solutions** of the web application.	6
	PO 5	Effective web pages are developed by using computer software related to web development with concepts related to PHP for client/server based web applications.	1
	PO 6	Apply the contextual knowledge of client side and server side scripting to assess societal, health and the consequent responsibilities relevant to the professional engineering practice.	1
	PO 7	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	2
	PO 8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	2
	PO 9	Design the webpages effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	6
	PO 10	Communicate effectively on complex Engineering activities related to web development with the customer to take the specific needs in designing client/server based web applications by using PHP .	4
	PO 12	Recognize the need for advanced concepts in developing web applications through continuing education efforts with ongoing learning – stays up with industry trends/ new technology related to the concepts of PHP.	4
	PSO 1	Understand the need and constraints related to programming concepts of PHP in designing web pages.	4
	PSO 2	Focus on improving **software reliability and information retrieval systems** by implementing appropriate data validation functions.	1
	PSO 3	Make use of modern computer tool in designing Web applications by applying the technical skills and Knowledge on advanced frameworks and platforms .	1
CO 4	PO 1	Make use of (apply) programming constructs such as arrays, functions and database connectivity (knowledge) in solving (complex) engineering problems related to web applications by applying the principles of **engineering fundamentals and mathematical principles.**	3

	PO 2	Understand the given **problem statement** and **formulate** the (complex) engineering problems of creating fast and flexible web application to **collect data and information, develop solutions** based on the programming constructs of PHP, **validate** the web application in reaching substantiated conclusions by the **Interpretation of results.**	5
	PO 3	**Understand the user needs** of creating web applications, **use creativity** of widgets, containers and frames in applying the methods **for innovative solutions, and evaluate the outcomes** of the model analysis for developing the web applications **to achieve engineering objectives.**	5
	PO 5	Create the PHP code for interaction with the database to perform CRUD operations by properly using cookies and encryption in developing web application (complex) Engineering activities in **Computer software.**	1
	PO 6	Apply the contextual knowledge of PHP, client side and server side scripting to assess societal, health and the consequent responsibilities relevant to the professional engineering practice.	2
	PO 7	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	2
	PO 8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	2
	PO 9	Design the webpages effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	6
	PO 10	Communicate effectively on complex Engineering activities related to web development with the customer to take the specific needs in designing client/server based web applications by using PHP .	4
	PO 12	Create **web applications** according to **technological changes** done in **software environment.**	4
	PSO 1	Understand the need and constraints related to programming concepts of PHP in designing web pages.	3
	PSO 2	Focus on improving **software reliability and information retrieval systems** by implementing appropriate data validation functions.	1
	PSO 3	Make use of **modern computer tools** in designing Web applications at coding competitions and solving complex engineering problems	1
CO 5	PO 1	Apply the knowledge of client side and server side scripting, mark-up languages to validate the information and data provided by the user by applying principles of **mathematics and engineering fundamentals.**	2

	PO 2	Understand the given **problem statement and formulate** the(complex) engineering problems of creating user interface of Web application for the **collection of data and information develop solutions** based on open, send methods of request object, **validate** the web application in reaching substantiated Conclusions by the **Interpretation of results.**	5
	PO 3	**Understand the customer needs** of validating data; **identify the cost limitations** based on requirements and network traffic, **use creativity** in implementing validation functions for **innovative solutions** of the web application.	7
	PO 5	Create the PHP code for interaction with the database to perform CRUD operations by properly using cookies and encryption in developing web application(complex) Engineering activities in **Computer software.**	1
	PO 6	Apply the contextual knowledge of client side and server side scripting to assess societal, health and the consequent responsibilities relevant to the professional engineering practice.	2
	PO 7	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	2
	PO 8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	2
	PO 9	Design the webpages effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	5
	PO 10	Communicate effectively on complex Engineering activities related to web development with the customer to take the specific needs in designing client/server based web applications by using PHP with data base connectivity.	2
	PO 12	Create **web applications** according to **technological changes** done in **software environment.**	4
	PSO 1	Focus on improving **software reliability and information retrieval systems** by implementing appropriate data validation functions.	3
	PSO 2	Understand and develop web applications using PHP for **Improving software reliability.**	1
	PSO 3	Make use of modern computer tool in designing Web applications by **applying the technical skills and Knowledge on advanced frameworks and platforms .**	1
CO 6	PO 1	Relate the principles of HTML and XML for separation of data and presentation during the development (complex) of web pages by the **principles of mathematics and engineering fundamentals.**	2

	PO 2	Understand the given problem statement and formulate the(complex)engineering problems of creating user interface of Web application for the **collection of data and information develop solutions** based on open, send methods of request object, **validate** the web application in reaching substantiated Conclusions by the **Interpretation of results.**	8
	PO 3	**Manage the design process by understanding the customer needs for**simplification of sharing and transport of data and use creativity to wrap the data in order to **provide innovative solutions** for the requirements.	6
	PO 5	Create web site by using front end and backend technologies in developing web application by using **Computer software.**	1
	PO 6	Apply the contextual knowledge of client side and server side scripting to assess societal, health and the consequent responsibilities relevant to the professional engineering practice.	2
	PO 7	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	2
	PO 8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	2
	PO 9	Design the webpages effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	6
	PO 10	Communicate effectively on complex Engineering activities related to web development with the customer to take the specific needs in designing client/server based web applications by using PHP with data base connectivity.	3
	PO 12	Create **web applications** according to textbf technological changes Done in **software environment.**	4
	PSO 1	Make use of concepts in XML for improving **software reliability and information retrieval systems.**	3
	PSO 2	Understand and develop web applications for **Improving software reliability.**	1
	PSO 3	Make use of modern computer tool in designing Web applications **by applying the technical skills and Knowledge on advanced frameworks and platforms .**	1

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

COURSE OUTCOMES	Program Outcomes												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	3	10	10	11	1	5	3	3	12	5	12	8	6	2	2
CO 1	2	8	7	-	1	2	2	2	7	3	-	4	4	2	2
CO 2	2	5	6	-	1	2	2	2	6	3	-	6	4	2	2
CO 3	2	5	6	-	1	1	2	2	6	4	-	4	4	1	1
CO 4	3	5	5	-	1	2	2	2	6	4	-	4	3	1	1
CO 5	2	5	7	-	1	2	2	2	5	2	-	4	3	1	1
CO 6	2	8	6	-	1	2	2	2	6	3	-	4	3	1	1

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	C	SEE Exams	C	Seminars	-
Laboratory Practices	C	Student Viva	C	Certification	-
Assignments	-				

XIII ASSESSMENT METHODOLOGY INDIRECT:

C	Early Semester Feedback	C	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK I	**INSTALLATIONS**
	Installation of XAMPP and WAMP servers.
WEEK II	**HTML**
	1. Create a table to show your class time table. 2. Use tables to provide layout to your HTML page describing your college infrastructure. 3. Use <span> and <div> tags to provide a layout to the above page instead of a table layout.
WEEK III	**HTML**
	1. Use frames such that page is divided into 3 frames 20% on left to show contents of pages, 60% in center to show body of page, remaining on right to show remarks. 2. Embed Audio and Video into your HTML web page.

WEEK IV	**HTML**
	1. Create a webpage with HTML describing your department use paragraph and list tags. 2. Apply various colors to suitably distinguish key words, also apply font styling like italics, underline and two other fonts to words you find appropriate, also use header tags. 3. Create links on the words e.g. Wi-Fi‖ and LAN‖ to link them to Wikipedia pages. 4. Insert an image and create a link such that clicking on image takes user to other page. 5. Change the background color of the page; At the bottom create a link to take user to the top of the page.
WEEK V	**HTML**
	Develop static pages (using only HTML) of an online book store, the pages should resemble: www.amazon.com, the website should consist the following pages, home page, registration and user login, user profile page, books catalog, shopping cart, payment by credit card, order confirmation.
WEEK VI	**CASCADING STYLE SHEET**
	Write an HTML page that contains a selection box with a list of 5 countries, when the user selects a country, its capital should be printed next to the list; Add CSS to customize the properties of the font of the capital (color, bold and font size).
WEEK VII	**CASCADING STYLE SHEET**
	Let your visitors change the style sheet on your web site, this script will let your visitors choose between five style sheets, which can create yourself or use the one's included.
WEEK VIII	**JAVASCRIPT**
	1. Write a Java Script program to test the first character of a string is uppercase or not. 2. Write a pattern that matches e-mail addresses. 3. Write a Java Script function to print an integer with commas as thousands separators.
WEEK IX	**JAVASCRIPT**
	1. Write a Java Script program to sort a list of elements using quick sort. 2. Write a Java Script for loop that will iterate from 0 to 15 for each iteration, it will check if the current number is odd or even, and display a message to the screen. 3. Write a Java Script function which will take an array of numbers stored and find the second lowest and second greatest numbers, respectively.
WEEK X	**JAVASCRIPT**
	1. Write a Java Script program which compute, the average marks of the following students then this average is used to determine the corresponding grade. 2. Write a Java Script program to sum the multiples of 3 and 5 under 1000. 3. To design the scientific calculator and make event for each button using java script.

WEEK XI	**PHP**
	1. A simple calculator web application that takes two numbers and an operator (+, -,/,*and %) from an HTML page and returns the result page with the operation performed on the operands. 2. Write php program how to send mail using PHP.
WEEK XII	**PHP**
	1. Write php program to convert a string, lower to upper case and upper case to lower case or capital case. 2. Write php program to change image automatically using switch case.
WEEK XIII	**PHP**
	1. Write php program to calculate current age without using any pre-define function. 2. Write php program to upload image to the server using html and PHP.
WEEK XIV	**PHP**
	1. Write php program to upload registration form into database. 2. Write php program to display the registration form from the database.
WEEK XV	**PHP**
	1. Write php program to update the registration form present in database. 2. Write php program to delete the registration form from database

REFERENCE BOOKS

1. Uttam K Roy, Web Technologies‖, Oxford University Press, 1st Edition, 2010.

2. Steven Holzner, The Complete Reference PHP‖, Tata McGraw-Hill, 1st Edition, 2007

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Refer-ence
1	Installations	CO1	T2:1
2	HTML tables	CO1	T1:2.6-2.9
3	HTML frames	CO1	T1:4.1-4.2
4	HTML basic tags.	CO1	T1:2.1-2.4 T1:2.6-2.9
5	HTML form elements	CO2	T1:4.2-4.3
6	HTML using CSS	CO2	T1:4.4-4.7
7	Javascript functions.	CO3	T1:5.6-5.10
8	Javascript Control statements	CO3	T1:5.6-5.10
9	Javascript Control statements	CO3	T1:5.6-5.10
10	PHP	CO4	T2:1, 2
11	PHP functions	CO4	T2:2

12	PHP database access	CO4	T2:10
13	PHP database access	CO4	T2:10

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	Updating latest version and new features of the PHP Language.
2	Familiarizing the role of Java script Objects in developing system level programs.
3	Updating to latest Technology React JS in developing all devices interoperability

Signature of Course Coordinator **HOD IT**
Mr. A Krishna Chaitanya, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
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Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	INFORMATION TECHNOLOGY				
Course Title	LINUX PROGRAMMING				
Course Code	AITB12				
Program	B.Tech				
Semester	VI				
Course Type	CORE				
Regulation	R-18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	2	1	3	-	-
Course Coordinator	A KRISHNA CHAITANYA, ASSISTANT PROFESSOR				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACS001	I	Computer Programming
B.Tech	AIT003	IV	Computer Networks

II COURSE OVERVIEW:

This course provides a deep understanding of the operating system architecture and low-level interfaces (principally, system calls and library functions) that are required to build system-level, multithreaded, and network applications on Linux and UNIX systems. The course consists of a mixture of detailed presentations coupled with a large number of carefully designed practical exercises that allow participants to apply the knowledge learned in the presentations.By the completion of the course, participants will have the mastery needed to write complex system, network, and multithreaded applications on a Linux or UNIX system.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Linux Programming	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	✓	MOOC
✓	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
10 %	Remember
70 %	Understand
20 %	Apply
0 %	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Quiz	AAT	
CIA Marks	20	05	05	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination
Two Quiz exams shall be online examination consisting of 50 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

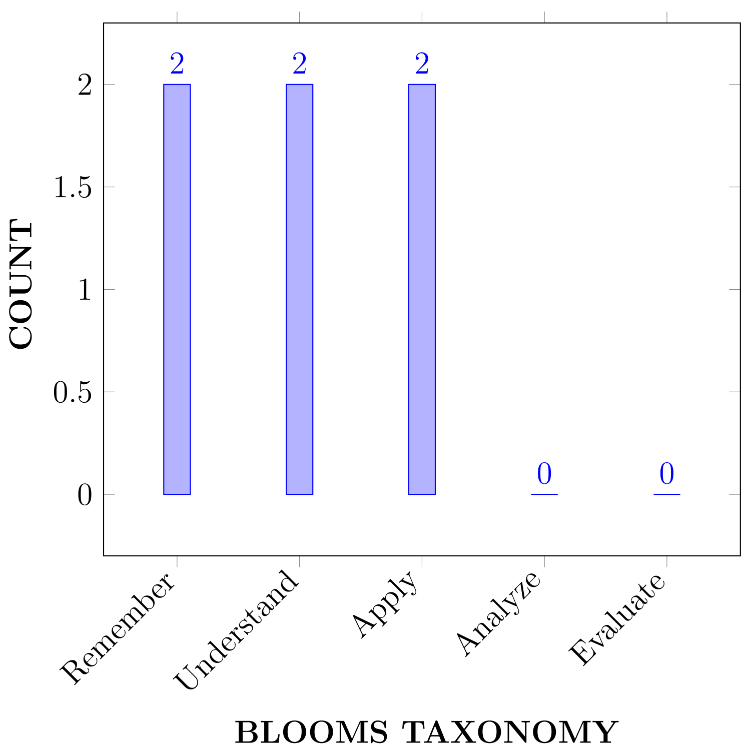
I	The features and architecture of Linux operating system along with linux utilities and shell scripting language to solve problems.
II	The concepts of Low-Level system call for file handling and process management.
III	To develop skills the necessary for systems programming including file system programming, process and signal management.
IV	Mechanisms for establishing communication in client- server applications.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Demonstrate** operations using file handling, text processing and linux utilities.	Understand
CO 2	**Outline** the different shell scripts to execute systems programs and application programs.	Remember
CO 3	**Make use of** different system calls for file I/O operations and managing the file systems.	Apply
CO 4	**Demonstrate** the concepts of process and signal system calls for process creation, scheduling, controlling and termination.	Understand
CO 5	**Outline** IPC mechanisms such as pipes, shared memory, message queues, semaphores for performing inter process communication	Remember
CO 6	**Utilize** socket concepts for connection-oriented and connectionless communication between client and server systems.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:**Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	SEE/CIE, Quiz/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	SEE/CIE, Quiz/AAT
PO 3	**Design / development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	2	SEE/ CIE, AAT, QUIZ
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	3	SEE/ CIE, AAT, QUIZ

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	3	Assignments
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	2	Assignments
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	-	-

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	✓	-	-	-	-	-	-	-	✓	-	-
CO 2	✓	-	-	-	✓	-	-	-	-	-	-	-	-	-	-
CO 3	✓	-	-	-	✓	-	-	-	-	-	-	-	-	-	-
CO 4	✓	✓	-	-	✓	-	-	-	-	-	-	-	-	✓	-
CO 5	✓	-	✓	-	✓	-	-	-	-	-	-	-	✓	-	-
CO 6	✓	-	✓	-	✓	-	-	-	-	-	-	-	✓	-	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	**Apply the knowledge of mathematics, science, engineering fundamentals** for overcoming the problems of operating systems like Windows, Mac etc and managing file systems.	3
	PO 5	**Create, select, and apply appropriate techniques** to solve the problems in inter process communication.	3
	PSO 1	**Understand, analyze and develop computer programs** to implement own operating systems using system calls and utilities.	3
CO 2	PO 1	**Apply the knowledge of mathematics, science, engineering fundamentals** for overcoming the problems of operating systems like Windows, Mac etc and managing file systems.	3
	PO 5	**Create, select, and apply appropriate techniques** to solve the problems in inter process communication.	3
CO 3	PO 1	**Apply the knowledge of mathematics, science, engineering fundamentals** for overcoming the problems of operating systems like Windows, Mac etc and managing file systems.	3
	PO 5	**Create, select, and apply appropriate techniques** to solve the problems in inter process communication.	3
CO 4	PO 1	**Apply the knowledge of mathematics, science, engineering fundamentals** for overcoming the problems of operating systems like Windows, Mac etc and managing file systems.	3
	PO 2	**Identify and analyze complex engineering problems** for accessing operating services.	2
	PO 5	**Create, select, and apply appropriate techniques** to solve the problems in inter process communication.	3

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO 2	**Ability to apply standard practices and strategies in software project devleopment using open ended programming** to design client server applications.	2
CO 5	PO 1	**Apply the knowledge of mathematics, science, engineering fundamentals** for overcoming the problems of operating systems like Windows, Mac etc and managing file systems.	3
	PO 3	**Design solutions for complex engineering problems** using inter process communication mechanisms.	3
	PO 5	**Create, select, and apply appropriate techniques** to solve the problems in inter process communication.	3
	PSO 1	**Understand, analyze and develop computer programs** to implement own operating systems using system calls and utilities.	3
CO 6	PO 1	**Apply the knowledge of mathematics, science, engineering fundamentals** for overcoming the problems of operating systems like Windows, Mac etc and managing file systems.	3
	PO 3	**Design solutions for complex engineering problems** using inter process communication mechanisms.	3
	PO 5	**Create, select, and apply appropriate techniques** to solve the problems in inter process communication.	3
	PSO 1	**Understand, analyze and develop computer programs** to implement own operating systems using system calls and utilities.	3

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	3	-	-	-	-	-	-	-	3	-	-
CO 2	3	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO 3	3	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO 4	3	2	-	-	3	-	-	-	-	-	-	-	-	2	-
CO 5	3	-	2	-	3	-	-	-	-	-	-	-	3	-	-
CO 6	3	-	2	-	3	-	-	-	-	-	-	-	3	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	100	-	-	-	100	-	-	-	-	-	-	-	100	-	-
CO 2	100	-	-	-	100	-	-	-	-	-	-	-	-	-	-
CO 3	100	-	-	-	100	-	-	-	-	-	-	-	-	-	-
CO 4	100	40	-	-	100	-	-	-	-	-	-	-	-	40	-
CO 5	100	-	40	-	100	-	-	-	-	-	-	-	100	-	-
CO 6	100	-	40	-	100	-	-	-	-	-	-	-	100	-	-

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation
1 -$5 < C \leq 40\%$ – Low/ Slight
2 - $40\ \% < C < 60\%$ –Moderate
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	3	-	-	-	-	-	-	-	3	-	-
CO 2	3	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO 3	3	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO 4	3	2	-	-	3	-	-	-	-	-	-	-	-	2	-
CO 5	3	-	2	-	3	-	-	-	-	-	-	-	3	-	-
CO 6	3	-	2	-	3	-	-	-	-	-	-	-	3	-	-
TOTAL	18	4	4	-	18	-	-	-	-	-	-	-	9	2	-
AVERAGE	3	2	2	-	3	-	-	-	-	-	-	-	3	2	-

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	
Laboratory Practices		Student Viva		Certification	
Term Paper		5 Minutes Video	✓	Open Ended Experiments	
Assignments					

XVII ASSESSMENT METHODOLOGY-INDIRECT:

x	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	INTRODUCTION AND LINUX UTILITIES
	Introduction to Linux operating system: History of Linux, features of Linux, architecture of Unix/Linux, Linux Utilities-File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking commands, Filters, Text processing utilities and Backup utilities;Applications: Shell programming with Bourne again shell(bash)- Introduction, shell responsibilities, pipes and Redirection, here documents, running a shell script, the shell as a programming language, shell meta characters, file name substitution, shell variables, command substitution, shell commands, the environment, quoting, test command, control structures, arithmetic in shell, shell script examples, interrupt processing, functions, debugging shell scripts.
MODULE II	FILES AND DIRECTORIES SYSTEM CALLS
	Files and Directories: File Concept, File types, File System Structure, File metadata- Inodes, kernel support for files, System calls for file I/O operations- open, create, read, write, close, lseek,dup2, file status informationstat family, file and record locking- fcntl function, permission- chmod, fchmod, file ownership- chown, lchown, links- soft links and hard links- symlink, link, unlink; Directories: creating, removing and changing directories- mkdir, rmdir, chdir, obtaining current working directory- getcwd, directory contents, scanning directories- opendir, readdir, closedir, rewinddir functions.
MODULE III	PROCESS AND SIGNALS
	Process – Process concept, Layout of a C program, image in main memory, process environment- environment list, environment variables, getenv, setenv, Kernel support for process, process identification, process control - process creation, replacing a process image, waiting for a process, process termination, zombie process, orphan process, system call interface for process management- fork, vfork, exit, wait, waitpid, exec family, process groups, sessions and controlling terminal, differences between threads and processes. Signals– Introduction to signals, Signal generation and handling, Kernel support for signals, Signal function, unreliable signals, reliable signals, kill, raise, alarm, pause, abort, sleep functions.
MODULE IV	INTERPROCESS COMMUNICATION
	Inter process Communication: Introduction to IPC, IPC between processes on a single computer system, IPC between processes on different systems, Pipes- creation, IPC between related processes using unnamed pipes, FIFOs- creation, IPC between unrelated processes using FIFOs(named pipes), differences between unnamed and named pipes. Message Queues- Kernel support for messages, APIs for message queues, client/server example; Semaphores-Kernel support for semaphores, APIs for semaphores, file locking with Semaphores.
MODULE V	SHARED MEMORY AND SOCKETS
	Shared Memory- Kernel support for shared memory, APIs for shared memory, shared memory example. Sockets: Introduction to Berkeley Sockets, IPC over a network, client/server model, Socket Address structures (UNIX domain and internet domain), Socket system calls for connection oriented protocol and connectionless protocol, example-client / server programs- single client/server connection, Multiple simultaneous clients.

TEXTBOOKS

1. Sumitabha Das, “Your Unix The Ultimate Guide”, Tata McGraw-Hill, New Delhi, India, 2012.
2. W. Richard. Stevens, ”Advanced Programming in the UNIX Environment” Pearson Education, New Delhi, India, 2013.

REFERENCE BOOKS:

1. T. Chan, ”Unix System Programming using C++” PHI. 4 th Edition, 2007.
2. N. Mathew, R. Stones, Wrox, ”Beginning Linux Programming”, Wiley India Edition, 4 th Edition, 2014.
3. Graham Glass, King Ables, ”Unix for Programmers and Users”,Pearson Education, 3 rd Edition, 2008.
4. A. Hoover, ”System Programming with C and Unix”, 3 rd Edition, 2008.
5. K. A. Robbins, ”System Programming, Communication, Concurrency and Threads”, Pearson Education, 4 thEdition, 2014.

WEB REFERENCES:

1. https://www.edx.org/course/introduction-linux-linuxfoundationx-lfs101x-0
2. http://www.tutorialspoint.com/listtutorials/linux/1
3. http://www.compsci.hunter.cuny.edu/ sweiss/course_materials/unix_lecture_notes.php.

COURSE WEB PAGE:

https://www.youtube.com/playlist?list=PLzkMouYverAL-n5gSzmx00aAusHgyzfGD

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
OBE DISCUSSION			
1	In Outcome-Based Education (OBE), we discussed about course delivery assessment that are planned to achieve stated objectives and outcomes. We will focuses on measuring student performance i.e. outcomes at different levels. Course outcomes(CO),Program Outcomes(PO)and Program Specific Outcomes(PSO) and also mapping of CO's to PO's PSO's and their attainments are discussed.		
CONTENT DELIVERY (THEORY)			
2	Understand history of Linux and its features	CO 1	T2: 1.1-1.5, T1: 4.1
3	Architecture of Unix/Linux	CO 1	T2: 4.7-4.8, 5.3-5.4
4-5	Linux Utilities-File handling utilities,	CO 1	T2: 3.10,15.6, 17.5-17.6

6	Security by file permissions, Process utilities,	CO 1	T2: 3.10,15.6, 17.5-17.6
7-8	Disk utilities, Networking commands, Filters.	CO 1	T2: 12.3-12.9 15.9-15.10
9	Text processing utilities and Backup utilities.	CO 1	T2: 13.4
10-11	Demonstrate pattern scanning and processing in problem solving.	CO 1	T2: 18.1, T2:18.12
12-13	Understand basic shell scripting.	CO 2	T2: 8.5
14	Understand shell script execution.	CO 2	T2: 14.14
15	Classify use of special characters.	CO 2	T2: 8.9
16-17	Illustrate forwarding the command output into another context	CO 2	T2: 8.4, 8.10
18-19	Develop solutions to complex tasks.	CO 2	T2: 14.5-14.17
20	Demonstrate the use of the formatting Specifies of IO.	CO 3	R4: 4.1-4.14
21-22	Demonstrate standard stream and buffer based input and output system calls.	CO 3	R4: 5.1-5.9
23	Demonstrate layout of what's being printed.	CO 3	R4: 5.10-5.11
24-25	Demonstrate modification and editing.	CO 2	R4: 3.1-3.12, 4.2
26-27	Demonstrate security concepts in files.	CO 3	T2: 5.2
28	Discuss scanning and linking methods.	CO 3	R4: 4.20-4.22, 4.15-4.17
29-31	Understand internal procedures and states of IPC	CO 4	R4: 8.6
32-33	Illustrate daemons and varieties.	CO 4	R4: 8.6
34	Classify processes to respond to asynchronous events.	CO 4	R4: 10.1-10.3
35-36	Understand and to handle exceptional situations.	CO 4	R4: 10.4-10.19
37-38	Demonstrate inter related process communication	CO 5	R4: 14.1-14.4
39	Demonstrate named pipes.	CO 5	R4: 14.5
40	Discuss types of restricting and accessing different resources.	CO 5	R4: 14.6
41-43	Demonstrate dividing up work among to balance work over multiple processes.	CO 5	R4: 14.7
44	Demonstrate user variables and semaphore operations, provided at the kernel level.	CO 5	R4: 14.8
45-46	Solve security hurdles using programming interface of Linux	CO 5	R4: 14.8
47	Demonstrate common memory portion which other processes	CO 6	R4: 14.9
48-49	Illustrate common memory sharing interfacing example.	CO 6	R4: 14.9

50-51	Demonstrate parallelism in Linux based system calls.	CO 6	T1: 13.1-13.2
52	Demonstrate concurrency in Linux APIs.	CO 6	T1: 13.4
53-54	Demonstrate multiple processes to a common resource in Linux based parallel	CO 6	T1: 13.5
55-57	Demonstrate multiple threads access the same resource for read and write.	CO 6	T1: 13.5
58	Understand end to end network communication	CO 6	R2: 15.1
59-60	Understand TCP based system calls	CO 6	R2: 15.5
61-62	Understand UDP protocol system calls	CO 6	R2: 15.5
63-64	Demonstrate connection oriented, connectionless communications in two and three	CO 6	R2: 15.5
PROBLEM SOLVING/ CASE STUDIES			
1	Problems on shell scripting in linux operating system to do various operations.	CO 3	R2:7.5
2	Problems on file system calls to implement utilities in linux operating system.	CO 2	R2:7.5
3	Problems on directory system calls to create and access directory files in linux operating system.	CO 3	R2:7.5
4	Problems on process for creating and terminating of linux operating system.	CO 2	R2:7.5
5	Problems on signals to control the process in linux.	CO 2	R2:7.5
6	Problems on Interprocess communication using pipes, fifo mechanisms.	CO 3	R2:7.5
7	Problems on Interprocess communication using message queues system calls.	CO 3	R2:7.5
8	Problems on Interprocess communication using shared memory and semaphores.	CO 3	R2:7.5
9	Problems on connection oriented and connection less to exchange data between process using system calls.	CO 3	R2:7.5
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Definitions on linux operating system and utilities	CO 1	T1:1.2
2	Definitions on shell responsibilities	CO 2	T1:1.6
3	Definitions on process system calls	CO 3	T1:8,9
4	Definitions on signal system calls	CO 4	T1:9.1
5	Definitions on inter process communication mechanisms	CO 5	T1:10,11

DISCUSSION OF QUESTION BANK			
1	Linux architecture and utilities, shell programming	CO 1	T1:1.2
2	Files and Directory system calls	CO 2	T1:1.5
3	Process and Signals	CO 3	T1:8,9
4	Inter Process Communication mechanisms of pipes, fifo, message queues	CO 4	T1:9.1
5	Inter Process Communication using TCP and UDP protocols	CO 5,6	T1:10,11

Signature of Course Coordinator **HOD,IT**
Mr. A Krishna Chaitanya, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**INFORMATION TECHNOLOGY**				
Course Title	**PRINCIPLES OF ARTIFICAL INTELLIGENCE**				
Course Code	ACSB13				
Program	B.Tech				
Semester	VI				
Course Type	Core				
Regulation	R-18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Putta Hemalatha, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
UG	AHSC08	II	Probability and Statistics
UG	ACSB03	II	Data Structures
UG	ACSB04	III	Discrete Mathematical Structures
UG	AITB05	IV	Design and Analysis of Algorithms

II COURSE OVERVIEW:

Driven by the combination of increased access to data, computational power, and improved sensors and algorithms, Artificial Intelligence (AI) technologies are entering the mainstream of technological innovation. These technologies include search, machine learning, natural language processing, robotics and image processing.

Artificial intelligence (AI) is a study field that examines how to achieve intelligent human behaviours on a computer. An ultimate objective of AI is to make a PC that can learn, plan, and take care of issues independently.

In spite of the fact that AI has been thought for many years, we can't make a PC that is as clever as a human in all perspectives. Still, we do have several successful applications. In some cases, the computer implemented with AI technology can be even more clever than us. The Deep Blue system which won against the world chess champion is a great example.

Presentation of artificial intelligence is though, ideas and methods to familiarize the student with the basic programs in the field and their underlying theory. Students will explore this through problem-solving paradigms, logic and theorem proving, language and image understanding, search and control methods and learning.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Principles of Artificial Intelligence	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
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x	Others						

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Two Quiz exams shall be online examination consisting of 50 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

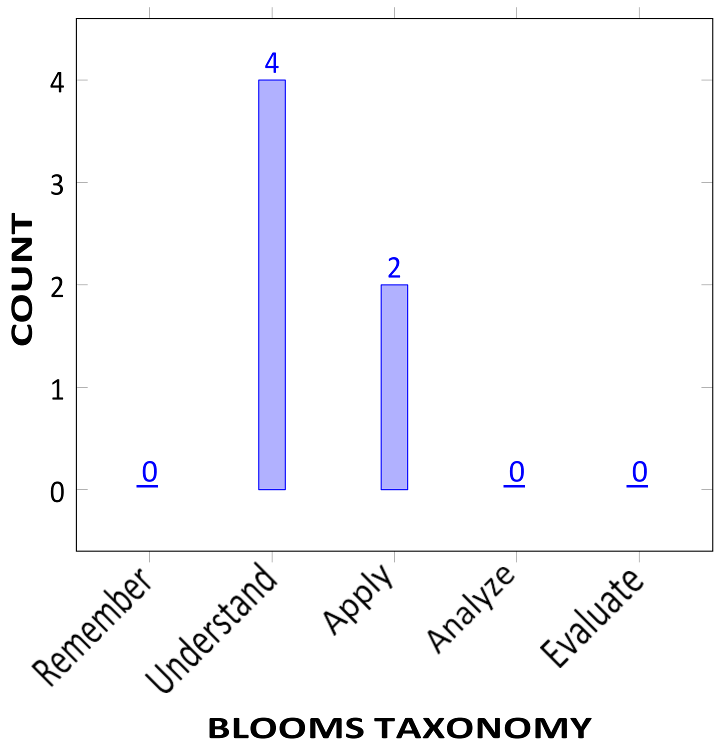
I	Gain a historical perspective of AI and its foundations.
II	Become familiar with basic principles of AI toward problem solving, inference, knowledge representation, and learning.
III	Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
IV	Experience AI development tools such as Prolog (AI language), expert system shell, and/or data mining tool.
V	Explore the current scope, potential, limitations, and implications of intelligent systems.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Summarize** knowledge representation and issues in AI and Related fields.	Understand
CO 2	**Demonstrate** knowledge reasoning with predicate logic and inference rules in the presence of incomplete and/or uncertain information.	Understand
CO 3	**Choose** Heuristic, Adversarial search and game playing algorithms for addressing a particular AI problem and implement the selected strategy.	Apply
CO 4	**Experiment with** uncertainty issues by using statistical and symbolic reasoning approaches.	Apply
CO 5	**Outline** subfields and applications of AI such as planning, learning, and expert systems in specific domain problems.	Understand
CO 6	**Demonstrate** knowledge representation with the help of AI languages and tools.	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/Quiz/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	CIE/Quiz/AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	1	CIE/Quiz/AAT
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	1	CIE/Quiz/AAT
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	1	CIE/Quiz/AAT
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	1	CIE/Quiz/AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	3	CIE / Quiz / AAT
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	2	CIE / Quiz / AAT

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	3	CIE / Quiz / AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	-	-	-	-	-	-	-		✓	-	-
CO 2	-	-	✓	-	-	-	-	-	-	-	-	-	-	✓	-
CO 3	✓	-	-	-	-	-	-	-	-	-	-	-	✓	-	-
CO 4	✓	-	-	-	-	-	-	-	-	-	-	-	✓	-	-
CO 5	✓	✓	✓	-	-	-	-	-	-	✓	-	-	-	✓	-
CO 6	✓	✓	-	-	-	-	-	-	-	-	-		✓	-	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Learn definition of AI and its underlying assumptions. The approaches also evolved from the foundation of AI algorithms to the paradigm slot in symbolic algorithms and expert system development, Machine learning and Deep learning **to support study of their own engineering discipline applying mathematical and scientific principles.**	3
	PSO 1	Understand Early works in AI to design **System Software** and make use of these in the areas related to **Web design, Machine learning and Networking.**	4
CO 2	PO 3	Relate Knowledge and understand approaches to knowledge representation **in commercial and economic context of engineering process to Various problems, customer and user needs, cost effective and creative solutions, design process and Management techniques.**	7
	PSO 2	Understand Issues in Knowledge Representation in improving **Software reliability, security and information retrieval systems.**	2
CO 3	PO 1	Compare procedural and declarative knowledge in **solving complex engineering problems.**	3
	PSO 1	Demonstrate algorithms for **solving logic programming.**	4
CO 4	PO 1	Recall steps of algorithm to convert casual forms with **scientific principles and mathematical principles.**	2

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO 1	Make use of **algorithms** to convert casual forms relating formula in proof.	4
CO 5	PO 1	Explain axioms and rules of inference in nonmonotonic reasoning to extend some kind of numeric measure of certainty using **scientific principles and mathematical principles.**	2
	PO 2	Explore techniques for solving problems with incomplete and uncertain models **by identifying the problem statement, information collection and develop a solution and documentation**	4
	PO 3	Design solutions for uncertainty problems in any AI system that seeks to model and reasoning by **investigating, identifying constraints to establish innovative solutions evaluate outcomes and promote sustainability.**	5
	PO 10	Understand the techniques for solving problems and **communicate effectively with the engineering community and with society at large.**	3
	PSO 2	Understand the techniques of uncertainty for improving **software reliability and information retrieval.**	2
CO 6	PO 1	Apply inference and resolution for conversion of facts into first order logic, statements into CNF(Conjunctive Normal form) using **scientific, mathematical principles and support study of their own engineering discipline**	3
	PO 2	Build refutation proofs that are proofs by contradiction by **identifying, formulating and analysing complex engineering problems with the help of basic mathematics and engineering sciences.**	7
	PSO 1	Make use of inference and resolution to **design and analyze computer programs** for converting the facts and statements	3

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	-	-		4	-	-
CO 2	-	-	7	-	-	-	-	-	-	-	-	-	-	2	-
CO 3	3	-	-	-	-	-	-	-	-	-	-	-	4	-	-
CO 4	2	-	-	-	-	-	-	-	-	-	-	-	4	-	-
CO 5	2	4	5	-	-	-	-	-	-	3	-	-	-	2	-
CO 6	3	7	-	-	-	-	-	-	-	-	-		3	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.6	0.0	0.0
CO 2	0.0	0.0	70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100	0.0
CO 3	100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.6	0.0	0.0
CO 4	66.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.6	0.0	0.0
CO 5	66.6	40	50	0.0	0.0	0.0	0.0	0.0	0.0	60	0.0	0.0	0.0	100	0.0
CO 6	100	70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50	0.0	0.0

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - 0 ≤ C≤ 5% – No correlation

1 -5 <C≤ 40% – Low/ Slight

2 - 40 % <C < 60% –Moderate

3 - 60% ≤ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	0	0	0	0	0	0	0	0	0	0	0	3	0	0
CO 2	0	0	3	0	0	0	0	0	0	0	0	0	0	3	0
CO 3	3	0	0	0	0	0	0	0	0	0	0	0	3	0	0
CO 4	3	0	0	0	0	0	0	0	0	0	0	0	3	0	0
CO 5	3	2	2	0	0	0	0	0	0	3	0	0	0	3	0
CO 6	3	3	0	0	0	0	0	0	0	0	0	0	2	0	0
TOTAL	15	5	5	0	0	0	0	0	0	3	0	0	11	6	0
AVERAGE	2.5	0.83	1.6	0	0	0	0	0	0	0.5	0	0	1.8	1.0	0

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	Open Ended Experiments	-
Assignments	✓				

XVII ASSESSMENT METHODOLOGY-INDIRECT:

X	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**INTRODUCTION OF AI AND KNOWLEDGE REPRESENTATION**
	Definition of AI, The AI Problems, The Underlying Assumption, AI Techniques, The Level of the Model, Criteria for Success, The importance of AI, Early works in AI, AI and Related fields, The Foundations of Artificial Intelligence, The History of Artificial Intelligence. Defining the Problem as a State Space Search, Production Systems, Problem Characteristics, Production System Characteristics, Issues in the Design of Search Programs. Knowledge Representation Issues: Representations and Mappings, Approaches to Knowledge Representation, Issues in Knowledge Representation. AI Languages and Tools: Lisp, Prolog, CLIPS.
MODULE II	**FIRST ORDER LOGIC AND INFERENCE**
	Using Predicate Logic: Representing Simple Facts in Logic, Representing Instance and ISA Relationships, Computable Functions and Predicates, Properties of Wff, Clausal Forms, Conversion to clausal forms, Resolution. Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning, Matching, Control Knowledge.
MODULE III	**SEARCH TECHNIQUES**
	Heuristic Search Techniques: Generate-and-Test, Hill Climbing, Best-first Search, A* algorithm, AO* algorithm, Problem Reduction, And-Or search, Constraint Satisfaction, Means-ends Analysis. Adversarial Search and Game Playing: Optimal Decision in Games, The minimax algorithm, Alpha-Beta pruning, Iterative Deepening, Expectimax search.
MODULE IV	**HANDLING UNCERTANITY**
	Symbolic Reasoning Under Uncertainty: Introduction to Non monotonic Reasoning, Logics for Non monotonic Reasoning, Implementation Issues, Augmenting a Problem-solver. Statistical Reasoning: Probability and Bayes' Theorem, Certainty Factors and Rule-based Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic.
MODULE V	**PLANNING, LEARNING AND EXPERT SYSTEMS**
	Planning: Overview, An Example Domain: The Blocks World, Components of a Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems. Learning: What is learning, Rote learning, Learning by taking Advice, Learning from example: Induction, Explanation based learning (EBL), Discovery, Clustering, Analogy, Neural net and genetic learning, Reinforcement learning. Expert System: Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition, Expert System Architectures, Rule based systems, Non production system, knowledge acquisition.

TEXTBOOKS

1. Elaine Rich, Kevin Knight and Shivashankar B Nair, Artificial Intelligence, Tata McGraw Hill, 3rd Edition, 2009.

2. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, Prentice-Hall, 2007

REFERENCE BOOKS:

1. Nils J.Nilsson, Principles of Artificial Intelligence, Narosa Publishing House, 1990.
2. Stuart Russell and Peter Norvig, Artificial Intelligence A Modern Approach, Pearson Education, 2nd Edition, 2010.
3. VS Janakiraman K, Sarukesi Gopalakrishnan, Foundations of Artificial Intelligence & Expert Systems, Macmillan.

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO - PO Mapping		
CONTENT DELIVERY (THEORY)			
1	Definition of AI, The AI Problems, The Underlying Assumption	CO 1	T1:1.1-1.8, 2.2
2	AI Techniques, The Level of the Model, Criteria for Success	CO 1	T1:1.10
3	The importance of AI, Early works in AI	CO 2	T2:2.7
4	AI and Related fields, The Foundations of Artificial Intelligence	CO 3	T2:2.8
5	The History of Artificial Intelligence.	CO 4	T3:2.8
6	Defining the Problem as a State Space Search.	CO 1	
7	Production Systems, Problem Characteristics,	CO 4	T1:3.1-3.2
8	Production System Characteristics,	CO 4	T1:4.2,7.1-7.4
9	Issues in the Design of Search Programs.	CO 5	T1:3.3-3.7
10	Representations and Mappings.	CO 5	T1:4.2,7.1-7.4
11	Approaches to Knowledge Representation	CO 1	T2:2.8
12	Issues in Knowledge Representation.	CO 4	T1:1.3 T1:1.7,7.4
13	Representing Simple Facts in Logic,	CO 6	T1: 7.6 7.7, 8.9-8.10
14	Representing Instance and ISA Relationships,	CO 4	T1:1.3 T1:1.7,7.4
15	Computable Functions and Predicates,.	CO 3	T1:1.1 T1:1.1-1.4
16	Properties of Wff, Clausal Forms, Conversion to clausal forms, Resolution	CO 5	T1: 7.6 7.7, 8.9-8.10
17	Procedural Versus Declarative Knowledge, Logic Programming,	CO 4	T1:1.1-1.2 T1:1.5-1.7
18	Forward Versus Backward Reasoning,	CO 1	T1:1.3 T1:1.7,7.4
19	Matching, Control Knowledge.	CO 4	T1:1.1-1.2 T1:1.5-1.7
20	Generate-and-Test, Hill Climbing,	CO 1	T1:3.1-3.4 T1:2.1-2.4

21	Best-first Search,Problem Reduction,	CO 5	T1:5.1-5.3 T1:2.8,3.7-3.8
22	And-Or search, Constraint Satisfaction, Means-ends Analysis.	CO1	T1:1.1-1.2 T1:1.5-1.7
23	A* algorithm, AO* algorithm	CO 2	T1:3.3-3.5 T1:2.6
24	Optimal Decision in Games,	CO 3	T1:5.1-5.3 T1:2.8,3.7-3.8
24	The minimax algorithm, Alpha-Beta pruning,	CO 5	T1:3.3-3.5 T1:2.6
25	Iterative Deepening, Expectimax search.	CO 4	T1:5.1.-5.10 T1:3.6
26	Introduction to Non monotonic Reasoning,	CO 4	T1:4.4-4.6 T1: 5.11 T1:3.10
27	Logics for Non monotonic Reasoning,	CO 1	T1:5.1-5.3 T1:2.8,3.7-3.8
28	Probability and Bayes' Theorem,	CO 5	T1:3.3-3.5 T1:2.6
29	Certainty Factors and Rule-based Systems,.	CO1	T1: 5.11 T1:3.10
30	Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic	CO2	T1:3.3-3.5 T1:2.6
31	Overview, An Example Domain: The Blocks World,	CO 5	T1:6.1,6.4 T1:4.1-4.5
32	Components of a Planning System,	CO 5	T1:6.3,6.10 T1:4.9-4.10
33	Goal Stack Planning, Nonlinear Planning Using Constraint Posting,	CO1	T1:5.1-5.3 T1:2.8,3.7-3.8
34	Hierarchical Planning, Reactive Systems. What is learning, Rote learning,	CO 1	T1:3.3-3.5 T1:2.6
35	learning by taking Advice, learning from example:	CO 5	T1:6.2-6.3,6.7 T1:4.8,4.11
36	Induction, Explanation based learning (EBL),	CO1	T1: 7.6 7.7, 8.9-8.10
37	Discovery, Clustering, Analogy, Neural net and genetic learning, Reinforcement learning.	CO2	T1:6.1,6.4 T1:4.1-4.5
38	Representing and Using Domain Knowledge,	CO3	T1:5.1.-5.10 T1:3.6
39	Expert System Shells, Explanation, Knowledge Acquisition, Expert System Architectures,	CO 6	T1:6.3,6.10 T1:4.9-4.10
40	Rule based systems, Non production system, knowledge acquisition	CO 1	T1:1.3 T1:1.7,7.4
PROBLEM SOLVING			
41	Enumerate Classical "Water jug Problem". Describe the state space for this problem and also give the solution	CO 1	T1:6.1,6.4 T1:4.1-4.5
42	Illustrate Knowledge Organization and Manipulation IN AI	CO1	T1:6.1,6.4 T1:4.1-4.5

43	Imagine that you had been to an aquarium and seen a shark and an octopus .Describe these to a child who has never seen one. What resources and mechanisms does the child use to comprehend the nature of these marine animals?	CO2	T1: 7.6 7.7, 8.9-8.10
44	Analyze each of them with respect to the seven problem characteristics, Chess, 8-puzzle, Missionaries and cannibals, Monkey and bananas, Tower of Hanoi, Crypt arithmetic	CO1	T1:6.3,6.10 T1:4.9-4.10
45	Find a good state space representation for the following. Water jug, Traveling salesman, Tower of Hanoi , Crypt arithmetic, Chess , 8-puzzle.	CO2	T1:5.1.-5.10 T1:3.6
46	Trace the operation of the unification algorithm on each of the following pairs of literals: f(Marcus) and f(Caesar) ii. f(x) and f(g(y)) f(Marcus,g(x,y)) and f(x,g(Caesar,Marcus))	CO3	T1:6.1,6.4 T1:4.1-4.5
47	Convert the following well formed formula into clause from with sequence of steps: x: [Roman(x) Know (x, Marcus)] [hate(x, Caesar) v (y: z: hate(y,z) thinkcrazy(x,y))]	CO4	T1: 7.6 7.7, 8.9-8.10
48	Assume the following facts: Steve only likes easy courses. Science courses are hard. All the courses in the basketweaving department are easy BK301 is a basketweaving course. Use resolution to answer the question, “What course would Steve like?”	CO3	T1:6.2-6.3,6.7 T1:4.8,4.11
49	Imagine a Robot trying to move from one place in a city to other.It has complete knowledge of the connecting roads in the city.As it moves the road condition keep changing.If the robot is to reach its destination with in a prescribed time,Suggest an algorithm for the same [HINT:Split the roadmap into a set of connected nodes and imagine that the costs of moving from one node to another change based on sometime dependent conditions].	CO2	T1: 7.6 7.7, 8.9-8.10
50	What are the Implementation Issues and explain about Augmenting a Problem-solver.	CO2	T1:5.1-5.3 T1:2.8,3.7-3.8
51	Use Fuzzy logic.For example,you might want to define such fuzzy sets as honest people or greedy people and describe Abott,Babbit,and Cabot’s memberships in those sets.	CO1	T1:6.3,6.10 T1:4.9-4.10
52	Show how a JTMS could be used in medical diagnosis. Consider rules such as, “If you have a runny nose, assume you have a cold unless it is allergy season.”	CO4	T1:6.1,6.4 T1:4.1-4.5
53	Explain in detail about STRIPS and write the components of STRIPS for the given scenario: “Consider a flight journey in a luxurious flight fom India to US”	CO3	

54	Consider the problem of building a program to learn a grammar for a language such as English. Assume that such a program would be provided, as input, with a set of pairs, each consisting of a sentence and a representation of the meaning of the sentence. This is analogous to the experience of a child who hears a sentence and sees something at the same time. How could such a program be built using the techniques	CO4	T1: 7.6 7.7, 8.9-8.10
55	Consider the problem of devising a plan for cleaning the kitchen. (a)Write a set of STRIPS-style operators that might be used. When you describe the operators, take into account such considerations as: Cleaning the stove or the refrigerator will get the floor dirty. To clean the oven, it is necessary to apply oven cleaner and then to remove the cleaner. Before the floor can be washed, it must be swept. Before the floor can be swept, the garbage must be taken out. Cleaning the refrigerator generates garbage and messes up the counters. Washing the counters or the floor gets the sink dirty. (b) Write a description of a likely initial state of a kitchen in need of cleaning. Also write a description of a desirable (but perhaps rarely obtained) goal state. (c) Show how the technique of planning using a goal stack could be used to solve this problem.	CO3	T1:5.1-5.3 T1:2.8,3.7-3.8
DEFINITION AND TERMINOLOGY			
56	Define Artificial Intelligence	CO1	T1:6.2-6.3,6.7 T1:4.8,4.11
57	What is a Support Vector Machine?	CO2	T1:6.1,6.4 T1:4.1-4.5
58	What is Disjunctive normal form?	CO4	T1: 7.6 7.7, 8.9-8.10
59	Why is Depth-first search used?	CO2	T1:6.3,6.10 T1:4.9-4.10
60	Define the term STRIPS	CO5	T1:6.3,6.10 T1:4.9-4.10
DISCUSSION OF TUTORIAL QUESTION BANK			
61	Solve the Water Jug problem: you are given 2 jugs, a4-gallon one and 3-gallon one. Neither has any measuring maker on it. There is a pump that can be used to fill the jugs with water. How can you get exactly 2 gallons of water into 4-gallon jug? Explicit assumptions: A jug can be filled from the pump, watercan be poured out of a jug onto the ground, water can be poured from one jug to another and that there are no other measuring devices available.	CO1	T1:5.1-5.3 T1:2.8,3.7-3.8

62	What problems would be encountered in attempting to represent the following statements in predicate logic?It should be possible to deduce the final statement from the others John only likes to see French movies. It’s safe to assume a movie is American unless explicitly told otherwise The playhouse really shows the Foreign films People don’t do things that will cause them to be in situations that they don’t like	CO3	T1:6.2-6.3,6.7 T1:4.8,4.11
63	The constraint satisfaction procedure we have described performs depth-first search whenever some kind of search is necessary.But depth-first search is not the only way to conduct such a search (a) Rewrite the constraint satisfaction procedure to use breadth first search (b) Rewrite the constraint satisfaction procedure to use best first search	CO2	T1: 7.6 7.7, 8.9-8.10
64	Construct a Bayesian Network and define the necessary CPTs for the given scenario. We have a bag of three biased coins a,b and c with probabilities of coming up heads of 20%, 60% and 80% respectively. One coin is drawn randomly from the bag (with equal likelihood of drawing each of the three coins) and then the coins flipped three times to generate the outcomes X1, X2 and X3.	CO4	T1:6.3,6.10 T1:4.9-4.10
65	Explain in detail about STRIPS and write the components of STRIPS for the given scenario: “Consider a flight journey in a luxurious flight fom India to US”	CO5	T1:6.1,6.4 T1:4.1-4.5

Signature of Course Coordinator **HOD,IT**

Putta Hemalatha, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**INFORMATION TECHNOLOGY**				
Course Title	**DATA WAREHOUSING AND DATA MINING**				
Course Code	ACSB14				
Program	B.Tech				
Semester	VI	IT			
Course Type	Core				
Regulation	IARE-R18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Ms. Vijaya durga CSL, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSB08	IV	Database Management System
B.Tech	AHSB12	II	Probability and statistics

II COURSE OVERVIEW:

Data mining refers to extracting or mining knowledge from large amounts of data. It emphasizes various techniques and algorithms used to explore, analyze and leverage data and turn it into valu-able and actionable information. It includes data warehousing and data mining functionalities suchas analytical processing, descriptive analysis, association mining, classification, clustering and outlier analysis. The techniques are used to tackle data centric applications in various domains such as finan- cial analysis, telecommunication industry, intrusion detection, and complex data mining applicationsin stream, web, text, spatial and other scientific applications.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Data Warehousing and Data Mining	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIE examinations or the marksscored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
20 %	Understand
60 %	Apply
10 %	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 25 marks for Continuous Internal Examination (CIE) and 05 marks for Quiz \Alternative Assessment Tool (AAT).

Component	Theory		Total Marks
Type of Assessment	CIE Exam	Quiz \AAT	
CIA Marks	25	05	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 17^{th} week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination
Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

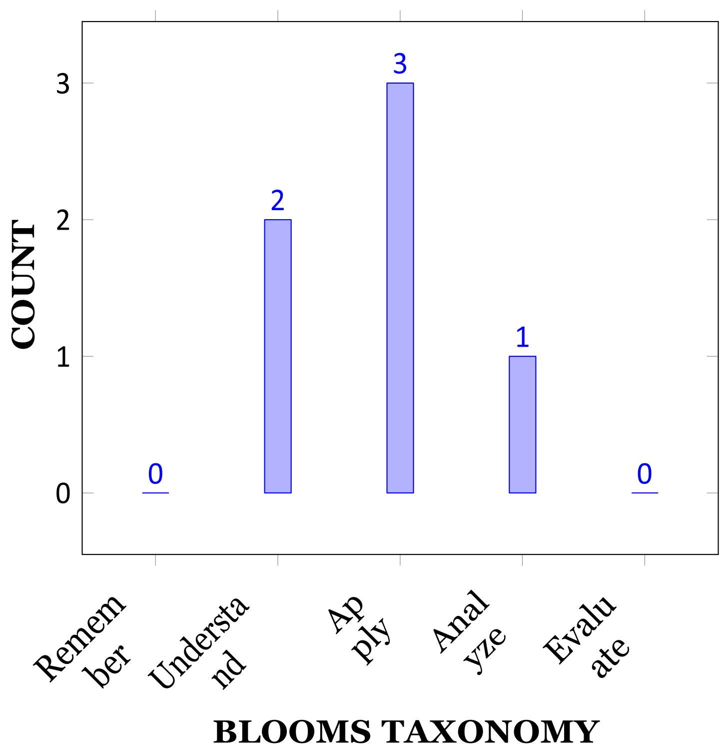
I	The scope and essentiality of data warehousing and mining.
II	The analysis of data, choosing relevant models and algorithms for respective applications.
III	The process and mining of complex data types such as streams, spatial, web and multimedia
IV	The research perspectives towards advances in data mining

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Relate** knowledge discovery in databases (KDD) process with the help of data warehouse fundamentals and data mining functionalities	Under-stand
CO 2	**Select** appropriate preprocessing techniques on real time data for usage of data mining algorithms	Apply
CO 3	**Apply** Apriori and FP growth methods on transaction data for frequent pattern mining	Apply
CO 4	**Choose** classification or clustering algorithm for building a classification or prediction model.	Apply
CO 5	**Infer** complex data models with respect to multimedia, streams, spatial and web mining	Under-stand
CO 6	**Examine** data mining algorithms for solving real world problems	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/Quiz/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	CIE/Quiz/AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	1	CIE/Quiz/AAT
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	1	CIE/Quiz/AAT
PO 5	Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	3	CIE/Quiz/AAT
PO 10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	3	CIE/Quiz/AAT
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	2	CIE/Quiz/AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Profi-ciency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	3	Quiz
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	1	Quiz
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2	CIE/Quiz/ AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	✓	✓	-	-	-	-	-	-	-	✓	-	✓	✓	-	✓
CO 3	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	-	✓
CO 4	✓	✓	✓	✓	✓	-	-	-	-	✓	-	✓	✓	✓	✓
CO 5	✓	✓	✓	✓	✓	-	-	-	-	✓	-	-	✓	✓	✓
CO 6	✓	✓	✓	✓	✓	-	-	-	-	✓	-	-	✓	✓	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Explain the knowledge extraction Process by using mathematical ,computer science principles by integrating computer science knowledge.	3
CO 2	PO 1	Explain the data preprocessing techniques by applying mathematical principles and computer science principles by integrating computer science knowledge	3
	PO 2	Understand the data and apply the appropriate preprocessing techniques to solve real time data specific Problem statement and system definition, Problem formulation and abstraction , Information and data collection by including variant sizes of information and data collection, validation, experimental design, solution development and interpretation of results.	8

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 10	Communicate in written form by comprehending and writing effective reports and design documentation of prediction data model with the engineering community by having major focus on clarity on content with appropriate References and good Speaking style.	3
	PO 12	Recognize the need for advanced concepts in classification and prediction for developing data centric applications through continuing education efforts with ongoing learning stays up with industry trends/ new technology	1
	PSO 1	Develop data mining applications for specific problems by including huge volume of data and related to Algorithms, Artificial Intelligence, Machine Learning.	3
	PSO 2	Develop data mining applications for specific problems with a major focus on improving software reliability, network security and information retrieval systems.	1
	PSO 3	Develop applications by using modern computer tools related to create innovative career paths.	1
CO 3	PO 1	Select appropriate frequent pattern mining method for finding associations among attributes of data in transaction data using mathematical principles and computer science principles by integrating computer science knowledge.	3
	PO 2	Make use of Apriori or FP growth methods on transaction Problem statement and system definition, Problem formulation and abstraction , Information and data collection validation, experimental design, Solution development and interpretation of results.	6
	PO 3	Identify the appropriate model for various problems,by understanding customer and user needs, with cost effective and creative solutions by managing the design process, knowledge on economic context, management techniques for the requirement engineering activities to promote sustainable development.	8
	PSO 1	Make use of data mining concepts on huge volume data used to develop analytical solutions related to Machine Learning.	1
CO 4	PO 1	Develop a prediction model by extending classification model with the help of mathematical and scientific principles by integrating computer science knowledge.	3
	PO 2	Extend a created data model for specific prediction problems by including specific problems by including variant sizes of information and data collection, validation, experimental design, solution development,Implementation ,and interpretation of results and documentation is used as a sample data for new projects	8

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 3	Develop a data model by investigating and defining various problems, understanding customer and user needs, with cost effective and creative solutions with variant algorithms by managing the design process, knowledge on economic context, management techniques.	7
	PO 4	Develop a prediction and classification data model with laboratory skills, technical literature and quality issues to Identify, classify and describe the performance of systems through analytical methodsfor quantitative methodsand technical uncertainty	8
	PO 5	Make use of software / libraries for developing prediction model	1
	PO 10	Communicate effectively in orally and written by comprehend and write effective reports and design documentation and presentations on data exploration with the engineering community by having major focus on clarity on **content, Grammar/Punctuation, appropriate References, good Speaking style and depth in subject matter.**	5
	PO 12	Recognize the need for **advanced concepts** in big data technologies for developing applications through **continuing education efforts with ongoing learning** – stays up with industry trends/ new technology and continued personal development in the broadest context of technological change.	5
	PSO 1	Develop data mining applications for specific problems by including huge volume of data and related to Algorithms, Artificial Intelligence, Machine Learning	3
	PSO 2	Develop data mining applications for specific problems with a major focus on improving software reliability, network security and information retrieval systems.	1
	PSO 3	Develop applications by using modern computer tools related to create innovative career paths	1
. CO 5	PO 1	Select any data models with respect to multimedia, streams, spatial and web mining using mathematical principles and computer science principles by integrating computer science knowledge.	3
	PO 2	Make use of spatial and web mining methods on transaction data collection, validation, experimental design, Solution development and interpretation of results.	5
	PO 3	Select appropriate frequent pattern mining methodfor investigating and defining various problems, understanding customer and user needs, with cost effective and creative solutions with variant algorithms by managing the design process, knowledge on economic context, management techniques.	8

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 4	Develop a text based model with laboratory skills, technical literature and quality issues to Identify, classify and describe the performance of systems through analytical methodsfor quantitative methodsand technical uncertainty	7
	PO 5	Make use of software / libraries for finding text based and web based mining	1
	PO 10	Communicate in written form by comprehending and writing effective reports and design documentation of multimedia data model with the engineering community by having major focus on clarity on content	1
	PSO 1	Explain the complex data models used to process and querying the data in the areas related to Algorithms, Artificial Intelligence, Machine Learning	3
	PSO 2	Develop applications using data mining concepts with a major focus on improving software reliability, network securityand information retrieval systems.	1
	PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies	1
. CO 6	PO 1	Understand the data mining model and examine the accuracy of the model by applying mathematical and scientific principles by integrating computer science knowledge.	3
	PO 2	Extend a created data model for specific real time problems by including specific problems by including variant sizes of information and data collection, validation, experimental design, solution development,Implementation ,and interpretation of results and documentation is used as a sample data for new projects	8
	PO 3	Develop a real time model by investigating and defining various problems, understanding customer and user needs, with variant algorithms by managing the design process, knowledge on economic context, management techniques	6
	PO 4	Develop a data model with laboratory skills, technical literature and quality issues to Identify, classify and describe the performance of systems through analytical methods	6
	PO 5	Make use of software / libraries for developing mining model.	1
	PO 10	Communicate in orally form by comprehending and writing effective reports and design documentation data mining applications with the engineering community by having major focus content with good Speaking style.	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO 1	Categorize various data mining concepts in the areas related to Algorithms, Artificial Intelligence, Machine Learning.	3
	PSO 2	Develop applications using data mining concepts with a major focus on improving software reliability, network securityand information retrieval systems.	1

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	3	8	-	-	-	-	-	-	-	1	-	2	3	-	2
CO 3	3	7	8	-	-	-	-	-	-	-	-	-	-	-	1
CO 4	3	8	7	8	1	-	-	-	-	3	-	1	3	1	1
CO 5	3	5	8	7	1	-	-	-	-	1	-	-	3	1	1
CO 6	3	8	6	6	1	-	-	-	-	1	-		3	1	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	100	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	100	80	-	-	-	-	-	-	-	20	-	16.6	50	-	100
CO 3	100	70	80	-	-	-	-	-	-	-	-	-	-	-	50
CO 4	100	80	70	72.7	100	-	-	-	-	60	-	8.3	50	50	50
CO 5	100	50	80	63.6	100	-	-	-	-	20	-	-	50	50	50
CO 6	100	80	60	54.5	100	-	-	-	-	20	-		50	50	-

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation

1 - $5 < C \leq 40\%$ – Low/ Slight

2 - $40\% < C < 60\%$ –Moderate

3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	3	3	-	-	-	-	-	-	-	1	-	1	2	-	3
CO 3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	2
CO 4	3	3	3	3	3	-	-	-	-	2	-	1	2	2	1
CO 5	3	2	3	3	3	-	-	-	-	1	-	-	2	2	2
CO 6	3	3	2	2	3	-	-	-	-	1	-	-	2	2	-
TOTAL	18	14	11	8	9	-	-	-	-	5	-	2	8	6	8
AVER-AGE	3	2.8	2.75	2.6	3.0	-	-	-	-	1.25	-	1	2.0	2.0	2.0

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	✓
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	Open Ended Experiments	-
Assignments	✓				

XVII ASSESSMENT METHODOLOGY-INDIRECT:

	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**DATA WAREHOUSING**
	Introduction to Data warehouse, A Multi-dimensional data model- Star, Snow flake and Fact constellationschemas, Measures, Concept hierarchy, Data warehouse architecture- A three tier Data warehouse architecture, types of OLAP servers, Data warehouse Implementation, Data Marts, Differences between OLAT and OLTP.
MODULE II	**DATA MINING**
	Introduction, What is Data Mining, Definition, Knowledge Discovery in Data (KDD), Kinds of data bases, Data mining functionalities, Classification of data mining systems, Data mining task primitives, Data Preprocessing: Data cleaning, Data integration and transformation, Data reduction, Data discretization and Concept hierarchy.

MODULE III	**ASSOCIATION RULE MINING**
	Association Rules: Problem Definition, Frequent item set generation, The APRIORI Principle, support and confidence measures, association rule generation; APRIORI algorithm. FP-Growth Algorithms, Compact Representation of Frequent item Set-Maximal Frequent item set, closed frequent item set.
MODULE IV	**CLASSIFICATION AND PRIDICTION**
	Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back propagation, Classification Based on Concepts from Association Rule Mining, Other Classification Methods, Prediction, Classifier Accuracy.
MODULE V	**CLUSTERING**
	Types of data, categorization of major clustering methods, K-means partitioning methods, hierarchical methods, density based methods, grid based methods, model based clustering methods, outlier analysis. Mining Complex Types of Data: Multidimensional Analysis and Descriptive Mining of Complex, Data Objects, Mining Spatial Databases, Mining Multimedia Databases, Mining Time-Series and Sequence Data, Mining Text Databases, Mining the World Wide Web.

TEXTBOOKS

1. Jiawei Han, Michelin Kamber, "Data Mining-Concepts and techniques", Morgan Kaufmann Publishers, Elsevier, 2nd Edition, 2006
2. Alex Berson, Stephen J.Smith, "Data warehousing Data mining and OLAP", Tata McGraw- Hill, 2nd Edition, 2007

REFERENCE BOOKS:

1. Arum K Pujari, "Data Mining Techniques", 3rd Edition, Universities Press, 2005
2. Pualraj Ponnaiah, Wiley, "Data Warehousing Fundamentals", Student Edition, 2004
3. Ralph Kimball, Wiley, "The Data Warehouse Life Cycle Toolkit", Student Edition, 2006.
4. Vikram Pudi, P Radha Krishna, Data Mining, Oxford University, 1st Edition, 2007.

WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc21_cs06/preview
2. http://www.anderson.ucla.edu
3. https://www.smartzworld.com

COURSE WEB PAGE:

https://www.youtube.com/watch?v=IlD7-ipjQUk

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
OBE DISCUSSION			
1	In Outcome-Based Education (OBE), we discussed about course delivery assessment that are planned to achieve stated objectives and outcomes. We will focuses on measuring student performance i.e. outcomes at different levels. Course outcomes(CO),Program Outcomes(PO)and Program Specific Outcomes(PSO) and also mapping of CO's to PO's PSO's and their attainments are discussed.		
CONTENT DELIVERY (THEORY)			
2	Introduction to Data warehouse	CO1	T1: 3.1
3	Difference between operational database systems and datawarehouses	CO1	T1: 3.1
4	Data warehouse architecture- A three tier Data warehouse architecture	CO1	T1: 3.3
5	Types of OLAP servers	CO1	T1: 3.3
6	Data warehouse Implementation	CO1	T1: 3.3
7	Data Marts, Differences between OLAT and OLTP.	CO1	T1: 3.3
8	Multi-dimensional data model: Star Schema	CO5	T1: 3.2
9	Multi-dimensional data model: Snow Flake Schema	CO5	T1: 3.2
10	Fact Consultation, Fact Table, Dimension Table	CO5	T1: 3.2
11	OLAP Cube and OLAP Operations	CO2	T1: 3.4-3.5
12	OLAP Server Architecture-ROLAP	CO2	T1: 3.4-3.5
13	OLAP Server Architecture- MOLAP	CO2	T1: 3.4-3.5
14	OLAP Server Architecture- HOLAP.	CO2	T1: 3.4-3.5
15	Data Mining: Introduction, Fundamentals of Data Mining, Definition	CO1	T1: 1.1-1.7
16	KDD, Challenges, Data Mining Tasks.	CO1	T1: 1.1-1.7
17	Data Processing	CO2	T1: 2.1-2.5
18	Data Cleaning	CO2	T1: 2.1-2.5
19	Dimensionality Reduction	CO2	T1: 2.1-2.5
20	Feature Subset Selections	CO4	T1: 2.3-2.4

21	Data Transformation.	CO4	T1: 2.3-2.4
22	Discretization and Measures of Similarity and Dissimilarity-Basics.	CO4	T1: 2.3-2.4
23	Association Rules	CO5	T1: 5.3
24	Problem definition	CO5	T1: 5.3
25	Frequent item set generation,	CO5	T1: 5.3
26	The APRIORI Principle, Support and confidence measures	CO3	T1: 5.2
27	Association rule generation; APRIORI algorithm.	CO3	T1: 5.2
28	The partition algorithms	CO3	T1: 5.2.2
29	FP-growth Algorithm.	CO3	T1: 5.2.2
30	Compact Representation of Frequent item Set- Maximal Frequent item set closed frequent itemset.	CO5	T1: 5.2.4
31	Classification and prediction	CO4	T1: 6.1-6.2
32	Basic concepts	CO4	T1: 6.1-6.2
33	Classification by Decision Tree Induction	CO4	T1: 6.1-6.2
34	Classification by Back propagation	CO4	T1: 6.1-6.2
35	Issues Regarding Classification and Prediction	CO4	T1: 6.1-6.2
36	Introduction about Bayesian classification	CO4	T1: 6.4
37	Types of Bayesian classification	CO4	T1: 6.4
38	Rule based classification C	CO4	T1: 6.5
39	Classification by back propagation	CO4	T1: 6.5
40	Classification Based on Concepts from Association Rule Mining	CO4, CO6	T1: 6.6
41	Other Classification Methods	CO4, CO6	T1: 6.6
42	Prediction, Classifier Accuracy	CO4, CO6	T1: 6.6
43	Clustering Analysis, Hierarchical methods	CO4	T1: 7.1-7.3
44	Density based methods	CO5	T1: 7.5
45	Grid based methods, outlier analysis	CO5	T1: 7.6
46	Mining Complex Types of Data	CO5	T1: 7.11
47	Multi dimensional Analysis and Descriptive Mining of Complex	CO5	T1: 7.11
48	Types of Data: Data Objects	CO5	T1: 7.11
49	Mining Spatial Databases	CO5	T1: 7.11
50	Mining Multimedia Databases	CO5	T1: 7.11
51	Mining Time-Series and Sequence Data	CO5	T1: 7.11
52	Mining Text Databases	CO6	T1: 7.11
53	Mining The World Wide Web	CO6	T1: 7.11

54	Real Time Applications	CO6	T1: 7.11
55	Example Systems	CO6	T1: 7.11
PROBLEM SOLVING/ CASE STUDIES			
1	Problems on Hierarchical and lattice structures of attributes in warehouse dimensions for location and time.	CO 3	R2:7.5
2	Problems on Multi-dimensional modelling	CO 2	R2:7.5
3	Problems on Analytical processing	CO 3	R2:7.5
4	Problems on Implementation techniques of data warehouse	CO 2	R2:7.5
5	Problems on OLAP operations on multi-dimensional data cube at possible levels.	CO 2	R2:7.5
6	Problems on preprocessing techniques and relate to the given data to perform summarization and visualization	CO 3	R2:7.5
7	Problems on applications of frequent pattern mining methods	CO 3	R2:7.5
8	Problems on frequent item set methods and pattern growth approach	CO 3	R2:7.5
9	Problems on Basic Classification Methods	CO 3	R2:7.5
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Definitions on Data Warehousing	CO 1	T1:1.2
2	Definitions on Data Mining	CO 2	T1:1.6
3	Definitions on Association Rule Mining	CO 3	T1:8,9
4	Definitions on Classification and Prediction	CO 4	T1:9.1
5	Definitions on Clustering	CO 5	T1:10,11
DISCUSSION OF QUESTION BANK			
1	Data warehouse architecture	CO 1	T1:1.2
2	Classification of data mining systems	CO 2	T1:1.5
3	FP-Growth Algorithms	CO 3	T1:8,9
4	Issues Regarding Classification and Prediction	CO 4	T1:9.1
5	Clustering Methods	CO 5,6	T1:10,11

Signature of Course Coordinator **HOD IT**

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	INFORMATION TECHNOLOGY				
Course Title	INTERNET OF THINGS (IoT)				
Course Code	AITB20				
Program	B. Tech				
Semester	VI				
Course Type	Professional Elective				
Regulation	R-18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Vijaya Durga C.S.L, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AIT003	IV	Computer Networks

II COURSE OVERVIEW:

Internet of things (IoT) is a network of things that are embedded with software and sensors to process data. This course include physical and logical design of IoT systems, M2M systems, SDN, IoT Architecture components such as physical devices and endpoints, physical servers and cloud offerings. This is used in various applications such as Smart Refrigerator, Smart Homes and Smart environments.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Internet of Things	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	x	Chalk & Talk	x	Assignments	x	MOOC
✓	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIE examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
50%	Understand
25%	Apply
15%	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 25 marks for Continuous Internal Examination (CIE) and 05 marks for Quiz \Alternative Assessment Tool (AAT).

Component	Theory		Total Marks
Type of Assessment	CIE Exam	Quiz \AAT	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 17^{th} week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination
Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

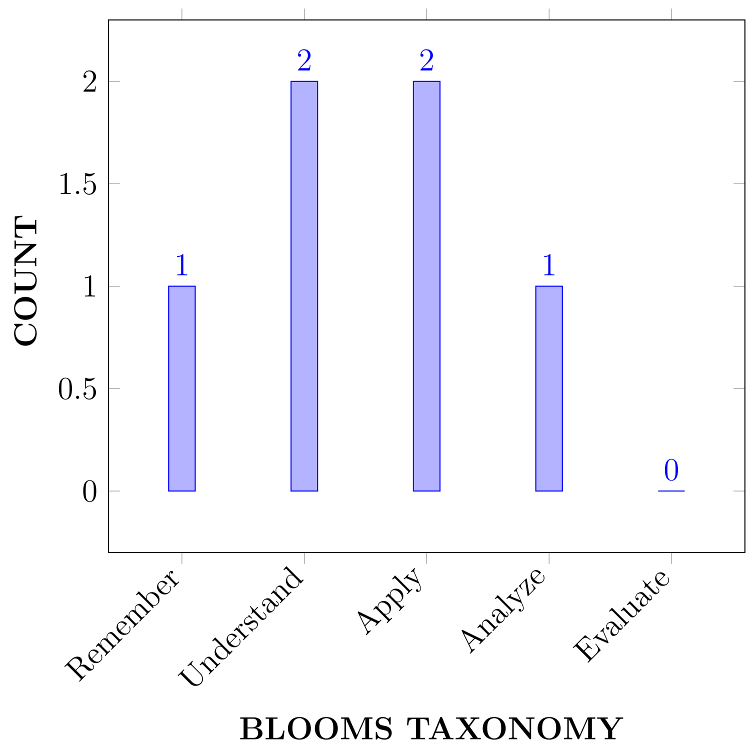
I	The significance of the Internet of Things
II	The sensors, actuators and communication protocols used for establishing communication in M2M.
III	The real time IoT applications related to smart environments.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Relate** the characteristics and appropriate levels of IoT for reusing of deployed IoT resources across application domains.	Remember
CO 2	**Identify** the necessity of communication models, protocols and API's for accessing data from sensors and actuators to overcome issues like failure of any connected devices.	Apply
CO 3	**Compare** Machine to Machine withIoT and identifying the role of SDN,NFV, NETCONFG-YANG for data exchange between devices and management on network.	Understand
CO 4	**Relate** architectural reference model and state of the art methodologies in IoT application domains for managing access control of IoT devices using simulation tools.	Understand
CO 5	**Choose** raspberry Pi device and set up the environment for connecting other devices/sensors to communicate with raspberry pi using Python language.	Apply
CO 6	**Analyze** different cloud storage models and protocols that are scalable & available on demand for designing IoT applications.	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Program Outcomes	
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/Quiz/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	CIE/Quiz/AAT

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	3	Seminar/ Conferences/ Workshops
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	3	Seminar/ Conferences/ Workshops
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	3	Assignments/ Discussion
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	3	Seminars/ Workshops/ Short term courses
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	3	Seminars/ Workshops/ Short term courses
PO 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	3	Seminars/ Workshops/ Short term courses

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	2	Research papers/ Group discussion

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	2	Research papers/ Group discussion
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	1	Seminar/ Assign-ments

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	-	-	✓	✓	-	-	✓	-	-	✓	-	✓	✓	-	✓
CO 2	-	✓	-	✓	-	-	-	-	-	-	-	-	✓	✓	-
CO 3	✓	✓	✓	-	-	-	-	-	-	✓	-	✓	✓	-	-
CO 4	✓	✓	✓	✓	✓	-	-	-	-	-	-		✓	-	-
CO 5	-	-	✓	✓	✓	-	-	-	-	✓	-	✓	✓	-	-
CO 6	✓	✓	✓	✓	✓	-	-	-	-	✓	-	✓	✓	-	✓

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 3	Relate the characteristics and appropriate levels of IoT for **designing solutions** for **complex engineering problems** and reusing of deployed IoT resources **in design system components or processes** that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations across **application domains.**	4
	PO 4	Use **research-based knowledge** and **research methods** including **design of experiments** for reusing of **deployed IoT resources** across **application domains.**	5

	PO 7	Relate the characteristics and appropriate levels of IoT in the impact of the **professional engineering solutions in societal and environmental contexts** and **demonstrate the knowledge** of deployed IoT resources across application domains for sustainable development.	2
	PO 10	The characteristics and appropriate levels of IoT are used in deployed IoT resources across application domains to **Communicate effectively** on **complex engineering activities** with the **engineering community** and **with society at large.**	4
	PO 12	Recognize the need for characteristics and appropriate levels of IoT for reusing of deployed IoT resources across application domains in **life-long learning** in the **broadest context of technological change**.	2
	PSO1	Relate the **characteristics and appropriate levels** of IoT for **designing next-generation computer systems.**	2
	PSO3	Relate the characteristics and appropriate levels of IoT for **practical experience** in **shipping real world software** reusing of deployed IoT resources across application domains.	2
CO 2	PO 2	Identify the necessity of communication models, protocols and API's and **analyze complex engineering problems** reaching **substantiated conclusions** using **engineering sciences**.	3
	PO 4	Identify the **necessity of communication models**, protocols and **API's for accessing data from sensors** and actuators in the **design of experiments**, **analysis** and **interpretation of data.**	5
	PSO 1	Identify the necessity of communication models, protocols and API's for **designing next-generation computer systems.**	2
	PSO 2	Identify the necessity of communication models, protocols and API's for accessing data from sensors and actuators and learn the **emerging technologies and frameworks in demand with employers** and **contemporary challenges.**	2
CO 3	PO 1	**Apply** the **knowledge of engineering fundamentals** for identifying the role of SDN,NFV, NETCONFG-YANG for data exchange between devices and management on network to the **solution of complex engineering problems.**	3
	PO 2	Identifying the role of SDN,NFV, NETCONFG-YANG for data exchange between devices and management on network and **analyze complex engineering problems** reaching **substantiated conclusions** using **engineering sciences.**	3

	PO 3	Use either Machine to Machine or IoT to **design solutions** for **complex engineering problems** that meet the specified needs with **appropriate consideration** for the public health and safety, and the cultural, societal, and **environmental considerations.**	4
	PO 10	**Communicate effectively** on **complex engineering activities** using Machine to Machine with IoT and identifying the role of SDN, NFV, NETCONFG-YANG for data exchange between devices **with the engineering community** and **with society at large**.	4
	PO 12	Recognize the need for Machine to Machine with IoT and identifying the role of SDN,NFV, NETCONFG-YANG for data exchange between devices and management on network for **life-long learning** in the **broadest context of technological change.**	2
	PSO 1	Compare Machine to Machine with IoT and identify the role of SDN,NFV,NETCONFG-YANG for **designing next- generation computer systems.**	2
CO 4	PO 1	**Apply the knowledge** of **engineering fundamentals** to relate the architectural reference model and state of the art methodologies in IoT application domains for the **solution of complex engineering problems.**	3
	PO 2	Identify state of the art methodologies in IoT application domains for managing access control of IoT devices and **analyze complex engineering problems** using **principles of engineering sciences.**	3
	PO 3	**Design solutions** for **complex engineering problems** by relating architectural reference model and state of the art methodologies in **IoT application domains** for managing access control of IoT devices.	3
	PO 4	Use **research methods** including **design of experiments**, and **analyze** state of the art methodologies in **IoT application domains** for managing **access control of IoT devices.**	6
	PO 5	Relate architectural reference model and state of the art methodologies in IoT application domains to create, select, and **apply appropriate techniques, modern engineering and IT tools** for managing access control of IoT devices using simulation tools for modelling to complex engineering activities.	1
	PSO 1	Relate **architectural reference model** and state of the art methodologies in IoT application domains for **designing next-generation computer systems** and use the data for **knowledge discovery tools.**	3

CO 5	PO 3	**Design solutions** for **complex engineering problems** using raspberry Pi device and set up the environment for connecting other devices/sensors **to communicate specified needs** with **appropriate consideration** for the public health and safety, and the cultural, societal, and environmental considerations.	4
	PO 4	Use **research-based knowledge** and **research methods** including **design of experiments** using raspberry Pi device and **set up the environment** for connecting other devices/sensors **to communicate** with raspberry pi using Python language.	5
	PO 5	Select and apply appropriate techniques to set up the environment for connecting other devices/sensors to communicate with raspberry pi using Python language for **modeling to complex engineering activities.**	1
	PO 12	Recognize the need for raspberry Pi device and the environment for connecting other devices/sensors to communicate with raspberry pi using Python language in **life-long learning** in the broadest context of **technological change**.	2
	PSO 1	Choose raspberry Pi device and **set up the environment** for **designing next-generation computer systems** to connect other devices/sensors to communicate with raspberry pi using Python language.	3
CO 6	PO 1	**Apply the knowledge** of different cloud storage models and protocols that are scalable & available on demand for designing IoT applications and an **engineering specialization** to the **solution of complex engineering problems.**	3
	PO 2	**Identify** different cloud storage models and protocols that are scalable & available for **complex engineering problems** reaching **substantiated conclusions** using **principles of engineering sciences** for **designing IoT applications.**	5
	PO 3	**Design solutions** for **complex engineering problems** using different cloud storage models and protocols that are scalable & available on demand for **designing IoT applications** for the public health and safety, and the cultural, societal, and **environmental considerations.**	4
	PO 4	Use **research-based knowledge** and **research methods** including **design of experiments, analysis** and **interpretation of data** for using different cloud storage models and protocols that are scalable & available on demand for **designing IoT applications.**	6
	PO 5	Select, and apply appropriate cloud storage models and protocols that are scalable & available on demand for **modeling to complex engineering activities.**	1

	PO 10	Analyze different cloud storage models and protocols that are used to **Communicate effectively** on **complex engineering activities** with the **engineering community** and **with society at large** for designing IoT applications.	4
	PO 12	Recognize the need for different cloud storage models and protocols in **life-long learning** in the **broadest context of technological change** for designing IoT applications.	2
	PSO 1	**Analyze** different cloud storage models and protocols that are scalable & available on demand for **designing next-generation IoT applications.**	2
	PSO 3	Analyze different cloud storage models and protocols that are scalable & available on demand for designing IoT applications for **practical experience in shipping real world software using industry standard tools and collaboration techniques.**	2

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	Program Outcomes/ No. of Key Competencies Matched												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	3	10	10	11	1	5	3	3	12	5	12	8	6	2	3
CO 1	0	0	4	5	0	0	1	0	0	4	0	2	2	0	2
CO 2	0	3	0	5	0	0	0	0	0	0	0	0	2	2	0
CO 3	3	3	4	0	0	0	0	0	0	4	0	2	2	0	0
CO 4	3	3	3	5	1	0	0	0	0	0	0	0	3	0	0
CO 5	0	0	4	5	1	0	0	0	0	0	0	2	3	0	0
CO 6	3	5	4	6	1	0	0	0	0	4	0	2	2	0	2

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	3	10	10	11	1	5	3	3	12	5	12	8	6	2	3
CO 1	0.0	0.0	40.0	45.5	0.0	0.0	43.3	0.0	0.0	80.0	0.0	25.0	34.0	0.0	100
CO 2	0.0	30.0	0.0	45.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.0	100	0.0
CO 3	100	30.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	80.0	0.0	25.0	34.0	0.0	0.0
CO 4	100	30.0	30.0	45.5	100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0
CO 5	0.0	0.0	40.0	45.5	100	0.0	0.0	0.0	0.0	0.0	0.0	25.0	50.0	0.0	0.0
CO 6	100	50.0	40.0	55.0	100	0.0	0.0	0.0	0.0	80.0	0.0	25.0	34.0	0.0	100

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation

1 -$5 < C \leq 40\%$ – Low/ Slight

2 - 40 % <C < 60% –Moderate
3 - 60% ≤ C < 100% – Substantial /High

COURSE	PROGRAM OUTCOMES												PSO'S		
OUTCOMES	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	3	10	10	11	1	5	3	3	12	5	12	8	6	2	3
CO 1	-	-	1	2	-	-	2	-	-	3	-	1	1	-	3
CO 2	-	1	-	2	-	-	-	-	-	-	-	-	1	3	-
CO 3	3	1	1	-	-	-	-	-	-	3	-	1	1	-	-
CO 4	3	1	1	2	3	-	-	-	-	-	-	-	2	-	-
CO 5	-	-	1	2	3	-	-	-	-	-	-	1	2	-	-
CO 6	3	2	1	2	3	-	-	-	-	3	-	1	1	-	3
TOTAL	9	5	5	10	9		2			9		4	8	3	6
AVERAGE	3.0	1.25	1.0	2.0	3.0		2.0			3.0		1.0	1.33	3.0	3.0

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	-	Open Ended Experiments	✓
Assignments	-				

XVII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	**INTRODUCTION TO INTERNET OF THINGS (IoT)**
	Definition and characteristics of IoT, physical design of IoT, logical design of IoT, IoT enabling technologies, IoT levels and deployment, domain specific IoTs.
MODULE II	**IoT AND M2M**
	Introduction, M2M, difference between IoT and M2M, software defined networking (SDN) and network function virtualization (NFV) for IoT, basics of IoT system management with NETCONF- YANG.
MODULE III	**IoT ARCHITECTURE AND TOOLS**
	IoT Architecture: State of the art introduction, state of the art; Architecture reference model: Introduction, reference model and architecture, IoT reference model. IoT Reference model-IoT ecosystem and Business models- Introduction to Protocols of IoT: D2D, D2S, S2S, Introduction to simulation tools.
MODULE IV	**IoT PHYSICAL DEVICES AND ENDPOINTS**
	Introduction to Raspberry Pi interfaces (Serial, SPI, I2C), programming Raspberry PI with Python, other IoT devices.

MODULE V	**IoT PHYSICAL SERVERS AND CLOUD OFFERINGS**
	Introduction to cloud storage models and communication APIs; WAMP: AutoBahn for IoT, Xively cloud for IoT; Case studies illustrating IoT design: Home automation, smart cities, smart environment.

TEXTBOOKS

1. Arshdeep Bahga, Vijay Madisetti, —Internet of Things: A Hands-on-Approach, VPT, 1st Edition, 2014.
2. Matt Richardson, Shawn Wallac, –Getting Started with Raspberry Pi, O'Reilly (SPD), 3rd Edition, 2014.
3. Bernd Scholz-Reiter, Florian Michahelles, — Architecting the Internet of Things, Springer

REFERENCE BOOKS:

1. Adrian McEwen, Hakim Cassimally, –Designing the Internet of things, John Wiley and sons, 1st edition, 2014.
2. Francis Da Costa, –Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, Apress Publications, 1st Edition, 2013.

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
	OBE DISCUSSION		
1	Institutions adopting OBE try to bring changes to the curriculum by dynamically adapting to the requirements of the different stakeholders like Students,Parents, Industry Personnel and Recruiters. OBE is all about feedback and outcomes.In this we will discuss about the course outcomes and program outcomes and their attainment		
	CONTENT DELIVERY (THEORY)		
1	Understanding the basics concepts of IoT	CO1	T1:19-22
2	Motivations of IoT and various Applications of IoT	CO1	T1:22-24
3	Describe the Things of IoT and characteristics of IoT	CO1	T1:24-26
4-6	Analysis and Design of IoT in physical view	CO2	T1:26-30
7-8	Understandings the Logical design of IoT	CO2	T1:31-34
9-10	Describing various IoT enabling technologies	CO2	T1:34-49
11-12	Identifying specific Domains IoTs	CO1	T1:53-72
13	Understanding the basic differences between IoT and M2M	CO3	T1: 72-80
14	Implementation of SDN and NFV architecture in IoT	CO3	T1:80-85
15	Identifying IoT system management with NETCONF-YANG	CO3	T1:91-92
16	Uses of SNMP in IoT protocols	CO3	T1:93-94
17-18	Implementation of NETCONF-YANG by using Python	CO3	T1:96-97

19-21	Development of IoT Architecture and Reference model with standards	CO4	T3:170-186
22-27	IoT ecosystem and Business models and introduction to Protocols of IoT	CO4	T1:141-150
28-35	Describe the physical endpoints used in IoT	CO5	T1:186-196
36-38	Identifying the various IoT physical servers and cloud offerings	CO6	T1:197-198
39-45	Real time applications of IoT with Case studies design	CO1 & CO6	T1:254-264
PROBLEM SOLVING/ CASE STUDIES			
1	Determine the IoT levels for designing home automation IoT system including smart lighting and intrusion detection.	CO2	T1:19-72
2	In Forest fire detection which level of IoT is used? Explain with a neat diagram and its working principle.	CO2	T1:19-72
3	Explain domain specific home automation of IoT	CO1,CO6	T1:19-72
4	Write a Python program for controlling an LED with a switch.	CO5	T1:141-150
5	Write a Python program for switching LED/Light based on reading LDR reading.	CO5	T1:141-150
6	Implement the air pollution monitoring system using the webSocket approach.	CO1,CO2	T1:24
7	Design and discuss the levels of IoT in smart Irrigation.	CO2	T1:24
8	Write a python script to interface LED and switch with Raspberry Pi	CO5	T1:141-150
9	Explain about IoT cloud with home automation.	CO6	T1:197-198
10	What are the impacts that can be observed in implementing internet of Things on Agriculture sector?	CO1	T1:254-264
11	Write a Python program for blinking LED with Raspberry Pi?	CO5	T1:141-150
12	Discuss about the analysis of IoT with smart environment.	CO1,CO6	T1:254-264
13	What Impacts will the Internet Of Things have on infrastructure and smart cities sector?	CO6	T1:254-264
14	Write a Python program for sending an email on a switch press.	CO5	T1:141-150
15	Extend the functionality of the home intrusion detection IoT system by interfacing a webcam. Implement a function in the controller to capture an image from the webcam and send it as an attachment in the email alert when an intrusion is detected.	CO1,CO6	T1:254-264
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Define interoperable characteristics of IoT	CO1	T1:19
2	Expand the term UART	CO2	T1:19
3	Expand the term MQTT	CO2	T1:19

4	Which protocols provide connectivity between M2M nodes within an M2M area network?	CO3	T1: 72-80
5	What is the role of Configuration API in NETCONF?	CO3	T1:91-92
DISCUSSION OF QUESTION BANK			
1	What are the risks and challenges that we should be aware of when it comes to the Internet of Everything?	CO 1,CO 2	T1:19-72
2	Determine the IoT levels for designing structural health monitoring. Explain with a neat diagram.	CO 1,CO6	T1:74-97
3	Define the various domain specific applications of IoT.Explain any 2 in detail.	CO 1,CO6	T1:70-140
4	What is the purpose of information model and function model in IoT reference model ?	CO 5	T1:186-198
5	How Rasberry Pi different from a desktop computer? Justify your answer with an illustration.	CO 6	T1:254-264

Signature of Course Coordinator **HOD, IT**
Ms.Vijaya Durga C.S.L, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**INFORMATION TECHNOLOGY**				
Course Title	**INFORMATION SECURITY**				
Course Code	AITB22				
Program	B.Tech				
Semester	VI				
Course Type	Elective				
Regulation	R-18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Dr P L Srinivasa murthy, Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AITB10	V	Computer Networks

II COURSE OVERVIEW:

This course focuses on the fundamentals of security that are used in protecting both the information present in computer storage as well as information passing over any computer networks. It includes attacks, security mechanisms, and secret-key and public-key cryptography. The authentication protocols and key management techniques for providing security in Email, IP and web, Firewalls and virtual private networks are learned.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Information Security	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIE examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with ”either” or ”choice” will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
10%	Remember
45%	Understand
18%	Apply
27%	Analyze

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks, with 25 marks for Continuous Internal Examination (CIE) and 05 marks for Quiz \Alternative Assessment Tool (AAT).

Component	Theory		Total Marks
Type of Assessment	CIE Exam	Quiz \AAT	
CIA Marks	25	05	30

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8^{th} and 17^{th} week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination

Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

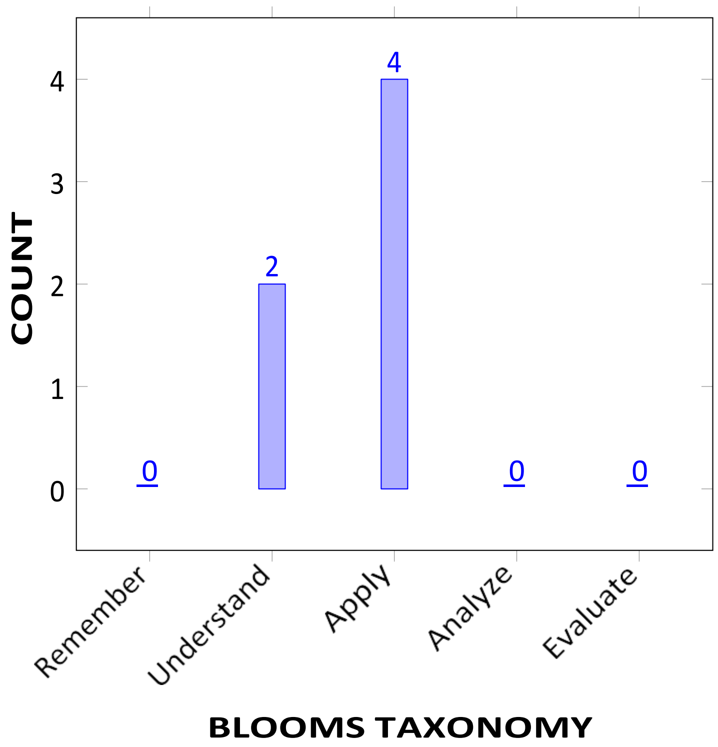
I	Understand security standards and practices. The scope and essentiality of threats, attacks to computers and networks associated to them
II	The symmetric and asymmetric key generation techniques used for providing message authentication, confidentiality and Integrity
III	The use cases on cryptography and security systems for server and client systems such as web, email and firewalls

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Outline** dmodel for network security and cryptographic algorithms to prevent attacks on computer and computer security.	Understand
CO 2	**Demonstrate** symmetric and asymmetric key ciphers for messaging end to end encryption used in different types of cryptographic algorithms	Understand
CO 3	**Make use of** tools and protocols used in message authentication and hashing functions for every day computing to remine secure	Apply
CO 4	**Choose** appropriate architecture and protocols used in email and IP security to protect against attackers and intruders	Apply
CO 5	**Select** firewalls to provide web security as case study in cryptography and network security	Apply
CO 6	**Utilize** cryptographic and security algorithms to enhance defence against cyber attacks and to improve organization working culture.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	2.3	SEE / CIE / AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2.6	SEE / CIE / AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	1.3	SEE / CIE / AAT
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	1	SEE / CIE / AAT
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	1	SEE / CIE / AAT
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	1	SEE / CIE / AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by	
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	3	SEE/CIE/AA	T
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	2	SEE/CIE/AA	T T
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	2	SEE/CIE/AA	

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	✓	✓	✓	-	-	-	-	-	✓	-	✓	✓	✓	✓
CO 2	✓	✓	✓	-	-	-	-	-	-	✓	-	✓	✓	✓	✓
CO 3	✓	✓	✓	-	-	-	-	-	-	✓	-	✓	✓	✓	✓
CO 4	✓	✓	✓	-	-	-	-	-	-	✓	-	✓	✓	✓	✓
CO 5	✓	✓	✓	-	-	-	-	-	-	✓	-	✓	✓	✓	✓
CO 6	✓	✓	✓	✓	-	-	-	-	-	✓	-	✓	✓	✓	✓

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Summarize the knowledge of mathematics, Scientific and Engineering principals to prevent attacks on computer using network security and cryptographic algorithms	3
	PO 2	Classify different network security and cryptographic algorithms by problem identification, formulation, abstraction, data collection, design and provide solution to prevent attacks on computer	7
	PO 3	Outline the customer requirements, maintenance and engineering activities to prevent attacks on computer using network and cryptography algorithms.	3
	PO 4	Interpret the appropriate quantitative method, engineering principles and the ability to apply them to develop the cryptographic and network security algorithms to prevent attacks on computer.	4

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 10	Security problems on computers will be solved with clear applications of engineering network, security and cryptographic algorithms	2
	PO 12	Use appropriate techniques and algorithms in computer science related, industry oriented applications for preventing attacks on computers.	3
	PSO 1	Understand the problem specific constraints to prevent attacks on computers by applying appropriate network security and cryptographic algorithms.	4
	PSO 2	Focus on improving network security by selecting appropriate network security and cryptographic algorithms to prevent attacks on computer.	1
	PSO 3	Extend the use of modern computer tools for creating innovative career paths to prevent attacks on computer using network security and cryptographic algorithms.	1
CO 2	PO 1	Summarize the knowledge of mathematics, Scientific and Engineering principals to prevent attacks on computer using symmetric and asymmetric key ciphers for messaging end to end encryption.	3
	PO 2	Classify different network security and cryptographic algorithms by problem identification, formulation, abstraction, data collection, design and provide solution to prevent attacks on computer using symmetric and asymmetric key ciphers for messaging end to end encryption	6
	PO 3	Outline the customer requirements, maintenance and engineering activities to prevent attacks on computer using symmetric and asymmetric key ciphers for messaging end to end encryption.	3
	PO 10	Security problems on computers will be solved with clear applications of engineering network, security and cryptographic algorithms	2
	PO 12	BUse appropriate techniques and algorithms in computer science related, industry oriented applications for preventing attacks on computers.	3
	PSO 1	IUnderstand the problem specific constraints to provide end to end security by applying appropriate symmetric and asymmetric key ciphers for messaging end to end encryption used in different types of cryptographic algorithms.	4
	PSO 2	Focus on improving network security by selecting appropriate symmetric and asymmetric key ciphers to provide end to end security.	1
	PSO 3	BExtend the use of modern computer tools for creating innovative career paths to prevent attacks on computer using symmetric and asymmetric key ciphers for messaging end to end encryption used in different types of cryptographic algorithms.	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 3	PO 1	Apply the knowledge of mathematics and Engineering principals to use the tools and protocols used in message authentication and hashing functions for every day computing to remain secure.	2
	PO 2	Classify different tools and protocols required for problem identification, formulation, abstraction, data collection, design and provide solution to prevent attacks on computer using MAC and Hash Function.	7
	PO 3	Outline the customer requirements, maintenance and engineering activities to remain secure in every day computing using MAC and Hash Functions.	3
	PO 10	Security problems on computers will be solved with clear applications of engineering network, security and cryptographic algorithms	2
	PO 12	Use appropriate techniques and algorithms in computer science related, industry oriented applications for preventing attacks on computers.	3
	PSO 1	Understand the problem specific constraints to prevent attacks on computers by applying appropriate network security and cryptographic algorithms.	4
	PSO 2	Focus on improving network security by selecting appropriate tools and protocols used in message authentication and hashing functions for every day computing to remain secure.	1
‘	PSO 3	Make use of modern computer tools for creating innovative career paths for every day computing to remain secure using MAC and Hash functions.	1
CO 4	PO 1	Apply the knowledge of mathematics and Engineering principals to Choose appropriate architecture and protocols to provide security to email against attackers and intruders.	2
	PO 2	Make use of appropriate architecture and protocols required for problem identification, formulation, abstraction, data collection, design and to provide security to E-mail and IP.	7
	PO 3	Outline the customer requirements, maintenance and engineering activities to provide security to email against attackers and intruders.	4
	PO 10	Security problems on computers will be solved with clear applications of engineering network, security and cryptographic algorithms	2
	PO 12	Use appropriate techniques and algorithms in computer science related, industry oriented applications for preventing attacks on computers.	3
	PSO 1	Understand the problem specific constraints to prevent attacks on E-mail and IP by choosing appropriate architecture and protocols.	4

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO 2	Focus on improving network security by selecting appropriate network security and cryptographic algorithms to prevent attacks on computer.	1
	PSO 3	Extend the use of modern computer tools for creating innovative career paths to prevent attacks on E-mail using appropriate algorithms.	1
CO 5	PO 1	Apply the knowledge of mathematics and Engineering principals to Select firewalls to provide web security as case study in cryptography and network security	2
	PO 2	Classify different firewalls required for problem identification, formulation, abstraction, data collection, design and to provide web security.	7
	PO 3	Outline the customer requirements, maintenance and engineering activities to provide web security using appropriate firewalls.	4
	PO 10	Security problems on computers will be solved with clear applications of engineering network, security and cryptographic algorithms .	2
	PO 12	Use appropriate techniques and algorithms in computer science related, industry oriented applications for preventing attacks on computers.	3
	PSO 1	Understand the problem specific constraints to provide web security by using appropriate firewall.	4
	PSO 2	Focus on improving network security by selecting appropriate firewalls and methods to provide web security.	1
	PSO 3	Extend the use of modern computer tools for creating innovative career paths to to provide web security by using appropriate firewall.	1
CO 6	PO 1	Apply the knowledge of mathematics and Engineering principals to to enhance defence against cyber-attacks and to improve organization working culture using cryptographic and security algorithms.	3
	PO 2	Classify different cryptographic and security algorithms required for problem identification, formulation, abstraction, data collection, design and provide solution to enhance defence against cyber-attacks and to improve organization working culture.	7
	PO 3	Outline the customer requirements, maintenance and engineering activities to enhance defence against cyber-attacks and to improve organization working culture using cryptographic and security algorithms	5
	PO 4	Interpret the appropriate quantitative method, engineering principles and the ability to enhance defence against cyber-attacks and to improve organization working culture	5
	PO 10	Security problems on computers will be solved with clear applications of engineering network, security and cryptographic algorithms	2

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 12	Use appropriate techniques and algorithms in computer science related, industry oriented applications for preventing attacks on computers.	3
	PSO 1	Understand the problem specific constraints to prevent attacks on computers by applying appropriate network security and cryptographic algorithms.	4
	PSO 2	Focus on improving network security by selecting appropriate network security and cryptographic algorithms to prevent attacks on computer.	1
	PSO 3	Extend the use of modern computer tools for creating innovative career paths to prevent attacks on computer using network security and cryptographic algorithms.	1

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	7	3	4	-	-	-	-	-	2	-	1	4	1	1
CO 2	3	6	3	-	-	-	-	-	-	2	-	1	4	1	1
CO 3	2	7	3	-	-	-	-	-	-	2	-	1	4	1	1
CO 4	2	7	4	-	-	-	-	-	-	2	-	1	4	1	1
CO 5	2	7	4	-	-	-	-	-	-	2	-	1	4	1	1
CO 6	3	7	5	5	-	-	-	-	-	2	-	1	4	1	1

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	100	70	30	36.3	-	-	-	-	-	40	-	12.5	66.6	50	50
CO 2	100	60	30	-	-	-	-	-	-	40	-	12.5	66.6	50	50
CO 3	60	70	30	-	-	-	-	-	-	40	-	12.5	66.6	50	50
CO 4	60	70	40	-	-	-	-	-	-	40	-	12.5	66.6	50	50
CO 5	60	70	40	-	-	-	-	-	-	40	-	12.5	66.6	50	50
CO 6	60	60	40	45.4	-	-	-	-	-	40	-	12.5	66.6	50	50

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation

1 -5 <C≤ 40% – Low/ Slight

2 - $40\% < C < 60\%$ –Moderate

3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	1	1	-	-	-	-	-	1	-	1	3	2	2
CO 2	3	2	1		-	-	-	-	-	1	-	1	3	2	2
CO 3	2	3	1	-	-	-	-	-	-	1	-	1	3	2	2
CO 4	2	3	2	-	-	-	-	-	-	1	-	1	3	2	2
CO 5	2	3	2	-	-	-	-	-	-	1	-	1	3	2	2
CO 6	2	2	1	1	-	-	-	-	-	1	-	1	3	2	2
TOTAL	14	16	8	2	-	-	-	-	-	6	-	6	18	12	12
AVERAGE	2.3	2.6	1.3	1	-	-	-	-	-	1	-	1	3	2	2

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	✓
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	Open Ended Experiments	-
Assignments	-	-	-	-	-

XVII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	**ATTACKS ON COMPUTERS AND COMPUTER SECURITY**
	Attacks on computers and computer security: Introduction, the need for security, security approaches, principles of security, types of security attacks, security services, security mechanism, a model for network security; Cryptography concepts and techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.
MODULE II	**SYMMETRIC KEY CIPHERS**
	Symmetric key ciphers:Block cipher principles andalgorithms (DES,AES,Blowfish), differential and linear cryptanalysis, block cipher modes of operation, stream ciphers,RC4 location, and placement of encryption function, key distribution; Asymmetric key ciphers: Principles of public key cryptosystems, algorithms (RSA Diffie-Hellman, ECC) key distribution.

MODULE III	**MESSAGE AUTHENTICATION ALGORITHM AND HASH FUNCTIONS**
	Message authentication algorithm and hash functions: Authentication requirements, functions, message, authentication codes, hash functions, secure hash algorithm, whirlpool, HMAC, CMAC, digital signatures, knapsack algorithm. Authentication application: Kerberos, X.509 authentication service, public – key infrastructure, biometric authentication.
MODULE IV	**E-MAIL SECURITY**
	E-mail Security: Pretty Good Privacy; S/MIMI IP Security: IP security overview, IP security architecture, authentication header, encapsulating security payload, combining security associations, key management.
MODULE V	**WEB SECURITY**
	Web security: Web security considerations, secure socket layer and transport layer security, secure electronic transaction intruders; Virus and firewalls: Intruders, intrusion detection password management, virus and related threats, countermeasures, firewall design principles; Types of firewalls Case Studies on Cryptography and security: Secure inter-branch payment transactions, cross site scripting vulnerability, virtual electronics.

TEXTBOOKS

1. William Stallings, —Cryptography and Network Security , Pearson Education, 4th Edition, 2005.
2. Atul Kahate, —Cryptography and Network Security , McGraw-Hill, 2nd Edition, 2009.

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1. C K Shymala, N Harini, Dr. T R Padmanabhan, —Cryptography and Network Security , Wiley India, 1st Edition, 2016.
2. Behrouz A. Forouzan Debdeep Mukhopadhyay, —Cryptography and Network Security , McGraw- Hill, 2nd Edition, 2010.

WEB REFERENCES:

1. http://bookboon.com/en/search?q=INFORMATION+SECURITY
2. https://books.google.co.in/books/about/Cryptography_Network_Security_Sie_2E.html?id=Kokjwdf0C
3. https://books.google.co.in/books/about/Information_Security.html?id=Bh45pU0_E_4C
4. www.technofest2u.blogspot.com

COURSE WEB PAGE:

https://lms.iare.ac.in/index ?route=course/details& course id=84

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO - PO Mapping	-	-
CONTENT DELIVERY (THEORY)			
2	Introduction, the need for security	CO 1	T1:1.1-1.4
3	security approaches, principles of security	CO 1	T1:1.5
4	types of security attacks, security services	CO 1	T2:2.2
5	security mechanism, a model for network security	CO 1	T2:2.2
6	Cryptography concepts and techniques: Introduction, plain text and cipher text,	CO 1	T2:2.1-2.2
7	substitution techniques	CO 1	T2:2.3-2.5
8	transposition techniques,	CO 1	T1:2.6
9	encryption and decryption	CO 1	T1:2.7-2.8
10	symmetric and asymmetric key cryptography,	CO 1	T1:3.1-3.2
11	steganography, key range and key size	CO 1	T1:3.2-3.4
12	possible types of attacks.	CO 1	T1:5.2
13	Symmetric key ciphers:Block cipher principles andalgorithms (DES,AES,Blowfish)	CO 2	T1:5.3
14	differential and linear cryptanalysis,	CO 2	T1:5.3
15	block cipher modes of operation,	CO 2	T1:5.3
17	stream ciphers,RC4 location, and placement of encryption function	CO 2	T1:5.4-5.5
18	key distribution; Asymmetric key ciphers: Principles of public key cryptosystems	CO 2	T1:5.6, 21.4
19	algorithms (RSA Diffie-Hellman, ECC) key distribution.	CO 2	T1:6.1
20	Message authentication algorithm and hash functions	CO 3	T1:6.2-6.3
21	Authentication requirements, functions, message	CO 3	T1:6.4
22	authentication codes, hash functions	CO 3	T1:6.5
23	secure hash algorithm	CO 3	T1:6.6-6.7
24	whirlpool, HMAC	CO 3	T1:8.1
26	CMAC	CO 3	T1:8.2
27	digital signatures,	CO 3	T1:8.3

29	knapsack algorithm	CO 3	T1:8.4-8.5
30	Authentication application: Kerberos	CO 3	T1:8.6
31	X.509 authentication service,	CO 3	T1:8.6
33	public – key infrastructure, biometric authentication.	CO 3	T1:9.5
34	E-mail Security: Pretty Good Privacy;	CO 4	T1:9.6
35	S/MIMI IP Security	CO 4	T1:10.1-10.2
36	IP security overview	CO 4	T1:10.3
37	IP security architecture	CO 4	T1:10.5
38	authentication header	CO 4	T1:10.6
39	encapsulating security payload	CO 4	T1:10.6
40	combining security associations	CO 4	T1:11.3
41	key management.	CO 4	T1:11.4
43	Web security: Web security considerations,	CO 5	T1:11.5
44	secure socket layer and transport layer security,	CO 5	T1:11.6
45	secure electronic transaction intruders	CO 5	T1:12.1-12.3
46	Virus and firewallst	CO 5	T1:12.4-12.6
48	Intruders, intrusion detection password management	CO 5	T1:12.7-12.8
49	virus and related threats, countermeasures	CO 6	T1:7.1-7.2
50	firewall design principles;	CO5	T1:8.1
51	Types of firewalls Case Studies on Cryptography and security	CO 5	T1:8.2
52	Secure inter-branch payment transactions	CO 6	T1:8.3
55	cross site scripting vulnerability	CO 6	T2:27.8
56	Secure inter-branch payment transactions	CO 6	T2:27.9
57	virtual electronics.	CO 6	T1:8.2-8.3
PROBLEM SOLVING/ CASE STUDIES			
16	Problems on Substitution techniques	CO 1	T1:5.3-5.3
25	Problems on transposition techniques	CO 1	T1:8.1-8.3
28	Problems on RSA algorithm	CO 2	T1:8.4-8.6 T1:9.1-9.2
32	Problems on encryption and decryption methods	CO 3	T1:9.4-9.6
42	Problems on ceaser cipher method	CO 1	T1:11.3-11.6

47	Problems on Hill Ciphermethod	CO 2	T1:12.1-12.6
53	Problems on performance issues	CO 2	T1:8.1-8.3
54	Problems on DES Algorithm	CO 2	T1:8.1-8.3
DISCUSSION OF DEFINITION AND TERMINOLOGY			
58	Definitions on information security terminologies	CO 1	T1:1.2
59	Definitions on symmetric and asymmetric cipher	CO 2	T1:1.5
60	Definitions on MAC and Hash functions	CO 3	T1:8,9
61	Definitions on E-mil and PGP	CO 4	T1:10,11
62	Definitions on Intruders, Firewalls	CO 5, CO 6	T1:9.1
DISCUSSION OF QUESTION BANK			
1	Tyoes of security attacks	CO 1	T1:1.2
2	Symmetric and asymmetric algrorthims	CO 2	T1:1.5
3	Authentication and hashing algorithms	CO 3	T1:8,9
4	Email security algorithms	CO 4	T1:10,11
5	Intrusion Detection system and firewalls	CO 5,6	T1: 9.1

Signature of Course Coordinator

Dr P L Srinivasa murthy, Professor **HOD IT**

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**INFORMATION TECHNOLOGY**				
Course Title	**SOFT SKILLS AND INTERPERSONAL COMMUNICATION**				
Course Code	AHSB18				
Program	B.TECH				
Semester	VI				
Course Type	OPEN ELECTIVE				
Regulation	R-18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3		3	-	-
Course Coordinator	Ms. Waheeda Begum, Assistant Professor.				

I COURSE PREREQUISITES

Level	Course Code	Semester	Prerequisites
I B.Tech	AHSCO1	IV	Basic principles of soft skills and concepts of functional syntacticalities.

II COURSE OVERVIEW

The objectives of Soft Skills and Interpersonal Communication Skills are to give each student a realistic perspective of work and work expectations. It helps formulate problem solving skills and also it guides students in making appropriate responsible decisions. Besides, it creates a desire to fulfill individual goals, and to educate students about productive thinking, self-defeating emotional impulses, and self- defeating behaviors.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Soft skills and Interpersonal communication	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
✓	Open Ended Experiments	x	Seminars	x	Mini Project	✓	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

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Semester End Examination (SEE): Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with" either" or" choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question. The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
0%	Remember
80%	Understand
20%	Apply
0 %	Analyze
0%	Evaluate
0%	Create

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Quiz	AAT	
CIA Marks	20	-	10	30

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination

Two Quiz exams shall be online examination consisting of 50 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

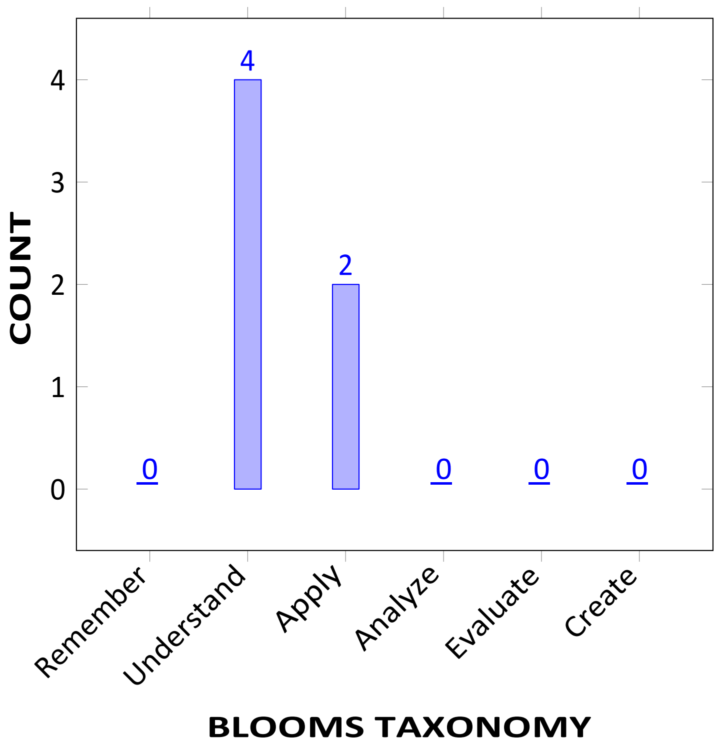
I	Communication skills effectively in both spoken and written languages.
II	All-round personalities with a matured outlook to function effectively in different formal and informal situations. .
III	Self-confidence by mastering inter-personal skills, team management skills, and leadership skills. .
IV	Effective presentation skills which give an edge while interacting with people at all levels.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Apply** soft skills in the development of personality and use them in their daily life.	Apply
CO 2	**Relate** how to listen actively and respond productively to others.	Understand
CO 3	**Classify** the correct usage of English grammar in writing and speaking	Understand
CO 4	**Demonstrate** the significance of verbal and non-verbal communication in academic and non-academic platforms...	Understand
CO 5	**Explain** some of the strategies and challenges for effective speaking skills and make use of prereading skills to understand the content of advanced level text books.	Understand
CO 6	**Develop** various written communication strategies of cover letter writing, resume writing, E-mail writing and report writing.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

Program Outcomes	
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO8	**Communication:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice (Ethics).	3	Seminar/ Conferences/ Quiz/ AAT Assignments/ Discussion
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	3	Seminar/ Conferences/ Quiz/ AAT Assignments/ Discussion

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	-	-
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	-	-
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	-	-

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	-	-	-	-	-	-	✓	-	-	-	-	-	-	-
CO 2	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	-
CO 4	-	-	-	-	-	-	-	✓	-	✓	-	-	-	-	-
CO 5	-	-	-	-	-	-	-	✓	-	✓	-	-	-	-	-
CO 6	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	-

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XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 8	Demonstrate the basic **professional ethics** of ethical choices, codes of ethics, professional practice, and ethical behaviour with special respect to the usage of soft skills and personality development. Besides, students are designed to **stand up for what they believed in** and they are encouraged to maintain a **high degree of trust and integrity.**	3
CO 2	PO 10	Explain with **clarity** on listening an audio clip and also maintain appropriate oral presentation skills with proper **grammatical** skills in both writing and **speaking** situations.	3
CO 3	PO 10	Describe the usage of **grammatical** knowledge in **writing** and **speaking** areas and also discuss the apt applicability of different grammar rules in **oral** presentations with **clarity.**	5

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 4	PO8	Illustrate **ethical choices knowledge of professional codes of ethics** and also **evaluates the ethical dimensions of professional practice** and demonstrates **ethical behaviour**. Besides, **stood up for what they believe in** and moreover **discover high degree of trust and integrity.**	5
CO 4	PO10	Extend the knowledge on **subject matter** with appropriate **clarity** using with proper **grammatical** structures in both areas of **speaking** and **written** communication practices.	5
CO 5	PO8	Interpret **ethical choices and knowledge of professional codes of ethics and also evaluates ethical dimensions of professional practice and demonstrates ethical behaviour** at workplace. Besides, illustrates how to **stand up for what they believed in.** Furthermore, **practice high degree of trust and integrity.**	3
CO 5	PO 10	Choose appropriate **reading** strategies in order to understand with proper **clarity.** Moreover, predict **syntactical** structures used in **spoken** communication and **written communication.**	5
CO 6	PO 10	Classify different **oral** and **written** communication strategies through systematic order and also recognize appropriate method in order to understand the writer's point of view with **clarity** while **reading** and practices proper **grammatical** functionalities to understand different **subject matters.**	5

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-
CO 2	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-
CO 4	-	-	-	-	-	-	-	3	-	5	-	-	-	-	-
CO 5	-	-	-	-	-	-	-	3	-	5	-	-	-	-	-
CO 6	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0	100	0.0

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0
CO 3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0
CO 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100	0.0	100	0.0	0.0	00	100	0.0
CO 5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100	0.0	100	0.0	0.0	0.0	0.0	0.0
CO 6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - 0 ≤ C ≤ 5% – No correlation
1 -5 <C≤ 40% – Low/ Slight
2 - 40 % <C < 60% –Moderate
3 - 60% ≤ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
CO 2	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0
CO 3	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0
CO 4	0	0	0	0	0	0	0	3	0	3	0	0	0	0	0
CO 5	0	0	0	0	0	0	0	3	0	3	0	0	0	0	0
CO 6	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0
TOTAL								9		15			0	0	0
AVERAGE								3		3				0	0

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	✓
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	✓	10 Minutes Video	✓	Open Ended Experiments	✓
Assignments	✓				

XVII ASSESSMENT METHODOLOGY-INDIRECT:

-	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	SOFT SKILLS
	Soft Skills: An Introduction – Definition and significance of soft skills; Process, Importance and application of soft skills, discovering the self; setting goals; positivity and motivation: developing positive thinking and attitude
MODULE II	EFFECTIVENESS OF SOFT SKILLS
	Developing interpersonal relationships through effective soft skills; Define Listening, Speaking, Reading and Writng skills; Barriers to Listening, Speaking, Reading and Writing; Essential formal writing skills; Public Speaking: Skills, Methods, Strategies and Essential tips for effective public speaking.
MODULE III	ORAL AND AURAL SKILLS
	Sounds of English vowels sounds and constant sounds, Word Accent and connected speech- contractions, questions tags, Listening for information, Taking notes while listening to lectures (use of Dictionary). Group Discussion: Importance, Planning, Elements, Skills, Effectively disagreeing, Initiating
MODULE IV	VERBAL AND NON-VERBAL COMMUNICATION
	Interpersonal communication-verbal and nonverbal etiquette; Body language, grapevine, Postures, Gestures, Facial expressions, Proximity; Conversation skills, Critical thinking, Teamwork, Group Discussion, Impact of Stress; Measurement and Management of Stress
MODULE V	WRITTEN COMMUNICATION
	Significance; Effectiveness of writing; Organizing principles of Paragraphs in documents; Writing introduction and conclusion; Techniques for writing precisely; Letter writing; Formal and Informal letter writing; E-mail writing, Report Writing.

TEXTBOOKS

1. Raman Meenakshi, Upadhyay Shalini (2017). Soft Skills: Key to Success in Workplace and Life. Cengage India Private Limited, Noida.

2. Handbook of English for Communication (Prepared by Faculty of English, IARE)

REFERENCE BOOKS:

1. Dorch, Patricia. What Are Soft Skills? New York: Execu Dress Publisher, 2013.

2. Klaus, Peggy, Jane Rohman & Molly Hamaker. —The Hard Truth about Soft Skill, London: HarperCollins E-books, 2007.

3. Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders. Washington, DC: Pfeiffer & Company, 2013.

4. Stein, Steven J. & Howard E. Book. —The EQ Edge: Emotional Intelligence and Your Success Canada: Wiley & Sons, 2006

5. Suresh Kumar. English for Success. Cambridge University Press IndiaPvt.Ltd.2010.

6. Dorling Kindersley. Communication Skills & Soft Skills - An Integrated Approach. India Pvt. Ltd. 2013.

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3. www.myenglishpages.com
4. http://grammar.ccc.comment.edu
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2. http://www.bloomsbury-international.com/images/ezone/ebook/writing-skills-pdf.pdf
3. http://learningenglishvocabularygrammar.com/files/idiomsandphraseswithmeaningsandexamplespdf
4. http://www.robinwood.com/Democracy/General Essays/CriticalThinking.pdf

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Discussion on mapping COs with POs (OBE)		T1:06.06
CONTENT DISCUSSION (THEORY)			
2	Introduction of soft skills	CO1	T1:06.09
3	Significance of soft skills..	CO1	T1:09.10
4	Process, importance and application of soft skills..	CO1	T1:08:05
5	Discovering one's self-qualities.	CO1	T1:06:02
6	Setting up goals	CO1	T1:04:74
7	Positivity and motivation.	CO1	T1:01:08
8	Developing one's positive thinking and attitude	CO 1	T1:03:01
9	Developing interpersonal relationships through soft skills..	CO2	T1:06:05
10	Significance of listening skills.	CO 2	T1:02:09
11	Significance of speaking skills.	CO 4	T1:26:11
12	Significance of reading skills..	CO 5	T1:46:08
13	Significance of writing skills.	CO 6	T1:16:20
14	Barriers to listening and speaking.	CO 2	T1:13:43
15	Barriers to reading and writing.	CO 6	T1:40:51
16	Essentials of formal writing skills.	CO 6	T1:19:07
17	Developing public speaking skills.	CO4	T1:69:62
18	Methods, strategies of public speaking..	CO 4	T1:5:05
19	Essential tips for effective public speaking.	CO4	T1:46:05
20	Introduction to phonetics.	CO 4	T1:09:18
21	Contractions and questions tags.	CO 3	T1:07:14
22	Listening for information.	CO 3	T1:32:96

23	Taking notes while listening to lectures.	CO 3	T1:55:21
24	Group discussion and its Importance.	CO 2	T1:14:25
25	Planning, elements, skills, effectively, disagreeing, initiating.	CO 2	T1:08:08
26	Developing interpersonal communication skills.	CO4	T1:22:74
27	The role of verbal and nonverbal etiquettes in one’s career.	CO1	T1:32:36
28	Significance of body language,	CO 1	T1:78:12
29	Grapevine communication.	CO4	T1:01:08
30	Developing critical thinking.	CO4	T1:04:18
31	Conversation skills at formal and informal situations. .	CO4	T1:06:08
32	The power of group discussion and the role of a team work.	CO4	T1:03:22
33	Impact of stress; measurement and management of stress.	CO4	T1:89:01
34	Significance and effectiveness of writing.	CO 5	T1:01:04
35	Organizing principles of paragraphs in documents;	CO 4	T1:74:32
36	Writing introduction and conclusion	CO 1	T1:25:10
37	Techniques for writing precisely;	CO 6	T1:09:07
38	Letter writing; Formal and Informal letter writing;	CO 6	T1:60:31
39	Rules of E-mail writing.	CO 6	T1:22:12
40	Strategies of report writing.	CO 6	T1:01:01
PROBLEM SOLVING/ CASE STUDIES			
1	When you’re in a team of specialists, you can easily find differences of opinions on what direction projects should take. How do you find consensus?	CO 1	R2:7.5
2	Have you ever had to convince a manager to try out a different solution to solve a problem?	CO 2	R2:7.5
3	An order hasn’t been delivered to a customer on time, and they’re furious. They want you to cancel the order and close their account immediately. How would you repair the damage and keep the customer?	CO 2	R2:7.5
4	Business has slowed, and you’re in a sales brainstorming session. Someone suggests lowering prices and focusing more on customer satisfaction. What’s your reaction?	CO 2	R2:7.5
5	You have an employee who’s excellent at their job, but is blunt and abrasive with colleagues and that’s causing friction in your department. How do you resolve the matter?	CO 4	R2:7.5
6	You’re in a meeting, and your manager misquotes pricing or a process that can have a significant impact on your department or a project. What do you do?	CO 5	R2:7.5
7	You notice that your manager (or a colleague) is inclined to shift blame and not accept responsibility when under pressure. How do you approach the subject?	CO 5	R2:7.5
8	If you had to make a decision based on incomplete information, how would you approach this?	CO 1	R2:7.5
9	How would you handle a situation where you and your teammates disagree on how to move forward on a project?	CO 5	R2:7.5

10	We're a year into the pandemic. Do you have a clear idea of where you're heading? Take a few minutes with us to look at how critical thinking skills can bring clarity to your business and help you get the best from your team.	CO 1	R2:7.5
11	Are you making decisions the same way you were before the pandemic? Have you considered what you could do differently? Would you like a system refresh for the new normal? These skills will help you give your thought processes a spring clean and sweep out the cobwebs. But they can do much more.	CO 1	R2:7.5
12	Ask a student to role-play a specific character or celebrity with a bad attitude. Ask other students to respond to this character. Ask a set of students to role-play the interaction of a team in conflict. Have them resolve the conflict during a set time limit. Use the workshop to teach communication and conflict resolution techniques.	CO 5	R2:7.5
13	Get into groups of five and introduce yourselves to each other. What do we say when there is nobody around and we find ourselves to face to face with a stranger?	CO 1	R2:7.5
14	How would you introduce two of your friends who have not been met before to each other?	CO 1	R2:7.5
15	Get into groups of three. Take the roles of a senior officer, a junior officer and a new employee and introduce the new employee to the senior officer.	CO 1	R2:7.5
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Definition and terminology of soft skills	CO 6	T1:69:08
2	Definition and terminology of contractions	CO 6	T1:65:66
3	Definition and terminology of question tags	CO 6	T1:42:03
4	Definition and terminology of verbal and nonverbal communication	CO6	T1:78:78
5	Definition and terminology of self discovery	CO 6	T1:09:01
DISCUSSION OF QUESTION BANK			
1	Module I - Soft skills and interpersonal communication.	CO 1	R4:2.1
2	Module II - Effectiveness of soft skills.	CO 1	T4:7.3
3	Module III - Oral and aural skills.	CO 3	R4:5.1
4	Module IV - Verbal and nonverbal communication.	CO4	T1:7.5
5	Module V - Interpersonal communication.	CO 2	T1: 4.1

Signature of Course Coordinator **HOD IT**

Ms. Waheeda Begum, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

INFORMATION TECHNOLOGY

COURSE DESCRIPTION

Course Title	**DATA WAREHOUSING AND DATA MINING LABORATORY**				
Course Code	ACSB15				
Program	B.Tech				
Semester	VI	IT			
Course Type	CORE				
Regulation	IARE - R18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	3	1
Course Coordinator	Ms. B. Pravallika, Assistant Professor				

I COURSE OVERVIEW:

Data mining techniques allow predicting future trends and behaviors of businesses to make proactive, knowledge-driven decisions. The data mining laboratory course is designed to practice the data mining techniques such as classification, clustering, pattern mining etc. with varied datasets and dynamic parameters on weka machine learning tool.

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AHSB12	II	Probability and Statistics
B.Tech	ACSC08	III	Database Management Systems

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Data Warehousing and Data Mining Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

C	Demo Video	C	Lab Worksheets	C	Viva Questions	C	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component			Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
-	-	-	-	-	-

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

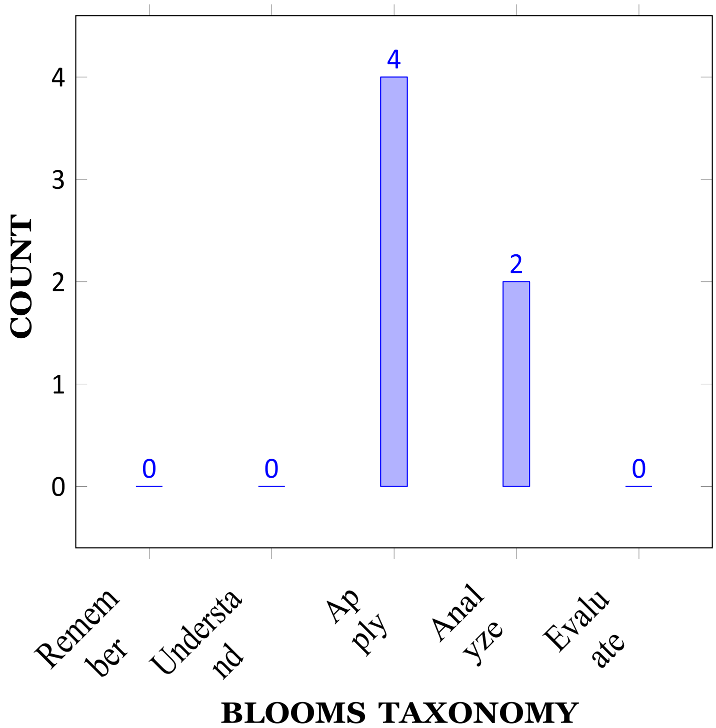
I	The data set understanding with visualizations and needed preprocessing.
II	The demonstration of data mining tasks such as classification.
III	The analysis on data models with variant parameters.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Apply** pre-processing statistical methods for any given raw data. .	Apply
CO 2	**Apply** Association rule process for a given dataset by using Apriori algorithm.	Apply
CO 3	**Apply** Association rule process for a given dataset by using FP-Growth algorithm.	Apply
CO 4	**Analyze** Classification rule process for a given raw data Decision tree and ID3 algorithm..	Analyze
CO 5	**Analyze** Classification rule process for a given raw data Decision tree and ID3 algorithm..	Analyze
CO 6	**Apply** Clustering on a given dataset by using k-means algorithm.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Problem analysis:** Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Lab Exercise, CIE, SEE

PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	Lab Exercise, CIE, SEE
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	3	Lab Exercise, CIE, SEE
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	3	Lab Exercise, CIE, SEE

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Profi-ciency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	1	Lab Exercises
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry	2	Lab Exercises

3 = High; 2 = Medium; 1 = Low

X JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 1	**Apply** the Pre-processing method for the given dataset by using mathematical and computer science and related methodologies.	3
	PO 2	**Analyze**the problem of a given dataset and apply the Pre-processing method to solve the problem.	3
	PO 3	**Apply** the Pre-processing method for the given dataset by using weka tool.	1

	PO 5	**Apply** the Pre-processing method for the given dataset by using weka tool.	1
CO 2	PO 3	**Analyze solution** for Association rule to the given dataset by applying Apriori algorithm	4
	PO 5	**Apply**the Association rule by using Apriori algorithm with weka tool.	1
	PSO1	**Analyze solution** for Association rule to the given dataset by applying Apriori algorithm.	2
	PSO3	**Apply**the Pre-processing method by using weka tool.	1
CO 3	PO 3	**Analyze solution** for Association rule to the given dataset by applying FP-Growth algorithm	4
	PO 5	**Apply**the Association rule by using FP-Growth algorithm with weka tool.	1
	PSO1	**Analyze solution** for Association rule to the given dataset by applying FP-Growth algorithm.	2
	PSO3	**Apply**the Pre-processing method by using weka tool.	1
CO 4	PO 2	**Analyze** the problem of a given dataset and apply the Classification method to solve the problem.	3
	PO 5	**Apply**the Classification method for a given raw dataset by using weka tool	1
	PSO3	**Apply**the Classification method for a given raw dataset by using weka tool	1
CO 5	PO 2	**Implement** Decision tree for the given raw dataset by using ID-3 algorithm.	2
	PO 3	**Analyze**solutions for Classification method to the given dataset by applying ID3-algorithm.	2
	PO 5	**Apply**the Classification method for a given raw dataset by using weka tool	1
	PSO1	**Analyze**solution for Classification method to the given dataset by applying ID-3 algorithml	1
	PSO3	**Apply**the Classification method for a given raw dataset by using weka tool	1
CO 6	PO 3	**Analyze solution** for Clustering method to the given dataset by applying K-means algorithm	3
	PO 5	**Apply**the Clustering method for a given raw dataset by using weka tool	1
	PSO 1	**Analyze solution** for Clustering method to the given dataset by applying K-means algorithm	2
	PSO 3	**Apply**the Clustering method for a given raw dataset by using weka tool	1

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Course Outcomes	Program Outcomes				Program Specific Outcomes	
	PO1	PO2	P03	PO5	, PSO1	PSO3
CO1	3	3	2		1	
CO2	3	1	2		1	
CO3	2	2	2	1		1
CO4	3	3	2	1		
CO5	2	3	3			1
CO6	2	1	3		1	1

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	PO 1, PO 2, PO 3, PO 5	SEE Exams	PO 1, PO 2, PO 3, PO 5	Seminars	-
Laboratory Practices	PO 2,PO 3, PO 5	Student Viva	PO 2, PO 3	Certification	-
Assignments	-				

XIII ASSESSMENT METHODOLOGY INDIRECT:

C	Early Semester Feedback	C	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK I	**PREPROCESSING**
	Simulate preprocessing methods dataset student and labor in weka..
WEEK II	**ASSOCIATION RULES**
	1. Simulate association rule process on dataset contact lenses. arff using apriori algorithm in weka
	2. Simulate Association rule process on dataset test. arff using apriori algorithm in weka
WEEK III	**CLASSIFICATION RULE BY J48**
	Simulate of classification rule process on dataset student. arff using j48 algorithm in weka
WEEK IV	**CLASSIFICATION RULE BY J48**
	Demonstration of classification rule process on dataset employee. arff using id3 algorithm.

WEEK V	**CLASSIFICATION RULE BY J48**
	CDemonstration of classification rule process on dataset employee. arff using id3 algorithm.
WEEK VI	**CLASSIFICATION RULE BY NAIVE BAYES**
	Demonstration of classification rule process on dataset employee. arff using naıve bayes..
WEEK VII	**CLASSIFICATION RULE BY K-MEANS**
	Demonstration of clustering rule process on dataset student. arff using simple k- means this macro to print the elements of the array.
WEEK VIII	**CLUSTERING**
	Demonstration of clustering rule process on dataset iris. arff using simple k-means this macro to print the elements of the array..
WEEK IX	**CLUSTERING BY K-MEANS**
	Implement k-means algorithm.
WEEK X	**DECISION TREE**
	Implement decision tree classification algorithm
WEEK XI	**ASSOCIATION RULE MINING BY APRIORI ALGORITHM.**
	Implement Apriori algorithm.
WEEK XII	**ASSOCIATION RULE MINING BY FP- GROWTH ALGORITHM**
	Implement FP- growth algorithm.

TEXTBOOKS

1. J.Han, M.Kamber, Data Mining: Concept and Technique, Academic Press, Morgan Kanfman Publishers, 3rd Edition, 2008.

2. Alex Berson, Stephen J. Smith, —Data Warehousing, Data Mining and OLAP, Tata McGraw-Hill, 10th Edition, 2007

REFERENCE BOOKS:

1. Craig Larman, Applying UML and Patterns: An Introduction to Object Oriented Analysis and Design and Iterative Development‖, Pearson Education, 3rd Edition, 2005.

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Refer-ence
1	Preprocessing.	CO 1	R1: 1.1
2	Association rule.	CO 1, CO 2	R1: 2.3
3	Classification rule by j48.	CO 1, CO 2	R1: 4.1
4	Classification rule by j48	CO 1, CO 2	R1: 5.1
5	Classification rule by id3.	CO 3 ,CO 4	R2: 6.1
6	Classification rule by naive bayes.	C,CO 4 ,CO 5	R1: 7.1

7	Clustering rule by k-means.	CO 3, CO 5 ,CO 6	R2: 11.4
8	Clustering.	CO 3, CO 5 ,CO	R1: 12.5
9	Clustering rule by k-means.	CO 3, CO 5 ,CO	R2: 14.3
10	Decision tree.	CO 3, CO 5 ,CO 6	R1: 15.1
11	Association rule mining by apriori algorithm.	CO 3	R2:16.4
12	Association rule mining by fp-growth algorithm.	CO 6	R1:20.5

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	**Finding** Association Rules for buying data.
2	**Finding**Association Rules for Banking data..
3	**Construct** Decision Tree for location.
4	**Write** a procedure for Visualization of Weather Table.
5	**Write** a procedure for Visualization of Banking Table.

Signature of Course Coordinator **HOD IT**
Ms B. Pravallika
Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

DEPARTMENT OF INFORMATION TECHNOLOGY
COURSE DESCRIPTION

Course Title	**LINUX PROGRAMMING LABORATORY**				
Course Code	AITB13				
Program	B.Tech				
Semester	VI	IT			
Course Type	Core				
Regulation	IARE - R18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	2	1
Course Coordinator	A Krishna Chaitanya, Assistant Professor				

I COURSE OVERVIEW:

This course covers operating system concepts in linux environment. It focuses on practice on shell commands and demonstration of process concepts such as creation and establishing communication using linux system calls. The main objective of the course is to teach the students how to work with linux environment and demonstration of operating systems concepts using linux system calls in C programs. This course reaches to student by power point presentations, lecture notes, and lab which involve the problem solving in mathematical and engineering areas. .

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSC04	I	PPS

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
LINUX PROGRAMMING LABORATORY	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

X	Demo Video	✓	Lab Worksheets	✓	Viva Questions	✓	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being Internal Examiner and the other being External Examiner, both nominated by the Principal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component			Total Marks
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

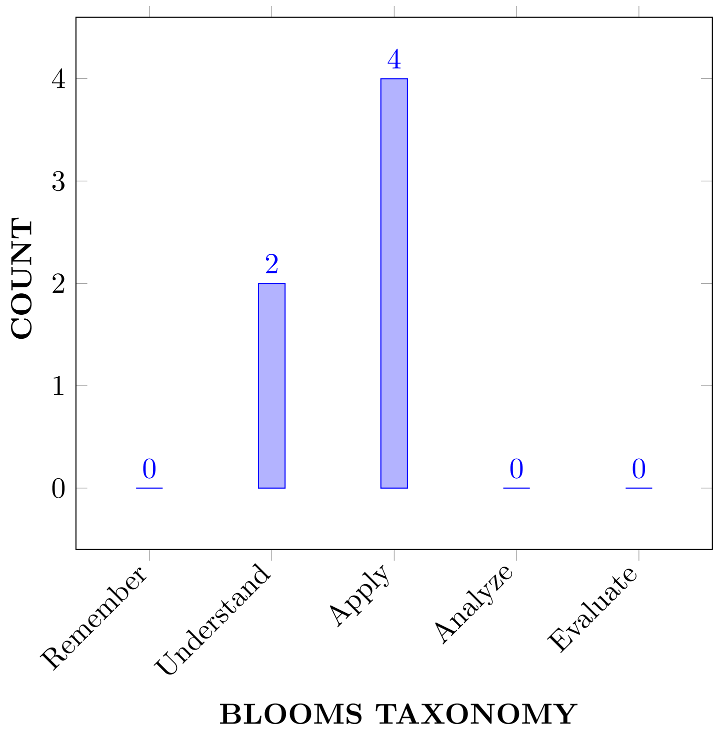
I	Familiar with the Linux command-line environment.
II	Understand system administration processes by providing a hands-on experience.
III	Understand Process management and inter-process communications techniques.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Demonstrate** text processing utilities, file handling utilities, security by file permissions, process utilities, disk utilities and networking commands with different options available for solving problems.	Understand
CO 2	**Make use of** bourne shell constructs, decision structures and loops in designing programs for complex problems.	Apply
CO 3	**Interpret** to write, compile, debug and run C language program in linux shell environment for implementing kernel level concepts.	Understand
CO 4	**Identify** basic methods and techniques used in solving simple programming tasks in the area of execution environment, processes signals and threads.	Apply
CO5	**Experiment with** IPC mechanisms such as pipes, named pipes, shared memory, message queues, semaphores and sockets for interprocess communication.	Apply
CO 6	**Choose** the appropriate protocol such as TCP or UDP for effective communication in client-server applications.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE / SEE/ Lab Exercises
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	CIE / SEE/ Lab Exercises
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	2	CIE / SEE/ Lab Exercises
PO 4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	3	CIE / SEE/ Lab Exercises
PO 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	2	CIE / SEE/ Lab Exercises

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	2	Lab Exercises
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	2	Lab Exercises
PSO 3	Practical experience in shipping real wor software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	2	Lab Exercises

3 = High; 2 = Medium; 1 = Low

X JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 1	Demonstrate shell commands for creating and searching files in **engineering fundamentals**, and an **engineering specialization** to the solution of **complex engineering problems.**	3
CO 2	PO 1	Make use of the following bourne shell constructs: test, if then, if then else, if then elif, for, while, until, and case to find the solution of **complex engineering problems.**	1
CO 3	PO 1	Interpret to write, compile, debug and run C language program in linux shell environment to apply the knowledge of **engineering fundamentals**, and an **engineering specialization** to the solution of **complex engineering problems**.	3
	PO 3	Interpret to write, compile, debug and run C language program in linux shell environment for designing solutions for **complex engineering problems**.	1
CO 4	PO 1	Identify basic methods and techniques used in solving simple programming tasks in the area of execution environment, processes and signals, threads and asynchronous I/O using **engineering fundamentals** for the solutions of **complex engineering problems**.	2
CO 5	PO 1	Apply the knowledge of IPC mechanisms for inter process communication in **engineering fundamentals**, and an **engineering specialization** to the solution of **complex engineering problems**.	3
	PO 2	Experiment with IPC mechanisms for inter process communication to analyze **complex engineering problems** reaching **substantiated conclusions** using **principles of engineering sciences**.	3
	PSO 1	Design **next-generation computer systems, networking devices** using IPC mechanisms for inter process communication..	2
CO 6	PO 1	Find the effective solution of **complex engineering problems** by choosing the appropriate protocol for effective communication in client-server applications.	1
	PSO 2	Focus on **web applications development** and learn the **emerging technologies** for effective communication in client-server applications.	2

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

COURSE OUTCOMES	PROGRAM OUTCOMES				PROGRAM OUTCOMES		
	PO 1	PO 2	PO 3	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3						
CO 2	1						
CO 3	3		1				
CO 4	2						
CO 5	3	3			2		
CO 6	1					2	

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	PO 1, PO 2, PO 3	SEE Exams	PO 1,PO 2, PO 3	Seminars	-
Laboratory Practices	PO 1,PO 2, PO 3	Student Viva	PO 1, PO 2, PO 3	Certification	-
Assignments	-				

XIII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK 1	**BASIC COMMANDS I**
	Study and Practice on various commands like man, passwd, tty, script, clear, date, cal, cp, mv, ln, rm, unlink, mkdir, rmdir, du, df, mount, umount, find, unmask, ulimit, ps, who, w.
WEEK 2	**BASIC COMMANDS II**
	Study and Practice on various commands like cat, tail, head , sort, nl, uniq, grep, egrep,fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, tar, cpio.
WEEK 3	**SHELL PROGRAMMING I**
	a) Write a Shell Program to print all .txt files and .c files. b) Write a Shell program to move a set of files to a specified directory. c) Write a Shell program to display all the users who are currently logged in after a specified time. d) Write a Shell Program to wish the user based on the login time.
WEEK 4	**SHELL PROGRAMMING II**
	a) Write a Shell program to pass a message to a group of members, individual member and all. b) Write a Shell program to count the number of words in a file. c) Write a Shell program to calculate the factorial of a given number. d) Write a Shell program to generate Fibonacci series.

WEEK 5	**SIMULATING COMMANDS I**
	a) Simulate cat command b) Simulate cp command
WEEK 6	**SIMULATING COMMANDS II**
	a) Simulate tail command b) Simulate head command
WEEK 7	**SIMULATING COMMANDS III**
	a) Simulate mv command b) Simulate nl command
WEEK 8	**SIGNAL HANDLING**
	Write a program to handle the signals like SIGINT, SIGDFL, SIGIGN
WEEK 9	**INTERPROCESS COMMUNICATIONS**
	Implement the following IPC forms a) FIFO b) PIPE
WEEK 10	**MESSAGE QUEUES**
	a) Write a C program(sender.c) to create a message queue with read and write permissions to write 3 messages to it with different priority numbers. b) Write a C program(receiver.c) that receives the messages (from the above message queue as specified and displays them.
WEEK 11	**SHARED MEMORY**
	Implement shared memory form of IPC.
WEEK 12	**SOCKET PROGRAMMING**
	a) Write client and server programs (using c) for interaction between server and client processes using TCP elementary functions. b) Write client and server programs (using c) for interaction between server and client processes using UDP elementary functions.

TEXTBOOKS

1. Sumitabha Das, "Your Unix The Ultimate Guide", Tata McGraw-Hill, New Delhi, India, 2007.

2. B. A. Forouzan and R. F. Gilberg, "Unix and Shell Programming", Cengage Learning.

REFERENCE BOOKS:

1. Robert Love, "Linux System Programming", O'Reilly, SPD.

2. Stephen G. Kochan, Patrick Wood, "Unix Shell Programming", Sams publications, 3rd Edition, 2007.

3. T. Chan, "Unix System Programming using C++", Prentice Hall India, 1999

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1. http://spoken-tutorial.org/tutorialsearch/?search_foss=Linux&search_language=English

2. https://www.redhat.com/en/files/resources/en-rhel-whats-new-in-rhel-712030417.pdf

3. http:// www.tutorialspoint.com/unix/ 4. http://cse09-iiith.virtual-labs.ac.in

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Basic Commands I	CO 1	T2: 4.7-4.8, 5.3-5.4
2	Basic Commands II.	CO 1	T2: 4.7-4.8, 5.3-5.4
3	Shell Programming I	CO 2	T2: 8.5, 14.14
4	Shell Programming II	CO 2	T2: 8.5, 14.14
5	Simulating Commands I	CO 3	T2: 12.3-12.9, 15.9-15.10
6	Simulating Commands II	CO 3	T2: 3.10,15.6, 17.5-17.6
7	Simulating Commands III	CO 3	T2: 3.10,15.6, 17.5-17.6
8	Signal Handling	CO 4	R4: 10.4-10.19
9	Inter process Communications.	CO 5	R4: 14.1-14.5
10	Message Queues	CO 5	R4: 14.1-14.5
11	Shared Memory	CO 5	R4: 14.7
12	Socket Programming	CO 5,CO 6	R2: 15.5

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	Write a C program to create a child process and allow the parent to display parent and the child to display child on the screen.
2	Write a C program to create a Zombie process.
3	Write a Shell script that receives any number of file names as arguments checks if every argument supplied is a file or a directory and reports accordingly. Whenever the argument is a file, the number of lines on it is also reported.
4	Write a C Program that makes a copy of a file using standard I/O and system calls.
5	Write a C program in which a parent writes a message to a pipe and the child reads the message.
6	Write a C program that illustrates how an orphan is created.
7	Write a C program that illustrates how an orphan is created.

Signature of Course Coordinator **HOD,IT**
A. Krishna Chaitanya, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	INFORMATION TECHNOLOGY				
Course Title	**BIG DATA ANALYTICS**				
Course Code	AITB14				
Program	B.Tech				
Semester	VII				
Course Type	Core				
Regulation	R-18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	0	3	-	-
Course Coordinator	Ms.B. Pravallika, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSB14	IV	Database Management Systems
B.Tech	ACSB08	VI	Data Ware House and Data Mining

II COURSE OVERVIEW:

This course provides a clear understanding on concepts of sources of big data, characteristics, storing and processing components, and analytics applications. This course emphasizes on potential impact of big data challenges, open research issues, and various tools associated with it. This course includes the introduction and processing big data with an overview of Hadoop technology and its components such as pig, hive, etc.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Big Data Analytics	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	x	Chalk & Talk	x	Assignments	x	MOOC
✓	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIE examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
40 %	Understand
50 %	Apply
10 %	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component	Theory		Total Marks
Type of Assessment	CIE Exam	AAT	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 17^{th} week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination
Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

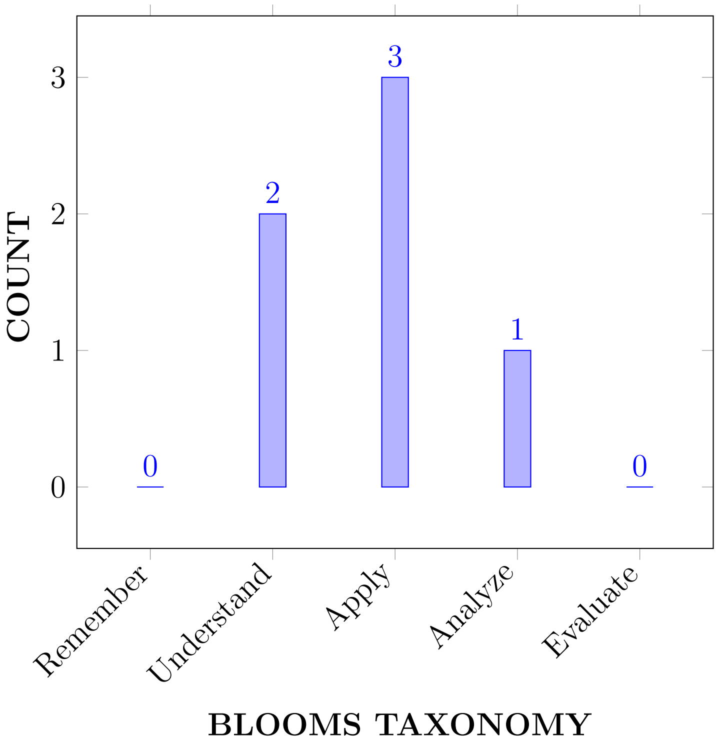
I	The scope and essentiality of Big Data and Business Analytics.
II	The technologies used to store, manage, and analyze big data in a Hadoop ecosystem.
III	The techniques and principles in big data analytics with scalability and streaming capability.
IV	The hypothesis on the optimized business decisions in solving complex real-world problems.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Explain** the evolution of big data and big data analytics along with its characteristics and challenges included in traditional business intelligence.	Understand
CO 2	**Make use of** appropriate components for processing, scheduling and knowledge extraction from large volumes the applications for handling huge volume of data	Apply
CO 3	**Develop** a Map Reduce application for optimizing the jobs.	Apply
CO 4	**Develop** the applications for handling huge volume of data using Pig Latin.	Apply
CO 5	**Explain** the importance of bigdata framework HIVE and its built-in functions, data types and services like DDL in Hadoop distributed file system.	Understand
CO 6	**Extend** the big data technologies used to process and querying the bigdata in Hadoop, MapReduce, Pig and Hive.	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/SEE/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	CIE/AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	1	CIE/AAT
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	1	SEE /CIE,AAT
PO 5	**Individual and Teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	2	SEE/ CIE/AAT
PO 12	**Life - Long Learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	1	SEE/ CIE, AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	3	Research papers/ Group discussion/ Short term courses
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	2	Research papers/ Group discussion/ Short term courses
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	3	Research papers/ Group discussion/ Short term courses

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	✓	✓	-	✓	-	-	-	-	✓	-	✓	✓	✓	✓
CO 2	✓	✓	✓	-	✓	-	-	-	-	✓	-	✓	✓	✓	✓
CO 3	✓	✓	✓	-	✓	-	-	-	-	✓	-	✓	✓-	✓	✓
CO 4	✓	✓	✓	-	✓	-	-	-	-	✓	-	✓	✓	✓	✓
CO 5	✓	✓	✓	-	✓	-	-	-	-	✓	-	✓	✓	✓	✓
CO 6	✓	✓	✓	-	✓	-	-	-	-	✓	-	✓	✓	✓	✓

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Compare big data analysis and analytics in optimizing business decisions **knowledge** by using the **mathematical principles** and **computer science methodologies**.	3

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 2	Explain the evolution of big data and big data analytics along with its characteristics the **problem** and challenges includes the **problem statement,data collection ,validation** and **documentation** in traditional business intelligence.	5
	PO 3	Explain the evolution of big data in **knowledge and understanding** the big data analytics along with its characteristics and **understand** and **manage**challenges included in traditional business intelligence in **engineering process**.	4
	PO 5	Explain the evolution of big data and big data analytics along with its characteristics and challenges included in traditional business intelligence in **computer software**.	1
	PO 10	Explain the evolution of big data and big data analytics along with its characteristics in**clarity** and also challenges included in traditional business intelligence in **reference**.	2
	PO 12	**keeping trend in CSE** Explain the evolution of big data and big data analytics along with its characteristics in **personal continuing** and **on going learning** in challenges included in traditional business intelligence in **project management**.	4
	PSO 1	Explain the evolution of big data and big data analytics along with its characteristics and challenges in **search engines ,next generation computer systems,networking devices**,included in traditional business intelligence in **knowledge discovery tools**.	4
	PSO 2	Explain the evolution of big data and big data analytics along with its characteristics and challenges in **mobile and web application development** included in traditional business intelligence.	2
	PSO 3	Explain the evolution of big data and big data analytics along with its characteristics and challenges included in traditional business intelligence in **practical experience in shipping real world software ,using industry standard tools**.	2
CO 2	PO 1	Make use of appropriate components for processing, scheduling and knowledge extraction from large volumes the applications for handling huge volume of data by **applying mathematical principles,scientific methodology,computer science**	3
	PO 2	**identify problem,problem statement** and Make use of appropriate components for processing, scheduling and knowledge extraction to **validate the data** from large volumes for applications to handling huge volume of data in **information and data collection** in **documentation**	7

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 3	**Investigate and define a problem identification** appropriate components for processing, scheduling and knowledge extraction from large volumes the applications for handling huge volume of data **to manage the design process**	4
	PO 5	Make use of appropriate components for processing, scheduling and knowledge extraction from large volumes the applications for handling huge volume of data in **computer software**	1
	PO 10	Make use of appropriate components for processing, scheduling and knowledge extraction from large volumes in **clarity** the applications for handling huge volume of data with **reference**	2
	PO 12	Make use of appropriate components for processing, scheduling and knowledge extraction from large volumes the applications for handling huge volume of data **In personal continued and ongoing learning**	3
	PSO 1	Make use of Hadoop components on huge volume data used to develop analytical solutions related to **Bigdata, Artificial Intelligence, Machine Learning and Networking**.	4
	PSO 2	Make use of Hadoop components on huge volume data used to develop analytical solutions related to **mobile and web application in emerging technologies**.	3
	PSO 3	Make use of Hadoop components on huge volume data used to develop analytical solutions related to**using industry standard tools and collabaration**.	2
CO 3	PO 1	Apply scientific **principles and methodologies, other engineering disciplines** in map reduce, Hadoop.	3
	PO 2	**Problem** Analysis in map reduce,**problem statement,datacollection,validation,documentation** in Hadoop.	5
	PO 3	Get the **knowledge and understanding** of a Map Reduce application **understand** and **manage** for optimizing the jobs in **engineering process**.	5
	PO 5	Develop a Map Reduce application for optimizing the jobs in **computer software**.	1
	PO 12	**keeping trend in CSE** Develop a Map Reduce application for optimizing the jobs in **personal continuing,on going learning, project management**.	4
	PSO 1	Develop a Map Reduce application for optimizing the jobs in **Big data,Artificial Intelligence,Machine learning**.	3
	PSO 2	Develop a Map Reduce application for optimizing the jobs in **mobile and web application in emerging technologies**.	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO 3	Develop a Map Reduce application for optimizing the jobs related to using **industry standard tools**	1
CO 4	PO 1	Apply **scientific principles and methodologies, other engineering disciplines** to applications for handling huge volume of data using Pig Latin.	3
	PO 2	Analyze **problem,problem statement** in applications for handling huge volume of data using Pig Latin in **data collection,validation,documentation**.	5
	PO 3	**Conduct investigation of complex problems** for developing virtual machines using **knowledge of process, laboratory skills, understanding knowledge and ability to apply a systems approach** application for handling huge volume of data using Pig Latin.	4
	PO 5	Develop the applications for handling huge volume of data using Pig Latin in **computer software**.	1
	PO 10	Develop the applications with **clarity** for handling huge volume of data using Pig Latin with **reference**.	2
	PO 12	**Keeping current in CSE and advanced engineering concepts** of advanced applications for handling huge volume of data using Pig Latin in **personal continuing,on going,project management**	4
	PSO 1	**Understand, Design and Analyze Computer Programs** used in applications for handling huge volume of data using Pig Latin.	2
	PSO 2	**Focus on improving Network Security and IRS** in developing applications for handling huge volume of data using Pig Latin.	1
	PSO 3	Develop the applications for handling huge volume of data using Pig Latin in **Industry standard tools and collabaration** .	1
CO 5	PO 1	Understand the importance of big data framework HIVE by using **computer science methodologies, mathematical and scientific principles**.	3
	PO 2	Demonstrate the HIVE functions and services for specific problems by including huge volume of **information and data collection, file structure translation, validation and solution development with proper documentation**.	5
	PO 3	Explain the HIVE application process by including **various problems, customer and user needs, with cost effective and creative solutions by managing the design process, knowledge on economic context, management techniques**.	5
	PO 5	Explain the HIVE application process by **computer software**.	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 10	the importance of bigdata framework HIVE and its built-in functions, data types and services like DDL in **clarity** DDLin Hadoop distributed file system in **reference**	2
	PO 12	**keeping trend in CSE** Explain the HIVE application in **personal continuning** and **On going learning** process by **project management**.	4
	PSO 1	Explain the HIVE features and services for analyzing programs in the areas related to **Algorithms, Bigdata, Artificial Intelligence, Machine Learning and Networking**.	4
	PSO 2	Explain the HIVE features and services for analyzing programs in the areas related to **Mobile and web applicatin in emerging technologies** .	3
	PSO 3	Explain the HIVE features and services for analyzing programs in the areas related to **Industry standard tools and collabaration** .	2
CO 6	PO 1	Explain the big data technologies used to process and querying the bigdata by **applying mathematical principles and computer science methodologies**	3
	PO 2	Understand the **problem** and develop solutions using **big data technologies and document the results for interpretation**	4
	PO 3	Identify the appropriate technology like pig, hive etc. suitable for **various problems, by understanding customer and user needs, with cost effective and creative solutions by managing the design process, knowledge on economic context, management techniques**.	4
	PO 5	Identify the appropriate technology like pig, hive etc. suitable for **computer software**	1
	PO 10	Identify the appropriate technology like pig, hive etc in **clarity**. with suitable examples for **Reference**	2
	PO 12	**keeping current in CSE and advanced engineering concepts**Identify the appropriate technology like pig, hive etc in **personal continuing ,on going,project management**.	7
	PSO 1	Explain the big data technologies used to process and querying the bigdata in the areas related to **Algorithms, Bigdata, Artificial Intelligence, Machine Learning and Networking**.	4
	PSO 2	Explain the big data technologies used to process and querying the bigdata in the areas related to**Mobile and web applicatin in emerging technolgies**.	4
	PSO 3	Explain the big data technologies used to process and querying the bigdata in the areas related to **Industry standard tols and collabaration**.	2

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	Program Outcomes/ No. of Key Competencies Matched												PSO'S		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	3	10	10	11	1	5	3	3	12	5	12	8	6	2	3
CO 1	3	4	4	-	1	-	-	-	-	2	-	4	4	2	2
CO 2	3	7	4	-	1	-	-	-	-	2	-	5	4	2	2
CO 3	3	4	4	-	1	-	-	-	-	2	-	4	4	2	2
CO 4	3	4	4	-	1	-	-	-	-	2	-	4	3	1	2
CO 5	3	4	4	-	1	-	-	-	-	2	-	5	4	2	2
CO 6	3	4	4	-	1	-	-	-	-	2	-	4	3	2	2

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	100	40	40	-	100	-	-	-	-	40	-	50	66.6	100	66.6
CO 2	100	70	40	-	100	-	-	-	-	40	-	62.5	66.6	66.6	40
CO 3	100	40	40	-	100	-	-	-	-	40	-	50	66.6	60	60
CO 4	40	40	40	-	100	-	-	-	-	40	-	50	40	60	40
CO 5	100	40	40	-	100	-	-	-	-	40	-	62.5	40	60	40
CO 6	100	40	40	-	100	-	-	-	-	40	-	50	40	60	60

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation
1 -$5 < C \leq 40\%$ – Low/ Slight
2 - $40\% < C < 60\%$ –Moderate
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	-	3	-	-	-	-	2	-	2	3	2	2
CO 2	3	3	2	-	3	-	-	-	-	2	-	3	3	2	2
CO 3	3	2	2	-	3	-	-	-	-	2	-	2	3	2	1
CO 4	3	2	2	-	3	-	-	-	-	2	-	2	2	2	1
CO 5	3	2	2	-	3	-	-	-	-	2	-	3	3	1	1
CO 6	3	2	2	-	3	-	-	-	-	2	-	2	2	3	2

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	Concept Video	✓	Open Ended Experiments	-
Assignments	-				

XVII ASSESSMENT METHODOLOGY-INDIRECT:

X	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE-I	**INTRODUCTION TO BIG DATA**
	Types of Digital Data: Classification of Digital Data, Structured Data, SemiStructured data, Unstructured Data; Introduction To Big Data: Characteristic of Data, Evolution, Big Data and its Importance, Four V's of Big Data, Drivers for Big Data, Introduction to Big Data Analytics, Big Data Analytics applications
MODULE II	**BIG DATA TECHNOLOGIES**
	NoSQL (Not only SQL): Use of NoSQL, Types of NoSQL, Advantages of NoSQL. Use of No SQL in Industry, NoSQL Vendors, SQL versus NoSQL, NewSQL; Hadoop: Features of Hadoop, Version of Hadoop, Hadoop Ecosystems, Hadoop Distributions, Hadoop versus SQL.
MODULE III	**HADOOP**
	Hadoop: RDBMS vsHadoop,Hadoop Overview, Hadoop distributors, HDFS, HDFS Daemons, Anatomy of File Read and Write, working with HDFS commands, special features HDFS. Processing data with Hadoop, managing resources and applications with Hadoop YARN, interacting with Hadoop Ecosystem Pig, Hive, Sqoop, Hbase.
MODULE IV	**UNDERSTANDING MAP REDUCE FUNDAMENTALS**
	Map Reduce Framework: Exploring the features of Map Reduce, Working of Map Reduce, Exploring Map and Reduce Functions, Techniques to optimize Map Reduce jobs, Uses of Map Reduce.Controlling MapReduce Execution with Input Format, Reading Data with custom Record Reader,-Reader, Writer, Combiner, Partitioners, Map Reduce Phases, Developing simple MapReduce Application
MODULE V	**INTRODUCTION TO PIG AND HIVE**
	Introducing Pig: Pig architecture, Benefits, Installing Pig, Properties of Pig, Running Pig, Getting started with Pig Latin, Working with operators in Pig, Working with functions in Pig. Introducing Hive: Getting started with Hive, Hive Services, Data types in Hive, Built-in functions in Hive, Hive DDL.

TEXTBOOKS

1. Seema Acharya, Subhashini Chellappan, —Big Data and Analytics, Wiley Publications, 2nd Edition,2014DT Editorial Services, —Big Data, Dream Tech Press, 2nd Edition, 2015.

2. Tom White, —Hadoop: The Definitive Guide, O'Reilly, 3rd Edition, 2012.

3. Black Book Big Data, dreamtech publications, 1st Edition, 2017

REFERENCE BOOKS:

1. Michael Minelli, Michele Chambers, Ambiga Dhiraj, —Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business, Wiley CIO Series, 1st Edition, 2013.

2. Rajiv Sabherwal, Irma Becerra- Fernandez, —Business Intelligence –Practice, Technologies and Management, John Wiley, 1st Edition, 2011.

3. Arvind Sathi, —Big Data Analytics: Disruptive Technologies for Changing the Game, IBM Corporation, 1st Edition, 2012.

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
	OBE DISCUSSION		
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO-PO Mapping	-	
	CONTENT DELIVERY (THEORY)		
1	Define big data and its importance.	CO 1	T1:2.3
2-3	Describe the elements of big data-volume, variety, velocity and veracity	CO 1	T1:2.1, 2.5
4-5	Understand the life cycle of big data	CO 1	T1:2.4
6-7	Define the importance and challenges of big data.	CO 1,	T1:2.5 – 2.6 R2:21.51
8	Understand Traditional Vs Big Data Business Approach	CO 1	T1:2.9
9-10	Classify the Big data analytics - Classification of Analytics	CO 1	T1:3.1 R2:21.51
11	Importance and challenges facing big data,	CO 2	T1:3.7 -3.8
12-14	Explain the terminologies Used in Big Data Environments	CO 2	T1:3.12 R2:21.55
15	Explain the Big Data Technology Landscape with Hadoop ecosystem.	CO 3	T1:4.1 – 4.2 R2:21.58
16	Understand the core components of Hadoop-big data.	CO 3	T2:26.16 R2:21.61
17-18	Outline Hadoop ecosystem and Computing Challenges, RDBMS versus Hadoop	CO 3,CO 4	T1:5.1 – 5.5 R2:21.24
19	Recall the history and overview of Hadoop	CO 3,CO 4	T1:5.5 R2:21.29

20	Demonstrate the real time use case in Hadoop	CO 4	T1:5.6 – 5.7 R2:21.31
21-22	Explain Hadoop Distributors and processing Data with Hadoop	CO 4,CO 5	T1:5.8 R2:21.33
23	Summarize the other components in Hadoop Interacting in Hadoop Ecosystem	CO 4,CO 6	T1:5.9
24	Explain the Design concepts of HDFS	CO 5	T1:5.11 R2:21.64
25	Find differences between Basic Filesystem Operations and Hadoop Filesystems.	CO 4,CO 6	T1:5.10-5.13 T2:3
26-27	Explain the Java Interface for Reading Data from a Hadoop URL Using the Filesystem API	CO 4,CO 6	T2:3
28-29	Explain Writing Data and Data Flow- Anatomy of a File Read, Anatomy of a File Write, Limitations	CO 4,CO 6	T1:5.10 T2:3
30-31	Explore the features of MapReduce and Map and Reduce Functions	CO 4	T1:8.1-8.3 T2:8
32	Outline the techniques to optimize MapReduce jobs and uses	CO 4,	T2:27.8
33-35	Illustrate the controlling MapReduce Execution with Input Format	CO 4,CO 6	T2:7
36-37	Explain the reading Data with custom Record Reader, -Reader, Writer, Combiner, Practitioners, MapReduce Phases	CO 5	T1:8.2 – 8.3
38	Develop a simple MapReduce Application	CO 6	T1:8.4 – 8.8
39	Explain Pig architecture	CO 5	T1:10.1-10.6
40-41	Summarize Installation process of Pig along with Properties and getting started with Pig Latin,	CO 4,CO 5	T2:11
42	Develop applications by working with operators in Pig, Working with functions in Pig.	CO 6	T1:10.7-10.12
43	Explain the Hive component and Hive Services	CO 4	T1:9.1-9.2 T2:12
44-45	Demonstrate Hive Data types, Built-in functions and Hive DDL.	CO 6	T1:9.3-9.8
PROBLEM SOLVING/ CASE STUDIES			
1	Develop a simple MapReduce Application	CO3	R2:7.5
2	Explain Pig architecture	CO5	T2:3
3	Summarize Installation process of Pig along with Properties and getting started with Pig Latin.	CO5	R2:7.5
4	Develop applications by working with operators in Pig, Working with functions in Pig.	CO 5	R2:7.5
5	Explain the Hive component and Hive Services	CO 2	T1:4.1
6	Demonstrate Hive Data types, Built-in functions and Hive DDL.	CO 2	T3:4.5
7	Features of Hadoop explain in detail	CO 1	R4:5.2
8	Findingthe differences between Hadoop and Big Data	CO 1	T2:5.2
9	Describe Map Reduce Architecture	CO 3	R2:7.5

10	Challenges of Big data and Business analytics .	CO 1	R2:7.5
11	Features of Hadoop vs SQL	CO 2	R2:7.5
12	Describe Job Tracker and Task Tracker	CO 3	R2:7.5
13	Explain PIG, components of PIG and HIVE	CO 4	R2:7.5
14	Explain word count using pig scripting language	CO 6	R2:7.5
15	Difference between Pig Latin and Apache with example	CO 6	R2:7.5
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Big data,Business Analytics,Structured data, semi-structured data,Structured data, Challenges of Big data	CO 1	R4:2.1
2	Hadoop,Hadoop Distributed File System, Features of Hadoop Distributed File System,Key Distinctions of Hadoop, Hadoop Components	CO 2	R4:2.1
3	Streaming Access pattern,File System, Comparing FS and HDFS,Hadoop Cluster, HDFS Architecture,Hadoop vs SQL	CO 3	R4:2.1
4	Definitionof map reduce,Map reduce architecture,Job Tracker,Task tracker, map reduce engine work	CO 4	R4:2.1
5	PIG,HIVEandWord count using pig,Pig components and pig tutorial,pig Latin data language,characteristics of Apache	CO 5	R4:2.1
DISCUSSION OF QUESTION BANK			
1	Module I : Discuss in detail about the following: i) Multivariate analysis performed in big data. ii) Methods of stochastic search.	CO 1,2	R4:2.1
2	Module II : Explain in brief bout the Hadoop's rack topology with the following terms: i) Rack awareness ii) Fault tolerance.	CO 3	T4:7.3
3	Module III : List the features of hadoop which made it popular. Explain any three features in detail	CO 4	R4:5.1
4	Module IV : Discuss some techniques to optimize MapReduce jobs and the points you need to consider while designing a file system in MapReduce.	CO 5,6	T1:7.5
5	Module V: Explain architecture of Apache Hive and various data insertion techniques in Hive with example.	CO 6	T1: 4.1

Signature of Course Coordinator **HOD,IT**

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)

Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**INFORMATION TECHNOLOGY**				
Course Title	**CLOUD COMPUTING**				
Course Code	AITB15				
Program	B.Tech				
Semester	VII				
Course Type	Core				
Regulation	R-18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Ms. G.Lohitha Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSB08	IV	Database Management Systems
B.Tech	AITB04	IV	Operating Systems
B.Tech	AITB10	V	Computer Networks

II COURSE OVERVIEW:

Cloud Computing is a large-scale distributed computing paradigm which has become a driving force for information technology over the past several years. The exponential growth data size in scientific instrumentation/simulation and social media has triggered the wider use of cloud computing services. We will explore solutions and learn design principles for building large network-based systems to support both compute and data intensive computing across geographically distributed infrastructure.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Cloud computing	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	x	Chalk & Talk	x	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	✓	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
20%	Remember
40%	Understand
25%	Apply
15 %	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Quiz	AAT	
CIA Marks	20	05	05	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination
Two Quiz exams shall be online examination consisting of 50 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

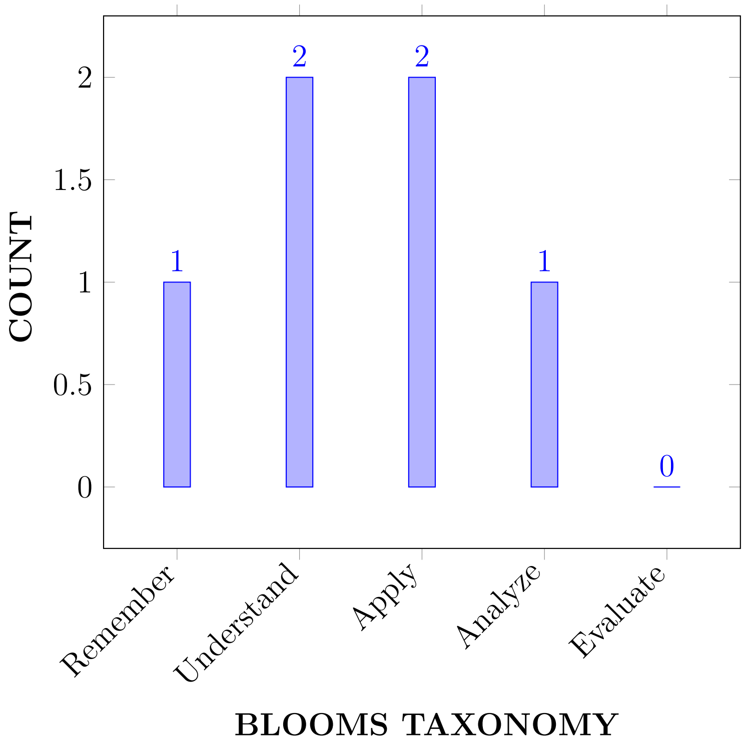
I	The fundamentals of Cloud Computing, the evolution of the paradigm, its applicability, benefits, as well as current and future challenges.
II	The crucial facts and principles in data center design, cloud management techniques and cloud software deployment considerations
III	The different CPU, memory and I/O virtualization techniques that serve in offering software, computation and storage services on the cloud.
IV	The Cloud storage technologies and relevant distributed file systems, databases and object storage
V	The scheduling and fault tolerance concepts in different cloud programming models

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Explain** the concept of cloud computing, its evolution and distributed cloud computing system models for on- demand network access to a shared pool of configurable computing resources over the internet using Multi-core CPUs and Multithreading Technologies to handle diversified tasks in Network based Systems.	Understand
CO 2	**List** the benefits , drawbacks of cloud software environments and the cloud security providers ,their impact for distributed systems that help multiple computers to host different software components for obtaining power requirements of high performance computing (HPC)/ high density applications.	Remember
CO 3	**Outline** the architectural design of various layers in the cloud building blocks for running applications, storing data, files and performing backups of compute the storage clouds differentiating cloud service models which satisfy a unique set of industry requirements	Understand
CO 4	**Distinguish** various threats and techniques used in cloud security reasons for full virtualization and para virtualization Techniques ,classical OS virtual memory and system memory virtualization for accurate access control between cloud providers and their customers used in CPUs toenhance resource sharing and improve computer performance for CPU and I/O devices communication management	Analyze
CO 5	**Identify** the need for policies, mechanisms and techniques of fundamental aspects of parallel and distributed programming models for automation of resources and key scheduling in cloud to implementing Inter-Process Communication in Cloud and Grid platforms	Apply
CO 6	**Compare** Amazon AWS, MS Azure and Google cloud programming models used in programming large clusters of servers to obtain solutions for cloud problems such as storage and design to meet exact needs.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Program Outcomes	
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/SEE/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	1	CIE/SEE/AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	2	CIE/SEE/AAT
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	2	SEE/CIE/AAT
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	1	SEE/ CIE, AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools	3	CIE/AAT
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges	1	Laboratory Practices
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	1	Laboratory Practices

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	-	-	-	-	-	-	-		-	✓	✓
CO 2	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	✓
CO 3	✓	-	✓	-	-	-	-	-	-	-	-	-	✓	-	✓
CO 4	✓	✓	✓	-		-	-	-	-	-	-	-	✓	-	✓
CO 5	✓	-	✓	-	-	-	-	-	-	-	-	-	✓	-	-
CO 6	✓	-	-	-	✓	-	-	-	-	-	-	✓	✓	-	✓

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	**Explain** the concept of cloud computing and discuss their significance, advantages and disadvantages, economic benefits the need for Multi-core CPUs and Multithreading Technologies to handle different problems in Network based **Systems using the knowledge of mathematics, science and engineering fundamentals.**	3
	PSO 2	**Explain** the concept of cloud computing , mobile and web applications and learn the emerging technologyies and frame works.	4
	PSO 3	**Make use of world real software, using industry standard tools** and **collaboration techniques** to handle different problems in Network based Systems	4

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 2	PO 1	Understand the characteristics of cloud software environments the various characteristics for obtaining power requirements of high performance computing (HPC) **using science and engineering fundamentals to host different software components to accomplish a common goal**.	3
	PO 2	**Identify** various cloud security techniques and **review research** literature to calculate their impact in obtaining power requirements in HPC.	4
	PSO 3	**Practical experience of real world software, using industry standard t ools and collaboration techniques** to identify the drawbacks of cloud software environments and their impact for distributed systems	4
CO 3	PO 1	Draw the architecture of compute and storage clouds various layers in the cloud building blocks and differentiate cloud service models for a unique set of industry requirements using the knowledge of **Engineering fundamentals** and obtain solutions for running applications of **complex Engineering problems** to perform backups	3
	PO 3	Discuss concepts behind data center design, management, software deployment considerations and their impact using complex **Engineering problems and design system components.**	4
	PSO 1	**Explain** the architectural design using **next-generation computer systems** for running applications, storing data, files using **knowledge discovery tools.**	3
	PSO 3	**Explain** the architectural design of various layers in the cloud building blocks for running applications in **real world software,using industry standard tools and collaboration techniques** which satisfy a unique set of industry requirements	4
CO 4	PO 1	**Analyze** various security isolations provided for Indicate how system complexity can be managed in terms of levels of abstractions and well-defined interfaces, and different CPU , I/O devices communication management techniques for finding the solution of OS virtual memory by virtualization and utilized by the cloud using **engineering fundamentals and Scientific principles.**	4
	PO 2	Understand the given problem and analyze CPU and I/O devices various threats and techniques used in cloud security for accurate access control between cloud providers and their customers in demand with employers and contemporary challenges.	2

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 3	solutions for complex Engineering problems and identify various threats and techniques used in cloud security hat meet the specified needs with appropriate consideration for the public health and safety, and the cultural,societal, and Environmental considerations .	1
	PSO 1	**Understand** the basics of CPU and I/O devices communication for designing **next-generation computer systems and knowledge discovery tools in implementing virtualization**	4
	PSO 3	Identify conditions for virtualizing CPUs, different virtual machine types such as process and system virtual machines **using industry standard tools and collaboration techniques.**	4
CO 5	PO 1	**Identify** the technique of mapping a set of jobs fundamental aspects of parallel and distributed programming models for implementing Inter-Process Communication in Cloud and Grid platforms to a set of virtual machines by understanding **computer science methodologies and scientific principles.**	3
	PO 3	Understand the given **problem and choose appropriate method** (problem formulation) for allocating VMs to run on the available resources in order to fulfill users' demands.	4
	PSO 1	Understand the given problem and develop the technique of mapping a set of jobs to a set of virtual machines for designing **next-generation computer systems and intelligent systems**	. 3
CO 6	PO 1	**Apply** cloud programming models used large clusters of servers that store many terabytes and petabytes of information by understanding **computer science methodologies and scientific methodologies.**	3
	PO 5	**identify** the Amazon AWS, MS Azure and Google cloud programming models and **modern Engineering and IT tools including prediction and modelling to complex Engineering activitiesto obtain solutions** for cloud problems such as storage and design to meet exact needs.	2
	PO 12	**Compare** different cloud platforms such as Amazon AWS, MS Azure and Google cloud used in programming large clusters of servers through **life-long learning** in the technological change to identify their pros and cons.	4
	PSO 1	**Understand** the given programming model and develop the solutions for cloud problems such as storage and design to meet exact needs for designing **next-generation computer systems and intelligent systems**	3

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO 3	**Identify** conditions for different cloud programming models such as IaaaS, PaaS, SaaS to obtain solution for a given problem **using industry standard tools and collaboration techniques.**	4

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	-	4	4
CO 2	3	4	-	-	-	-	-	-	-	-	-	-	-	-	4
CO 3	3	-	4	-	-	-	-	-	-	-	-	-	3	-	4
CO 4	3	4	1	-	-	-	-	-	-	-	-	-	3	-	4
CO 5	3	-	4	-	-	-	-	-	-	-	-	-	3	-	4
CO 6	3	-	-	-	2	-	-	-	-	-	-	4	3	-	4

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	100.0	-	-	-	-	-	-	-	-	-	-	-	-	40	40
CO 2	66.7	40	-	-	-	-	-	-	-	-	-	-	100	-	40
CO 3	66.7	-	40	-	-	-	-	-	-	-	-	-	-	-	40
CO 4	66.7	40	10	-	-	-	-	-	-	-	-	-	100	-	40
CO 5	66.7	-	40	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	100	-	-	-	100	-	-	-	-	-	-	100	-	-	40

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation
1 -$5 < C \leq 40\%$ – Low/ Slight
2 - $40\ \% < C < 60\%$ –Moderate
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	-	2	2
CO 2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO 3	3	-	2	-	-	-	-	-	-	-	-	-	3	-	2
CO 4	3	2	1	-	-	-	-	-	-	-	-	-	3	-	2
CO 5	3	-	2	-	-	-	-	-	-	-	-	-	3	-	-

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 6	3	-	-	-	2	-	-	-	-	-	-	2	3	-	2
TOTAL	18	4	5	-	2	-	-	-	-	-	-	2	12	2	10
AVERAGE	3.0	2.0	1.6	-	2.0	-	-	-	-	-	-	2.0	3	-	3.3

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	Concept Video	✓	Open Ended Experiments	-
Assignments	-				

XVII ASSESSMENT METHODOLOGY-INDIRECT:

x	Early Semester Feedback	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**SYSTEM MODELING, CLUSTERING AND VIRTUALIZATION**
	Scalable computing over the Internet, Technologies for network-based systems, System models for distributed and cloud computing, Software environments for distributed systems and clouds, Performance, security and energy efficiency.
MODULE II	**VIRTUAL MACHINES AND VIRTUALIZATION OF CLUSTERS AND DATA CENTERS**
	Implementation levels of virtualization, Virtualization tools, structures and mechanisms, Virtualization of CPU, Memory and I/O devices, Virtual clusters and resource management, Virtualization for data center automation
MODULE III	**CLOUD PLATFORM ARCHITECTURE**
	Cloud computing and service models, Architectural design of compute and storage clouds, Public cloud platforms, Inter-cloud resource management. Cloud security and trust management, Service Oriented Architecture (SOA), Message-oriented middleware architecture.
MODULE IV	**CLOUD PROGRAMMING AND SOFTWARE ENVIRONMENTS**
	Features of Cloud and grid platforms, Parallel and distributed programming paradigms, Programming support of Google App Engine, Programming on Amazon AWS and MS Azure, Emerging cloud software environments.
MODULE V	**CLOUD RESOURCE MANAGEMENT AND SCHEDULING**
	Policies and mechanisms for resource management applications of control theory to task scheduling in a cloud, Stability of a two-level resource allocation architecture, Feedback controls based on dynamic thresholds, Coordination of specialized autonomic performance managers, Resource Bundling

TEXTBOOKS

1. Cloud computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M.Goscinski, wiley,2011

2. Distributed and Cloud Computing, Kai Hwang, Geofferyu C.Fox, Jack J.dongarra, Elsevier, 2012
3. Cloud Computing, Theory and Practice, Dan Marinescu, Elsevier.
4. Cloud Computing, A Hands-On Approach, Arshadeep Bagra and Vijay Madisetti, University Press

REFERENCE BOOKS:

1. Cloud Computing: A practical approach, Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, Tata McGrawHill,2011
2. Enterprise Cloud Computing, Gautam Shroff, Cambridge University press,2010
3. Cloud Computing: Implementation, Management and Security, John W. Ritting house, James F. Ransom, CRC press, rp2012
4. Cloud Applications Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O Reilly, SPD, rp2011

WEB REFERENCES:

1. http://searchcloudcomputing.techtarget.com/definition/cloud-computing.
2. http://in.pcmag.com/networking-communications software/38970/feature/what is cloud computing

COURSE WEB PAGE:

https://akanksha.iare.ac.in/

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO - PO Mapping	-	-
CONTENT DELIVERY (THEORY)			
1-2	Explain the core concepts of the cloud computing paradigm how and why this paradigm shift came.	CO1	T1: 1.1, 1.2
3-4	What are the characteristics, advantages and challenges brought about by the various models and services in cloud computing.	CO1	T1: 1.2
5-6	Economic benefits as well as issues/risks of the cloud paradigm for businesses as well as cloud providers.	CO1	T1: 1.2
7-8	List some of the common cloud providers and their associated cloud stacks and recall popular cloud use case scenarios	CO2	T1: 1.3
9-10	Describe the evolution of data centers and outline the architecture of a modern data center.	CO2	T1: 3.6
11-12	Recall challenges and requirements for a cloud-centric data center and how they differ from large, single-entity warehouse-scale computers	CO3	T1: 1.1

13-14	Identify the need for and techniques behind automation and orchestration of resources	CO3	T1: 1.1, T1: 3.8
14-15	What are the key scheduling considerations in the cloud?	CO3	T1: 4.2,4.3
16-17	Understand the implications of building a multi-tier cloud application to achieve resiliency and elasticity	C04	T1: 4.2,4.3 T2:26.10
18-19	What are the and the latency implications of multi-tier cloud Application	CO4	T1: 4.4
20-21	Describe and evaluate different cloud software deployment considerations such as scaling strategies, load balancing, fault tolerance, accounting for tail latencies and optimizing for cost.	CO4	T1: 4.7
22-23	Define virtualization and identify different virtual machine types such as process and system virtual machines	CO4	T1: 4.9
24-25	Identify conditions for virtualizing CPUs, recognize the difference between full virtualization and paravirtualization	CO4	T1: 4.9
26-27	Explain emulation as a major technique for CPU virtualization, and examine virtual CPU scheduling in Xen	CO4	T1: 5.1,5.4
28-29	Outline the difference between classical OS virtual memory and system memory virtualization	CO4	T1: 5
30-31	explain the multiple levels of page mapping as imposed by memory virtualization, define memory over-commitment	CO4	T1: 5.1
32-33	Illustrate VMWare memory ballooning as a reclamation technique for memory over-committed virtualized systems	CO4	T1: 6.1,6.4,6.5
34-35	Explain how CPU and I/O devices can communicate with and without virtualization	CO5	T1: 6.1
36-40	identify the three main interfaces, system call, device driver and operation level at which I/O virtualization can be carried, and apply I/O virtualization to Xen.	CO5	T1: 6.1
41-43	Outline recent developments in software defined networking and software defined storage from the cloud computing perspective	CO5	T1: 6.9, 6.10, 6.11
44-46	Compare and contrast different types of file systems and discuss their design considerations.	CO5	T1: 6.13
47-49	Compare and contrast Hadoop Distributed File System (HDFS) with Ceph File System (CephFS).	CO5	T1: 6.14
50-53	Illustrate the fundamental concepts of cloud storage	CO 6	T1: 9
54-57	Demonstrate their use in storage systems such as Amazon S3 and HDFS.	CO6	T1: 9.5
58-60	Analyze various cloud programming models and apply them to solve problems on the cloud.	CO6	T1: 9.6
PROBLEM SOLVING/ CASE STUDIES			
1	Cloud computing delivery models with security and the reliability of each model.Peer-to-peer systems and clouds the in terms of architecture,resource management, scope, and security	CO 1, CO 2	T1:3.6

2	Is cloud elasticity based on over provisioning sustainable? Give arguments to support.Debating whether to install a private cloud or to use a public cloud (e.g., the AWS) for its computational and storage needs for an organization.	CO 1, CO 2	T1:3.6
3	Mobile devices could benefit from cloud computing; explain the reasons.	CO 1, CO 2	T1:3.6
4	Tips for managing multi-cloud environment with real time example.Deploying a multi-tenant application across multiple cloudplatforms.	CO 2, CO 6	T1:4.3
5	Usage of apache zookeeper to build distributed apps and describe how Zookeeper works.Case study on Hadoop distributed file system used in cloudComputing.Solving redundancy problems using different architecturalstyles	CO 2, CO 6	T1:4.3
6	Create a Map Reduce Application model by using data intensive model.Compare the latest Top 500 list with the Top 500 Green Listof HPC systems based on publicly reported data.	CO 2, CO 6	T1:4.3
7	Discuss Virtualization Middleware for Scientific Cloud Computing in Open Source Offerings.Identify a hybrid cloud allows a company to maintain critical, confidential data and money on the new resources.Design a large-scale virtual cluster system	CO 3	T1:4.9, R2:4.7
8	VMs practically share all resources of the virtual infrastructure including virtual switch. Using Virtualization analyze memory virtualization, processor virtualization, and virtualization of a communication channel. Analyze the results of the performance comparison by using virtual machines.	CO 3	T1:4.9, R2:4.7
9	Virtualization of the processor combined with virtual Memory management poses multiple challenges.Describe the approaches used to exchange data among thedomains of Xen and design experiments to compare the performance of data communication between the domains.	CO 3	T1:4.9, R2:4.7
10	Implementation of resource management policies: control theory, machine learning, utility-based, and market-oriented.Optimal strategies for one could be in conflict with optimal strategies for one or more of the other classes	CO 4	T1:6.1, R1:6.14
11	Relationship between the scale of a system and the policies and the mechanisms for resource management.Workflow of cloud application use XML to describe this workflow, including the instances and the storage requiredfor each task.	CO 4	T1:6.1, R1:6.14
12	Set up Hadoop-YARN cluster with ports to start each worker.Itanium architecture , and identify several possible reasons.	CO 4	T1:6.1, R1:6.14
13	Identify the main security threats for the SaaS cloud delivery model on a Public cloud.Analyze Amazon's privacy policies and design a service-level agreement.Cloud service to analyze images and sign them before beinglisted and made available to the general public.	CO 5	T1:9.1, R1:9.9

14	Analyze the implications of the two-level security model of commodity operating systems.Virtualization security on public, private, and hybrid clouds.Security risk posed by XenStore?	CO 5	T1:9.1, R1:9.9
15	Six attack surfaces are illustrated cloud delivery models. Impact of international agreements regarding privacy laws on cloud computing.Security and functionality in a hypervisor" and discuss theperformance of the system.Virtual machine security and its application with an realtime example by considering any one cloud service provider.	CO 5	T1:9.1, R1:9.9
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Definition, characteristics, benefits, challenges of cloud computing, cloud models, deployment models, types of cloud computing, cloud service provider, applications of cloud computing.	CO 1, CO 6	T1:3.6
2	Cloud architecture, architectural styles, programming models.	CO 2, CO 6	T1:4.3
3	Basics of virtualization, types of virtualization techniques, merits and demerits of virtualization, virtual machine basics, taxonomy of virtual machines, process vs system virtual machines.	CO 3	T1:4.9, R1:4.7
4	Policies and mechanisms for resource management, resource bundling, combinatorial , fair queuing, start time fair queuing, borrowed virtual time.	CO 4	T1:6.1, R1:6.14
5	Multi-tenancy issues, security in VM, OS, virtualization system security issues and vulnerabilities, technologies for virtualization.	CO 5	T1:9.1, R1:9.9
DISCUSSION OF QUESTION BANK			
1	Discussion of Question on Challenges of cloud computing ,Cloud services and Applications of cloud computing	CO 1, CO 6	R4:2.1
2	Discussion of Question on Cloud Architecture and programming model	CO 2, CO 6	T4:7.3
3	Discussion of Question on Cloud resource virtualization	CO 3	R4:5.1
4	Discussion of Question on Cloud Resource Management and Scheduling	CO 4	T1:7.5
5	Discussion of Question on Cloud Security	CO 5	T1: 4.1

Signature of Course Coordinator **HOD,IT**

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**INFORMATION TECHNOLOGY**				
Course Title	**ADVANCED DATABASES**				
Course Code	ACSB26				
Program	B.TECH				
Semester	VII				
Course Type	ELECTIVE				
Regulation	R-18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Mr. Rajesh Kumar Bhavani, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACS005	III	Database Management Systems

II COURSE OVERVIEW:

This course provides theoretical knowledge and practical skills in advanced topics in database systems, big data and modern data-intensive systems. The specific topics include indexing methods, query processing and optimization strategies for relational database systems, Object Relational Mapping and Object Database design, distributed database systems, spatial access and uncertainty in databases.It provides tools and techniques to implement and administer complex database systems including backup and recovery.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Advanced Databases	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
20%	Remember
20 %	Understand
40 %	Apply
20 %	Analyze
0 %	Evaluate

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Quiz	AAT	
CIA Marks	20	05	05	30

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination

Two Quiz exams shall be online examination consisting of 50 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

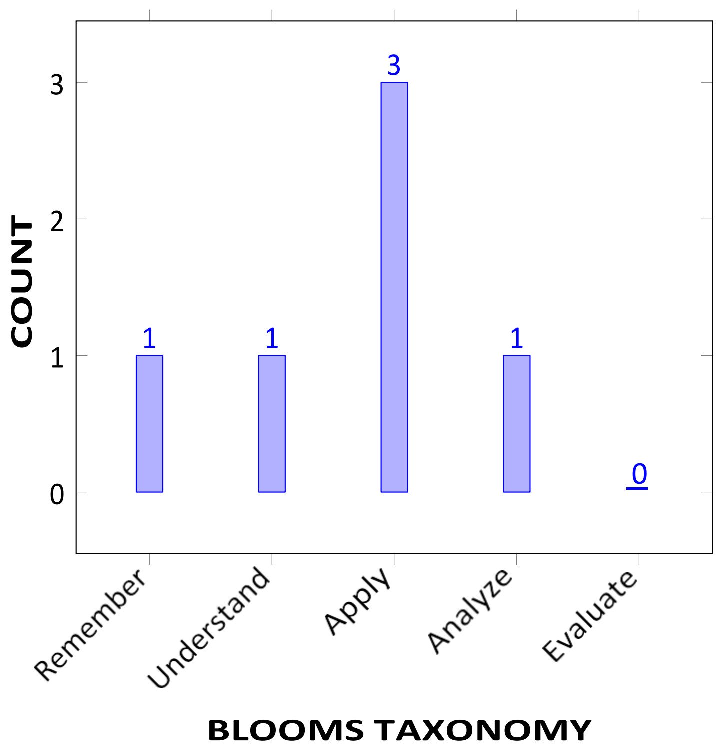
I	Query languages to support temporal and object databases.
II	Internals of database management system.
III	Data processing paradigms.
IV	Research and usage of emerging technologies for solving existing database problems.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Compare** different database techniques to defining the concept of Time domain and associating facts with time for representing queries for constructing a database	Understand
CO 2	**Model** the real world database systems for open problems from the requirement specification for optimal real world databases.	Apply
CO 3	**Implement** queries in transact-SQL and recursive queries using query optimization techniques for retrieving desired information from hierarchical data	Remember
CO 4	**Describe** spatial data access methods to apply different data processing techniques for satisfying the exact need of the user for effective data retrieval	Apply
CO 5	**Compare** different lattice based and probabilistic based approaches for efficient relational databases	Apply
CO 6	**Analyze** a full real size database system for an industry or business scenario	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	2	CIE/Quiz/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	CIE/Quiz/AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	8	CIE/Quiz/AAT
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	8	Assignments/ SEE /CIE, AAT, QUIZ
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	4	SEE/ CIE, AAT, QUIZ

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	2	Quiz
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry	2	Quiz

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	-	-	-	-	-	-	-		-	✓	-
CO 2	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	✓	✓	-	-		-	-	-	-	-	-		✓	✓	-
CO 5	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	✓	✓	-	-		-	-	-	-	-	-	-	-	-	

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Compare different database techniques for constructing a database **using the knowledge of mathematics, science, and engineering fundamentals.**	3
	PO 4	**Demonstrate open problems on active databases** by applying Workshop and laboratory skills, through understanding of contexts, in which engineering knowledge can be applied, by understanding of appropriate codes of practice and industry standards and by understanding of and ability to apply a systems approach to engineering problems.	4
CO 2	PO 1	Model the real world database systems by discussing open problems from the requirement specification using the **knowledge of mathematics, science, and engineering fundamentals.**	3
	PO 2	Model active databases and its various applications,with the **Problem statement , system definition, Problem formulation , abstraction , Information , data collection and model translation.**	4
	PO 3	Identify a real world scenario **to Investigate and define a problem and identify constraints, Manage the design process and evaluate outcomes**	2
	PO 12	Identify open issues related to various databases by **working on advanced degree , keeping current in CSE and advanced engineering concepts ,personal continuing education efforts and by ongoing learning - stays up with industry trends/ new technology**	4
	PSO 2	Identify open issues related to various databases by **keeping focus emerging technologies and frameworks in demand with employers and contemporary challenges.**	2

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO 3	Identify open issues related to various databases by **by making use of computational and experimental tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.**	2
CO 3	PO 1	Describe concept of time domain and associating facts with time **using principles of mathematics, science, and engineering fundamentals.**	3
CO 4	PO 1	Build queries in transact-SQL the using **knowledge ofmathematics , science and engineering fundamentals.**	3
	PO 2	Build queries in different databases with the **Problem statement and system definition, Problem formulation, abstraction, Information and data collection**	3
	PO 3	Apply temporal query language support for TSQL2 by **investigating and defining a problem, identifying constraints, managing the design process and evaluating the outcomes**	3
	PO 4	Identify different levels of queries by applying Workshop and laboratory skills, through understanding of contexts, in which engineering knowledge can be applied, by understanding of appropriate codes of practice and industry standards and by understanding of and ability to apply a systems approach to engineering problems	4
	PO 12	Choose query optimization techniques by working on advanced degree , keeping current in CSE and **advanced engineering concepts ,personal continuing education efforts and by ongoing learning – stays up with industry trends/ new technology**	4
	PSO 2	Apply query languages by keeping focus e **emerging technologies and frameworks in demand with employers and contemporary challenges.**	4
CO 5	PO 1	Apply hierarchical data concept **with knowledge of mathematics, science and Engineering Fundamentals.**	3
	PO 2	Use recursive queries in SQL with respect to the **Problem statement and system definition**	1
CO 6	PO 2	Identify query optimization technique with respect to the **Problem statement, system definition, Problem formulation, abstraction , Information, data collection and model translation**	4
	PO 3	Analyze optimization process by **identifying constraints, manage the design process and evaluate outcomes**	2
	PO 4	Examine different levels of queries by **understanding contexts in which engineering knowledge can be applied**	1

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	-	-		-	2	-
CO 2	3	5	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	5	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	3	5	-	-		-	-	-	-	-	-		2	2	-
CO 5	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	3	4	-	-	-	-	-	-	-	-	-		-	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	100	-	-	-	-	-	-	-	-	-	-		-	100	-
CO 2	100	50	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	100	50	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	100	50	-	-		-	-	-	-	-	-		100	100	-
CO 5	100	40	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	100	40	-	-		-	-	-	-	-	-		-	-	-

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - 0 ≤ C≤ 5% – No correlation

1 -5 <C≤ 40% – Low/ Slight

2 - 40 % <C < 60% –Moderate

3 - 60% ≤ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	-	3	
CO 2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	3	2	-	-	-	-	-	-	-	-	-	-	3	3	-
CO 5	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	28	16	2	4	-	-	-	-	-	-	-	-	3	9	6
AVERAGE	2.9	1.6	2	2	-	-	-	-	-	-	-	-	3	3	3

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Tech Talk	✓	Concept Video	✓	Open Ended Experiments	-
Assignments					

XVII ASSESSMENT METHODOLOGY-INDIRECT:

	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**ACTIVE DATABASES**
	Syntax and Semantics (Starburst, Oracle, DB2): Taxonomy, applications, integrity management, workflow management, business rules, design principles, properties, rule modularization, rule debugging, IDEA methodology, open problems.
MODULE II	**TEMPORAL AND OBJECT DATABASES**
	Overview: Time domain, data types, associating facts with time, temporal query language; Transact - SQL (T-SQL): Time ontology, data model, language constructs; Implementation: System architecture,temporal support, support for TSQL2.
MODULE III	**COMPLEX QUERIES AND REASONING**
	Logic of Query Languages: Relational calculi, relational algebra, recursive rules, syntax and semantics of data log, fix point semantics. Implementation Rules and Recursion: Rule rewriting methods, compilation and optimization, recursive queries in SQL, open issues.
MODULE IV	**SPATIAL, TEXT AND MULTIMEDIA DATABASE**
	Traditional Indexing Methods: Secondary keys, spatial access methods, text retrieval; Multimedia indexing: 1D time series, 2D color images, sub pattern matching.
MODULE V	**UNCERTAINTY IN DATABASES AND KNOWLEDGE BASES**
	Introduction: Uncertainty in image database, uncertainty in temporal database, uncertainty in null value;Models of uncertainty; Uncertainty in relational databases: Lattice based relational databases, probabilistic relational databases

TEXTBOOKS

1. Carlo Zaniolo, Stefano Ceri, -Advanced Database Systems , Morgan Kauffmann Publishers,VLDB Journal, 1st Edition, 1997

2. Abraham Silberschatz, Henry F. Korth and S.Sudarshan, -Database System Concepts, Tata McGraw-Hill, 6thEdition, 2010

REFERENCE BOOKS:

1. Raghu Ramakrishnan, Database Management System , McGraw-Hill Publications, 3rd Edition, 2000

2. Silberschatz A, Database Systems Concepts McGraw-Hill Publications, 6 th Edition, 2000

WEB REFERENCES:

1. https://nptel.ac.in/courses/112105171/1

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
OBE DISCUSSION			
1	Outcome based eductaion, course outcomes, course objectives		
CONTENT DELIVERY (THEORY)			
2	Syntax and Semantics Starburst, Syntax and Semantics Starburst	CO 1	T2: 1.1-1.3, T1: 4.1
3-4	Syntax and Semantics DB2, Taxonomy.	CO 1	T2: 1.4,1.5, R1: 3.1
5-6	Applications ,integrity management, Workflow management	CO 1	T2: 1.8, T2: 1.8.1
7-8	Business rules, Design principles, properties	CO 1	T2: 1.10, T1: 2.1
9-10	Rule modularization, rule debugging, IDEA methodology	CO 1	T2: 2.2, T1: 2.4
11-12	Open problems, Overview: temporal and object databases	CO 2	T1: 3.2, T1: 19.1, 19.1.3
13-14	Time domain, data types	CO 3	T1: 3.5
15-16	Associating facts with time, temporal query language, Overview :Transact-SQL (T-SQL)	CO3, CO4	T1: 3.7, T1: 4.1
17-18	Time ontology, data model, language constructs, Implementation: System architecture, temporal support, support for TSQL2	CO 04	T1: 4.2.2 - 4.2.5, T1:4.3, 4.4
19-21	Logic of Query Languages, Relational calculi, relational algebra, recursive rules,	CO5	T1: 19.1, T1:19.1.3
22-25	Syntax and semantics of data log, fix point semantics.	CO 5	T1: 19.4
26-29	Implementation Rules and Recursion	CO 5	T1:19.4, 19.5
30-33	Compilation and optimization, recursive queries in SQL	CO 6	T1: 19.7, 19.8.1
34-37	Open issues, Traditional Indexing Methods, Secondary keys, spatial access methods	CO 4	T1: 19.8.2, T2: 15.1-15.3

38-39	Text retrieval, Multimedia indexing, 1D time series, 2D color images, sub pattern matching	CO 5	T2: 15.4 - 15.6, 16.1-16.4
40-42	Uncertainty in image database, uncertainty in temporal database, Uncertainty in null value, Models of uncertainty	CO 6	T2: 17.1-17.6
43-45	Uncertainty in relational databases, Lattice based relational databases, Probabilistic relational databases	CO 5, CO6	T2: 17.7, 17.8, T1: 8.1,8.3.1
PROBLEM SOLVING/ CASE STUDIES			
1	Syntax and Semantics (Starburst, Oracle, DB2): Taxonomy, applications, integrity management, workflow management, business rules, design principles, properties, rule modularization, rule debugging, IDEA methodology, open problems.	CO 1	R4:2.1
2	Overview: Time domain, data types, associating facts with time, temporal query language; Transact - SQL (T-SQL): Time ontology, data model, language constructs; Implementation: System architecture,temporal support, support for TSQL2.	CO 2	R:8.1
3	Logic of Query Languages: Relational calculi, relational algebra, recursive rules, syntax and semantics of data log, fix point semantics. Implementation Rules and Recursion: Rule rewriting methods, compilation and optimization, recursive queries in SQL, open issues.	CO3, CO4	R:9.4
4	Traditional Indexing Methods: Secondary keys, spatial access methods, text retrieval; Multimedia indexing: 1D time series, 2D color images, sub pattern matching.	CO5	R:11.6
5	Introduction: Uncertainty in image database, uncertainty in temporal database, uncertainty in null value;Models of uncertainty; Uncertainty in relational databases: Lattice based relational databases, probabilistic relational databases	CO6	R: 13.6
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Syntax and Semantics (Starburst, Oracle, DB2): Taxonomy, applications, integrity management, workflow management, business rules, design principles, properties, rule modularization, rule debugging, IDEA methodology, open problems.	CO 1	R4:2.1
2	Overview: Time domain, data types, associating facts with time, temporal query language; Transact - SQL (T-SQL): Time ontology, data model, language constructs; Implementation: System architecture,temporal support, support for TSQL2.	CO 2	R:8.1
3	Logic of Query Languages: Relational calculi, relational algebra, recursive rules, syntax and semantics of data log, fix point semantics. Implementation Rules and Recursion: Rule rewriting methods, compilation and optimization, recursive queries in SQL, open issues.	CO3, CO4	R:9.4
4	Traditional Indexing Methods: Secondary keys, spatial access methods, text retrieval; Multimedia indexing: 1D time series, 2D color images, sub pattern matching.	CO5	R:11.6

5	Introduction: Uncertainty in image database, uncertainty in temporal database, uncertainty in null value;Models of uncertainty; Uncertainty in relational databases: Lattice based relational databases, probabilistic relational databases	CO6	R: 13.6
DISCUSSION OF QUESTION BANK			
1	Syntax and Semantics (Starburst, Oracle, DB2): Taxonomy, applications, integrity management, workflow management, business rules, design principles, properties, rule modularization, rule debugging, IDEA methodology, open problems.	CO 1	R4:2.1
2	Overview: Time domain, data types, associating facts with time, temporal query language; Transact - SQL (T-SQL): Time ontology, data model, language constructs; Implementation: System architecture,temporal support, support for TSQL2.	CO 2	R:8.1
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4	Traditional Indexing Methods: Secondary keys, spatial access methods, text retrieval; Multimedia indexing: 1D time series, 2D color images, sub pattern matching.	CO5	R:11.6
5	Introduction: Uncertainty in image database, uncertainty in temporal database, uncertainty in null value;Models of uncertainty; Uncertainty in relational databases: Lattice based relational databases, probabilistic relational databases	CO6	R: 13.6

Course Coordinator **HOD IT**
Mr. Rajesh Kumar Bhavani, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043
COURSE DESCRIPTION

Department	**INFORMATION TECHNOLOGY**				
Course Title	**SOFTWARE ENGINEERING**				
Course Code	AITB26				
Program	B.Tech				
Semester	VI	CSE			
Course Type	Core				
Regulation	IARE - R18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Ms. A. Rajitha, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	-	-	Basic knowledge of computer Hardware and Software

II COURSE OVERVIEW:

This course concentrates on developing basic understanding about various activities that are involved in a software development. This course enables the student to develop necessary skills for developing a product or applications. The course focuses on all activities involved in software development (communication, planning, modeling, construction, deployment).In this course; students will gain a broad understanding of the discipline of software engineering and its application to the development and management of software systems. Student can implement and get knowledge about development of the software and gains knowledge of basic engineering methods and practices, and their appropriate application.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
SOFTWARE ENGINEERING	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	PPT	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

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The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
33.30%	Remember
50%	Understand
16.66%	Apply
0 %	Analyze

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Quiz	AAT	
CIA Marks	20	05	05	30

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination

Two Quiz exams shall be online examination consisting of 50 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

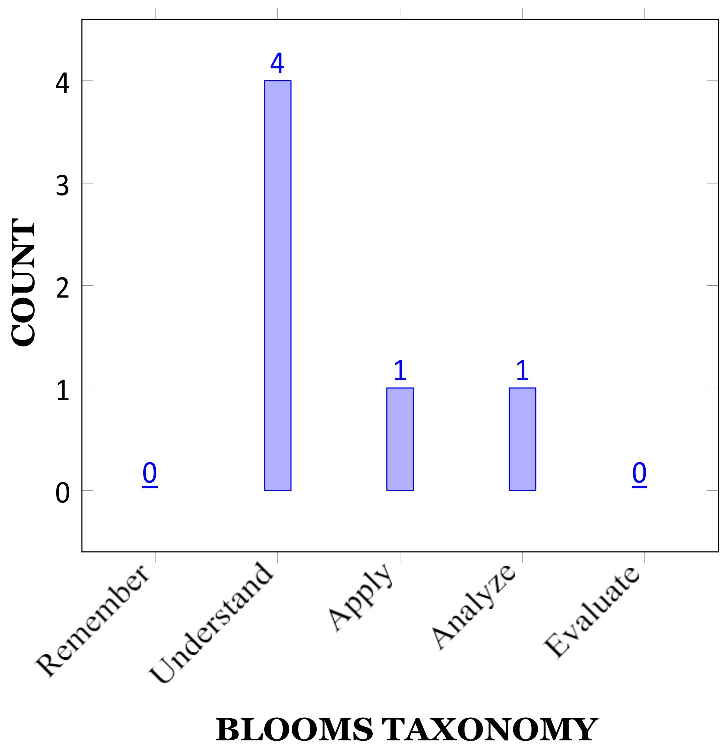
I	Learn how to elicitate requirements and develop software life cycles.
II	Understand the design considerations for enterprise integration and deployment.
III	Analyze quality assurance techniques and testing methodologies.
IV	Prepare a project plan for a software project that includes estimates of size and effort, a schedule, resource allocation, configuration control, and project risk.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Describe** process models, approaches and techniques for managing a software development process.	Understand
CO 2	**Recognize** the importance project planning activities that accurately help in selection and initiation of individual projects and of portfolios of projects in the enterprise.	Understand
CO 3	**Explain** software model and behavior of a software system.	Understand
CO 4	**Develop** the approaches to verification and validation including static analysis and reviews.	Apply
CO 5	**Demonstrate** the concept of risk management through risk identification, risk measurement and mitigation.	Understand
CO 6	**Make use of** earned value analysis and project metric for scheduling and improving the quality of software.	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 10	**Project management and finance:**Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	2	CIE/Quiz/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	CIE/Quiz/AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	3	CIE/Quiz/AAT
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	3	CIE / Quiz / AAT
PO 5	Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations	3	CIE / Quiz / AAT
PO 10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2	CIE / Quiz / AAT
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	3	CIE / Quiz / AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	3	CIE / Quiz / AAT
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	2	CIE / Quiz / AAT
PSO 3	Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry.	2	CIE / Quiz / AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	✓	-	-	-	-	-	-	-	-	-	-	-	✓	-	-
CO 3	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	✓	✓	✓	-	-	-	-	-	-	✓	-		✓	-	-
CO 5	✓	✓	✓	-	-	-	-	-	-	✓	-	-	✓	-	-
CO 6	✓	✓	-	-	-	-	-	-	-	✓	-	-	-	-	-

XII JUSTIFICATIONS FOR CO – (PO, PSO) MAPPING -DIRECT:

COURSE OUTCOMES	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 1	Explain the evolution of software and its characteristics and challenges **by applying computer science methodologies**	1
CO 2	PO 1	Compare process models, approaches and techniques to manage a given software development process by using the **mathematical principles and computer science methodologies.**	3
	PSO 1	Understand the differences between analysis and analytics in the areas related to **Algorithms, Bigdata, Artificial Intelligence, Machine Learning and Networking.**	4

CO 3	PO 1	Understand the concept of Earned Value Analysis (EVA) to measure the projects progress at any given point in time by applying **mathematical principles and computer science methodologies**	2

	PO 2	Understand the key issues in **problems identification and formulation, data collection, model translation, validation, interpretation of results and documentatio**n in optimizing business decisions.	6
	PO 3	Classify the key issues in terms of **defining various problems, customer and user needs, cost effective and creative solutions, design process, economic context and management techniques.**	7
CO 4	PO 1	Explain the concept of data dictionary process and querying the software by applying **mathematical principles and computer science methodologies**	2
	PO 2	Understand the **problem and develop solutions using different data technologies and document the results for interpretation**	4
	PO 3	Identify the appropriate technology like black box testing and white box testing. suitable for various problems, by understanding **customer and user needs, with cost effective and creative solutions by managing the design process, knowledge on economic context, management techniques.**	7
	PO 10	Communicate effectively in orally and written by comprehend and write effective **reports and design documentation with the**	5
	PO 12	Recognize the need for **advanced concepts** testing technologies for developing applications through **continuing education efforts with ongoing learning** – stays up with industry trends/ new technology and continued personal development in the broadest context of technological change.	5
	PSO 1	Explain the technologies used to process and querying the data in the areas related to **Algorithms, Bigdata, Artificial Intelligence, Machine Learning and Networking.**	4
CO 5	PO 1	Select appropriate process modelcomponent for finding model the structure and behavior of a software system. using **computer science methodologies**.	1
	PO 2	Make use of Hadoop components on huge volume of **information and data collected from various sources and perform model translation and validation**	3
	PO 4	Make use of Hadoop components for developing applications based on **technical literature and quality issues. Identify, classify and describe the performance of systems through analytical methods and techniques.**	3

	PO 10	Communicate in written and orally by comprehending and writing effective reports and design documentation and presentations on Hadoop components for developing applications with the engineering community by having major focus on clarity on content, **Grammar/Punctuation with appropriate References, good Speaking style and depth in subject matter.**	5
	PSO 1	Make use of Hadoop components on huge volume data used to develop analytical solutions related to **Bigdata, Artificial Intelligence, Machine Learning and Networking.**	4
CO 6	PO 1	Translate the data from traditional file system to HDFS for analyzing big data in Hadoop ecosystem using the **mathematical principles and computer science methodologies**	2
	PO 2	Translation of data structure from traditional to HDFS includes volume of **information and data, file structure translation methods, validation and solution development with proper documentation.**	6
	PO 10	Communicate in written form by comprehending and writing effective reports and design documentation on HDFS file system applications with the engineering community by having major focus on clarity on content, **Grammar/Punctuation with appropriate References, good Speaking style and depth in subject matter.**	5

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – (PO, PSO) MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	2	-	-	-	-	-	-	-	-	-	-	-	4	-	-
CO 2	6	7	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	2	4	7	-	1	-	-	-	-	-	5	-	-	4	-
CO 5	1	3	3	-	-	-	-	-	-	5	-	-	-	-	-
CO 6	2	6	-	-	-	-	-	-	-	3	-		-	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – (PO, PSO):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	33.3	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	66.7	-	-	-	-	-	-	-	-	-	-	-	66.7	-	-

CO 3	66.7	60.0	70.0	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	66.7	40.0	70.0	-	-	-	-	-	-	100	-	60.0	66.7	-	-
CO 5	33.3	30.0	30.0	-	-	-	-	-	-	100	-	-	-	-	-
CO 6	66.7	60.0	-	-	-	-	-	-	-	60.0	-		66.7	-	-

XV COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - 0≤ C≤ 5% – No correlation

2 - 40 % <C < 60% –Moderate

1-5 <C≤ 40% – Low/ Slight

3 - 60% ≤ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	-	-	-	-	-	-	-	-	-	-		-	-	-
CO 2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	3	2	3	-	-	-	-	-	-	3	-		-	-	-
CO 5	1	1	1	-	-	-	-	-	-	3	-	-	-	-	-
CO 6	3	3	-	-	-	-	-	-	-	3	-		-	-	-
TOTAL	23	18	16	11	9	-	-	-	-	3	-	-	1.5	1.5	1.5
AVER-AGE	2.5	2.5	2.6	2.7	3.0	-	-	-	-	2.6	-	3	3..0	2.5	3.0

XVI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	PO 1,PO 2, PO 3, PO 4	SEE Exams	PO 1,PO 2, PO 3, PO 4	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	PO 4	Open Ended Experiments	-
Assignments	PO 1, PO 2, PO 3, PO 4				

XVII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE I	**SOFTWARE PROCESS AND PROJECT MANAGEMENT**
	Software process and project management: Introduction to software engineering, software process, perspective and specialized process models; Software project management: Estimation: LOC and FP based estimation, COCOMO model; Project scheduling: Scheduling, earned value analysis, risk management.
MODULE II	**REQUIREMENT ANALYSIS AND SPECIFICATION**
	Requirement Analysis and Specification: Software requirements: Functional and nonfunctional, user requirements, system requirements, software requirements document; Requirement engineering process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management; Classical analysis: Structured system analysis, petri nets, data dictionary.
MODULE III	**SOFTWARE DESIGN**
	Software Design: Design process: Design concepts, design model, design heuristic, architectural design, architectural styles, accessing alternative architectural designs, and architectural mapping using data flow. User interface design: Interface analysis, interface design; Component level design: Designing class based components, traditional components.
MODULE IV	**TESTING AND IMPLEMENTATION**
	Testing and Implementation : Software testing fundamentals: Internal and external views of testing, white box testing, basis path testing, control structure testing, black box testing, regression testing, unit testing, integration testing, validation testing, system testing and debugging; Software implementation techniques: Coding practices, refactoring.
MODULE V	**PROJECT MANAGEMENT**
	Project Management: Estimation: FP based, LOC based, make/buy decision; COCOMO II: Planning, project plan, planning process, RFP risk management, identification, projection; RMMM: Scheduling and tracking, relationship between people and effort, task set and network, scheduling; EVA: Process and project metrics.

TEXTBOOKS

1. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", McGraw-Hill International Edition, 7th Edition, 2010.

2. Ian Somerville, "Software Engineering", Pearson Education Asia, 9th Edition, 2011.

REFERENCE BOOKS:

1. Rajib Mall, "Fundamentals of Software Engineering", PHI Learning Private Limited, 3rd Edition, 2009.

2. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 1st Edition, 2010.

WEB REFERENCES:

1. https://nptel.ac.in/courses/112105171/1

COURSE WEB PAGE:

1. lms.iare.ac.in

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Institutions adopting OBE try to bring changes to the curriculum by dynamically adapting to the requirements of the different stakeholders like Students, Parents, Industry Personnel and Recruiters. OBE is all about feedback and outcomes. In this we will discuss about the course outcomes and program outcomes and their attainment		
CONTENT DELIVERY (THEORY)			
1-2	Introduction to Software Engineering	CO1	T2: 1.1-1.3
2-5	Software processes	CO2	T1: 2.2-2.3
6-9	Process models	CO4	T1: 2.1,2-3-2.6
11-12	Software Project Management	CO3	R2: 3.4-3.9
11-12	LOC and FP based estimation COCOMO model	CO5	R2: 4.1-4.3
12-13	Project Scheduling, EVA	CO5	T1: 27.1
14	Risk management	CO5	T1: 28.1
15-17	Software Requirements	CO4	T2: 4.1-4.3
18-19	Requirements Engineering process	CO6, 5	T1: 4.4-4.7
20-21	Classical Analysis	CO2	R1: 1.1-1.4
22-24	Design process	CO2	T1 8.1-8.4
25-28	Architectural design	CO3, CO1	T1:9.1, 9.3,9.4,9.6
29-33	User interface design	CO4	T1:11.3-11.4
34-37	Component level design	CO3	T1:10.2, 10.5
38-44	Software Testing fundamentals	CO2	T1:17.3,17.6-17.8
45-47	Software implementation techniques	CO1	T1:10.1-1.3
48-51	Project management	CO1	T1: 26.2, 26.6.4,
52-55	COCOMO II	CO1, 2	T1:26.1-26.3 28.1- 28.7
56-59	Project Scheduling	CO3, 4	T1:27.1-27.6
60-62	Project Metrics	CO2	T1:25.1-25.6
CASE STUDIES			

1	Develop a set of actions for the communication activity. Select one action and define a task set for it.	CO 6	T1:11.2.1
2	Developing software in which quality is "good enough"	CO 6	T1:11.2.2
3	Explain why systems developed as prototypes should not normally be used as production systems.	CO 6	T1:11.2.18
4	Software myth	CO 6	T1:11.2.25
5	layered technology of software engineering.	CO 6	T1:11.4.1
6	Software myth.	CO 6	T1:11.4.2
7	Evolutionary process models	CO 6	R2:7.5
8	Spiral model	CO 6	R2:7.5
4	concurrent development model (or) concurrent engineering model.	CO 6	R2:7.5
10	layers of software engineering.	CO 6	R2:7.5
11	COCOMO model.	CO 6	T1:11.4.1
12	component level design and deployment level design elements.	CO 6	T1:11.4.2
13	software architecture	CO 6	T1:11.5.1
14	system representation in architectural context	CO 6	T1:11.5.2
15	Coupling and Cohesion in designing class based components. s	CO 6	T2:7.5
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Definations of Software Process and Poject Management	CO 1	R1:2.1-2.11
2	Definations of Requirement Analysis and Specification	CO 2, 3	R1:4.2-4.11
3	Definations of Software Design	CO 4	R2:5.6-5.9
4	Definations of Testing and Implementation	CO 5	R4:8.1-8.9
5	Definations of Project Management	CO 6	R2:12.1-12.16
DISCUSSION OF QUESTION BANK			
1	Software Process and Poject Management	CO 1,	R1:2.1-2.11
2	Requirement Analysis and Specification	CO 2, 3	R1:4.2-4.11
3	Software Design	CO 4	R2:5.6-5.9
4	Testing and Implementation	CO 5	R4:8.1-8.9
5	Project Management	CO 6	R2:12.1-12.16

Signature of Course Coordinator **HOD IT**
Ms. A. Rajitha, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**Information Technology**				
Course Title	**E-COMMERCE**				
Course Code	AITB35				
Program	B. Tech				
Semester	Seven				
Course Type	Elective				
Regulation	R-18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Ms. B Varasree, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AHS015	V	Business Economics and financial analysis

II COURSE OVERVIEW:

This course encompasses the marketing of products using the internet. It provides ultimate knowledge and skills to become an e-commerce whizz and resolve the organizational problems to succeed as an entrepreneur. The concepts include anatomy of e-commerce applications, electronic payment mechanisms, inter and intra organizational networks, resource discovery paradigm and multimedia involvement in e-commerce.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
E-Commerce	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

x	Chalk & Talk	x	Quiz	x	Assignments	x	MOOC
✓	PPT	x	Seminars	x	Mini Project	x	Videos
x	Open Ended Experiments						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
0 %	Remember
60%	Understand
20 %	Apply
20 %	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE) and 10 marks for Alternative Assessment Tool (AAT).

Component	Theory		Total Marks
Type of Assessment	CIE Exam	AAT	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination
Two Quiz exams shall be online examination consisting of 50 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

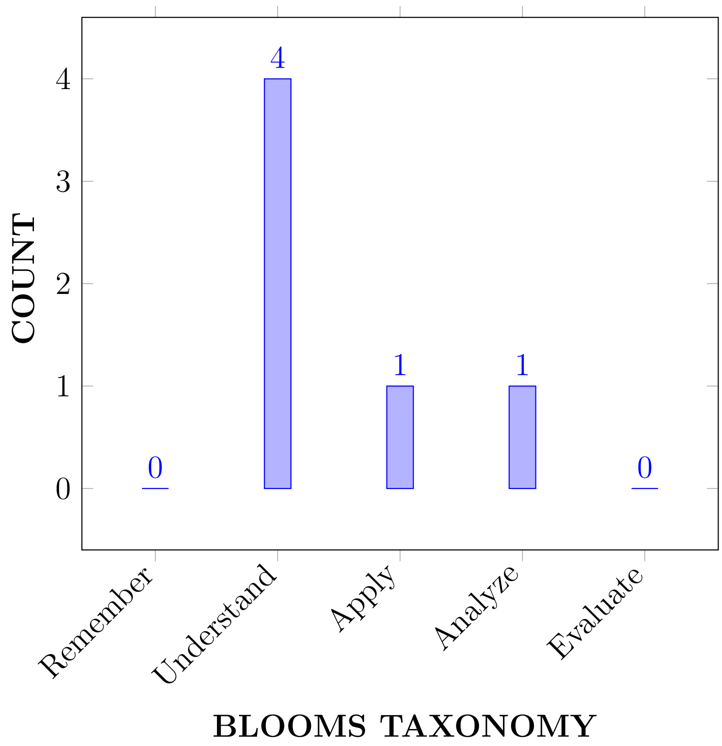
I	The foundations and importance of E-commerce and its technology for business.
II	The steps, tools, and network mechanisms needed to start selling online.
III	The techniques and principles in Electronic Payment System and its environment.
IV	The main business and marketplace models for Electronic Communications and Trading.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Explain** business-to-consumer, business-to-business, and intra organizational models to develop an internet trading relationships.	Understand
CO 2	**Demonstrate** the retailing procedure in E-commerce to expertise in market research effectively	Understand
CO 3	**List** out the key features of internet, intranets and extranets to explain the use network systems in e-commerce business.	Analyze
CO 4	**Describe** digital library and supply chain management concepts to develop best management practices	Understand
CO 5	**Make** use of the major E-commerce revenue models to evaluate existing websites	Apply
CO 6	**Explain** theoretical and practical issues of conducting business over the internet and the Web to understand the multimedia effects on e- commerce .	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
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PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
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PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	2	CIE/AAT
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PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	2	CIE/AAT
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	3	CIE /AAT
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3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Design next-generation computer systems, networking devices, search engines, soft computing and intelligent systems, web browsers, and knowledge discovery tools.	3	AAT
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges.	2	CIE / AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	-	-	-	-	-	-	-	-	-	-	-	✓	-
CO 2	✓	✓	✓	-	-	-	-	-	-	✓	-	-	-	-	-
CO 3	✓	✓	-	-	-	-	-	-	-	✓	-	-	-	-	-
CO 4	✓	-	✓	✓	-	-	-	-	-	-	-	-	✓	-	-
CO 5	✓	-	✓	-	-	-	-	-	-	-	-	-	✓	-	-
CO 6	-	-	-	✓	-	-	-	-	-	-	-	-	-	-	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Explain Business to Consumer, Business-to-Business, and Intra organizational on Internet trading relationships by Applying the **knowledge** of science, **engineering** fundamentals	2
	PSO 2	Focus on **mobile applications** and explain the components in the construction, operation and types of insulators and underground cables.	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 2	PO 1	Understand the key issues and applications effectiveness of market research by applying **mathematical principles** and **computer science methodologies**	2
	PO 2	Understand the key issues in **problems identification**and **analyse complex Engineering problems** in optimizing business decisions like **Information and data collection** and **Interpretation of results**	5
	PO 3	Make use of retailing procedure in E-commerce to expertise in market research effectively **define a problem identify constraints including environmental** and **risk assessment issues** and**Manage the design process innovative solutions**and **environmental and sustainability limitations**	7
	PO 10	Classify the key issues in terms of defining various problems, customer and user needs, **cost effective** and **creative solutions**, **design process**, **economic context** and **management techniques**.	5
CO 3	PO 1	List out the key features of Internet, Intranets and Extranets and explain how they relate to each other using **computer science methodologies**	1
	PO 2	Make use of internet information and **data collected** from various sources and **perform model translation** and **validation** by **Experimental design** and check **Interpretation of results**	5
	PO 10	Make use of different internet components for developing applications based on **technical literature** and **quality issues. Identify, classify** and describe the performance of systems through **analytical methods** and **techniques.**	5
CO 4	PO 1	discuss modern computing infrastructures from the perspective of the internet and organizations **computer science methodologies, mathematical** and **scientific principles.**	3
	PO 3	make use of digital library and supply chain management concepts to develop best management practices **safety** and **risk assessment issues Identify and manage cost drivers** and **Manage the design process and evaluate outcomes**	5
	PO 4	discuss modern computing infrastructures from the perspective of the internet and organizations**Conduct Investigations of Complex Problems** for Understanding of appropriate codes of practice and **industry standards** and **Ability to work with technical uncertainty** and the use of **analytical methods**— and **modeling techniques**	5

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO 1	Make use of **next-generation computer systems** and **networking devices** to develop management practices for **knowledge discovery tools**	4
CO 5	PO 1	Make use of the major e-commerce revenue models to evaluate existing websites **mathematical** and **scientific principles** by integrating **computer science knowledge.**	3
	PO 3	Major e-commerce revenue models to evaluate existing websites by **investigating** and defining various **problems**, **understanding** customer and user needs, with cost effective and creative solutions by managing the **design process**, **knowledge** on **economic context, management techniques.**	7
	PSO 1	Make use of **networking devices, search engines** and E-Commerce revenue models for **existing websites** to develop **web browsers**	4
CO 6	PO 4	make use of theoretical and practical issues of conducting business over the internet and the multimedia effects on e- commerce **Knowledge of management** and **Understanding of commercial** and **economic context** of **engineering processes including personnel**, **health**, **safety**, and **risk issues**	7

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – (PO, PSO) MAPPING:

COURSE OUTCOMES	Program Outcomes/ No. of Key Competencies Matched												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	3	10	10	11	1	5	3	3	12	5	12	12	6	2	2
CO 1	2	-	-	-	-	-	-	-	-	-	-	-	-	1	-
CO 2	2	5	7	-	-	-	-	-	-	5	-	-	-	-	-
CO 3	1	5	-	-	-	-	-	-	-	5	-	-	-	-	-
CO 4	3	-	5	5	-	-	-	-	-	-	-	-	4	-	-
CO 5	3	-	7	-	-	-	-	-	-	-	-	-	4	-	-
CO 6	-	-	-	7	-	-	-	-	-	-	-	-	-	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – (PO, PSO):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	66.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20	0.0
CO 2	66.7	50	70	0.0	0.0	0.0	0.0	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0
CO 3	33.3	50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0

CO 4	100	0.0	50	45.45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.7	0.0	0.0
CO 5	100	0.0	70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40	0.0	0.0
CO 6	0.0	0.0	0.0	63.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

XV COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - 0$\leq$ C$\leq$ 5% – No correlation
2 - 40 % <C < 60% –Moderate
1-5 <C$\leq$ 40% – Low/ Slight
3 - 60% $\leq$ C < 100% – Substantial /High

	PROGRAM OUTCOMES												**PSO'S**		
COURSE OUTCOMES	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	-	2	-
CO 2	3	2	3	-	-	-	-	-	-	3	-	-	-	-	-
CO 3	1	2	-	-	-	-	-	-	-	3	-	-	-	-	-
CO 4	3	-	2	2	-	-	-	-	-	-	-	-	3	-	-
CO 5	3	-	3	-	-	-	-	-	-	-	-	-	3	-	-
CO 6	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-
TOTAL	13	4	8	5	-	-	-	-	-	6	-	-	6	2	-
AVERAGE	2.6	2.0	2.6	2.5	-	-	-	-	-	3.0	-	-	3.0	2.0	-

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	x
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	Concept Video	✓	Open Ended Experiments	-
Assignments	x				

XVII ASSESSMENT METHODOLOGY-INDIRECT:

x	Assessment of mini projects by experts	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**INTRODUCTION TO ELECTRONIC COMMERCE**
	Electronic Commerce: Frame work, media coverage; anatomy of e-commerce applications: E-commerce Consumer applications, E-ecommerce organization applications

MODULE II	**ELECTRONIC PAYMENT SYSTEMS**
	Types of electronic payment systems; Digital token based electronic payment system: E-cash, properties of e-cash, electronic cash in action, business issues and electronic cash, operational risk and electronic Cash, electronic checks; smart cards and electronic payment system; Credit card based electronic payment system; Risk and electronic payment system; Designing electronic payment system
MODULE III	**PERFORMANCE OF TRANSMISSION LINES**
	Inter organizational commerce: Electronic data interchange, electronic data interchange implementation, and value added networks; Intra organizational commerce: Work flow, automation customization and internal commerce, supply chain management. Corporate digital library: Document library, digital document types, corporate data warehouses; Advertising and marketing: Information based marketing, advertising on internet, on-line marketing Process, market research.
MODULE IV	**CONSUMER SEARCH AND RESOURCE DISCOVERY**
	Search and resource discovery paradigms, information search and retrieval, commerce catalogues, Information filtering.
MODULE V	**MULTIMEDIA**
	Multimedia: Key multimedia concepts, digital video and electronic commerce, desktop video processing, desktop video conferencing.

TEXTBOOKS

1. Ravi Kalakata, Whinston Andrew B, Frontiers of Electronic Commerce, Pearson, 1st Edition, 1996.

REFERENCE BOOKS:

1. David Whitley, E-Commerce-Strategy, Technologies and Applications, Tata McGraw-Hill, 2nd Edition, 2000.
2. Kamlesh K. Bajaj, E-Commerce the Cutting Edge of Business, Tata McGraw-Hill, 1st Edition, 2005
3. Christopher Westland, Theodore H. K Clark, Global Electronic Commerce- Theory and Case Studies, University Press, 1st Edition, 1999.

WEB REFERENCES:

1. www.engr.sjsu.edu/gaojerry/course/cmpe296u/296z/introduction.pdf

COURSE WEB PAGE:

1. https://akanksha.iare.ac.in

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO - PO Mapping	-	-

CONTENT DELIVERY (THEORY)			
1	Electronic Commerce: Frame work, media coverage anatomy of e-commerce	CO 1	R1:1.1
2	anatomy of e-commerce	CO 1	R1:1.1
3	consumer applications E-ecommerce organization applications	CO 2	T1:1.2
4	E-ecommerce organization applications	CO 2	T1:1.2
5	Types of electronic payment systems.	CO 3	T1:1.3
6	Digital token based electronic payment system: E-cash.	CO 3	T1:1.3
7	Electronic Cash In Action	CO 4	R1:1.5
8	Business Issues And Electronic Cash	CO 4	R1:1.5
9	operational risk and electronic Cash, electronic checks	CO 4	R1:1.5
10	Smart cards and electronic payment system.	CO 5	T1:3.2
11	Credit card based electronic payment system.	CO 5	T1:3.2
12	Risk and electronic payment system	CO 3	T1:3.5
13	Designing electronic payment system	CO 3	T1:3.5
14	Performance of Transmission Lines	CO 3	T1:4.3
15	Inter organizational commerce: Electronic data Interchange	CO 3	T1:4.3
16	Electronic Data Interchange Implementation	CO 8	T1:5.2
17	And Value Added Networks	CO 3	T1:5.2
18	Intra organizational commerce	CO 3	T1:5.2
19	Work flow, automation customization	CO 3	T1:5.2
20	internal commerce, supply chain management	CO 3	T1:5.2
21	Corporate digital library: Document library, digital document types, corporate data warehouses	CO 4	T1:6.2
22	digital document types, corporate data warehouses	CO 4	T1:6.2
23	Advertising and marketing: Information based marketing	CO 6	T1:6.5
24	advertising on internet, on-line marketing process, market research	CO6	T1:6.5
25	Search and resource discovery paradigms	CO 5	T1:10.2
26	information search and retrieval	CO 5	T1:10.2
27	Commerce Catalogues, Information Filtering	CO 2	T1:10.2
28	Information Filtering	CO 2	T1:10.2
29	Multimedia	CO 3	T1:10.4
30	Multimedia: Key Multimedia Concepts	CO 3	T1:10.4
31	Digital Video and Electronic Commerce	CO 3	T1:10.4
32	Desktop Video Processing, Desktop Video Conferencing.	CO 3	T1:10.4
PROBLEM SOLVING/ CASE STUDIES			
1	how to develop the data processing technology of Big Data banking systems improve the credit risk management process?	CO 1	R1:1.5
2	what are the tools and techniques of Artificial Intelligence (AI) that can help in improving electronic commerce (E-commerce)?	CO 1	R1:1.5

3	Will the social aspects of interpersonal contacts be a barrier to the creation of electronic banks without staff?	CO 1	R1:1.5
4	Write use of electronic brokerages?	CO 1	T1:3.2
5	List the New forms of organizational structures?	CO 4	T1:3.2
6	What are the main characteristics of cash payment in contrast with cheque payment?	CO 4	T1:3.2
7	Why is a certifying authority required in E Commerce?	CO 4	T1:4.3
8	Define Trade cycle and describe the different stages of a Trade cycle.	CO 5	T1:4.3
9	What are the necessary conditions a hash function used in digital signature should satisfy?	CO 1	T1:4.3
10	Why is security important in E-Commerce?	CO 3	T1:6.2
11	how should merchants promote their ecommerce sites?	CO 1	T1:6.2
12	what security risk does ecommerce involve?	CO 1	T1:6.2
13	what are Internet Security Services? explain each one of them with an example	CO 5	T1:6.5
14	Write about the security service that are to be offered in E-Payment system in detail.	CO 5	T1:6.5
15	Once a company has acquired customer, the key to maximizing revenue is keeping them. explain how e-commerce is helpful in customer retention?	CO 5	T1:6.5
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Discussion of definition and terminology on Introduction to electronic commerce	CO 1	R1:1.5
2	Discussion of definition and terminology on Electronic payment systems	CO 2	T1:3.2
3	Discussion of definition and terminology on Performance of transmission lines	CO 3	T1:5.2
4	Discussion of definition and terminology on Consumer Search and Resource discovery	CO 4,5	T1:6.2,6.5
5	Discussion of definition and terminology on Multimedia	CO 5,6	T1:10.2,4
DISCUSSION OF QUESTION BANK			
1	Discussion of Question on Introduction to electronic commerce	CO 1	R1:1.5
2	Discussion of Questionon Electronic payment systems	CO 2	T1:3.2
3	Discussion of Question on Performance of transmission lines	CO3	T1:5.2
4	Discussion of Question on Consumer Search and Resource discovery	CO 4,5	T1:6.2,6.5
5	Discussion of Question on Multimedia	CO 5,6	T1:10.2,4

Signature of Course Coordinator **HOD,IT**

INSTITUTE OF AERONAUTICAL ENGINEERING
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Dundigal, Hyderabad - 500 043

INFORMATION TECHNOLOGY
COURSE DESCRIPTION

Course Title	BIG DATA AND ANALYTICS LABORATORY				
Course Code	AITB16				
Program	B.Tech				
Semester	VII				
Course Type	Laboratory				
Regulation	R18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	3	1.5
Course Coordinator	B Pravallika,Assistant professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSB09	III	Database Management Systems Laboratory
B.Tech	ACS002	IV	Object Oriented Programming Through Java Laboratory
B.Tech	ACS002	VI	LINUX Laboratory
B.Tech	ACSB15	VI	DDWDM Laboratory

II COURSE OVERVIEW:

Big data and Analytics Laboratory demonstrates distributed computing environment. It includes hands on experience on installation process of VMWare, LINUX commands, HDFS file management, MapReduce functions, Pig and Hive operations. This experience can be used to develop big data applications such as Web click stream analysis, Recommendation systems, Sentiment analysis etc.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Big Data and analytics laboratry	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

X	Demo Video	✓	Lab Worksheets	✓	Viva Questions	✓	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component	**Laboratory**		**Total Marks**
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
-	-	-	-	-	-

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

I	The steps involved in creating distributed environment.
II	The platform for creating and run big data MapReduce programs on Hadoop.
III	Fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
IV	How to solve complex real-world problems in for decision support

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Demonstrate** distributed environment and its ecosystem with the help of VMWare and Linux commands. .	understand
CO 2	**Make use of** hadoop distributed file management modes for handling big data in business analytics.	Apply
CO 3	**Analyze** the Big Data using Map-reduce programming in Hadoop framework.big data in business analytics.	Analyze
CO 4	**Apply** Hive commands for reading, writing and managing large datasets in hdfs .	Apply
CO 5	**Implement** the Pig Latin scripts in two different modes to perform a particular operation on the data that exists in the HDFS.	Apply
CO 6	**Analyze** adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL

VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1	Lab Exercises,CIE,SEE

PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	3	Lab Exercises,CIE,SEE
PO 3	**Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations	3	Lab Exercises,CIE,SEE
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations..	3	Lab Exercises,CIE,SEE

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		**Strength**	**Proficiency Assessed by**
PSO 2	Focus on mobile and web applications development and learn the emerging technologies and frameworks in demand with employers and contemporary challenges	3	Lab Exercises

3 = High; 2 = Medium; 1 = Low

XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

COURSE OUTCOMES	PROGRAM OUTCOMES				PSO'S
	PO 1	PO2	PO 3	PO 5	PSO 3
CO 1	3	2	-	-	-
CO 2	2	2	3	2	3
CO 3	-	2	3	-	3
CO 4	3	3	-	-	-
CO 5	-	3	-	2	-
CO 6	2	2	3	-	1

XII ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	✓	Student Viva	✓	Certification	-

XIII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

WEEK I	**INSTALL VMWARE**
	Installation of VMWare to setup the Hadoop environment and its ecosystems .
WEEK II	**QUERIES USING DDL AND DML**
	a. Perform setting up and Installing Hadoop in its three operating modes. i. Standalone. ii. Pseudo distributed. iii. Fully distributed. b. Use web based tools to monitor your Hadoop setup.
WEEK III	**USING LINUX OPERATING SYSTEM**
	Implementing the basic commands of LINUX Operating System – File/Directory creation, deletion, update operations.
WEEK IV	**FILE MANAGEMENT IN HADOOP**
	Implement the following file management tasks in Hadoop: a.Adding files and directories b.Retrieving files c.Deleting files Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command linux utilities.
WEEK V	**MAPREDUCE PROGRAM 1**
	Run a basic word count Map Reduce program to understand Map Reduce Paradigm.
WEEK VI	**MAPREDUCE PROGRAM 2**
	Write a Map Reduce program that mines weather data. Hint: Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with Map Reduce, since it is semi structured and record-oriented.
WEEK VII	**MAPREDUCE PROGRAM 3**
	Implement matrix multiplication with Hadoop Map Reduce.
WEEK VIII	**PIG LATIN LANGUAGE – PIG**
	Installation of PIG.
WEEK IX	**PIG COMMANDS**
	Write Pig Latin scripts sort, group, join, project, and filter your data
WEEK X	**PIG LATIN MODES, PROGRAMS**
	a.Run the Pig Latin Scripts to find Word Count. b. Run the Pig Latin Scripts to find a max temp for each and every year.
WEEK XI	**HIVE**
	Installation of HIVE.
WEEK XII	**HIVE OPERATIONS**
	Use Hive to create, alter, and drop databases, tables, views, functions, and indexes.

TEXTBOOKS

1. Rajiv Sabherwal, Irma Becerra- Fernandez, “Business Intelligence –Practice, Technologies and Management”, John Wiley, 1st Edition, 2011

REFERENCE BOOKS:

1. Jay Liebowitz, "Big Data and Business Analytics Laboratory", CRC Press.

XV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Install VMware.	CO 1	T1:4.1, T2:1.1
2	Hadoop Modes	CO 2	T1:4.9,4.11, T2:7
3	Using Linux Operating System	CO 3,CO4	T1:3, T2:8
4	File Management In Hadoop	CO1,CO 4	T1:6.6, T2:12
5	Mapreduce Program 1	CO 3	T1:4.4, T2:10
6	Mapreduce Program 2	CO 3	T1:4.6, T2:10
7	Mapreduce Program 3	CO 5	T2:15
8	Mapreduce Program 4.	CO 3	T2:18
9	Pig Latin Language – Pig.	CO 6	T2:18
10	Pig Commands.	CO 5	T2:18
11	Pig Latin Modes, Pig Program	CO 6	T2:10
12	Hive	CO 4	T1:2, T2:1
12	Hive Operations	CO 5	T1:2, T2:1

XVI EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	**I**mplementation of application that stores big data in MongoDB.
2	**E**xperimental Methods for the Evaluation of Big Data Systems.
3	**S**implified data processing on large clusters by using mapreduce.
4	**U**sing virtual clusters to decouple computation and data management in high throughput analysis applications.
5	**U**nderstanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data.

Signature of Course Coordinator **HOD,IT**

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

INFORMATION TECHNOLOGY

COURSE DESCRIPTION

Course Title	**CLOUD COMPUTING LABORATORY**				
Course Code	AITB17				
Program	B.Tech				
Semester	VII				
Course Type	Laboratory				
Regulation	R18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	3	1.5
Course Coordinator	Ms S.Swarna Keerth, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AITB13	VI	Linux Programming Laboratory
B.Tech	ACSB09	IV	Database Management Systems Laboratory
B.Tech	ACSB02	IV	Programming for Problem Solving Laboratory

II COURSE OVERVIEW:

This Laboratory course provides a foundation for which we can access the applications as utilities over the internet. It allows us to create, configure, and customize the business applications online. a cloud application, or cloud app, is a software program where cloud-based and local components work together. This model relies on remote servers for processing logic that is accessed through a web browser with a continual internet connection. Hadoop is an open-source framework that allows to store and process big data in a distributed environment across clusters of computers using simple programming models. It is designed to scale up from single servers to thousands of machines, each offering local computation and storage

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Cloud computing Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Demo Video	✓	Lab Worksheets	✓	Viva Questions	✓	Probing further Questions

V EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal from the panel of experts recommended by Chairman, BOS. The emphasis on the experiments is broadly based on the following criteria given in Table: 1

	Experiment Based	Programming based
20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
20 %	Conclusion	Conclusion
20 %	Viva	Viva

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Component	**Laboratory**		**Total Marks**
Type of Assessment	**Day to day performance**	**Final internal lab assessment**	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

1. **Experiment Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

2. **Programming Based**

Objective	Analysis	Design	Conclusion	Viva	Total
2	2	2	2	2	10

VI COURSE OBJECTIVES:

The students will try to learn:

I	Learn to run virtual machines of different configuration..
II	Develop Big Data application using Hadoop..
III	Exposed to tool kits for cloud environment.
IV	Developing web services/Applications in cloud framework.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Make use of** Virtualization and parallel processing on guest and host OS for performing different tasks by installing virtual machines.	Apply
CO 2	**Develop** Mapper and Reducer on simple applications by using Apache Hadoop on single node setup installation.	Apply
CO 3	**Construct** simple applications on services rendered by Amazon Web Service Cloud Service Provider.	Apply
CO 4	**Build** simple applications on services rendered by Google Service Provider.	Apply
CO 5	**Utilize** simple applications on services rendered by Microsoft Azure cloud Service Provider.	Apply
CO 6	**Develop** web based App by using Yahoo! pipes.	Apply

VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Program Outcomes	
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PSO 1	**Professional Skills:** The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.	1	Lab Exercises
PSO 2	**Problem-Solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.	3	Lab Exercises
PSO 3	**Successful Career and Entrepreneurship:** Practical experience in shipping real world software, using industry standard tools and collaboration techniques will equip to secure and succeed in first job upon graduation in IT industry	3	Lab Exercises

3 = High; 2 = Medium; 1 = Low

X MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

COURSE OUTCOMES	PROGRAM OUTCOMES			PSO'S
	PO 1	PO 3	PO 5	PSO 3
CO 1	3	3	3	2
CO 2	3	3	3	2
CO 3	3	3	3	2
CO 4	3	3	3	2
CO 5	3	3	3	3
CO 6	3	3	3	2

XI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	✓	Student Viva	✓	Certification	-

XII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIII SYLLABUS:

WEEK I	**VIRTUALIZATION**
	Install Oracle Virtual box and create two VMs on your laptop.
WEEK II	**VIRTUALIZATION**
	Install Turbo C in guest OS and execute C program.
WEEK III	**VIRTUALIZATION**
	Test ping command to test the communication between the guest OS and Host OS.
WEEK IV	**HADOOP**
	Install Hadoop single node setup.
WEEK V	**HADOOP**
	Develop a simple hadoop application called Word Count. It counts the number of occurrences of each word in a given input set.
WEEK VI	**HADOOP**
	Develop hadoop application to count no of characters, no of words and each character frequency.
WEEK VII	**HADOOP**
	Develop hadoop application to process given data and produce results such as finding the year of maximum usage, year of minimum usage.

WEEK VIII	**HADOOP**
	Develop hadoop application to process given data and produce results such as how many female and male students in both schools the results should be in following format. GP-F #number GP-M #numbers MS-F #number MS-M #number
WEEK IX	**CLOUD PROGRAMMING**
	Establish an AWS account. Use the AWS Management Console to launch an EC2 instance and connect to it.
WEEK X	**CLOUD PROGRAMMING**
	Design a protocol and use Simple Queue Service(SQS)to implement the barrier synchronization after the first phase.
WEEK XI	**CLOUD PROGRAMMING**
	Use the Zookeeper to implement the coordination model in Problem 10.
WEEK XII	**CLOUD PROGRAMMING**
	Develop a Hello World application using Google App Engine
WEEK XIII	**CLOUD PROGRAMMING**
	Develop a Guestbook Application using Google App Engine.
WEEK XIV	**WINDOWS AZURE**
	Develop a Windows Azure Hello World application using.
WEEK XV	**PIPES**
	Create a Mashup using Yahoo! Pipes.

REFERENCE BOOKS:

1. Dan Marinescu, ―Cloud Computing: Theory and Practice‖, M K Publishers, 1st Edition, 2013.
2. Kai Hwang, Jack Dongarra, Geoffrey Foxr, ―Distributed and Cloud Computing, FromParallel Processing to the Internet of Things‖, M K Publishers, 1st Edition, 2013.
3. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, ―Cloud Computing: A Practical Approach‖, McGraw Hill,, 1st Edition, 2009.
4. Arshdeep Bahga, Vijay Madisetti, ―Distributed and Cloud Computing, Cloud computing A Hands on Approach‖, Universities Publications, 1st Edition, 2013.

XIV COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference
1	Install Virtual Machine on Guest and Host OS	CO1	T1:4.9,R1:4.7
2	Single node set up Installation	CO2	T1:4.9,R1:4.7
3	Simple applications on services rendered by Amazon Web Service Cloud Service Provider.	CO3	T1:3.6

4	Simple applications on services rendered by Google Service Provider.	CO4	T1:3.6
5	Simple applications on services rendered by Microsoft Azure cloud Service Provider.	CO5	T1:3.6
6	Web based App by using Yahoo! pipes	CO6	T1:3.6

XV EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	Install Hadoop in semi-distributed environment.
2	ERP solutions using Google Cloud Service Provider.
3	CRMsolutions using Amazon Web Service Provider.

Signature of Course Coordinator **HOD,IT**
Ms S.Swarna Keerthi, Assistant Professo

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043
COURSE DESCRIPTION

Department	**INFORMATION TECHNOLOGY**				
Course Title	**ENERGY FROM WASTE**				
Course Code	ACEB52				
Program	B.Tech				
Semester	VIII				
Course Type	Open Elective				
Regulation	IARE - R18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Mr. S.Selvaprakash, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	AHSB07	II	Environmental Studies

II COURSE OVERVIEW:
The course is designed to create environmental awareness and consciousness among the present generation to become environmental responsible citizens. The course will discuss on the municipal solid waste composition, characteristics and to improve the methods to minimize municipal solid waste generation. This course deals with methods of disposal of solid waste by thermal biochemical processes and production of energy from different types of waste sand to know the environmental impacts of all types of municipal waste. This course will discuss the overall scenario of E-Waste management in India in comparison with other countries around the globe. This course will deals with E-waste legislation and government regulations on E-waste management.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Energy From Waste	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	PPT	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Open Ended Experiments	x	Seminars	x	Mini Project	✓	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIE examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
20%	Remember
60%	Understand
20%	Apply
0%	Analyze
0%	Evaluate

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 25 marks for Continuous Internal Examination (CIE) and 05 marks for Quiz \Alternative Assessment Tool (AAT).

Component	Theory		Total Marks
Type of Assessment	CIE Exam	Quiz \AAT	
CIA Marks	25	05	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 17^{th} week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination
Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Open Ended Experiment
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

I	The principles of solid waste management in reducing and eliminating dangerous impacts of waste materials on human health and the environment to contribute economic development and superior quality of life.
II	The insight of the design and operations of a municipal solid waste landfill by collection, transfer and transportation of municipal solid waste for the final disposal.
III	The main operational challenges in operating thermal and biochemical energy from waste facilities and device processes involved in recovering energy from wastes.
IV	The scenario of E-Waste management in India and other countries around the globe and assess the impact of electronic waste on human, environment and society by informal recycling and management. The sustainable solution of E-Waste Management can be achieved by adopting modern techniques and Life-Cycle Analysis approach.

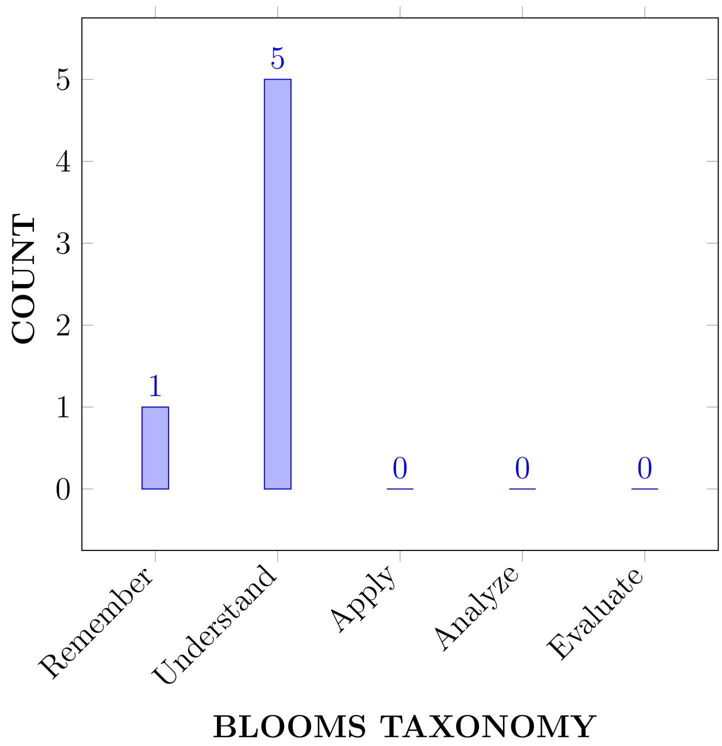
VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Identify** the different sources, types of solid waste by the properties of municipal solid waste for segregation and collection of waste.	Remember
CO 2	**Understand** the Composition, characteristics of leachate and preliminary design considerations of landfill to control the emission of gases and monitoring the movement of landfill leachate.	Understand
CO 3	**Outline** the Biochemical conversion of biomass for energy generation by anaerobic digestion of solid waste.	Understand
CO 4	**Illustrate** the thermo-chemical conversion of solid waste by using Gasification and pyrolysisprocess for energy generation.	Understand

CO 5	**Identify** the need to stringent health safeguards and environmental protection laws of India for the effective disposal of E-waste.	Understand
CO 6	**Interpret** the global scenario of environmental concerns and health hazards by the generation of E- waste.	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations

Program Outcomes	
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering commMODULEy and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	CIE/SEE/AAT
PO 3	**Design/development of solutions:** : Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	1	CIE/SEE/AAT

PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	1	CIE/SEE/AAT
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	3	CIE/Quiz/AAT
PO 12	**Life-long learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	1	CIE/SEE/AAT

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		**Strength**	**Proficiency Assessed by**
PSO 2	Focus on Improving Performance of Structures with reference to Safety, Serviceability and Sustainable Green Building Technology.	3	CIE/SEE/AAT

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	**PROGRAM OUTCOMES**												**PSO'S**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	-	✓	-	-	✓	✓	-	-	-	-		-	-	-
CO 2	-	-	✓	-	-	✓	-	-	-	-	-	-	-	-	-
CO 3	✓	-	-	-	-	✓	✓	-	-	-	-	-	-	✓	-
CO 4	✓	-	✓	-	-	-	✓	-	-	-	-		-	-	-
CO 5	-	-	-	-	-	✓	-	-	-	-	-	✓	-	✓	-
CO 6	-	-	-	-	-	✓	-	-	-	-	-	✓	-	-	-

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	**PO'S PSO'S**	**Justification for mapping (Students will be able to)**	**No. of Key competencies matched.**
CO 1	PO 1	Apply the **Scientific principles** for energy generation by applying different technologies from waste management plants.	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 3	Identify the **constraints including environmental health and safety and risk assessment issues** of different methods of disposal of municipal solid waste by aerobic composting **to promote sustainable development.**	2
	PO 6	Apply the **knowledge of management techniques** by understanding the **requirement for engineering activities**of municipal solid waste for the **sustainable development**.	3
	PO 7	Interpret the discarding of solid waste and their impact on **socio economic, environment** is considered and energy generation activities by aerobic composting of waste.	2
CO 2	PO 3	Identify **constraints including environmental and sustainability limitations, health and safety and risk assessment issues** for environmental monitoring system of land fill gases and composition of leachate and **Understanding commercial and economic context** of managing the land fill site	2
	PO 6	Understand the characteristics, generation and movement of leachate in landfills by the **management techniques** which uses for controlling the emission of gases in landfills **to promote sustainable development**	2
CO 3	PO 1	Explain the **Scientific principles** for Energy generation from waste bio-chemical conversion and **to integrate / support the engineering disciplines**	2
	PO 6	Apply the knowledge in planning and operations of waste to Energy plants **for sustainable development** by following **legal legislation** related to solid waste management for **high level of professional and ethical values.**	3
	PO 7	Identify the sources of energy generation by anaerobic digestion of sewage and municipal waste for **socio economic solutions** and direct combustion of municipal solid waste for environmental solutions.	2
	PSO 2	Identify the Energy generation processes from waste by bio-chemical conversion and help in **Sustainable** development and **Safety** of the public life.	2
CO 4	PO 1	Illustrate the methods of pyrolysis process by understanding **Scientific principles and methodology** and apply to **integrate / support study of their own engineering discipline** for solving environmental problems	2

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 3	Interpret thermo-chemical conversion sources of energy generation, gasification of waste and **identify constraints including environmental and sustainability limitations**	2
	PO 7	Understand the environmental benefits by using thermo-chemical process will decrease the emission of harmful gases and will attain **Environmental sustainability.**	1
CO 5	PO 6	Define the global scenario of environmental concerns by the increase in the generation of E-waste worldwide causing the **personnel, health, safety, and risk (including environmental risk) issues** and the problem can solved by imposing strong legal regulation for disposing of E-waste and help in **sustainable development**	2
	PO 12	List out the health hazards by the generation of E-waste and their impact on environment will be solved by the proper management and formal disposal of E-waste and this can be achieved by long term learning process in **Professional certifications, advanced degree** for developing advanced technologies in recycling of E-waste.	2
	PSO 2	Apply strong environmental protection laws in India for the effective disposal of E-waste and constraints including environmental and **sustainability** development and while recycling the E-waste and problem including production, operation, maintenance and disposal with proper **safety**	2
CO 6	PO 6	Define the global scenario of environmental concerns by the increase in the generation of E-waste worldwide causing the **personnel, health, safety, and risk (including environmental risk) issues** and the problem can solved by imposing strong legal regulation for disposing of E-waste and help in **sustainable development**	2
	PO 12	List out the health hazards by the generation of E-waste and their impact on environment will be solved by the proper management and formal disposal of E-waste and this can be achieved by long term learning process in **Professional certifications, advanced degree** for developing advanced technologies in recycling of E-waste.	2

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	-	2	-	-	3	2	-	-	-	-	-	-	-	-
CO 2	-	-	2	-	-	2	-	-	-	-	-	-	-	-	-
CO 3	2	-	-	-	-	3	2	-	-	-	-	-	-	2	-
CO 4	2	-	2	-	-	-	1	-	-	-	-	-	-	-	-
CO 5	-	-	-	-	-	2	-	-	-	-	-	2	-	2	-
CO 6	-	-	-	-	-	2	-	-	-	-	-	2	-	-	-

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	33.3	-	20.0	-	-	60.0	66.6	-	-	-	-	-	-	-	-
CO 2	-	-	20.0	-	-	40.0	-	-	-	-	-	-	-	-	-
CO 3	66.6	-	-	-	-	60.0	66.6	-	-	-	-	-	-	66.6	-
CO 4	66.6	-	20.0	-	-	-	33.3	-	-	-	-	-	-	-	-
CO 5	-	-	-	-	-	40.0	-	-	-	-	-	25	-	66.6	-
CO 6	-	-	-	-	-	40.0	-	-	-	-	-	25	-	-	-

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq$ C$\leq$ 5% – No correlation
1 -5 <C$\leq$ 40% – Low/ Slight
2 - 40 % <C < 60% –Moderate
3 - 60% $\leq$ C < 100% – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	-	1	-	-	2	3	-	-	-	-		-	-	-
CO 2	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-
CO 3	3	-	-	-	-	2	3	-	-	-	-	-	-	3	-
CO 4	3	-	1	-	-	-	1	-	-	-	-		-	-	-
CO 5	3	-	-	-	-	1	3	-	-	-	-	1	-	3	-
CO 6	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-

TOTAL	10	-	3	-	-	7	10	-	-	-	-	2	-	6	-
AVERAGE	3.0	-	1.0	-	-	1.0	3.0	-	-	-	-	1.0	-	3.0	

XVI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	-	Student Viva	-	Certification	-
Term Paper	-	5 Minutes Video	✓	Open Ended Experiments	-
Assignments	✓	Tech talk	-	-	

XVII ASSESSMENT METHODOLOGY INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XVIII SYLLABUS:

MODULE - I	**INTRODUCTION TO WASTE AND WASTE PROCESSING**
	Solid waste sources solid waste sources, types, composition, properties, global warming; Municipal solid waste: Physical, chemical and biological properties, waste collection and, transfer stations, waste minimization and recycling of municipal waste, segregation of waste, size reduction, managing waste, status of technologies for generation of energy from waste treatment and disposal aerobic composting, incineration, furnace type and design, medical waste / pharmaceutical waste treatment technologies, incineration, environmental impacts, measures to mitigate environmental effects due to incineration
MODULE - II	**WASTE TREATMENT AND DISPOSAL**
	Land fill method of solid waste disposal land fill classification, types, methods and sitting consideration; Layout and preliminary design of landfills: Composition, characteristics, generation, movement and control of landfill leachate and gases, environmental monitoring system for land fill gases.
MODULE - III	**BIO-CHEMICAL CONVERSION**
	Energy generation from waste bio-chemical conversion: Sources of energy generation, anaerobic digestion of sewage and municipal waste, direct combustion of MSW-refuse derived solid fuel. Industrial waste, agro residues and anaerobic digestion.

MODULE - IV	**THERMO-CHEMICAL CONVERSION**
	Biogas production, land fill gas generation and utilization, thermo-chemical conversion: Sources of energy generation, gasification of waste using gasifies briquetting, utilization and advantages of briquetting, environmental benefits of bio-chemical and thermo-chemical conversion
MODULE - V	**E-WASTE MANAGEMENT**
	E-waste: E-waste in the global context: Growth of electrical and electronics industry in India, environmental concerns and health hazards; Recycling e-waste: A thriving economy of the unorganized sector, global trade in hazardous waste, impact of hazardous e-waste in India; Management of e-waste: E-waste legislation, government regulations on e-waste management, international experience, need for stringent health safeguards and environmental protection laws of India.

TEXTBOOKS

1. Nicholas P Cheremisinoff, —Handbook of Solid Waste Management and Waste Minimization Technologie, An Imprint of Elsevier, New Delhi, 2003.
2. P AarneVesilind, William A Worrell and Debra R Reinhart, —Solid Waste Engineering, 2 nd edition 2002.
3. M Dutta , B P Parida, B K Guha and T R Surkrishnan, —Industrial Solid Waste Management and Landfilling practice, Reprint Edition New Delhi, 1999.
4. RajyaSabha Secretariat, —E-waste in India: Research MODULE, Reprint Edition, June, 2011.

REFERENCE BOOKS:

1. C Parker and T Roberts (Ed), —Energy from Waste, An Evaluation of Conversion Technologies, Elsevier Applied Science, London, 1985.
2. KL Shah,"Basics of Solid and Hazardous Waste Management Technology", Prentice Hall, Reprint Edition, 2000.
3. M Datta, —"Waste Disposal in Engineered Landfill", Narosa Publishing House, 1997.

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
OBE DISCUSSION			
1	Outcome Based Education, CO PO attainment and Blooms Taxonomy		
CONTENT DELIVERY (THEORY)			
1	Sources of Municipal Solid waste	CO 1	T1:3.3, T2:1.2, R2: 2.2

2	Types of Municipal Solid waste	CO 1	T1:3.4, T2:1.4
3	Composition of Municipal Solid waste	CO 1	T1:3.5, R2:1.5
4	Effects of Global warming	CO 1	T1:3.7, R2:1.8
5	Segregation of waste, size reduction and managing waste	CO 1	T1: 3.9, R3: 1.10
6	Waste collection and transfer stations	CO 1	T1:5.5, T2:6.2, R3:4.8
7	Waste minimization and recycling of municipal waste	CO 1	T1:5.6, T2:6.3, R3:7.5
8	Properties of Municipal solid waste	CO 1	T1:4.3, T2:5.2, R2: 5.7
9	Incineration, furnace type and design	CO 1	T1: 4.4, R1:3.3
10	Measures to mitigate environmental effects due to incineration	CO 1	T1:4.5, T2: 5.4, R3: 7.3
11	Land fill methods and disposal of solid waste	CO 2	T1:4.6, T2:5.5
12	land fill classification	CO 2	T1: 4.5.2, T2: 5.6
13	Landfill sitting consideration	CO 2	T1:4.6, T2:5.5
14	Layout and preliminary design of landfills	CO 2	T1:4.6.2, T2:5.5.2
15	Characteristics and composition of landfill	CO 2	T1:4.7, T2:5.6
16	Movement and control of landfill leachate and gases	CO 2	T1:4.7, T2:5.8
17	Environmental monitoring system for land fill gases	CO 2	T1:4.7.2, T2:5.8.2
18	Energy generation from waste by bio-chemical conversion	CO 3	T1:4.8, T2:5.9
19	Sources of energy generation from bio solid waste	CO 3	T1:4.9, T2:5.7
20	Anaerobic digestion of sewage and municipal waste	CO 3	T1:6.2, T2:5.6
21	Direct combustion of MSW-refuse derived solid fuel	CO 3	T1:6.3, T2:5.7

22	Industrial waste, agro residues and anaerobic digestion	CO 3	T1:6.4, T2:5.8
23	Biogas production	CO 3	T1:6.5, T2:5.3
24	land fill gas generation and utilization	CO 3	T1:6..6, T2:5.2
25	Thermo-chemical conversion	CO 4	T1:6.7, T2:5.3
26	Sources of energy generation	CO 4	T1:6.5, T2:7.5
27	Gasification of waste using gasifies briquetting	CO 4	T1: 6.2, R2:7.9
28	Utilization and advantages of briquetting	CO 4	T1: 6.2
29	Environmental benefits of bio-chemical	CO 4	T1:6.2, T2:7.2
30	E-waste in the global context	CO 5	T1:6.3, T2:7.3
31	Growth of electrical and electronics industry in India	CO 5	T1:6.4, T2:7.5
32	Environmental concerns and health hazards	CO 5	T1: 6.2, T2: 5.6
33	Recycling e-waste	CO 5	T1:6.3, T2: 5.7
34	A thriving economy of the unorganized sector and global trade in hazardous waste	CO 5	T1:6.4, T2:5.8
35	Impact of hazardous e-waste in India	CO 5	T1:2.1, T2:9.1
36	Management of e-waste	CO 5	T1:2.2, T2:9.2
37	E-waste legislation	CO 5	T1: 2.1, R2: 9.1
38	Government regulations on e-waste management	CO 5	T1:2.6, R1:5.1
39	International experience in management of e-waste	CO 6	T1:2.7, R1:5.2
40	Need for stringent health safeguards and environmental protection laws of India.	CO 6	T1:2.8, R1:5.5
41	Summarize government regulations on E-waste management	CO 6	T1:2.1, R1:5.6
42	Outline international E-waste management and the guidelines imposed for formal disposal	CO 6	T1:2.2, R1:5.4
43	Explain the need for stringent health safeguards of human health and their effects	CO 6	T1:2.4,R1:5
44	Discuss the need for environmental protection laws and	CO 6	T1:2.4, R1:5.5

45	Outline environmental protection laws of India with respect to E-waste management.	CO 6	T1:2.4, R1:5.5
PROBLEM SOLVING/ CASE STUDIES			
1	Explain different Types of Municipal Solid waste	CO 1	T1:3.3, T2:1.2, R2: 2.2
2	Explain the Composition of Municipal Solid waste	CO 1	T1:3.4, T2:1.4
3	Effects of Global warming	CO 1	T1:3.5,R2:1.5
4	Illustrate the importance of Land fill classification	CO 2	T1:4.5, T2: 5.4, R3: 7.3
5	Landfill sitting consideration	CO 2	T1:4.6, T2:5.5
6	Layout and preliminary design of landfills	CO 2	T1: 4.5.2, T2: 5.6
7	Anaerobic digestion of sewage and municipal waste	CO 3	T1:4.6, T2:5.5
8	Direct combustion of MSW-refuse derived solid fuel	CO 3	T1:4.6.2, T2:5.5.2
9	Industrial waste, agro residues and anaerobic digestion	CO 3	T1:4.7, T2:5.6
10	Explain the Thermo-chemical conversion	CO 4	T1:4.7, T2:5.8
11	E-waste in the global context	CO 5	T1:4.7.2, T2:5.8.2
12	Growth of electrical and electronics industry in India	CO 5	T1:4.7.2, T2:5.8.2
13	E-waste legislation	CO 5	T1:4.8, T2:5.9
14	Government regulations on e-waste management	CO 6	T1:4.9, T2:5.7
15	International experience in management of e-waste	CO 6	T1:6.3, T2: 5.7
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Solid waste sources solid waste sources, types, composition, properties, Municipal solid waste: Physical, chemical and biological properties, waste collection and, transfer stations, waste minimization and recycling of municipal waste, environmental impacts, measures to mitigate environmental effects due to incineration	CO 1	T1:1.5, T2: 5.4, R3: 7.3

2	Land fill method of solid waste, classification, types, methods and sitting consideration; Layout and preliminary design of landfills: Composition, characteristics, generation, movement and control of landfill leachate and gases, environmental monitoring system for land fill gases.	CO 2	T1:4.5, T2: 5.4, R3: 7.2
3	Energy generation from waste bio-chemical conversion: Sources of energy generation, anaerobic digestion of sewage and municipal waste, direct combustion of MSW-refuse derived solid fuel. Industrial waste, agro residues and anaerobic digestion.	CO 3	T1:4.5, T2: 5.4, R3: 7.3
4	Biogas production, land fill gas generation and utilization, thermo-chemical conversion:gasification of waste using gasifies briquetting, utilization and advantages of briquetting, environmental benefits of bio-chemical and thermo- chemical conversion	CO 4	T1:4.5, T2: 5.4, R3: 7.3
5	E-waste in the global context: Growth of electrical and electronics industry in India, environmental concerns and health hazards; global trade in hazardous waste, Management of e-waste, legislation, government regulations on e-waste management, international experience and environmental protection laws of India	CO 5	T1:4.5, T2: 5.4, R3: 7.3
DISCUSSION OF QUESTION BANK			
1	Explain the composition of Municipal solid waste and various types of solid waste in detail.	CO 1	T1:3.3, T2:1.2, R2: 2.2
2	Explain the various phases of municipal solid waste decomposition in a closed landfill cell.	CO 2	T 1.4:7.3
3	Explain in-detail step by step procedure of bio-chemical conversion	CO 3	T1:6.2, T2:5.6
4	Discuss in detail the process of biogas production in thermo chemical conversion.	CO 4	T1:6.7, T2:5.3
5	Discuss in detail about regulations by government on e-waste management	CO 5, CO 6	T1:2.4, R1:5.5

Signature of Course Coordinator **HOD, IT**
Mr. S.Selvaprakash, Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**INFORMATION TECHNOLOGY**				
Course Title	**SOFT COMPUTING**				
Course Code	ACSB30				
Program	B.Tech				
Semester	VIII				
Course Type	Elective				
Regulation	R-18				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	G.LOHITHA,Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B TECH	AHSB12	II	Probability and Statistic
B TECH	AITB05	IV	Design and Analysis of Algorithms

II COURSE OVERVIEW:

Soft computing course provides students with fundamental theory and applications of heuristics, meta heuristics and evolutionary computations. It is used for approximate calculations to provide imprecise but useable solutions to complex problems. This includes intelligence systems, artificial neural network models, fuzzy logic and its inference system, and neuro-fuzzy system. The applications of Soft Computing across different industries such as kinematics, automobile, image processing and data compression, Decision Support System, Power System Analysis and investment and trading.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Soft Computing	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	Power Point Presentations	x	Chalk & Talk	x	Assignments	x	MOOC
✓	Open Ended Experiments	x	Seminars	x	Mini Project	x	Videos
x	Others						

V EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

Percentage of Cognitive Level	Blooms Taxonomy Level
%	Remember
%	Understand
%	Apply
0 %	Analyze

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Quiz	AAT	
CIA Marks	20	05	05	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination
Two Quiz exams shall be online examination consisting of 50 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)
This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning center. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc. The AAT chosen for this course is given in table

Concept Video	Tech-talk	Complex Problem Solving
40%	40%	20%

VI COURSE OBJECTIVES:

The students will try to learn:

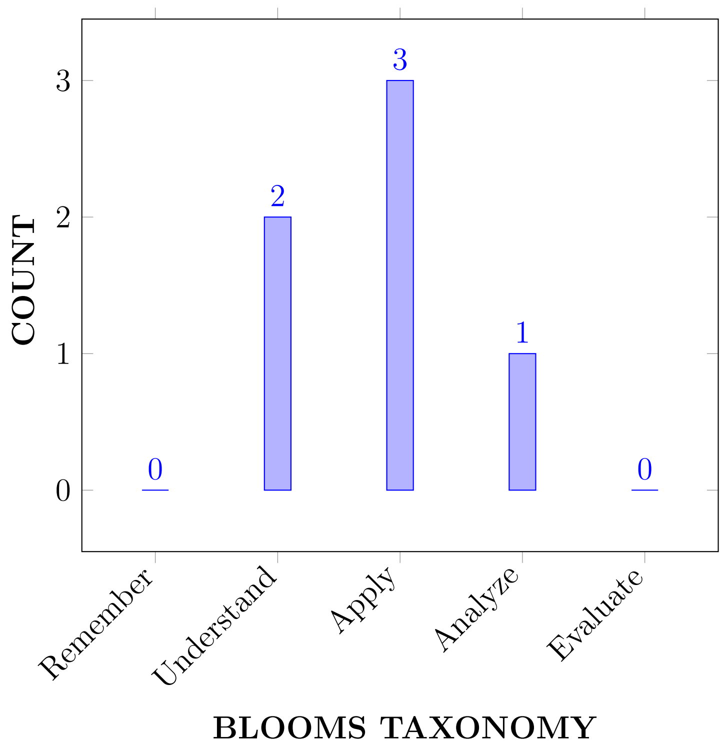
I	The basics of intelligence techniques and methodologies of soft computing that differs from conventional artificial computations.
II	The design and analysis of problem solving using concepts of neural networks, neuro-modeling, several neural networks paradigms and its applications.
III	The concepts of fuzzy logic and inference systems, neuro-fuzzy system, and applications to handle uncertainity in engineering problems.
IV	The soft computing techniques used in different applications for optimization.

VII COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Demonstrate** the constituents and models of artificial neural network systems for classification of soft computing problems.	Understand
CO 2	**Compare** the importance of auto and hetero associative memories for distinct cases of neural network systems.	Understand
CO 3	**Make use of** fuzzy logic and fuzzy inference systems for modeling and decision making of soft computing systems.	Apply
CO 4	**Choose** the appropriate ANFIS/CANFIS hybrid learning algorithms to solve applications for regression.	Apply
CO 5	**Build a** fuzzy system for information retrieval and pattern recognition applications.	Apply
CO 6	**Categorize** the soft computing and intelligent based learning approaches for solving the scientific and engineering problems.	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-Long Learning:** Recognize the need for and having the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

PROGRAM OUTCOMES		Strength	Proficiency Assessed by
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	SEE/CIE/AAT
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	SEE/CIE/AAT
PO 3	**Design/Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations	2	SEE/CIE/AAT
PO 10	**Communication:** Communicate effectively on complex Engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2	SEE/CIE/AAT
PO 12	**Life - Long Learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	3	Short Term Course

3 = High; 2 = Medium; 1 = Low

X HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO 1	Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Big data, Artificial Intelligence, Machine Learning and Networking.	3	SEE/CIE /AAT /Seminar
PSO2	Focus on improving software reliability, network security / information retrieval systems.	2	SEE/CIE /AAT /Seminar/Project

PROGRAM SPECIFIC OUTCOMES		Strength	Proficiency Assessed by
PSO3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies	2	SEE/CIE /AAT /Seminar /Project

3 = High; 2 = Medium; 1 = Low

XI MAPPING OF EACH CO WITH PO(s),PSO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	✓	✓	✓	-	-	-	-	-	-	✓	-	✓	-	✓	✓
CO 2	✓	✓	-	-	-	-	-	-	-	✓	-	✓	-	✓	✓
CO 3	✓	✓	✓	-	-	-	-	-	-	✓	-	✓	-	✓	✓
CO 4	✓	✓	✓	-	-	-	-	-	-	✓	-	✓	✓	-	✓
CO 5	✓	-	✓	-	-	-	-	-	-	✓	-	✓	✓	✓	✓
CO 6	✓	✓	✓	-	-	-	-	-	-	✓	-	✓	✓	✓	✓

XII JUSTIFICATIONS FOR CO – PO/ PSO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	PO 1	Demonstrate the constituents and models of artificial neural network systems by using scientific, mathematical and own engineering principles for classification of soft computing problems.	3
	PO2	Identify, formulate, data collection, translation, design and develop solution for the constituents and models of artificial neural network systems of soft computing problems.	7
	PO3	Understand customer and user needs of the requirement for the engineering activities to develop solution of artificial neural network systems for classification of soft computing problems	2
	PO10	Communicate effectively on engineering activities with engineering community orally for constituents and models of artificial neural network systems for classification of soft computing problems	2
	PO12	Keeping current and advanced engineering concepts with on-going learning for continued personal development to model artificial neural network systems for classification of soft computing problems	3
	PSO2	Focus on to design and develop of information retrieval systems to model artificial neural network systems for classification of soft computing problems.	1

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO3	Make use of technical skills and knowledge on advanced frame works to model artificial neural network systems for classification of soft computing problems	1
CO 2	PO 1	Illustrate the importance of auto and hetero associative memories for distinct cases of neural network systems by using scientific, mathematical and own engineering principles.	3
	PO 2	Identify, formulate, data collection, translation, design and develop solution to outline the importance of auto and hetero associative memories for distinct cases of neural network systems.	6
	PO10	Communicate effectively on engineering activities with engineering community orally to interpret the importance of auto and hetero associative memories for distinct cases of neural network systems.	2
	PO12	Keeping current and advanced engineering concepts on the importance of auto and hetero associative memories for distinct cases of neural network systems with on-going learning for continued personal development	3
	PSO2	Focus on design and develop of information retrieval systems to relate the importance of auto and hetero associative memories for distinct cases of neural network systems.	1
	PSO3	Make use of technical skills and knowledge on advanced frame works to summarize the importance of auto and hetero associative memories for distinct cases of neural network systems.	1
CO 3	PO 1	Make use of fuzzy logic and fuzzy inference systems for modeling and decision making of soft computing by using scientific, mathematical and own engineering principles.	3
	PO 2	Identify, formulate, data collection, translation, design and develop solution for modeling and decision making of soft computing systems using fuzzy logic and fuzzy inference systems.	8
	PO 3	Define and identify problem constraints to understand customer and user needs of the requirement for the engineering activities for modeling and decision making of soft computing systems using fuzzy logic and fuzzy inference systems.	6
	PO 10	Communicate effectively on engineering activities with engineering community orally for modeling and decision making of soft computing systems using fuzzy logic and fuzzy inference systems.	2
	PO12	Keeping current and advanced engineering concepts for modeling and decision making of soft computing systems with on-going learning for continued personal development using fuzzy logic and fuzzy inference systems.	3

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PSO2	Focus on design and develop of information retrieval systems for modeling and decision making of soft computing systems using fuzzy logic and fuzzy inference systems.	1
	PS O3	Make use of technical skills and knowledge on advanced frame works for modeling and decision making of soft computing systems using fuzzy logic and fuzzy inference systems.	1
CO 4	PO 1	Choose the appropriate ANFIS/CANFIS hybrid learning algorithms to solve applications for regression by using scientific, mathematical and own engineering principles.	3
	PO 2	Identify, formulate, data collection, translation, design and develop solution to solve applications for regression by using appropriate ANFIS/CANFIS hybrid learning algorithms.	7
	PO 3	Define and identify problem constraints to understand customer and user needs of the requirement for the engineering activities to solve applications for regression by using appropriate ANFIS/CANFIS hybrid learning algorithms.	4
	PO 10	Communicate effectively on engineering activities with engineering community orally to solve applications for regression by using appropriate ANFIS/CANFIS hybrid learning algorithms.	2
	PO 12	Keeping current and advanced engineering concepts with on-going learning for continued personal development the appropriate ANFIS/CANFIS hybrid learning algorithms to solve applications for regression.	3
	PSO 1	Understand, design and analyze computer programs in the areas related to soft computing to solve applications for regression by using appropriate ANFIS/CANFIS hybrid learning algorithms.	6
	PSO 3	Make use of technical skills and knowledge on advanced frame works to solve applications for regression by using appropriate ANFIS/CANFIS hybrid learning algorithms.	1
CO 5	PO 1	Construct fuzzy system for information retrieval and pattern recognition applications by using scientific, mathematical and own engineering principles.	3
	PO 3	Define and identify problem constraints to understand customer and user needs of the requirement for the engineering activities of fuzzy system for information retrieval and pattern recognition applications.	6
	PO 10	Communicate effectively on engineering activities with engineering community orally to design fuzzy system for information retrieval and pattern recognition applications.	2

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
	PO 12	Keeping current and advanced engineering concepts to design fuzzy system for information retrieval and pattern recognition applications with on-going learning for continued personal development.	3
	PSO 1	Understand, design and analyze computer programs in the areas related to soft computing fuzzy system for information retrieval and pattern recognition applications.	6
	PSO 2	Focus on design and develop of information retrieval and pattern recognition applications using fuzzy systems.	1
	PSO 3	Make use of technical skills and knowledge on advanced frame works to design fuzzy system for information retrieval and pattern recognition applications.	1
CO 6	PO 1	Categorize the soft computing and intelligent based learning approaches for solving the scientific and engineering problems by using scientific, mathematical and own engineering principles.	3
	PO 2	Identify, formulate, data collection, translation, design and develop solution for solving the scientific and engineering problems using soft computing and intelligent based learning approaches.	6
	PO 3	Define and identify problem constraints to understand customer and user needs of the requirement for the engineering activities for solving the scientific and engineering problems using soft computing and intelligent based learning approaches.	4
	PO 10	Communicate effectively on engineering activities with engineering community orally for solving the scientific and engineering problems using soft computing and intelligent based learning approaches.	2
	PO 12	Keeping current and advanced engineering concepts for solving the scientific and engineering problems using soft computing and intelligent based learning approaches with on-going learning for continued personal development.	3
	PSO 1	Understand, design and analyze computer programs in the areas related to soft computing for solving the scientific and engineering problems using soft computing and intelligent based learning approaches.	6
	PSO 2	Focus on design and develop of information retrieval systems for solving the scientific and engineering problems using soft computing and intelligent based learning approaches.	1
	PSO 3	Make use of technical skills and knowledge on advanced frame works for solving the scientific and engineering problems using soft computing and intelligent based learning approaches.	1

XIII TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO/ PSO MAPPING:

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	7	2	-	-	-	-	-	-	2	-	3	-	1	1
CO 2	3	6	-	-	-	-	-	-	-	2	-	3	-	1	1
CO 3	3	8	6	-	-	-	-	-	-	2	-	3	-	1	1
CO 4	3	7	4	-	-	-	-	-	-	2	-	3	6	-	1
CO 5	3	-	6	-	-	-	-	-	-	2	-	3	6	1	1
CO 6	3	6	4	-	-	-	-	-	-	2	-	3	6	1	1

XIV PERCENTAGE OF KEY COMPETENCIES FOR CO – PO/ PSO

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	100.0	70.0	20.0	-	-	-	-	-	-	40.0	-	37.5	-	50.0	50.0
CO 2	100.0	60.0	-	-	-	-	-	-	-	40.0	-	37.5	-	50.0	50.0
CO 3	100.0	80.0	60.0	-	-	-	-	-	-	40.0	-	37.5	-	50.0	50.0
CO 4	100.0	70.0	40.0	-	-	-	-	-	-	40.0	-	37.5	100.0	-	50.0
CO 5	100.0	-	60.0	-	-	-	-	-	-	40.0	-	37.5	100.0	50.0	50.0
CO 6	100.0	60.0	40.0	-	-	-	-	-	-	40.0	-	37.5	100.0	50.0	50.0

XV COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

CO'S and PO'S and CO'S and PSO'S on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

0 - $0 \leq C \leq 5\%$ – No correlation
1 -5 $<C \leq 40\%$ – Low/ Slight
2 - 40 % $<C < 60\%$ –Moderate
3 - $60\% \leq C < 100\%$ – Substantial /High

COURSE OUTCOMES	PROGRAM OUTCOMES												PSO'S		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	-	-	-	-	-	-	2	-	3	-	2	2
CO 2	3	3	-	-	-	-	-	-	-	2	-	3	-	2	2
CO 3	3	3	3	-	-	-	-	-	-	2	-	3	-	2	2
CO 4	3	3	2	-	-	-	-	-	-	2	-	3	3	2	2
CO 5	3	-	3	-	-	-	-	-	-	2	-	3	3	2	2
CO 6	3	3	3	-	-	-	-	-	-	2	-	3	3	2	2
TOTAL	18	15	12	-	-	-	-	-	-	12	-	6	9	10	12
AVERAGE	3.0	3.0	2.4	-	-	-	-	-	-	2.0	-	1.0	3.0	2.0	2.0

XVI ASSESSMENT METHODOLOGY-DIRECT:

CIE Exams	PO 1, PO 2,PO 3,PO 12	SEE Exams	PO 1, PO 2,PO 3,PO 12,PSO 1,PSO 2,PSO 3	Assignments	-
Seminars	PSO 1,PSO 2,PSO 3	Laboratory Practices	-	Student Viva	-
Certification	PO12	Term Paper	-	Mini Project	-

XVII ASSESSMENT METHODOLOGY-INDIRECT:

✓	Early Semester Feedback	✓	End Semester OBE Feedback

XVIII SYLLABUS:

MODULE I	**INTRODUCTION TO SOFT COMPUTING**
	Characteristic behavior of intelligent systems, knowledge based systems, knowledge representation and processing, soft computing characteristics; Constitutes of soft computing: Fuzzy logic and computing, neural computing, evolutionary computing, rough sets, probabilistic reasoning and machine learning
MODULE II	**NEURAL NETWORKS**
	Fundamental concepts and models of artificial neural systems: Biological neurons and their artificial models, models of artificial neural networks, neural processing, learning and adaptation, neural network learning rules and comparison; Linearly and non-linearly separable pattern classification; Perception convergence theorem; Multi-layer feed forward network: Delta learning rule for Multi perceptron layer, generalized delta learning rule, feed forward recall and error back propagation training, learning factors, character recognition application; Associative memory: Hopfield network, bidirectional associative memory, radial basis function networks.
MODULE III	**FUZZY LOGIC AND FUZZY SYSTEMS**
	Evolution of fuzzy logic, fuzzy sets, fuzzy logic operations, fuzzy relations, fuzzy arithmetic and fuzzy measures, fuzzy rules and reasoning. Fuzzy inference systems: mamdani fuzzy model, sugeno fuzzy model, tsukamoto fuzzy model, fuzzy modeling and decision making, neuro-fuzzy modeling, input space partitioning and fuzzy modeling.
MODULE IV	**HYBRID SYSTEMS**
	ANFIS (Adaptive neuro-fuzzy inference systems): Introduction, ANFIS Architecture, and hybrid learning algorithm; Advantages and limitations of ANFIS; Application of ANFIS/CANFIS for regression.
MODULE V	**APPLICATIONS OF SOFT COMPUTING TECHNIQUES**

	Applications of fuzzy in pattern recognition: Printed character recognition, inverse kinematics problems, automobile fuel efficiency prediction, soft computing for color recipe prediction, applications of evolutionary computing in image processing and computer vision, soft computing in mobile ad-hoc networks, soft computing in information retrieval and semantic web, soft computing in software engineering.

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2. Satish Kumar,— Neural Networks – A Classroom Approach, Tata McGraw-Hill, 2nd Edition, 2005.
3. Kishan Mehrotra, Chilukuri. K. Mohan, Sanjay Ranka, — Elements of Artificial Neural Networks, Penram International Publishing India, 2nd Edition, 2004.
4. H. J. Zimmermann, Fuzzy Set Theory and its Applications, Allied Publishers Ltd, 1st Edition, 2004.
5. 5. John Hertz, Anders Krogh, Richard Palmer Introduction to The Theory of Neural Computation, Addison – Wesley Publishing Company, 1st Edition, 1991.

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2. http://www.rkala.in/softcomputingvideos.php
3. http://www.sharbani.org/home2/soft-computing
4. http://www.myreaders.info/html/soft_computing.html

COURSE WEB PAGE:

XIX COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

S.No	Topics to be covered	CO's	Reference T1: 4.1
	OBE DISCUSSION		

1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO - PO Mapping	-	-
CONTENT DELIVERY (THEORY)			
1	Characteristic behavior of intelligent systems, knowledge based systems	CO1	T2: 1.1-1.8, 2.2
2	knowledge based systems	CO 1	T2: 1.1-1.8, 2.2
3	knowledge representation and processing, soft computing characteristics.	CO 1	T2: 1.1-1.8, 2.2
4	Constitutes of soft computing: Fuzzy logic computing.	CO 1	T2:1.10
5	neural computing computing.	CO 1	T2:1.10
6	Evolutionary computing, rough sets, probabilistic reasoning and machine learning. computing.	CO 1	T2:1.10
7	, probabilistic reasoning and machine learning. computing.	CO 1	T2:1.10
8	Fundamental concepts and models of artificial neural systems	CO 1	T2:2.7
9	Biological neurons and their artificial models	CO 1	T2:2.7
10	models of artificial neural networks, neural processing, learning and adaptation.	CO 1	T2:2.7
11	neural network learning rules and comparison	CO 2	T2:2.8
12	Linearly and non-linearly separable pattern classification	CO 2	T2:2.8
13	Perception convergence theorem; Multi-layer feed forward network	CO 2	T2:2.8
14	Delta learning rule for Multi perceptron layer, generalized delta learning rule.	CO 2	T2:2.8
15	Feed forward recall and error back propagation training, learning factors character recognition application; Associative memory: Hopfield network, bidirectional associative memory, radial basis function networks.	CO 2	T2:2.8
16	, learning factors character recognition application; Associative memory: Hopfield network, bidirectional associative memory, radial basis function networks.	CO 2	T2:2.8
17	character recognition application; Associative memory	CO 2	T2:2.8
18	Hopfield network, bidirectional associative memory, radial basis function networks.	CO 2	T2:2.8
19	Evolution of fuzzy logic, fuzzy sets, fuzzy logic operationsfuzzy relations, fuzzy arithmetic and fuzzy ,measures, fuzzy rules and reasoning.	CO 3	T2: 3.1-3.2
20	fuzzy logic operationsfuzzy relations	CO 3	T2: 3.1-3.2
21	fuzzy arithmetic and fuzzy ,measures	CO 3	T2: 3.1-3.2
22	fuzzy rules and reasoning.	CO 3	T2: 3.1-3.2

23	Fuzzy inference systems mamdani fuzzy model	CO 3	T2: 3.3-3.7
24	sugeno fuzzy model, tsukamo to fuzzy model	CO 3	T2: 3.3-3.7
25	fuzzy modeling and decision making.	CO 3	T2: 3.3-3.7
26	neuro-fuzzy modeling, input space partitioning and fuzzy modeling.	CO 3	T2: 3.3-3.7
27	Adaptive neuro-fuzzy inference systems (ANFIS)	CO 8	T2:4.2,7.1-7.4, R3:1.1-1.4
28	Introduction, ANFIS Architecture, and hybrid learning algorithm.	CO 8	T2:4.2,7.1-7.4, R3:1.1-1.4
29	Advantages and limitations of ANFIS	CO 4	T2: 7.6 7.7
30	Application of ANFIS/CANFIS for regression	CO 4	T3:1.1
31	Applications of fuzzy in pattern recognition	CO 5	T3:1.1-1.2 ,R3:1.5-1.7
32	Printed character recognition, inverse kinematics problems	CO 5	T3:1.1-1.2 ,R3:1.5-1.7
33	automobile fuel efficiency prediction	CO 5	T3:1.1-1.2 ,R3:1.5-1.7
35	soft computing for color recipe prediction.	CO 5	T3:1.1-1.2 ,R3:1.5-1.7
36	Applications of evolutionary computing in image processing and computer vision	CO 6	T3:1.3 ,R3:1.7,7.4
37	soft computing in mobile ad-hoc networks	CO 6	T3:1.3 ,R3:1.7,7.4
38	soft computing in information retrieval	CO 6	T3:1.3 ,R3:1.7,7.4
39	semantic web, soft computing in software engineering.	CO 6	T3:1.3 ,R3:1.7,7.4
40	soft computing in software engineering.	CO 6	T3:1.3 ,R3:1.7,7.4
PROBLEM SOLVING/ CASE STUDIES			
1	What are the characteristics of soft computing and explain the uncertainity in handling .	CO 1	T2: 1.1-1.8, 2.2

2	How the input data can be handle with knowledge base for producing the output in rule base system. explain with an example?	CO 1	T2: 1.1-1.8, 2.2
3	Translate the output of u from the network with input x=$[-1,2]^T$ W=[-1,2] with activation function in hidden layer as: a) Unipolar activation function b) Bipolar sigmoidal function	CO 2	T2:1.10
4	Solve the back propagation algorithm for 2-3-1 neural network with the activation function. $\frac{1}{(1+e^{-N})}$	CO 2	T2:1.10
5	Solve the outputs of u from the perception activation function for the following input vectors x and weight vectors w: a) x=$[-1,0,2]^T$ w=$[-1,-3,2,-5]^T$	CO 2	T2:2.8
6	Find the output of u using activation function as defined for the 3-3 neural network with given input x=[3, 0, 1] and $w = \begin{bmatrix} 3 & -1 & 1 \\ 1 & -2 & -2 \\ -1 & 0 & -3 \end{bmatrix}$ $u = \begin{cases} 1, & u > 0 \\ 0, & u < 0 \end{cases}$	CO 2	T2:2.8
7	Explain the extension principle and min-max fuzzy relations in problem solving.	CO 4	T2: 3.1-3.2
8	List the components of fuzzy logic system. Explain each component in detail.	CO 3	T2: 3.1-3.2
9	Draw the typical membership function to predict the values using fuzzy relations.	CO 3	T2: 3.1-3.2
10	Construct an ANFIS that is equivalent to a two-input two-rule mamdani fuzzy model with min max composition and centroid defuzzification. Explain the function user use to approximate the centroid defuzzification.	CO 4	T2: 3.1-3.2
11	Construct an ANFIS that is equivalent to a two-input two-rule mamdani fuzzy model with sum-product composition and centroid defuzzification.	CO 4	T2:4.2,7.1-7.4, R3:1.1-1.4
12	Demonstrate the different premise and consequent parameters are there in ANFIS architecture (imagine generalized bell function is used for all the membership functions).	CO 5	T3:1.1
13	Explain in detail about indirect kinematics of a two joint planar robot arm.	CO 6	T3:1.3 ,R3:1.7,7.4
14	Explain the logic of applying ANFIS to MPG prediction.	CO 4	T3:1.1
15	Explain in detail about evolutionary computing.	CO 1	T3:1.3 ,R3:1.7,7.4
DISCUSSION OF DEFINITION AND TERMINOLOGY			
1	Discussion of definition and terminology on introduction to soft computing	CO 1	T2: 1.1-1.8, 2.2
2	Discussion of definition and terminology on neural networks	CO 2	T2:2.7

3	Discussion of definition and terminology on fuzzy logic and fuzzy systems	CO 3	T2:2.8
4	Discussion of definition and terminology on hybrid systems	CO 4	T2:4.2,7.1-7.4, R3:1.1-1.4
5	Discussion of definition and terminology on applications of soft computing techniques	CO 5	T3:1.1-1.2 ,R3:1.5-1.7
DISCUSSION OF QUESTION BANK			
1	Discussion of Question on introduction to soft computing	CO 1	T2: 1.1-1.8, 2.2
2	Discussion of Question on neural networks	CO 2	T2:2.7
3	Discussion of question on fuzzy logic and fuzzy systems	CO 3	T2:2.8
4	Discussion of question on hybrid systems	CO 4	T2:4.2,7.1-7.4, R3:1.1-1.4
5	Discussion of question on applications of soft computing techniques	CO 5	T3:1.1-1.2 ,R3:1.5-1.7

Signature of Course Coordinator **HOD,IT**