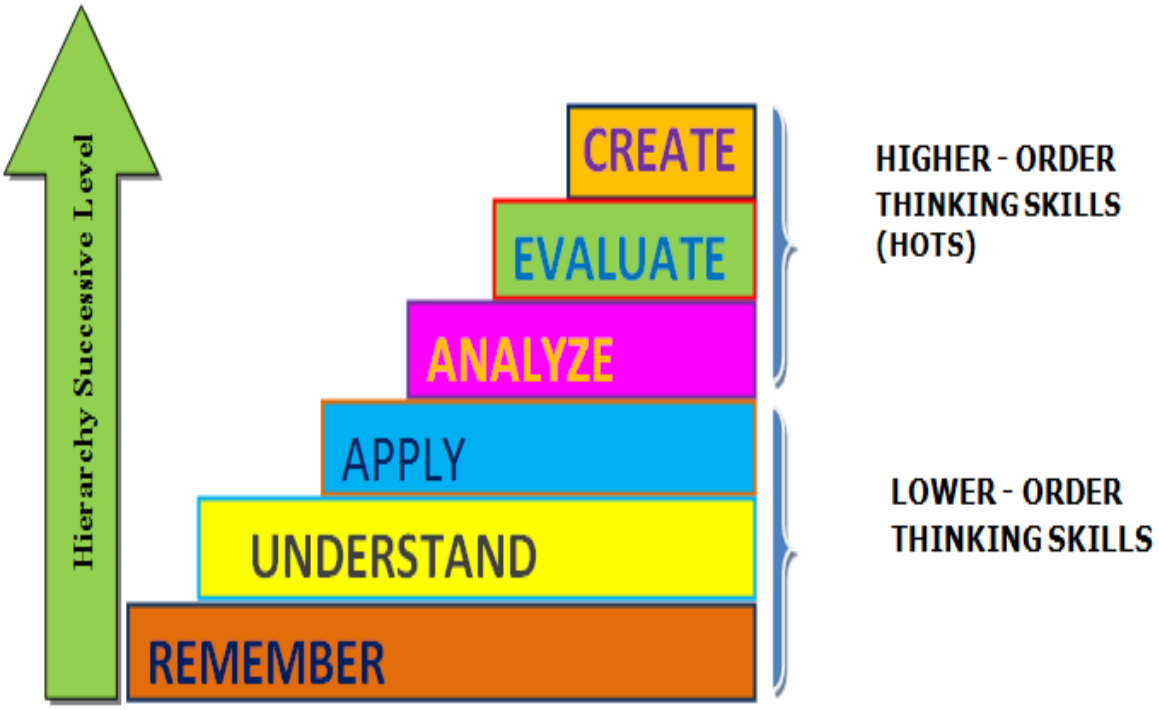
COURSE DESCRIPTOR BOOKLET

R-18 REGULATIONS

B.Tech – I & II SEM



BLOOM'S TAXONOMY OF LEARNING OUTCOMES

.....Moving Towards Perfection in Engineering

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Approved by AICTE; Affiliated to JNTUH and Accredited by NAAC with 'A' Grade
Dundigal, Hyderabad - 500 043

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AERONAUTICAL ENGINEERING

COURSE DESCRIPTOR

Course Title	**PROGRAMMING FOR PROBLEM SOLVING**				
Course Code	ACSB01				
Programme	B.Tech				
Semester	I	AE | ME			
	II	CSE | IT | ECE |EEE | CIVIL			
Course Type	Foundation				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	0	3	4	2
Chief Coordinator	Ms. N Jayanthi, Assistant Professor Ms. B Tejaswi, Assistant Professor				
Course Faculty	Dr. J Sirisha Devi, Professor Dr. B Venkateswara Rao, Professor Mr. N Poornachandra Rao, Assistant Professor Mr. P Ravinder, Assistant Professor Mr. B Padmaja, Associate Professor Ms. A Jayanthi, Assistant Professor Mr. S Laxman Kumar, Assistant Professor Ms. S Swarajya Lakshmi, Assistant Professor Ms. A Soujanya, Assistant Professor Mr. Ch Suresh Kumar Raju, Assistant Professor				

I. COURSE OVERVIEW:

The course covers the basics of programming and demonstrates fundamental programming techniques, customs and terms including the most common library functions and the usage of the preprocessor. This course helps the students in gaining the knowledge to write simple C language applications, mathematical and engineering problems. This course helps to undertake future courses that assume this programming language as a background in computer programming. Topics include variables, data types, functions, control structures, pointers, strings, arrays and dynamic allocation principles. This course in reached to student by power point presentations, lecture notes, and lab involve the problem solving in mathematical and engineering areas.

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II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
-	-	-	Basic Programming Concepts	-

III. MARKS DISTRIBUTION

Subject	SEE Examination	CIA Examination	Total Marks
Programming for Problem Solving	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	Chalk & Talk	✔	Quiz	✔	Assignments	✔	MOOCs
✔	LCD / PPT	✔	Seminars	✘	Mini Project	✔	Videos
✔	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 modules 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 emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 1), with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

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 centre. 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 section XI.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		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	Assignments/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	Assignments/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	-
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	-
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	-

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	**Professional skills:** Able to utilize the knowledge of aeronautical/aerospace engineering in innovative, dynamic and challenging environment for design and development of new products	2	Assignments/Quiz
PSO 2	**Practical implementation and testing skills:** Providing different types of in house and training and industry practice to fabricate and test and develop the products with more innovative technologies	3	Assignments/Quiz
PSO 3	**Successful career and entrepreneurship:** To prepare the students with broad aerospace knowledge to design and develop systems and subsystems of aerospace and allied systems and become technocrats	1	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
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.

IX. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
ACSB01.01	CLO 1	Identify and understand the working of key components of a computer system.	PO 1,PO2	2
ACSB01.02	CLO 2	Analyze a given problem and develop an algorithm to solve the problem.	PO 1,PO2	2
ACSB01.03	CLO 3	Describe the fundamental programming constructs and articulate how they are used to develop a program with a desired runtime execution flow.	PO 1,PO2	2
ACSB01.04	CLO 4	Gain knowledge to identify appropriate C language constructs to write basic programs.	PO 2,PO3	3
ACSB01.05	CLO 5	Identify the right data representation formats based on the requirements of the problem.	PO 2,PO12	2
ACSB01.06	CLO 6	Describe the operators, their precedence and associativity while evaluating expressions in program statements..	PO 1,PO2,PO3	3
ACSB01.07	CLO 7	Understand branching statements, loop statements and use them in problem solving.	PO 2	2
ACSB01.08	CLO 8	Learn homogenous derived data types and use them to solve statistical problems.	PO 1,PO2,PO3	3

ACSB01.09	CLO 9	Identify the right string function to write string programs.	PO 1,PO2,PO3	3
ACSB01.10	CLO 10	Understand procedural oriented programming using functions.	PO 1,PO2,PO3,PO5	3
ACSB01.11	CLO 11	Understand how recursion works and write programs using recursion to solve problems.	PO ,PO3	2
ACSB01.12	CLO 12	Differentiate call by value and call by reference parameter passing mechanisms.	PO 2,PO3	2
ACSB01.13	CLO 13	Understand storage classes and preprocessor directives for programming	PO 1,PO2,PO5	3
ACSB01.14	CLO 14	Understand pointers conceptually and apply them in C programs.	PO 1,PO2,PO3	3
ACSB01.15	CLO 15	Distinguish homogenous and heterogeneous data types and apply them in solving data processing applications.	PO 1,PO2	2
ACSB01.16	CLO 16	Explain the concept of file system for handling data storage and apply it for solving problems	PO 1,PO2,PO5	3
ACSB01.17	CLO 17	Differentiate text files and binary files and write the simple C programs using file handling functions.	PO 1,PO2	2
ACSB01.18	CLO 18	Apply the concepts to solve real-time applications using the features of C language.	PO 2, PO 12	2
ACSB01.19	CLO 19	Gain knowledge to identify appropriate searching and sorting techniques by calculating time complexity for problem solving.	PO 2,PO3,PO12	3
ACSB01.20	CLO 20	Possess the knowledge and skills for employability and to succeed in national and international level competitive examinations.	PO 5,PO12	2

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X. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1	3		1										2	2	
CLO 2	3	2											2	2	
CLO 3	3	2											3	2	
CLO 4	1	3	2										1	3	
CLO 5		2										2	3		
CLO 6	2	3	2											3	
CLO 7		2	2											3	
CLO 8	3	2	1										2	3	
CLO 9	2	3	1										2	3	
CLO 10	2	3	1		1								1	3	

CLO 11		2	3										2	3	
CLO 12		2	3										3	2	
CLO 13	3	2			2									3	
CLO 14	3	2	2										2	3	
CLO 15	2	3											3		
CLO 16	3	2			2								1	1	
CLO 17	3	2											2	3	
CLO 18		3										2			
CLO 19		3	3									2		3	
CLO 20					2							3			

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XI. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO 1	SEE Exams	PO 1	Assignments	PO 1	Seminars	PO 2
Laboratory Practices	PO 2	Student Viva	PO 2	Mini Project	-	Certification	PO 1
Term Paper	-						

XII. ASSESSMENT METHODOLOGIES - INDIRECT

✔	Early Semester Feedback	✔	End Semester OBEfeed Back
✘	Assessment of Mini Projects by Experts		

XIII. SYLLABUS

Module-I	**INTRODUCTION**	**Classes: 10**
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 STRUCTURES**	**Classes: 08**
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**	**Classes: 10**
Arrays: Concepts, one dimensional arrays, declaration and initialization of one dimensional arrays,		

two dimensional arrays, initialization and accessing, multi-dimensional arrays; Strings: Arrays of characters, variable length character strings, inputting character strings, character library functions, string handling functions.

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**	**Classes: 09**

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 BASICALGORITHMS**	**Classes: 08**

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).

Text Books:

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

2. E. Balagurusamy, “Programming in ANSI C”, McGraw Hill Education, 6th Edition, 2012.

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, 2nd 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.
7. B. A. Forouzan, R. F. Gillberg, “C Programming and Data Structures”, Cengage Learning, India, 3rd Edition, 2014.N. P. Bali, “Engineering Mathematics”, Laxmi Publications, 9th Edition, 2016.

Web References:

1. https://www.bfoit.org/itp/Programming.html
2. https://www.khanacademy.org/computing/computer-programming
3. https://www.edx.org/course/programming-basics-iitbombayx-cs101-1x-0
4. https://www.edx.org/course/introduction-computer-science-harvardx-cs50x

E-Text Books:

1. http://www.freebookcentre.net/Language/Free-C-Programming-Books-Download.htm
2. http://www.imada.sdu.dk/~svalle/courses/dm14-2005/mirror/c/
3. http://www.enggnotebook.weebly.com/uploads/2/2/7/1/22718186/ge6151-notes.pdf

MOOC Course:

1. https://www.alison.com/courses/Introduction-to-Programming-in-c
2. http://www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-s096-effective-programming-in-c- and-c-january-iap-2014/index.htm

XIV. COURSE PLAN:

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

Lecture No	Topic/s to be covered	Course Learning Outcomes (CLOs)	Reference
1 – 2	Introduction to Computers: computer systems, computing environments, Computer languages, creating and running programs	CLO 1	T2:1.1-1.2
3 – 4	Algorithms, flowcharts; Introduction to C language: Computer languages, History of C, basic structure of C programs, process of compiling and running a C program	CLO 2	T2:2.1-2.2
5 – 6	C tokens, keywords, identifiers, constants, strings	CLO 2	T2:1.4-1.5
7 – 8	Special symbols, variables, data types	CLO 3	T2:2.1-2.2
9 – 10	Operators and expressions	CLO 3	T2: 2.3-2.6,7
11 – 12	Simple if, if-else, else if ladder, Nested if and Case Statement-switch statement	CLO 3	T2:3.1-3.5
13 – 14	While, for and do while loops	CLO 5	T2: 5.2-5.3
15 – 16	Jump statements, break, continue, goto statements	CLO 7	T2: 6.1-6.6
17 – 18	Concepts, one dimensional arrays, declaration and initialization of one dimensional arrays	CLO 9	T2: 6.7
19 – 20	Two dimensional arrays, initialization and accessing	CLO 13	T2: 8.1-8.3,8.7-8.8
21-22	Multi-dimensional arrays; Strings: Arrays of characters	CLO 13	T2: 11.1-11.5
23-- 24	Variable length character strings, inputting character strings, character library functions, string handling functions	CLO 15	T2: 4.1-4.5
25	Need for user defined functions, function declaration, function prototype	CLO 15	T1:7 T2: 6.9 T2:G.1
26-27	Category of functions, inter function communication, function calls	CLO 11	T1:10 T2:10.1-10.2
28 – 29	Parameter passing mechanisms, recursion, passing arrays to functions, passing strings to functions,	CLO 16	T2:10.3-10.5
30 – 31	Storage classes ,preprocessor directive	CLO 16	T1:8
32 – 33	Structure definition, initialization, accessing structures, nested structures	CLO 16	T2: 12.3-12.4
34 – 35	Unions, C programming examples, BitFields, typedef, enumerations	CLO 16	T2:12.4 T2:12.1-12.2
36 -- 38	Arrays of structures, structures and functions, passing structures through pointers, self-referential structures	CLO 17	T2:2.1-2.2
39 – 40	Unions, bit fields, typedef, enumerations	CLO 17	T2: 2.3-2.6,7
41 – 42	Pointer basics, pointer arithmetic, pointers to pointers, generic pointers, array of pointers, pointers and arrays	CLO 19	T2:3.1-3.5
43 – 44	Pointers as functions arguments, functions returning pointers	CLO 19	T2: 5.2-5.3
45	Dynamic memory allocation: Basic concepts, library functions	CLO 20	T2: 6.1-6.6
39	Streams, basic file operations, file types, file opening modes, input and output operations with files	CLO 20	T2:10.4

Lecture No	Topic/s to be covered	Course Learning Outcomes (CLOs)	Reference
40-41	Special functions for working with files, file positioning functions	CLO 21	R3:12.1-12.3
42	Command line arguments. Searching	CLO 22	R3:12.4
43	Sorting algorithms bubble, insertion, selection	CLO 23	T2:11.4 R7:13.1-13.3
44-45	Algorithm complexity through example programs	CLO 23	T2:11.4 R7:13.1-13.3

XV. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S No	Description	Proposed Actions	Relevance With POs	Relevance With PSOs
1	Assist student to design system calls in operating systems	Seminars	PO 1	PSO 1
2	Stimulate students to develop graphics programming	Seminars/ NPTEL	PO 2	PSO 1
3	Encourage students to solve real time applications and prepare towards competitive examinations.	1.Build IT 2. Proficiency Test 3. Coding Hackthon/ Competitions	PO 2	PSO 1

XVI. DESIGN BASED PROBLEMS (DP) / OPEN ENDED PROBLEM:

1. Develop simple character-based Chess-game supporting standard partial chess moves. Chess board should be 8x8 Cell Board having each Cell of 4 characters. Basic chess board with empty shell should have W... Cell and B... For Black Cell. Wherever any player‟s Game elements such as Rook or Camel or King or Queen is on board Cell then it. Then it should be displayed such as BQN2 or WQN1 which indicated such as Queen of player-2 on black cell or queen of player-1 on white cell. Or Student can use his own conventions. Student should be able to demonstrate 5 moves for each player minimum.
2. (Airline Reservations System) A small airline has just purchased a computer for its new automated reservations system. The president has asked you to program the new system. You are to write a program to assign seats on each flight of the airline's only plane (capacity: 10 seats).

   Your program should display the following menu of alternatives: Please type 1 for "first class"

   Please type 2 for "economy"

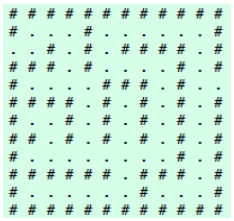
   If the person types 1, then your program should assign a seat in the first class section (seats 1- 5). If the person types 2, then your program should assign a seat in the economy section (seats 6-10). Your program should then print a boarding pass indicating the person's seat number and whether it is in the first class or economy section of the plane.

   Use a single-subscripted array to represent the seating chart of the plane. Initialize all the elements of the array to 0 to indicate that all seats are empty. As each seat is assigned, set the corresponding elements of the array to 1 to indicate that the seat is no longer

available.

Your program should, of course, never assign a seat that has already been assigned. When the first class section is full, your program should ask the person if it is acceptable to be placed in the economy section (and vice versa). If yes, then make the appropriate seat assignment. If no, then print the message "Next flight leaves in 3 hours.

3. (*Maze Traversal*) The following grid is a double-subscripted array representation of a maze.



The # symbols represent the walls of the maze, and the periods (.) represent squares in the possible paths through the maze. There is a simple algorithm for walking through a maze that guarantees finding the exit (assuming there is an exit). If there is not an exit, you will arrive at the starting location again. Place your right hand on the wall to your right and begin walking forward. Never remove your hand from the wall. If the maze turns to the right, you follow the wall to the right. As long as you do not remove your hand from the wall, eventually you will arrive at the exit of the maze. There may be a shorter path than the one you have taken, but you are guaranteed to get out of the maze. Write recursive function mazeTraverse to walk through the maze. The function should receive as arguments a 12-by-12 character array representing the maze and the starting location of the maze. As mazeTraverse attempts to locate the exit from the maze, it should place the character X in each square in the path. The function should display the maze after each move so the user can watch as the maze is solved.

Prepared By:
Ms. N Jayanthi, Assistant Professor
Ms. B Tejaswi, Assistant Professor

HOD, FRESHMAN ENGINEERING

INSTITUTE OF AERONAUTICAL ENGINEERING

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AERONAUTICAL ENGINEERING

COURSE DESCRIPTOR

Course Title	**LINEAR ALGEBRA AND CALCULUS**				
Course Code	AHSB02				
Programme	B. Tech				
Semester	I	AE | CSE | IT | ECE | EEE | ME |CE			
Course Type	Foundation				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	-	-
Chief Coordinator	**Ms. L Indira, Assistant Professor**				
Course Faculty	**Dr. M Anita, Professor** **Dr. S Jagadha, Professor** **Mr. Ch Somashekar, Associate Professor** **Mr. V Subba Laxmi, Associate Professor** **Mr. J Suresh Goud, Assistant Professor** **Ms. P Srilatha, Assistant Professor** **Ms. C Rachana, Assistant Professor** **Ms. P Rajani, Assistant Professor** **Ms. B Praveena, Assistant Professor**				

I. COURSE OVERVIEW:

The course focuses on more advanced Engineering Mathematics topics which provide with the relevant mathematical tools required in the analysis of problems in engineering and scientific professions. The course includes types of Matrices and its applications, maxima and minima of functions of several variables, solutions of higher order ordinary differential equations, multiple integrals and vector calculus. The mathematical skills derived from this course form a necessary base to analytical and design concepts encountered in the program.

II. COURSE PRE-REQUISITES:

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

III. MARKS DISTRIBUTION:

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

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	Chalk & Talk	✔	Quiz	✔	Assignments	✘	MOOCs
✔	LCD / PPT	✔	Seminars	✘	Mini Project	✔	Videos
✘	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.

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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.

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This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning centre. 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 section XI.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		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	Presentation on real- world 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	2	Seminar

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	**Professional skills:** Able to utilize the knowledge of aeronautical/aerospace engineering in innovative, dynamic and challenging environment for design and development of new products.	1	Seminar
PSO 2	**Problem-solving Skills**: Imparted through simulation language skills and general purpose CAE packages to solve practical, design and analysis problems of components to complete the challenge of airworthiness for flight vehicles.	-	-
PSO 3	**Practical implementation and testing skills:** Providing different types of in house and training and industry practice to fabricate and test and develop the products with more innovative technologies.	-	-
PSO 4	**Successful career and entrepreneurship:** To prepare the students with broad aerospace knowledge to design and develop systems and subsystems of aerospace and allied systems and become technocrats.	-	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Analyze and solve linear system of equations by using elementary transformations.
II	Determine the maxima and minima of functions of several variables by using partial differential coefficients..
III	Apply second and higher order linear differential equations to solve electrical circuits.
IV	Apply multiple integration to evaluate mass, area and volume of the plane.
V	Analyze gradient, divergence and curl to evaluate the integration over a vector field.

IX. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AHSB02.01	CLO 1	Demonstrate knowledge of matrix calculation as an elegant and powerful mathematical languagein connection with rank of a matrix.	PO 1 PO 2	3
AHSB02.02	CLO 2	Determine rank by reducing the matrix to Echelon and Normal forms.	PO 1 PO 2	3
AHSB02.03	CLO 3	Determine inverse of the matrix by Gauss Jordon Method.	PO 1 PO 2	3
AHSB02.04	CLO 4	Interpret the Eigen values and Eigen vectors of matrix for a linear transformation and use properties of Eigen values	PO 1 PO 2	3
AHSB02.05	CLO 5	Understand the concept of Eigen values in real-world problems of control field where they are pole of closed loop system.	PO 1	3
AHSB02.06	CLO 6	Apply the concept of Eigen values in real-world problems of mechanical systems where Eigen values are natural frequency and mode shape.	PO2	2
AHSB02.07	CLO 7	Use the system of linear equations and matrix to determine the dependency and independency.	PO 2	2
AHSB02.08	CLO 8	Determine a modal matrix, and reducing a matrix to diagonal form.	PO 2	2
AHSB02.09	CLO 9	Evaluate inverse and powers of matrices by using Cayley-Hamilton theorem.	PO 2	2
AHSB02.10	CLO 10	Apply the Mean value theorems for the single variable functions.	PO 1 PO 2	3
AHSB02.11	CLO 11	Find partial derivatives numerically and symbolically and use them to analyze and interpret the way a function varies.	PO 1 PO 2	3
AHSB02.12	CLO 12	Find partial derivatives of and apply chain rule derivative techniques to multivariable functions.	PO 1 PO 2	3
AHSB02.13	CLO 13	Understand the techniques of multidimensional change –of –variables to transform the coordinates by utilizing the Jacobian. Determine Jacobian for the coordinate transformation.	PO 2	2
AHSB02.14	CLO 14	Apply maxima and minima for functions of several variable's and Lagrange's method of multipliers.	PO 1	3
AHSB02.15	CLO 15	Find the complete solution of a non-homogeneous differential equation as a linear combination of the complementary function and a particular solution.	PO 1	3

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AHSB02.16	CLO 16	Solving Second and higher order differential equations with constant coefficients.	PO 1, PO 2	3
AHSB02.17	CLO 17	Apply the second order differential equations for real world problems of electrical circuits.	PO 1, PO 2	3
AHSB02.18	CLO 18	Evaluate double integral and triple integrals of the given functions.	PO 1, PO 2	3
AHSB02.19	CLO 19	Utilize the concept of change order of integration and change of variables to evaluate double integrals.	PO 1, PO 2	3
AHSB02.20	CLO 20	Determine the area and volume of a given curve using double and triple integral.	PO 1, PO 2	3
AHSB02.21	CLO 21	Analyze scalar and vector fields and compute the gradient, divergence and curl.	PO 1	3
AHSB02.22	CLO 22	Understand integration of vector function with given initial conditions.	PO1	2
AHSB02.23	CLO 23	Evaluate line, surface and volume integral of vectors.	PO 1	3
AHSB02.24	CLO 24	Use Vector integral theorems to facilitate vector integration.	PO 2	2

3 = High; 2 = Medium; 1 = Low

X. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO 1	3	2											1			
CLO 2	3	2														
CLO 3	3	3														
CLO 4	3	2											1			
CLO 5	3															
CLO 6		2														
CLO 7		2														
CLO 8		3											1			
CLO 9		2											1			
CLO 10	3	2														
CLO 11	2	2											1			
CLO 12	3	3											1			
CLO 13		2														
CLO 14	3												1			

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO 15	3															
CLO 16	3	2											1			
CLO 17	2	2											1			
CLO 18	2	1											1			
CLO 19	3	2											1			
CLO 20	3	1											1			
CLO21	2															
CLO22	3												2			
CLO23	3															
CLO24	2	2											2			

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO 1	SEE Exams	PO 1	Assignments	-	Seminars	PO 2
Laboratory Practices	-	Student Viva	-	Mini Project	-	Certification	-
Term Paper	-						

XII. ASSESSMENT METHODOLOGIES - INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feedback
✘	Assessment of Mini Projects by Experts		

XIII. SYLLABUS

Module-I	THEORY OF MATRICES AND LINEAR TRANSFORMATIONS	Classes: 09
Real matrices: Symmetric, skew-symmetric and orthogonal matrices; Complex matrices: Hermitian, Skew-Hermitian and unitary matrices; Elementary row and column transformations; Rank of a matrix: Echelon form and normal form; Inverse by Gauss-Jordan method; Cayley-Hamilton theorem: Statement, verification, finding inverse and powers of a matrix; Linear dependence and independence of vectors; Eigen values and Eigen vectors of a matrix and Properties (without proof); Diagonalization of matrix by linear transformation.		
Module-II	**FUNCTIONS OF SINGLE AND SEVERAL VARIABLES**	**Classes: 09**
Mean value theorems: Rolle's theorem, Lagrange's theorem, Cauchy's theorem-without proof; Functions of several variables: Partial differentiation, chain rule, total derivative, Euler's theorem, functional dependence, Jacobian, maxima and minima of functions of two variables without constraints		

and with constraints; Method of Lagrange multipliers.		
Module-III	**HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS AND THEIR APPLICATIONS**	**Classes: 09**
Linear differential equations of second and higher order with constant coefficients, non-homogeneous term of the type $f(x)=e^{ax}, \sin ax, \cos ax$ and $f(x)=x^n, e^{ax}v(x), x^n v(x)$; Method of variation of parameters; Applications to electrical circuits.		
Module-IV	**MULTIPLE INTEGRALS**	**Classes: 09**
Double and triple integrals; Change of order of integration. Transformation of coordinate system; Finding the area of a region using double integration and volume of a region using triple integration.		
Module-V	**VECTOR CALCULUS**	**Classes: 09**
Scalar and vector point functions; Definitions of Gradient, divergent and curl with examples; Solenoidal and irrotational vector point functions; Scalar potential function; Line integral, surface integral and volume integral; Vector integral theorems: Green's theorem in a plane, Stoke's theorem and Gauss divergence theorem without proofs.		
Text Books:		
1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th 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, 9th 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, 2nd Edition, Brooks/Cole, 2005. 4. Dr. M Anita, Engineering Mathematics-I, Everest Publishing House, Pune, First Edition, 2016.		

XIV. COURSE PLAN:

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

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Define types of matrices	CLO 1	T2:32.1 R1:4.1
2	Apply Elementary row and column transformation	CLO 2	T2:32.1 R1:4.2
3	Determine the Rank of a matrix, by Echelon form and Normal form	CLO 2	T2:32.1 R1:4.3
4	Apply Gauss Jordan method to find inverse	CLO 3	T2:32.1 R1:4.3
5	Apply Cayley-Hamilton theorem to find inverse of matrix	CLO 9	T2:32.5 R1:4.6
6	Distinguish Linear dependency and independence\y of vectors	CLO 7	T2:32.5 R1:4.6
7	Define and find Eigen values and Eigen vectors.	CLO 4	T2:32.4 R1:4.5
8	Define and apply the properties of Eigen values and Eigen vectors	CLO 4	T2:32.4 R1:4.5
9	Use diagonalisation to diagonalise a square matrix and find higher powers of a matrix	CLO 8	T2:32.7 R1:4.8
10	Apply the Rolle's theorem	CLO 10	T2:7.1

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
			R1:7.4
11	Apply Lagrange's Mean Value Theorem	CLO 10	T2:7.1 R1:7.4
12	Apply Cauchy's Mean Value Theorem	CLO 10	T2:7.1 R1:7.4
13	Find partial derivatives and apply chain rule	CLO 11	T3-4.10
14	Find total derivatives and apply Euler's theorem	CLO 11	T3-4.71
15	Apply Jacobian transformation	CLO 13	T3-4.42
16	Determine maximum and minimum of a function of several variables	CLO 14	T2:7.1 R1:7.4
17	Determine maximum and minimum of a function of several variables	CLO 14	T2:7.1 R1:7.4
18	Use the Lagrange multiplier method to find extreme of functions with constraints	CLO 14	T2:15.5 R1:7.4
19	Determine complementary function for homogeneous higher order linear differential equations	CLO 16	T3-2.9 R1:2.1
20	Solving non-homogeneous higher order linear differential equations: methods of finding particular integral	CLO 17	T3-2.15 R1:2.8
21	Determine particular non-homogeneous term of the type $f(x) = e^{ax}$	CLO 16	T3-2.5 R1:2.8
22	Determine particular non-homogeneous term of the type $f(x) = \sin ax, \cos ax$	CLO 16	T3-2.5 R1:2.8
23	Determine particular for non-homogeneous term of the type $f(x) = x^n$	CLO 16	T3-2.5 R1:2.8
24	Determine of finding particular for non-homogeneous term of the type $f(x) = e^{ax}v(x)$	CLO 16	T3-2.5 R1:2.8
25	Determine of finding particular integral for non-homogeneous term of the type $f(x) = x^n v(x)$	CLO 16	T3-2.5 R1:2.8
26	Solving second order linear differential equations using method of variation of parameters	CLO 16	T3-2.61 R1:2.10
27	Apply higher order differential method to electrical circuits	CLO 17	R1:2.12
28	Calculate double integrals of a function in Cartesian form	CLO19	T2:15.5 R1:7.5
29	Calculate double integrals of a function in polar form	CLO19	T2:16.5 R1:7.6
30	Use the Change of order of integrations Cartesian and polar form	CLO19	T2:16.5 R1:7.6
31	Use the Change of order of integrations Cartesian and polar form	CLO19	T2:16.5 R1:7.6
32	Use transformation of coordinate system to evaluate double integral	CLO19	T2:16.5 R1:7.6
33	Use transformation of coordinate system to evaluate double integral	CLO19	T2:16.5 R1:7.6
34	Calculate triple integrals in Cartesian form	CLO19	T2:11.1 R2:6.15
35	Apply double integration for finding the area	CLO20	T2:10.1 R1:16.1
36	Apply triple integration for finding the volume	CLO20	T2:10.1 R1:16.2
37	Define vector calculus and vector fields and their properties	CLO21	T2:10.3 R1:16.4
38	Determine Solenoidal and irrotational vector point function	CLO21	T2:11.3 R1:16.5

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
39	Determine Scalar potential function	CLO21	T2:11.3 R1:16.5
40	Calculate line integral along smooth path and find work done	CLO23	T2:11.3 R1:16.5
41	Calculate the surface area of field	CLO23	T2:11.3 R1:16.5
42	Calculate volume of field	CLO23	T2:11.3 R1:16.5
43	Use Green's theorem to evaluate line integrals along simple closed contours on the plane	CLO22	T2: 11.3 R1:16.11
44	Use Stokes' theorem to give a physical interpretation of the curl of a vector field	CLO22	T2: 11.3 R1:16.9
45	Use the divergence theorem to give a physical interpretation of the divergence of a vector field	CLO22	T2: 11.4 R1:16.18

XV. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S No	Description	Proposed Actions	Relevance With POs	Relevance With PSOs
1	Matrices and its applications, applications of maxima and minima of functions of single and several variable.	Seminars	PO 1	PSO 1
2	Change of order of integration, geometrical interpretation of vector integral theorems and properties of gamma and Bessel differential equation.	Seminars / NPTEL	PO 2	PSO 1
3	Encourage students to solve real time applications and prepare towards competitive examinations.	NPTEL	PO 2	PSO 1

Prepared by:
Ms. L. Indira, Assistant Professor

HOD, FRESHMAN ENGINEERING

INSTITUTE OF AERONAUTICAL ENGINEERING

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Dundigal, Hyderabad -500 043

AERONAUTICAL ENGINEERING

COURSE DESCRIPTOR

Course Title	**WAVES AND OPTICS**				
Course Code	AHSB04				
Programme	B.Tech				
Semester	I	AE | ECE | ME			
	II	EEE | CE			
Course Type	Foundation				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	3	1.5
Chief Coordinator	Mr. A Chandra Prakash Reddy, Assistant Professor				
Course Faculty	Dr. Rizwana, Professor				

I. COURSE OVERVIEW:

The course matter is divided into five modules covering duly-recognized areas of theory and study. This course develops abstract and critical reasoning by studying mathematical and logical proofs and assumptions as applied in basic physics and to make connections between physics and other branches of sciences and technology. The topics covered include waves, non-dispersive transverse and longitudinal waves, light and optics, wave optics, lasers, introduction to quantum mechanics, solution of wave equation and introduction to solids and semiconductors. The course helps students to gain knowledge of basic principles and appreciate the diverse applications in technological fields in respective branches.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
-	-	-	Basic principles of light waves

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Waves and Optics	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	Chalk & Talk	✔	Quiz	✔	Assignments	✘	MOOCs
✔	LCD / PPT	✔	Seminars	✘	Mini Project	✔	Videos
✘	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 emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 1), with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

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 centre. 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 section XI.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		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	Presentation on real-world 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.	2	Term paper
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

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	**Professional skills**: Able to utilize the knowledge of aeronautical/aerospace engineering in innovative, dynamic and challenging environment for design and development of new products.	-	-
PSO 2	**Problem-solving Skills**: Imparted through simulation language skills and general purpose CAE packages to solve practical, design and analysis problems of components to complete the challenge of airworthiness for flight vehicles	2	Seminar
PSO 3	**Practical implementation and testing skills**: Providing different types of in house and training and industry practice to fabricate and test and develop the products with more innovative technologies.	-	-
PSO 4	**Successful career and entrepreneurship**: To prepare the students with broad aerospace knowledge to design and develop systems and subsystems of aerospace and allied systems and become technocrats.	-	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Enrich knowledge in principles of quantum mechanics and semiconductors.
II	Correlate principles and applications of lasers and fiber optics.
III	Meliorate the knowledge of light and optics and also their applications.
IV	Develop strong fundamentals of transverse, longitudinal waves and harmonic waves.

IX. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AHSB04.01	CLO 1	Recall the basic principles of physics and apply these concepts of physics in solving the real-time problems.	PO 1, PO2	3
AHSB04.02	CLO 2	Acquire knowledge about fundamental in quantum mechanics.	PO 1, PO2	3
AHSB04.03	CLO 3	Interpretation of dual nature of matter wave concept using Davisson & Germer's experiment.	PO1, PO 4	3
AHSB04.04	CLO 4	Estimate the energy of the particles using Schrödinger's wave equation and apply it to particle in potential box.	PO 2, PO 4	2
AHSB04.05	CLO 5	Recollect the conductivity mechanism involved in semiconductors and calculate carrier concentrations.	PO 1	3
AHSB04.06	CLO 6	Understand the band structure of a solid and Classify materials as metals**,** insulators, or semiconductors, and sketch a schematic band diagram for each one.	PO 2, PO 4	2
AHSB04.07	CLO 7	Understand the basic principles involved in the production of Laser light and also real-time applications of lasers.	PO 1, PO2	3
AHSB04.08	CLO 8	Recollect basic principle, construction, types and attenuation of optical fibers.	PO 1, PO 4	3
AHSB04.09	CLO 9	Understand the importance of optical fibers in real-time communication system.	PO 2, PO 4	2
AHSB04.10	CLO 10	Apply different laws of radiation to understand the phenomenon behind production of light.	PO 1, PO 4	3
AHSB04.11	CLO 11	Apply the phenomenon of interference in thin films using Newton's rings experiment.	PO 1	3
AHSB04.12	CLO 12	Identify diffraction phenomenon due to slits.	PO 1, PO2	3
AHSB04.13	CLO 13	Acquire knowledge of basic harmonic oscillators and discuss in detail different types of harmonic oscillators.	PO 2, PO 4	2
AHSB04.14	CLO 14	Describe the steady state motion of forced damped harmonic oscillator.	PO 1, PO4	2
AHSB04.15	CLO 15	Acquire knowledge of reflection and transmission of waves at a boundary of media.	PO 1 PO2	3

3 = High; 2 = Medium; 1 = Low

X. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO 1	3	2												2		
CLO 2	3	2														
CLO 3	3			1												
CLO 4		2		1										1		
CLO 5	3															
CLO 6		2		1												
CLO 7	3	2														
CLO 8	3			1										2		
CLO 9		2		1										1		
CLO 10	3			1												
CLO 11	3															
CLO 12	3	2														
CLO 13		2		1												
CLO 14	3			1												
CLO 15	3	2														

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO 1	SEE Exams	PO 1	Assignments	-	Seminars	PO 4
Laboratory Practices	-	Student Viva	-	Mini Project	-	Certification	-
Term Paper	PO 2						

XII. ASSESSMENT METHODOLOGIES - INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feedback
✘	Assessment of Mini Projects by Experts		

XIII. SYLLABUS

Module-I	QUANTUM MECHANICS
Introduction to quantum physics, Black body radiation, Planck's law, Photoelectric effect, Compton effect, De-Broglie's hypothesis, Wave-particle duality, Davisson and Germer experiment, Time-independent Schrodinger equation for wave function, Born interpretation of the wave function, Schrodinger equation for one dimensional problems–particle in a box.	
Module-II	**INTRODUCTION TO SOLIDS AND SEMICONDUCTORS**
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, Carrier generation and recombination, Hall effect.	
Module-III	**LASERS AND FIBER OPTICS**
Characteristics of lasers, Spontaneous and stimulated emission of radiation, Metastable state, Population inversion, Lasing action, Ruby laser, He-Ne laser and applications of lasers. Principle and construction of an optical fiber, Acceptance angle, Numerical aperture, Types of optical fibers (Single mode, multimode, step index, graded index), Attenuation in optical fibers, Optical fiber communication system with block diagram.	
Module-IV	**LIGHT AND OPTICS**
Huygens' principle, Superposition of waves and interference of light by wavefront splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer. Fraunhofer diffraction from a single slit, circular aperture and diffraction grating.	
Module-V	**HARMONIC OSCILLATIONS AND WAVES IN ONE DIMENSION**
Mechanical and electrical simple harmonic oscillators, Damped harmonic oscillator, Forced mechanical and electrical oscillators, Impedance, Steady state motion of forced damped harmonic oscillator. Transverse wave on a string, the wave equation on a string, Harmonic waves, Reflection and transmission of waves at a boundary, Longitudinal waves and the wave equation for them, acoustics waves.	
Text Books:	
Dr. K. Vijaya Kumar, Dr. S. Chandralingam, "Modern Engineering Physics", Chand & Co. New Delhi, 1st Edition, 2010. I. G. Main, "Vibrations and waves in physics", Cambridge University Press, 1993. R. K. Gaur, S. L. Gupta, "Engineering Physics", Dhanpat Rai Publications, 8th Edition, 2001.	
Reference Books:	
H.J. Pain, "The physics of vibrations and waves", Wiley, 2006. A. Ghatak, "Optics", McGraw Hill Education, 2012. O. Svelto, "Principles of Lasers", Springer Science & Business Media, 2010.	

XIV. COURSE PLAN:

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

Lecture No.	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Introduction to quantum physics	CLO 1	T2:5.5 R1:1.12.1
2	Black body radiation	CLO 1	T2:5.6 R1:1.12.3
3	Planck's law, Photoelectric effect, Compton effect	CLO 1	T2:5.10 R1:1.15
4	De-Broglie's hypothesis, Wave-particle duality	CLO 3	T2:5.15 R1:1.16
5	Davisson and Germer experiment	CLO 3	T2:5.17 R1:1.13.1

Lecture No.	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
6	Time-independent Schrodinger equation for wave function	CLO 3	T2:5.18 R1:1.13.2
7	Born interpretation of the wave function	CLO 3	T2:5.19 R1:1.13.3
8	Schrodinger equation for one dimensional problems– particle in a box.	CLO 4	T2:5.20 R1:1.17.1
9	Bloch's theorem for particles in a periodic potential, Kronig-Penney model (Qualitative treatment)	CLO 6	T2:5.24 R1:1.17.3
10	Kronig-Penney model (Qualitative treatment)	CLO 6	T2:6.1 R1:2.3
11	Origin of energy bands	CLO 6	T2:6.3 R1:2.6.1
12	Types of electronic materials: metals, semiconductors, and insulators	CLO 6	T2:6.5 R1:2.6.2
13	Intrinsic semiconductors Carrier concentration	CLO 5	T2:7.3 R1:2.8
14	Intrinsic semiconductors Carrier concentration	CLO 5	T2:7.5,7.6 R1:2.9.2
15	Extrinsic semiconductors, Carrier concentration	CLO 5	T2:7.7 R1:2.10
16	Extrinsic semiconductors, Carrier concentration	CLO 5	T2:7.7 R1:2.10
17	Dependence of Fermi level on carrier-concentration and temperature	CLO 5	T2:7.11 R1:2.10.2
18	Carrier generation and recombination, Hall effect	CLO 5	T2:7.11 R1:2.32
19	Introduction and Characteristics of lasers	CLO 7	T2:15. R1:8.2
20	Spontaneous and stimulated emission of radiation	CLO 7	T2:15.7 R1:8.3.3
21	Metastable state, Population inversion, Lasing action	CLO 7	T2:15.13 R1:8.7.2
22	Ruby laser	CLO 7	T2:15.13 R1:8.7.2
23	He-Ne laser and applications of lasers	CLO 7	T2:15.16 R1:8.7.3
24	Introduction and Principle and construction of an optical fiber	CLO 8	T1:11.9 R2:12.24
25	Acceptance angle, Numerical aperture	CLO 8	T1:11.9 R3:12.25
26	Types of optical fibers (Single mode, multimode, step index, graded index)	CLO 8	T1:3.2 R3:3.2
27	Attenuation in optical fibers	CLO 9	T1:3.3.1 R3:3.2
28	Optical fiber communication system with block diagram.	CLO 9	T2:16.5 R1:8.10
29	Huygens' principle, Superposition of waves	CLO 10	T2:16.9 R1:8.11.1
30	Interference of light by wave front splitting and amplitude splitting;	CLO 10	T2:16.9 R1:8.11.2
31	Young's double slit experiment	CLO 10	T2:16.8 R1:8.12.1
32	Newton's rings	CLO 10	T2:16.8 R1:8.12.2
33	Michelson interferometer	CLO 10	T2:16.1 R1:8.14

Lecture No.	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
34	Fraunhofer diffraction from a single slit	CLO 11	T2:16.11 R1:8.20
35	Circular aperture and diffraction grating	CLO 11	T2:16.12 R1:8.19
36	Introduction and Mechanical and electrical simple harmonic oscillators	CLO 13	T2:16.12 R1:8.77
37	Damped harmonic oscillator	CLO 13	T2:1.2 R1:7.2
38	Forced mechanical and electrical oscillators	CLO 13	T2:1.16 R1:7.7
39	Impedance, Steady state motion of forced damped harmonic oscillator	CLO 13	T2:1.20 R1:7.8
40	Impedance, Steady state motion of forced damped harmonic oscillator	CLO 13	T2:1.20 R1:7.8
41	Transverse wave on a string, the wave equation on a string	CLO 14	T2:2.1 R1:7.9.2
42	Harmonic waves	CLO 14	T2:2.2 R1:7.9.1
43	Reflection and transmission of waves at a boundary	CLO 14	T2:2.3 R1:7.10
44	Longitudinal waves and the wave equation for them	CLO 15	T2:2.4 R1:7.11
45	Acoustics waves	CLO 15	T2:2.5 R1:7.11.1

XV. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs
1	Encourage the students to design the working models which are correlated with the syllabus.	Seminars / Laboratory Practies	PO 1	PSO 1
2	Insist the students to collect real-time applications of the basic principles they learn in physics.	Seminars / NPTEL	PO 2	PSO 1
3	Motivate the students to organise the seminars for the awareness of upcoming applications in physics.	NPTEL	PO 2	PSO 1

Prepared by:
Mr. A Chandra Prakash Reddy, Assistant Professor

HOD, FRESHMAN ENGINEERING

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

CIVIL ENGINEERING

COURSE DESCRIPTOR

Course Title	**ENGLISH**				
Course Code	AHSB01				
Programme	B.Tech				
Semester	I	ECE | EEE | CE			
	II	AE | CSE | IT | ME			
Course Type	Foundation				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	2	-	2	2	1
Chief Coordinator	**Ms. N Jayashree, Assistant Professor**				
Course Faculty	**Dr. P Narasimha Raju, Professor** **Ms. B Anand Lakshmi, Associate Professor** **Ms. P B Esther Rani, Assistant Professor** **Ms. Waheeda Begum, Assistant Professor** **Ms. E Madhavi, Assistant Professor** **Mr. B Ramesh Goud, Assistant Professor** **Mr. K Poul, Assistant Professor**				

I. COURSE OVERVIEW:

English has been especially designed for the students of first year B.Tech. The principle aim of the course is to help the students gain a well-rounded introduction to English language learning and its four skills of listening, speaking, reading and writing. Moreover, the course pays special attention to the typical problems and challenges of Indian learners of English, which are primarily confusing the sounds, spellings and structures of their mother tongue with the sounds, spellings and structures of English.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
-	-	-	Standard applicability of vocabulary and grammar

III. MARKS DISTRIBUTION:

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

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	Chalk & Talk	✔	Quiz	✔	Assignments	✘	MOOCs
✔	LCD / PPT	✔	Seminars	✘	Mini Project	✔	Videos
✘	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 emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 1), with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

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 centre. 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 section XI.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Strength	Proficiency assessed by
PO9	**Individual and Team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.	2	Term Paper
PO10	**Communication:** Identify, formulate, review research literature, 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 Listening Test Speaking Test-Presentation (Technical / Review: Movie/Book) and Group Discussion
PO11	**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.	1	Five minutes video

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	**Engineering Knowledge:** Graduates shall demonstrate sound knowledge in analysis, design, laboratory investigations and construction aspects of civil engineering infrastructure, along with good foundation in mathematics, basic sciences and technical communication.	-	-
PSO 2	**Broadness and diversity:** Graduates will have a broad understanding of economical, environmental, societal, health and safety factors involved in infrastructural development, and shall demonstrate ability to function within multidisciplinary teams with competence in modern tool usage..	1	Written Test – Verbal Aptitude for Placement and Higher studies
PSO 3	**Self learning and service:** Graduates will be motivated for continuous self-learning in engineering practice and/ or pursue research in advanced areas of civil engineering in order to offer engineering services to the society, ethically and responsibly.	-	

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Communicate in an intelligible English accent and pronunciation.
II	Use the four language skills i.e., Listening, Speaking, Reading and Writing effectively.
III	Develop the art of writing simple English with correct spelling, grammar and punctuation
IV	Develop the skills of writing emails, reports, formal and informal letters

IX. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AHSB01.01	CLO 1	Understand the value of English as an international language and try to improve the knowledge regarding language skills and elements to be perfect in their usage.	PO 9	2
AHSB01.02	CLO 2	Develop the ability to listen effectively in order to analyze the language used in descriptions and narrations.	PO 9	2
AHSB01.03	CLO 3	Paraphrase listening skills for different purposes with special emphasis on intensive listening.	PO 9	2
AHSB01.04	CLO 4	Interpret how to contextualize the use of language for different purposes.	PO 9	2
AHSB01.05	CLO 5	Ability to comprehend speaking skills for different purposes with special emphasis on Intensive listening.	PO 10, PO 11	2
AHSB01.06	CLO 6	Express fluently without any grammatical mistakes and also give presentations with proper modulation.	PO 10, PO 11	2
AHSB01.07	CLO 7	Translate the importance of critical reading to get information from the context with the help of root words and contextual clues.	PO 10	3
AHSB01.08	CLO 8	Grasp the importance of reading skills for focused and selective information at various levels of professional career.	PO 10	3
AHSB01.09	CLO 9	Summarize the topic to write different types of argumentative, narrative, descriptive and persuasive paragraphs and essays.	PO 10, PO 11	2
AHSB01.10	CLO 10	Infer the use of language for developing behavioral skills.	PO 10	3
AHSB01.11	CLO 11	Translate the importance of reading techniques and applying it to literary texts.	PO 9	2
AHSB01.12	CLO 12	Ability to learn and understand techniques of grammar to apply in the functions of English language.	PO 9	2
AHSB01.13	CLO 13	Remember to use the knowledge of grammar and vocabulary in writing more meaningfully.	PO 9	2

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AHSB01.14	CLO 14	Infer the importance of language and applying to learn to be sensitive according to the needs of the society.	PO 10	3
AHSB01.15	CLO 15	Develop writing skills in order to apply in day to day life.	PO 10	3
AHSB01.16	CLO 16	Understand the importance of written communication for the future correspondence throw out the career of the students.	PO 10	3
AHSB01.17	CLO 17	Develop the ability to analyze the results of experiments and be competent in writing reports, work in teams in real time situations.	PO10	3
AHSB01.18	CLO 19	Understand the value of writing skills to be a responsive, attentive and empathetic writer in order to face the real-world situations.	PO 10, PO11	2
AHSB01.19	CLO 19	Infer the importance of vocabulary and writing as an essential ability in the real-time situations for those who desire to advance their career.	PO 10	3

3 = High; 2 = Medium; 1 = Low

X. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1									2						
CLO 2									2						
CLO 3									2						
CLO 4									2						
CLO 5										3	1			1	
CLO 6										3	1			1	
CLO 7										3					
CLO 8										3					
CLO 9										3	1			1	
CLO 10										3					
CLO 11									2						
CLO 12									2						
CLO 13									2						

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 14										3					
CLO 15									2						
CLO 16										3					
CLO 17										3					
CLO 18										3	1			1	
CLO 19										3					

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES - DIRECT

CIE Exams	PO 9, PO 10, PO 11, PSO 2	SEE Exams	PO 10	Assignments	-	Seminars	PO 10
Laboratory Practices	PO 9, PO 10, PO 11, PSO 2	Student Viva	PO 10	Mini Project	-	Certification	-
Term Paper	PO 9						

XII. ASSESSMENT METHODOLOGIES - INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feedback
✘	Assessment of Mini Projects by Experts		

XIII. 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; 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.	
Text Books:	
1. Handbook of English (Prepared by the faculty of English, IARE).	
Reference Books:	
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.	

XIV. COURSE PLAN:

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

Lecture No	Topic's to be covered	Course Learning Outcomes (CLOs)	Reference
1	Explain the importance of English Language as a tool for Global Communication and emphasis to acquire communicative competence	CLO 1	T1:1.1
2	Improve the knowledge regarding language skills and elements to be perfect in their usage.	CLO 1	T1:1.1
3	Identify the learning levels and their competencies, make the learners understand and analyse different sounds of English	CLO 1	T1:1.1
4-7	Interpret specific information through listening skill.	CLO 2	R3:5
8	Develop the ability to understand that Speaking skills are essential to be a responsive, attentive and empathetic speaker in order to face the real-world situations.	CLO 2	R2:1.1
9-11	Apply the knowledge of preparation for oral presentation	CLO 3	R4:2.2
12	Identify common errors in the language through the concept of word formation	CLO 3	R4:60
13-15	Prepare the students to be aware of the importance of commonly used technical vocabulary	CLO 5	R4:1.1
16	Infer the concept of grammatical ambiguity & sentence construction.	CLO 7	R3:1.3
17	Recognize the concept of "Subject-Verb agreement" To familiarize the students with the usage of "Concord"	CLO 7	R4:4.1

Lecture No	Topic's to be covered	Course Learning Outcomes (CLOs)	Reference
16	Infer the concept of grammatical ambiguity & sentence construction	CLO 5	R4:4.2
17	Infer the concept of grammatical ambiguity & sentence construction	CLO 7	R3:1.3
18-22	Identify and understand conventional signs, prefixes, suffixes, Synonyms, antonyms, one word substitutes used by writers to make their meaning clear to the reader	CLO13	R4:47
23	Appraise the students in order to acquire the knowledge of sentence structure	CLO14	R4:42
24-25	Analyze the problems on star to delta transformation technique	CLO12	R3:4.4
26-27	Infer the difference between phrases and idioms & learn to use them in sentences	CLO12	T2:2.9
28	To make the students learn and identify commonly used technical vocabulary.	CLO13	R4:1.3
29	Understand the Significance, essentials, and effectiveness of reading	CLO03	T1:2.4
30	Interpret derivatives, and Standard Abbreviations in English through Reading skills	CLO18	T1:2.4
31-33	Infer the gist of the text, for identifying the topic through Reading skills	CLO7	T1:27
34	Apply the general meaning and specific information through Writing skills	CLO9	R4:5.8
35	Analyze and Interpret multiple choice questions, positive and negative comments through comprehension passages	CLO19	T1: 2.5
36	Identify passage for intellectual and emotional comments; Reading for the gist of a text.	CLO18	T1: 2.7
37	Associate the students to identify their common errors in the language	CLO17	T1:2.6
38	Understand the importance of proper punctuation, creating coherence, organizing principles of paragraphs in documents to foster the writing skills of the students.	CLO19	T1:4.1
39	Evaluate Letter writing-Formal and Informal writing and E-mail writing.	CLO19	R2:3
40	To make learners aware of the selection of language to make presentations and prepare the students for an effective presentation giving them necessary inputs	CLO18	R2:3
41	Distinguish writing skills such as Describing, Defining, Classifying, Writing introduction and conclusion.	CLO17	T1:4.3
42-43	Evaluate writing skills through creating coherence, organizing principles of paragraphs in documents.	CLO19	T1:3.1
44-45	Understand the importance of Vocabulary enrichment and grammar exercises to foster the writing skill of the students.	CLO19	T1:4.1

XV. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs
1	Construct basic and intermediate skills in English language.	Seminars	PO10	PSO2

S NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs
2	Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work.	Seminars and NPTL	PO10	PSO2
3	To build confidence for communicating in English and create interest for the life-long learning of English language.	NPTEL	PO10	PSO2

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INSTITUTE OF AERONAUTICAL ENGINEERING

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CIVIL ENGINEERING

COURSE DESCRIPTOR

Course Title	**FUNDAMENTALS OF ELECTRICAL ENGINEERING**				
Course Code	AEEB01				
Programme	B.Tech				
Semester	I	CSE | IT | CE			
Course Type	Foundation				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	3	1.5
Chief Coordinator	Mr. K Lingaswamy , Assistant Professor, EEE				
Course Faculty	Ms. Lekha Chandran, Associate Professor, EEE Dr. V.C. Jagan Mohan, Professor, EEE Ms. S Swathi, Assistant Professor, EEE Mr. G Hari Krishna, Assistant Professor, EEE Mr. S Srikanth, Assistant Professor, EEE Mr. K Devender Reddy, Assistant Professor, EEE Ms. T. Saritha Kumari, Assistant Professor, EEE				

I. 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 voltage shift theorem, zero current theorem, Tellegen's, superposition, reciprocity, Thevenin's, maximum power transfer, Norton's and compensation theorem

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
-	-	-	Fundamentals of Electrical circuits

III. MARKS DISTRIBUTION:

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

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	Chalk & Talk	✔	Quiz	✔	Assignments	✘	MOOCs
✔	LCD / PPT	✔	Seminars	✘	Mini Project	✘	Videos
✘	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 emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

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 centre. 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 section XI.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		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	Seminar
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	Five Minutes Video
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	Assignment
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.	2	Seminar

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	**Engineering Knowledge:** Graduates shall demonstrate sound knowledge in analysis, design, laboratory investigations and construction aspects of civil engineering infrastructure, along with good foundation in mathematics, basic sciences and technical communication.	-	-
PSO 2	**Broadness and Diversity:** Graduates will have a broad understanding of economical, environmental, societal, health and safety factors involved in infrastructural development, and shall demonstrate ability to function within	2	Seminars

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
	multidisciplinary teams with competence in modern tool usage.		
PSO 3	**Self-Learning and Service:** Graduates will be motivated for continuous self-learning in engineering practice and/ or pursue research in advanced areas of civil engineering in order to offer engineering services to the society, ethically and responsibly.	-	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Understand the classification of elements, circuit laws and different network reduction techniques to study the characteristics of electrical circuits.
II	Analyze the power in series and parallel AC circuits using complex notation.
III	Apply graph theory technique to analyze complex electrical network.
IV	State and use DC circuit theorems to determine unknown parameters and quantities.

IX. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AEEB01.1	CLO 1	Define the various nomenclature used to study the DC electrical circuits and classify electrical elements	PO1	3
AEEB01.2	CLO 2	Use Ohm's law and Kirchhoff's laws to determine equivalent resistance and current/voltage in any branch of a circuit.	PO1, PO2	2
AEEB01.3	CLO 3	Apply network reduction techniques to calculate unknown quantities associated with electrical circuits.	PO3, PO6	2
AEEB01.4	CLO 4	List out types of energy sources and describe source transformation technique to determine equivalent resistance and source current.	PO2, PO3	2
AEEB01.5	CLO 5	Calculate the equivalent resistance of complex networks using star delta transformation.	PO3, PO6	3
AEEB01.6	CLO 6	Determine mesh currents and node voltages using network reduction techniques.	PO2, PO3	2
AEEB01.7	CLO7	Interpret the alternating quantities with its instantaneous, average and root mean square values.	PO1, PO2	2
AEEB01.8	CLO 8	Illustrate the concept of impedance ,reactance, admittance susceptance and conductance	PO1, PO2,	3
AEEB01.9	CLO 9	Analyze the steady state behavior of series and parallel RL, RC and RLC circuits with sinusoidal excitation.	PO2, PO3, PO6	2

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AEEB01.10	CLO 10	Discuss the various nomenclatures related with network topology.	PO1	2
AEEB01.11	CLO 11	Formulate incidence, tie-set and cut-set matrix which are used to solve the behavior of complex electrical circuits.	PO1, PO2, P03	3
AEEB01.12	CLO 12	Understand the concepts of duality and importance of dual networks.	PO1	2
AEEB01.13	CLO 13	Explain the procedure of Voltage shift theorem, Zero current theorem and its applications.	PO2, PO3	2
AEEB01.14	CLO 14	Study the Tellegen's, Superposition, Reciprocity and for the electrical network with DC excitation.	PO1, PO2	2
AEEB01.15	CLO 15	Summarize the procedure of Thevenin's and Norton's and Maximum power transfer theorems to reduce complex network into simple equivalent network.	PO1, PO2,	2
AEEB01.16	CLO 16	Estimate the change in currents using Compensation theorem and understand the importance of Milliman's theorem.	PO1	3
AEEB01.17	CLO 17	Explore the knowledge and skills of employability to succeed in national and international level competitive examinations.	PO1, PO2. PO3, PO6	2

3 = High; 2 = Medium; 1 = Low

X. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

(CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1	3	2													
CLO 2	2	1													
CLO 3			2			2								2	
CLO 4		2	1												
CLO 5			2			3								2	
CLO 6	3		2											1	
CLO 7	2	2													
CLO 8	3	2													
CLO 9		2	2			2								2	

(CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
CLO 10	2														
CLO 11	2	3	2											2	
CLO 12	2														
CLO 13		2	2											1	
CLO 14		2	2											1	
CLO 15	2	2												2	
CLO 16	3														
CLO 17	2	2	2			2								2	

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO1, PO2, PO3	SEE Exams	PO1, PO2, PO3	Assignments	PO 2	Seminars	PO 2
Laboratory Practices	PO1, PO2, PO3, PO6	Student Viva	-	Mini Project	-	Certification	-
Term Paper	-						

XII. ASSESSMENT METHODOLOGIES – INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feed Back
✘	Assessment of Mini Projects by Experts		

XIII. SYLLABUS

Module - I	INTRODUCTION TO ELECTRICAL CIRCUITS
Circuit concept: Basic definitions, Ohm's law at constant temperature, classifications of elements, R, L, C parameters, Standard symbols for electrical components, Fuses, 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 by Kirchhoff's laws, inspection method, super mesh, super node analysis.	
Module - III	**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; Concept of reactance, impedance, susceptance and admittance, rectangular and polar form. 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 - IV	**NETWORK TOPOLOGY**

Network Topology: Definitions, graph, tree, incidence matrix, basic cut set and basic tie set matrices for planar networks, duality & dual networks.

Module - V	**NETWORK THEOREMS (DC)**

Theorems: Voltage shift theorem, Zero current theorem, Tellegen's, Superposition, Reciprocity, Thevenin's, Norton's, maximum power transfer, and Milliman's and Compensation theorems for DC excitations.
Text Books:
1. A Chakrabarthy, "Electric Circuits", DhanipatRai & Sons, 6th Edition, 2010. 2. C L Wadhwa "Electrical Circuit Analysis including Passive Network Synthesis", New Age International, 2nd Edition, 2009. 3. M E Van Valkenberg, "Network Analysis", PHI, 3rd Edition, 2014.
Reference Books:
1. A Sudhakar, Shyammohan S Palli, "Circuits and Networks", Tata McGraw-Hill, 4th Edition, 2009. 2. John Bird, "Electrical Circuit Theory and Technology", Newnes, 2nd Edition, 2003. 3. David A Bell, "Electric circuits", Oxford University Press, 7th Edition, 2009.

XIV. COURSE PLAN:

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

Lecture No	Topic/s to be covered	Course Learning Outcomes (CLOs)	Reference
1	Define the basic definitions like potential, potential difference, charge, current and power	CLO1	T1:1.1, R1:1.1
2	Understand the Ohms' law at constant temperature and its application	CLO2	T1:2.1, R1:1.1
3	Define active, passive, linear, non linear, bilateral, lumped, distributed, unilateral and bilateral elements	CLO1	T1:1.1, R1:1.4
4	Describe voltage and current relations of resistance, inductance and capacitance	CLO1	T1:1.2, R1:2.8
5	Describe the standard symbols for electrical components	CLO1	T1:1.5, R2:1.3
6	Understand the concept of Fuse and its characteristics	CLO1	T1:1.5, R1:1.4
7	Explain the Independent, dependent sources and their symbols	CLO1	T1:1.5, R1:1.10

Lecture No	Topic/s to be covered	Course Learning Outcomes (CLOs)	Reference
8	State and explain Kirchhoff's laws	CLO2	T1:2.1, R1:2.1
9-11	Use the concept of Kirchhoff's laws in circuit reduction technique	CLO3	T1:2.6, R1:2.1
12	Use the concept of Kirchhoff's laws in source transformation technique	CLO4	T1:1.6, R1:1.6
13	Describe the source transformation technique to determine equivalent resistance and source current	CLO4	T1:1.6, R1:1.6
14-16	Derive the expression for star to delta and delta to star transformation technique with numerical problems	CLO5	T1:1.9, R1:2.14
17-18	Use the concept of Kirchhoff's voltage law in mesh analysis	CLO6	T1:2.5, R1:2.8
19-20	Use the concept of Kirchhoff's current law in nodal analysis	CLO6	T1:2.6, R1:2.11
21-23	Use the concept of Kirchhoff's laws in super mesh, super node analysis	CLO6	T1:2.6, R1:2.10
24	Understand the concept of alternating quantities	CLO7	T1:7.1, R1:3.1
25	Describe basic definitions, peak value, average value, RMS value	CLO7	T1:7.2, R1:3.4
26	Understand the concept of phase, phase difference and power factor	CLO7	T1:7.2, R1:3.5
27	Describe the j notation for complex algebraic equations	CLO8	T1:7.7, R1:3.8
28	Explain the concept of impedance and reactance	CLO8	T1:7.7, R1:3.8
29	Explain the concept of susceptance and admittance	CLO8	T1:7.6, R1:3.8
30	Understand the concept of rectangular and polar form in complex algebra	CLO8	T1:7.3, R1:3.9
31	Understand Concept of real, reactive, apparent power in single phase AC circuits	CLO8	T1:1.1, R1:3.9
32	Describe the steady state response of R, L and C elements with sinusoidal excitation	CLO9	T1:4.1, R1:3.10
33-35	Derive the steady state response of series RL, RC, RLC circuits with sinusoidal excitation	CLO9	T1:4.2, R1:3.10

Lecture No	Topic/s to be covered	Course Learning Outcomes (CLOs)	Reference
36-37	Use the sinusoidal excitation to series RL, RC and RLC combination circuits to find response of circuits	CLO9	T1:4.3, R1:3.10
38	Understand the fundamentals of network topology	CLO10	T1:15.2, R1:6.1
39	Define graph, sub graph, path, directed graph, tree and co-tree	CLO10	T1:15.3, R1:6.2
40-41	Describe an incidence matrix using graph theory	CLO11	T1:15. , R1:6.4
42	Explain the properties of incidence matrix in graph theory	CLO11	T1:15.5, R1:6.5
43-44	Understand Incidence matrix using Kirchhoff current law.	CLO11	T1:15.5, R1:6.6
45-47	Develop basic Tie set and cut set matrix for planar networks	CLO11	T1:15.7, R1:6.7
48	Use the Kirchhoff's law to find tie set and cut set matrix currents and voltages	CLO11	T1:15.8, R1:6.8
49	Explain the concept of Duality and Dual networks with numerical problems	CLO12	T1:15.17, R1:6.13
50	Explain the procedure of Voltage shift theorem and Zero current theorem with DC excitation.	CLO13	T1:3.10, R1:7.8
51	Study the Tellegen's theorem with DC excitation.	CLO14	T1:3.10, R1:7.7
52-53	Prove the principle of Superposition theorem with DC excitation.	CLO14	T1:3.4, R1:7.1
54	State and prove the Reciprocity theorem with DC excitation.	CLO14	T1:3.7, R1:7.4
55-57	Understand the procedure to reduce complexity of network using Thevenin's and Norton's theorems	CLO15	T1:3.2, R1:7.3
58	Designing of load resistance using Maximum power transfer with DC excitation.	CLO15	T1:3.5, R1:7.6
59	Predict the change in current using Compensation theorem	CLO16	T1:3.9, R1:7.5
60	Predict the complexicity of network using Millimans theorem	CLO16	T1:3.6, R1:7.8

XV. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S. No	Description	Proposed Actions	Relevance With POs	Relevance With PSOs
1	Voltage Current relationship for passive elements for different input signals - ramp, saw tooth and triangular.	Guest Lecturers	PO1	PSO2
2	Resistance color coding	Laboratory practices	PO1	---

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COMPUTER SCIENCE ENGINEERING

COURSE DESCRIPTOR

Course Title	**ENGINEERING CHEMISTRY**				
Course Code	AHSB03				
Programme	B.Tech				
Semester	I	CSE | IT | EEE			
	II	AE | ECE | ME | CE			
Course Type	Foundation				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	3	1.5
Chief Coordinator	Dr. C Mahender, Professor				
Course Faculty	Dr. V Anita Rani, Professor Mr. B Raju, Assistant Professor Mr. M Praveen, Assistant Professor Ms. T Mallika, Assistant Professor Ms. M Lakshmi Prasanna, Assistant Professor Ms. M Malathi, Assistant Professor Mr. G Mahesh Kumar, Assistant Professor Ms. M Swathi, Assistant Professor				

I. 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.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
-	-	-	Vital principles of chemistry

III. MARKSDISTRIBUTION:

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

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	Chalk & Talk	✔	Quiz	✔	Assignments	✘	MOOCs
✔	LCD / PPT	✔	Seminars	✘	Mini Project	✔	Videos
✘	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 emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 1), with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

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 centre. 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 section XI.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		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	Seminar
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	2	NEPTL Videos
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutionsin societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	1	Presentation on real-world problems

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		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.	2	Seminar
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.	-	-
PSO 3	**Successful Career and Entrepreneurship:** The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies.	-	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Apply the electrochemical principles in batteries, understand the fundamentals of corrosion
II	Analysis of water for its various parameters and its significance in industrial and domestic applications
III	Analyze microscopic chemistry in terms of atomic, molecular orbitals and Intermolecular forces
IV	Analysis of major chemical reactions that are used in the synthesis of molecules.
V	Understand the chemistry of various fuels and their combustion

IX. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AHSB03.01	CLO 1	Extrapolate the knowledge of electrolytic cell, electrochemical cell, electrode Potential and reference electrodes	PO1	3
AHSB03.02	CLO 2	Use of primary and secondary batteries in various fields such as automobiles ,railways, medical devices, aircrafts and day to day life.	PO1	2
AHSB03.03	CLO 3	Explain the characteristic factors of a metal and environment influencing the rate of Corrosion.	PO1, PO2, PO7	3
AHSB03.04	CLO 4	Use appropriate methods such as protective, metallic and organic coatings to controlcorrosion in metals.	PO1, PO2,	2
AHSB03.05	CLO 5	Evaluate the quality and utility of suitable water for industrial as well as domestic applications.	PO1, PO2,	3
AHSB03.06	CLO 6	Use innovative methods to improve the quality of soft water for Potable andindustrial purpose at cheaper cost.	PO1	1
AHSB03.07	CLO 7	Understand the basic tenets of molecular orbital theories.	PO1	1
AHSB03.08	CLO 8	Understand the different approaches to types of chemical bonding.	PO1	1
AHSB03.09	CLO 9	Recognize and draw structural isomers,stereoisomersincluding enantiomers and diastereomers and racemic mixture.	PO1	1
AHSB03.10	CLO 10	Understand the mechanisms of major classes of organic reactions, including substitutions, eliminations and additions.	PO1	1
AHSB03.11	CLO 11	Retrieve and critically review information on drugs, including how to synthesize them, from literature resources	PO1, PO2,	1
AHSB03.12	CLO 12	Demonstrate comprehensive knowledge of conventional fuel properties on engine performance.	PO1, PO2	3
AHSB03.13	CLO 13	Understand the importance of cracking, knocking in IC engines and operationsinvolved in petroleum refining.	PO1, PO2	3
AHSB03.14	CLO 14	Describe the physical and chemical properties of fuels like natural gas, LPGand CNG.	PO1, PO2, PO7	2
AHSB03.15	CLO 15	Determine efficiency of the fuel in terms of calorific value and combustion reactions of the fuel.	PO1, PO2, PO7	2

3 = High; 2 = Medium; 1 = Low

X. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

CLOs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1	3														
CLO 2	2														
SCLO 3	3	2													
CLO 4	2	3					1						1		
CLO 5	3	3											1		
CLO 6	1														
CLO 7	1														
CLO 8	1														
CLO 9	1														
CLO 10	1														
CLO 11	1	1													
CLO 12	3	2													
CLO 13	3	2											2		
CLO 14	3	2					1						2		
CLO 15	3	2					1						2		

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES–DIRECT

CIE Exams	PO1	SEE Exams	PO 1	Assignments	PO 2	Seminars	PO 1
Laboratory Practices	-	Student Viva	-	Mini Project	-	Certification	-
Term Paper	-						

XII. ASSESSMENT METHODOLOGIES-INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feedback
✘	Assessment of Mini Projects by Experts		

XIII. 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 N_2, O_2F_2, 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 S_N1, S_N2 reactions; Electrophilic and nucleophilic addition reactions; Addition of HBrtopropene; 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 $KMnO_4$ and chromic acid; Reduction reactions: Reduction of carbonyl compounds using $LiAlH_4$& $NaBH_4$; 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.	
Text Books:	
1. P. C. Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company, 16th Edition, 2017. 2. Shashi Chawla, "Text Book of Engineering Chemistry" Dhanat Rai and Company, 2017. 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, 7thEdition 2010. 2. B. H. Mahan, "University Chemistry", Narosa Publishers, 4thEdition, 2009.	

XIV. COURSE PLAN:

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

Lecture No	Topic/s to be covered	Course Learning Outcomes (CLOs)	Reference
1	Concept of Electro chemical cells	CLO 1	T1,T2
2	Numerical problems on EMF: Galvanic Cells	CLO 1	T1,T2
3	Types of Electrodes: Calomel, Quinhydrone and Glass electrode.	CLO 1	T1,T2
4	Nernst equation and its applications	CLO 1	T1,T2
5	Batteries: Primary cells (dry cells)	CLO 2	T1,T2
6	Secondary cells (lead-Acid cell). Applications of batteries	CLO 2	T1,T2
7	Corrosion-Definition ,Causes and effects of corrosion, Theories of corrosion – Chemical corrosion theory	CLO 3	T1,T2
8	Types of corrosion (water line and pitting), Factors affecting rate of corrosion	CLO 3	T1,T2
9	Corrosion control methods – Cathodic protection and metallic coating.	CLO 4	T1,T2
10	Hardness of water, expression of hardness-units; Types of hardness: Temporary hardness, permanent hardness and numerical problems.	CLO 5	T1,T2
11	Estimation of temporary &permanent hardness of water by EDTA.	CLO 5	T1,T2
12	Potable water and its specifications, steps involved in its treatment of water.	CLO 6	T1,T2
13	Boiler troubles – Priming and foaming, caustic embrittlement	CLO 6	T1,T2
14	Treatment of boiler feed water – Internal treatment (Phosphate, carbonate and calgon conditioning)	CLO 2 CLO 6	T1,T2
15	Ion exchange process, steps involved in the treatment of this process.	CLO 6	T1,T2
16	Sterilization of potable water by chlorination and ozonization,	CLO 6	T1,T2
17	purification of water by reverse osmosis process.Numerical problems	CLO 6	T1,T2
18	Shapes of Atomic Orbitals	CLO 7	T2,T4
19	Linear combination of Atomic orbitals (LACO)	CLO 7	T2.T4
20	Molecular orbitals of diatomic molecules N_2 O_2 and F_2.	CLO 7	T2,T4
21	Molecular orbitals diatomic CO and NO molecule	CLO 7	T2,T4
22	Crystal Field Theory (CFT), Salient Features of CFT-Crystal Fields	CLO 7	T2,T4
23	Splitting of transition metal ion d- orbitals in Tetrahedral	CLO 7	T2,T4
24	Splitting of transition metal ion Octahedral and square planar geometries	CLO 7	T2,T4
25	Band structure of solids and effect of doping on conductance.	CLO 8	T2,T4
26	Introduction to representation of 3-dimensional structures	CLO 9	T2,T4
27	Structural and stereoisomers of organic compounds	CLO 9	T3
28	Configurations, symmetry and chirality.	CLO 9	T3
29	Enantiomers, diastereomers, optical activity and Absolute configuration	CLO 9	T3
30	Conformation alanalysis of n- butane	CLO 9	T3
31	Nucleophilic substitution reactions, Mechanism of S_N1, S_N2 reactions	CLO 9	T3
32	Electrophilic and nucleophilic addition reactions; Addition of HBrto propene; Markownikoff and anti Markownikoff's additions	CLO 10	T3
33	Grignard additions on carbonyl compounds, EliminationreactionsDehydro halogenation of alkylhalides	CLO 10	T3
34	Oxidation reactions: Oxidation of alcohols using $KMnO_4$ and	CLO 10	T3

Lecture No	Topic/s to be covered	Course Learning Outcomes (CLOs)	Reference
	chromicacid.		
35	Reduction reactions: Reduction of carbonyl compounds using $LiAlH_4$& $NaBH_4$	CLO 10	T3
36	Hydroboration of olefins	CLO 10	T3
37	Structure, synthesis and pharmaceutical applications of Paracetamol and Aspirin.	CLO 11	T3
38	Definition, classification of fuels and characteristics of a good fuels	CLO 12	T1,T2
39	Solid fuel Coal, analysis of coal- proximate analysis	CLO 12	T1,T2
40	Analysis of coal -ultimate analysis.	CLO 12	T1,T2
41	Liquid fuels: Petroleum and its refining Cracking: Fixed bed catalytic cracking;	CLO 13	T1,T2
42	Knocking: Octane and cetane numbers	CLO 13	T1,T2
43	Gaseous fuels: Composition, characteristics and applications of Natural gas, LPG and CNG	CLO 14	T1,T2
44	Combustion: Calorific value-Gross calorific value(GCV) and net calorific value(NCV)	CLO 15	T1,T2
45	Calculation of air quantity required for complete combustion of fuel, numerical problems.	CLO 15	T1,T2

XV. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S No	Description	Proposed Actions	Relevance With POs	Relevance With PSOs
1	Galvanic cell, batteries-Ni-Cd Batteries, Crevice corrosion, Fuel cells and its applications	Seminars / Guest Lectures / NPTEL	PO 1	PSO 1
2	Softening techniques, plastics, cement, Flue gas Analysis	Seminars / Guest Lectures / NPTEL	PO 1	PSO 1
3	Synthesis of nano material and its applications, spectroscopic techniques for analysis of organic molecules.	Assignments / Laboratory Practices	PO 1	PSO 1

Prepared by:
Dr.C.Mahender, Professor

HOD, FRESHMAN ENGINEERING

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

AERONAUTICAL ENGINEERING

COURSE DESCRIPTOR

Course Title	**MATHEMATICAL TRANSFORM TECHNIQUES**				
Course Code	AHSB11				
Programme	B.Tech				
Semester	II	AE | ECE | EEE | ME | CE			
Course Type	Foundation				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	-	-
Chief Coordinator	Mr. Ch Soma Shekar, Assistant Professor				
Course Faculty	Dr. M Anita, Professor Dr. S Jagadha, Professor Mr. V SubbaLakshmi, Assistant Professor Ms. C Rachana, Assistant Professor Ms. L Indira, Assistant Professor Ms. P Rajani, Assistant Professor				

I. COURSE OVERVIEW:

The course focuses on more advanced Engineering Mathematics topics which provide with the relevant mathematical tools required in the analysis of problems in engineering and scientific professions. The course includes root finding techniques, Interpolation and its applications, Curve fitting of linear and non linear curves, Laplace transforms, Fourier transforms and Partial differential equations with applications. The mathematical skills derived from this course form a necessary base to analytical and design concepts encountered in the program.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
-	-	-	Basic principles of calculus

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Mathematical Transform Techniques	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	Chalk & Talk	✔	Quiz	✔	Assignments	✘	MOOCs
✔	LCD / PPT	✔	Seminars	✘	Mini Project	✔	Videos
✘	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 emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 1), with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

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 centre. 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 section XI.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		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	Presentation on real-world 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	2	Seminar
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	Term Paper

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	**Professional Skills:** Able to utilize the knowledge of aeronautical/aerospace engineering in innovative, dynamic and challenging environment for design and development of new products	1	Seminar
PSO 2	**Problem solving skills:** Imparted through simulation language skills and general purpose CAE packages to solve practical, design and analysis problems of components to complete the challenge of airworthiness for flight vehicles	-	-
PSO 3	**Practical implementation and testing skills:** Providing different types of in house and training and industry practice to fabricate and test and develop the products with more innovative technologies	-	-
PSO 4	**Successful Career and Entrepreneurship:** To prepare the students with broad aerospace knowledge to design and develop systems and subsystems of aerospace and allied systems and become technocrats.	-	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Enrich the knowledge of solving Algebraic and Transcendental equations and Differential equation by numerical methods.
II	Determine the Fourier transforms for various functions in a given period.
III	Determine the Laplace and Inverse Laplace transforms for various functions using standard types.
IV	Formulate to solve Partial differential equation.

IX. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AHSB11.01	CLO 1	Evaluate the real roots of algebraic and transcendental equations by Bisection method, False position and Newton - Raphson method.	PO1	3
AHSB11.02	CLO 2	Apply the symbolic relationship between the operators using finite differences.	PO1	2
AHSB11.03	CLO 3	Apply the Newtons forward and Backward Interpolation method to determine the desired values of the given data at equal intervals.	PO2	3
AHSB11.04	CLO 4	Apply the Gauss forward and Backward Interpolation method to determine the desired values of the given data at equal intervals.	PO2	2
AHSB11.05	CLO 5	Apply the Interpolation method to determine the desired values of the given data at unequal intervals.	PO4	2
AHSB11.06	CLO 6	Ability to curve fit data using several linear and non linear curves by method of least squares.	PO2	2
AHSB11.07	CLO 7	Apply numerical methods to obtain approximate solutions to Taylors, Eulers, Modified Eulers and Runge-Kutta methods of ordinary differential equations.	PO1, PO2	3
AHSB11.08	CLO 8	Understand the concept of numerical solutions of ordinary differential equations to the real-world problems of physics, biology and electrical circuits.	PO4	2
AHSB11.09	CLO 9	Apply the nature of properties to Laplace transform and inverse Laplace transform of the given function.	PO2, PO4	2
AHSB11.10	CLO 10	Solving Laplace transforms and inverse Laplace transform of a given function using shifting theorems.	PO1, PO2	2
AHSB11.11	CLO 11	Evaluate Laplace transforms and inverse Laplace transform using derivatives of a given function.	PO1, PO2	2
AHSB11.12	CLO 12	Evaluate Laplace transforms and inverse Laplace transform using multiplication of a variable to a given function.	PO1	2
AHSB11.13	CLO 13	Apply Laplace transforms to periodic functions.	PO2	2
AHSB11.14	CLO 14	Solving Laplace transforms and inverse Laplace transform using derivatives and integrals.	PO1, PO2	2
AHSB11.15	CLO 15	Evaluate inverse of Laplace transforms and	PO2,	2

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
		inverse Laplace transform by the method of convolution.	PO4	
AHSB11.16	CLO 16	Solving the linear differential equations using Laplace transform.	PO4	2
AHSB11.17	CLO 17	Understand the concept of Laplace transforms to the real-world problems of electrical circuits, harmonic oscillators, optical devices, and mechanical systems	PO4	1
AHSB11.18	CLO 18	Understand the nature of the Fourier integral.	PO2	1
AHSB11.19	CLO 19	Ability to compute the Fourier transforms of the given function.	PO1, PO2	2
AHSB11.20	CLO 20	Ability to compute the Fourier sine and cosine transforms of the function.	PO1	3
AHSB11.21	CLO 21	Evaluate the inverse Fourier transform, Fourier sine and cosine transform of the given function.	PO1	3
AHSB11.22	CLO 22	Evaluate finite and infinite Fourier transforms.	PO1	2
AHSB11.23	CLO 23	Understand the concept of Fourier transforms to the real-world problems of circuit analysis, control system design	PO4	2
AHSB11.24	CLO 24	Understand the concept of order and degree with reference to partial differential equation	PO1	1
AHSB11.25	CLO 25	Formulate and solve partial differential equations by elimination of arbitrary constants and functions	PO1, PO2	2
AHSB11.26	CLO 26	Understand partial differential equation for solving linear equations by Lagrange method.	PO2, PO4	2
AHSB11.27	CLO 27	Apply the partial differential equation for solving non-linear equations by Charpit's method.	PO2, PO4	2
AHSB11.28	CLO 28	Solving the heat equation and wave equation in subject to boundary conditions.	PO2, PO4	2
AHSB11.29	CLO 29	Understand the concept of partial differential equations to the real-world problems of electromagnetic and fluid dynamics	PO4	2

3 = High; 2 = Medium; 1 = Low

X. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO 1	3															
CLO 2	2															
CLO 3		3														
CLO 4		2														

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO 5				2												
CLO 6		2														
CLO 7	3	2											1			
CLO 8				2									1			
CLO 9		2		1												
CLO 10	3	1														
CLO 11	2	2														
CLO 12	2															
CLO 13		2											1			
CLO 14	2	2														
CLO 15		2		2									1			
CLO 16				2									1			
CLO 17				1									1			
CLO 18		1														
CLO 19	2	2														
CLO 20	3															
CLO 21	3															
CLO 22	2															
CLO 23				2									1			
CLO 24	1															
CLO 25	2	1														
CLO 26		2		1												
CLO 27		2		2												
CLO 28		2		1												
CLO 29				2									1			

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO 1	SEE Exams	PO 1	Assignments	-	Seminars	PO 2
Laboratory Practices	-	Student Viva	-	Mini Project	-	Certification	-
Term Paper	PO 4						

XII. ASSESSMENT METHODOLOGIES - INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feedback
✘	Assessment of Mini Projects by Experts		

XIII. SYLLABUS

Module-I	**ROOT FINDING TECHNIQUES AND INTERPOLATION**
Root finding techniques: Solving algebraic and transcendental equations by bisection method, method of false position, Newton-Raphson method; Interpolation: Finite differences, forward differences, backward differences and central differences; Symbolic relations; Newton's forward interpolation, Newton's backward interpolation; Gauss forward central difference formula, Gauss backward central difference formula; Interpolation of unequal intervals: Lagrange's interpolation.	
Module-II	**CURVE FITTING AND NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**
Fitting a straight line; Second degree curves; Exponential curve, power curve by method of least squares; Taylor's series method; Step by step methods: Euler's method, modified Euler's method and Runge-Kutta method for first order differential equations.	
Module-III	**LAPLACE TRANSFORMS**
Definition of Laplace transform, linearity property, piecewise continuous function, existence of Laplace transform, function of exponential order, first and second shifting theorems, change of scale property, Laplace transforms of derivatives and integrals, multiplied by t, divided by t, Laplace transform of periodic functions. Inverse Laplace transform: Definition of Inverse Laplace transform, linearity property, first and second shifting theorems, change of scale property, multiplied by s, divided by s; Convolution theorem and applications.	
Module-IV	**FOURIER TRANSFORMS**
Fourier integral theorem, Fourier sine and cosine integrals; Fourier transforms; Fourier sine and cosine transform, properties, inverse transforms, finite Fourier transforms.	
Module-V	**PARTIAL DIFFERENTIAL EQUATIONS AND APPLICATIONS**
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equation by Lagrange method; Charpit's method; method of separation of variables; One dimensional heat and wave equations under initial and boundary conditions.	
Text Books:	
1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th 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, John Wiley & Sons, 9th Edition, , 2006. 2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.	

3. D. Poole, Linear Algebra: A Modern Introduction, Brooks/Cole, 2nd Edition, , 2005.
4. Dr. M Anita, Engineering Mathematics-I, Everest Publishing House, Pune, 1stEdition, 2016.

XIV. COURSE PLAN:

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

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Defining the terms of Algebraic and Transcendental equations	CLO 1	T1:28.1 R1:17.1
2	Apply Bisection method to determine the root of Algebraic and Transcendental equations	CLO 1	T1:28.2 R1:17.2
3	Apply False Position method to determine the root of Algebraic and Transcendental equations	CLO 1	T1:28.2 R1:17.2
4	Apply Newton-Raphson method to determine the root of Algebraic and Transcendental equations	CLO 1	T1:28.2 R1:17.2
5	Define the term interpolation of the given data	CLO 2	T1:29.1-29.3 R1:17.3
6	Explain symbolic relations the between the operators	CLO 2	T1:29.4-29.5 R1:17.3
7	Apply Newton"s forward interpolation formulae for evenly spaced intervals	CLO 3	T1:29.6 R1:17.3
8	Apply Newton"s backward interpolation formulae for evenly spaced intervals	CLO 3	T1:29.6 R1:17.3
9	Apply Gauss forward interpolation formulae for unevenly spaced intervals	CLO 4	T1:29.7-29.8 R1:17.3
10	Apply Gauss backward interpolation formulae for unevenly spaced intervals	CLO 4	T1:29.7-29.8 R1:17.3
11	Apply Lagrange"s interpolation formulae for unevenly spaced intervals	CLO 5	T1:29.9-29.10 R1:17.3
12	Describe the best fit of a straight line by method of least squares	CLO 6	T1:24.4-24.5 R1:18.5
13	Describe the best fit of a second degree parabola by method of least squares	CLO 6	T1:24.4-24.5 R1:18.5
14	Describe the best fit of an exponential curve by method of least squares	CLO 6	T1:24.6 R1:18.5
15	Describe the best fit of a power curve by method of least squares	CLO 6	T1:24.6 R1:18.5
16	Solve the ordinary differential equation by Taylor"s series method	CLO 7	T1:32.3 R1:19.1
17	Solve the ordinary differential equation by Euler"s Method-Euler"s modified method	CLO 7	T1:32.4-32.5 R1:19.1
18	Solve the ordinary differential equation by Runge-Kutta Method	CLO 7	T1:32.7 R1:19.1
19-20	Define Laplace transform and its properties	CLO 9	T1:21.1,21.4 R1:5.1
21	Define Piecewise continuous function, Existence of Laplace transform, Function of exponential order	CLO 9	T1:21.2 R1:5.1
22	Apply Shifting theorems, Change of scale property to evaluate Laplace Transform of a given function	CLO 10	T1:21.4 R1:5.1
23	Apply Laplace transforms of derivatives and integrals, multiplied by t, divided by t to a given function	CLO 11, CLO 12	T1:21.7-21.10 R1:5.2-5.4
24	Define periodic functions	CLO 13	T1:21.5 R1:5.2

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
25	Solve Inverse Laplace transform	CLO 10	T1:21.12 R1:5.1,5.6
26	Define and apply shifting theorem, change of scale property	CLO 10	T1:21.13 R1:5.1,5.3
27	Solve multiplied by s, divided by s	CLO 14	T1:21.13 R1:5.4
28	Define and apply Convolution theorem	CLO 15, CLO 16	T1:21.14 R1:5.5
29	Apply Fourier integral theorem to find integrals	CLO 18	T1:22.1-22.2 R1:10.8
30	Apply Fourier sine and cosine integrals to find integrals	CLO 18	T1:22.3 R1:10.8
31-33	Define and apply Fourier transforms	CLO 19	T1:22.4 R1:10.9
34-35	Use properties to solve the given functions	CLO 20	T1:22.5 R1:10.9
36	Define and apply Inverse transforms	CLO 21	T1:22.4 R1:10.9
37	Define and apply Finite Fourier transforms	CLO 22	T1:22.4 R1:10.9
38	Formulate partial differential equations by elimination of arbitrary constants and arbitrary functions	CLO 24, CLO 25	T1:17.1-17.2 R1:16.1-16.2
39-40	Determine Solutions of first order linear equation by Lagrange method	CLO 26	T1:17.5-17.6 R1:16.3.1
41	Solve by Charpit's method	CLO 27	T1:17.7 R1:16.3.2-16.3.3
42	Apply method of separation of variables	CLO 28	T1:18.1-18.2 R1:16.4
43-45	Solving One dimensional heat and wave equations under initial and boundary conditions.	CLO 28	T1:18.4-18.5 R1:16.4

XV. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S .No	Description	Proposed actions	Relevance with POs	Relevance with PSOs
1	Newton Raphson method, Lagranges interpolation, method of least square and Runge-kutta method	Seminars	PO 1	PSO 1
2	Fourier Integral Transforms, Convolution theorem in Fourier Transforms	Seminars / NPTEL	PO 2	PSO 1
3	Encourage students to solve real time applications and prepare towards competitive examinations	NPTEL	PO 4	PSO 1

Prepared by:
Mr. Ch Soma Shekar, Assistant Professor

HOD, FRESHMAN ENGINEERING

INSTITUTE OF AERONAUTICAL ENGINEERING

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AERONAUTICAL ENGINEERING

COURSE DESCRIPTOR

Course Title	**ENGINEERING MECHANICS**				
Course Code	AAEB01				
Program	B.Tech				
Semester	II	AE			
Course Type	Foundation				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	-	-
Chief Coordinator	Mr. S. Devaraj, Assistant Professor				
Course Faculty	Mr. T. Mahesh Kumar, Assistant Professor				

I. COURSE OVERVIEW:

The aim of Engineering Mechanics is to introduce students to the fundamental concepts and principles applied by engineers -whether civil, mechanical, aeronautical, etc. This course introduces the concepts of engineering based on forces in equilibrium. Topics include concentrated forces, distributed forces, forces due to friction, inertia, work –energy principle and vibrations as they apply to machines, structures, and systems. It is the branch of science for analyzing force systems that acts upon the bodies at either at rest or in motion.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
-	-	-	Basic concepts of physics and mathematics

III. MARKS DISTRIBUTION

Subject	SEE Examination	CIA Examination	Total Marks
Engineering Mechanics	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	Chalk & Talk	✔	Quiz	✔	Assignments	✔	MOOCs
✔	LCD / PPT	✔	Seminars	✘	Mini Project	✔	Videos
✘	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 modules 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 emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 1), with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

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 centre. 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 section XI.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		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	Presentation on real-world 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	2	Seminar
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	Term Paper

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	**Professional skills:** Able to utilize the knowledge of aeronautical/aerospace engineering in innovative, dynamic and challenging environment for design and development of new products	2	Presentation on real-world problems
PSO 2	**Problem solving skills:** imparted through simulation language skills and general purpose CAE packages to solve practical, design and analysis problems of components to complete the challenge of airworthiness for flight vehicles.		
PSO 3	**Practical implementation and testing skills:** Providing different types of in house and training and industry practice to fabricate and test and develop the products with more innovative technologies	-	-
PSO 4	**Successful career and entrepreneurship:** To prepare the students with broad aerospace knowledge to design and develop systems and subsystems of aerospace and allied systems and become technocrats.	-	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Students should develop the ability to work comfortably with basic engineering mechanics concepts required for analyzing static structures.
II	Identify an appropriate structural system to studying a given problem and isolate it from its environment, model the problem using good free-body diagrams and accurate equilibrium equations
III	Understand the meaning of centre of gravity (mass)/centroid and moment of Inertia using integration methods and method of moments
IV	To solve the problem of equilibrium by using the principle of work and energy, impulse momentum and vibrations for preparing the students for higher level courses such as Mechanics of Solids, Mechanics of Fluids, Mechanical Design and Structural Analysis etc...

IX. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AAEB01.01	CLO 1	A basic understanding of the laws and principle of mechanics	PO 1	3
AAEB01.02	CLO 2	The ability to solve simple force system problems in mechanics	PO 2	2
AAEB01.03	CLO 3	Determine the resultant and apply conditions of static equilibrium to a plane force system	PO 1	3
AAEB01.04	CLO 4	Solve the problems of simple systems with the friction, calculate the linear moving bodies in general plane motion and applications of friction	PO 1	3
AAEB01.05	CLO 5	Analyze planer and spatial systems to determine the force in the members of truss and frames	PO 2	3
AAEB01.06	CLO 6	Solve the problems on different types of beams	PO 2	2
AAEB01.07	CLO 7	Obtain the centroid, center of gravity, first moment and second moment of area	PO 2	3
AAEB01.08	CLO 8	Understand the concept of virtual work and an ability to solve practical problems	PO 2	2
AAEB01.09	CLO 9	Understand the concepts of kinematics of the particles and rectilinear motion	PO 3	1
AAEB01.10	CLO 10	Explore knowledge & ability to solve various particle motion problems.	PO 3	1
AAEB01. 11	CLO 11	Derive the D' Alembert's principle and apply it to various field problems of kinetic motion.	PO 2	2
AAEB01. 12	CLO 12	Determine the impact, impulse and impulsive forces occurring in the system and able to solve the problems	PO 2	2
AAEB01. 13	CLO 13	Develop the work energy relations and apply to connected systems.	PO 1	2
AAEB01. 14	CLO 14	Understand the fixed axis rotation theory and solving the field problems by application of work energy method.	PO 3	2
AAEB01. 15	CLO 15	Introduction to concepts of vibration and explain the relation between simple harmonic motion and the equilibrium systems.	PO 1	3

AAEB01. 16	CLO 16	Derive the expressions for the concepts of simple, compound and torsional pendulums.	PO 1, PO 2	3
AAEB01. 17	CLO 17	Explore the use of modern engineering tools, software and equipment to prepare for competitive exams, higher studies etc.	PO 1,PO 2	3

3 = High; 2 = Medium; 1 = Low

X. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO 1	3												1			
CLO 2		2														
CLO 3	3												2			
CLO 4	3												1			
CLO 5		3														
CLO 6		2														
CLO 7		3														
CLO 8		2														
CLO 9			1													
CLO 10			1													
CLO 11		2											2			
CLO 12		2											2			
CLO 13	2															
CLO 14			2													
CLO 15	3															
CLO 16	3	2											1			
CLO 17	3	2											2			

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO1 PO2 PO3	SEE Exams	PO1 PO2 PO3	Assignments	-	Seminars	PO2
Laboratory Practices	-	Student Viva	-	Mini Project	-	Certification	PO3
Term Paper	PO3						

XII. ASSESSMENT METHODOLOGIES - INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feed Back
✘	Assessment of Mini Projects by Experts		

XIII. SYLLABUS

Module-I	**INTRODUCTION TO ENGINEERING MECHANICS**	**Classes: 10**
Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy		
Module-II	**FRICTION AND BASICS STRUCTURAL ANALYSIS**	**Classes: 09**
Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack; Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams &types of beams; Frames &Machines;		
Module-III	**CENTROID AND CENTRE OF GRAVITY AND VIRTUAL WORK AND ENERGY METHOD**	**Classes: 10**
Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook. Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.		
Module-IV	**PARTICLE DYNAMICS AND INTRODUCTION TO KINETICS**	**Classes: 08**
Particle dynamics- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique). Introduction to Kinetics of Rigid Bodies covering, Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems;		
Module-V	**MECHANICAL VIBRATIONS**	**Classes: 08**
Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums;		

Text Books:
1. Irving H. Shames (2006), "Engineering Mechanics", Prentice Hall, 4th Edition,2013 2. F. P. Beer and E. R. Johnston (2011), "Vector Mechanics for Engineers", Vol I - Statics, Vol II, – Dynamics, Tata McGraw Hill , 9th Edition,2013. 3. R. C. Hibbler (2006), "Engineering Mechanics: Principles of Statics and Dynamics", Pearson Press.
Reference Books:
1. S.Bhavikatti,"ATextBookofEngineeringMechanics",NewAgeInternational,1st Edition,2012 2. A.K.Tayal, "Engineering Mechanics", Uma Publications, 14th Edition, 2013. 3. R. K. Bansal "Engineering Mechanics", Laxmi Publication, 8thEdition, 2013.

XIV. COURSE PLAN:

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

Lecture No	Topic/s to be covered	Course Learning Outcomes (CLOs)	Reference
1	Introduction to Engineering Mechanics	CLO 1	T2:5.5 R1:1.12.1
2	Basic Concepts- Force and types of forces	CLO 1	T2:5.6 R1:1.12.3
3	Laws of mechanics, Parallelogram laws of forces	CLO 1	T2:5.10 R1:1.15
4	Composition and resolution of forces	CLO 1	T2:5.15 R1:1.16
5	Problems on composition and resolution	CLO 3	T2:5.17 R1:1.13.1
6	Problems on concurrent forces	CLO 3	T2:5.18 R1:1.13.2
7	Composition of non-concurrent forces	CLO 3	T2:5.19 R1:1.13.3
8	Problems on non-concurrent forces	CLO 3	T2:5.20 R1:1.17.1
9	Composition of concurrent forces in space	CLO 2	T2:5.24 R1:1.17.3
10	Problems on concurrent forces in space	CLO 2	T2:6.1 R1:2.3
11	Moment concept, types of moments, Varginons principle	CLO 1	T2:6.3 R1:2.6.1
12	Moment couple, characteristics of couple, parallel like and unlike forces	CLO 1	T2:6.5 R1:2.6.2
13	Problems on moments	CLO 2	T2:7.3 R1:2.8
14	Problems on parallel like and unlike forces	CLO 2	T2:7.5,7.6 R1:2.9.2
15	Equilibrium and principles of equilibrium, Types of forces - Applied and non-Applied	CLO 2	T2:7.7 R1:2.10
16	Free body diagram, Lamis theorem statement and proof	CLO 1	T2:7.7 R1:2.10
17	Problems on Lamis theorem with strings	CLO 2	T2:7.11 R1:2.10.2
18	Problems on Lamis theorem with cylinders	CLO 2	T2:7.11 R1:2.32
19	Problems on equilibrium by using equilibrium equations	CLO 2	T2:15.2 R1:8.2

20	Problems on Rope by using equilibrium equations	CLO 2	T2:15.7 R1:8.3.3
21	Problems on concurrent force system in space	CLO 2	T2:15.13 R1:8.7.2
22	Introduction to friction, Theory of Friction, Angle of friction	CLO 4	T2:15.13 R1:8.7.2
23	Laws of Friction, Static and Dynamic Frictions	CLO 4	T2:15.16 R1:8.7.3
24	Derivation for Min and max force required to make the block equilibrium on inclined plane subjected to force parallel to plane	CLO 4	T1:11.9 R2:12.24
25	Derivation for Min and max force required to make the block equilibrium on inclined plane subjected to horizontal force	CLO 4	T1:11.9 R3:12.25
26	Derivation for Min and max force required to make the block equilibrium on inclined plane subjected to force inclined to plane	CLO 4	T1:3.2 R3:3.2
27	Problems on max and min force required to overcome the friction force	CLO 4	T1:3.3.1 R3:3.2
28	Problems on max and min force required to overcome the friction force	CLO 4	T2:16.5 R1:8.10
29-30	Problems on ladder	CLO 4	T2:16.9 R1:8.11.1
31-32	Problems on wedge	CLO 4	T2:16.8 R1:8.12.1
33-34	Problems on screw jack	CLO 4	T2:16.11 R1:8.14
35	Problems on differential screw jack	CLO 4	T2:16.12 R1:8.19
36	Concept of method of joints and method of sections	CLO 5	T2:16.12 R1:8.77
37	Problems on method of joints	CLO 5	T2:1.2 R1:7.2
38	Problems on method of sections	CLO 5	T2:1.16 R1:7.7
39	Beams- types of beams, types of supports and types of loads	CLO 6	T2:1.20 R1:7.8
40	Analysis of beams finding the reactions	CLO 6	T2:1.20 R1:7.8
41	Introduction to centroids and Centre of gravity	CLO 7	T2:2.1 R1:7.9.2
42-43	Problems on finding the centroid for simple figures	CLO 7	T2:2.2 R1:7.9.1
44-45	Problems on centroids of Composite Figures	CLO 7	T2:2.4 R1:7.11
46	Derivation for parallel axis theorem and perpendicular axis theorem	CLO 7	T2:16.8 R1:8.12.1
47-49	Problems on parallel and perpendicular axis theorem	CLO 7	T2:16.8 R1:8.12.2
50	Derive the equation for parallel and perpendicular axis theorems, finding surface areas and volumes of cone, sphere, etc	CLO 7	T2:5.17 R1:1.13.1
51	Moment of inertia, polar moment of inertia and radius of gyration	CLO 7	T2:5.18 R1:1.13.2

52-55	Problems on moment of inertia	CLO 7	T2:5.19 R1:1.13.3
55	Problems on polar moment of inertia and radius of gyration	CLO 7	T2:6.1 R1:2.3
56	Introduction to dynamics types of motions, equations of motion for uniform velocity, uniform acceleration, and variable acceleration.	CLO 9	T2:6.3 R1:2.6.1
57	Problems on rectilinear motion	CLO 9	T2:6.5 R1:2.6.2
58	Problems on rectilinear motion under gravity	CLO 9	T2:5.24 R1:1.17.3
59	Problems on rectilinear motion for variable acceleration	CLO 9	T2:6.1 R1:2.3
60	Curvilinear motion, 1 horizontal projection 2 inclined projection on level ground 3 inclined projection on different levels of ground	CLO 9	T2:6.3 R1:2.6.1
61	Problems on inclined projection	CLO 9	T2:15.13 R1:8.7.2
62	Problems on inclined plane and point of projection and point of strike at different levels	CLO 8	T2:15.13 R1:8.7.2
63	Kinematics of rigid bodies	CLO 14	T2:15.16 R1:8.7.3
64	General plane motion concept ICR, problems on ICR	CLO 14	T1:11.9 R2:12.24
65	Problems on rigid body plane motion	CLO 10	T1:11.9 R3:12.25
66	Introduction to kinetics	CLO 10	T1:3.2 R3:3.2
67-68	Problems on rectilinear kinetics	CLO 11	T1:3.3.1 R3:3.2
69	Problems on kinetics of centroidal rotation	CLO 11	T2:16.9 R1:8.11.1
70	Problems on general plane motion	CLO 12	T2:16.9 R1:8.11.2
71	Concept of work energy method	CLO 13	T2:15.13 R1:8.7.2
72	Problems on work energy method translation	CLO 13	T2:15.13 R1:8.7.2
73	Problems on work energy method rotation	CLO 13	T2:15.16 R1:8.7.3
74	Problems on work energy method plane motion	CLO 15	T1:11.9 R2:12.24
75	Introduction to vibration, simple harmonic motion	CLO 15	T1:11.9 R3:12.25
76	Problems on vibrations	CLO 16	T1:3.2 R3:3.2
77	Concept of simple pendulum, compound pendulum and torsional pendulum	CLO 17	T1:3.3.1 R3:3.2
78-80	Problems on simple, compound and torsional pendulum	CLO 16	T2:16.5 R1:8.10

XV. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S NO	Description	Proposed actions	Relevance with POs	Relevance with PSOs
1	To improve standards and analyze the concepts of Engineering mechanics.	Seminars	PO 1	PSO 1
2	To improve the aility of understanding the concept of centroids and center of gravity with some complex problems	Seminars / MOOC	PO 3	PSO 1
3	Encourage students to solve real time applications and prepare towards competitive examinations.	NPTEL	PO 2	PSO 1

Prepared by:

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HOD, AE

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Dundigal, Hyderabad -500 043

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTOR

Course Title	**PROBABILITY AND STATISTICS**				
Course Code	AHSB12				
Programme	B.Tech				
Semester	II	CSE | IT			
	III	AE | ME			
	IV	CE			
Course Type	Foundation				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	-	-
Chief Coordinator	Ms. P Srilatha, Assistant Professor				
Course Faculty	Mr. J Suresh Goud, Assistant Professor Ms. B Praveena, Assistant Professor				

I. COURSE OVERVIEW:

The course focuses on more advanced Engineering Mathematics topics which provide with the relevant mathematical tools required in the analysis of problems in engineering and scientific professions. The course includes probability, baye's theorem, random variables, probability distributions, correlation, regression, sampling distribution and testing of hypothesis. The mathematical skills derived from this course form a necessary base to analytical and design concepts encountered in the program.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
-	-	-	Basic principles of statistics

III. MARKS DISTRIBUTION:

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

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	Chalk & Talk	✔	Quiz	✔	Assignments	✘	MOOCs
✔	LCD / PPT	✔	Seminars	✘	Mini Project	✔	Videos
✘	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 emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 1), with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

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 centre. 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 section XI.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		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	Presentation on real-world 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	2	Seminar
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	Term Paper

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		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	Seminar
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.	-	-
PSO 3	**Successful Career and Entrepreneurship:** The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies.	-	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Enrich the knowledge of probability on single random variables and probability distributions.
II	Apply the concept of correlation and regression to find covariance.
III	Determine mean and variance of given data by sampling distribution.
IV	Analyze the given data for appropriate test of hypothesis.

IX. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AHSB12.01	CLO 1	Describe the basic concepts of probability.	PO 1	3
AHSB12.02	CLO 2	Summarize the concept of conditional probability and estimate the probability of event using Baye's theorem.	PO 2	2
AHSB12.03	CLO 3	Analyze the concepts of discrete and continuous random variables, probability distributions, expectation and variance.	PO 1	3
AHSB12.04	CLO 4	Use the concept of random variables in real-world problem like graph theory; machine learning, Natural language processing.	PO 1	3
AHSB12.05	CLO 5	Determine the binomial distribution to find mean and variance.	PO 2	2
AHSB12.06	CLO 6	Understand binomial distribution to the phenomena of real-world problem like sick versus healthy.	PO 2	2
AHSB12.07	CLO 7	Determine the poisson distribution to find mean and variance.	PO 2	2
AHSB12.08	CLO 8	Use poisson distribution in real-world problem to predict soccer scores.	PO 2	2
AHSB12.09	CLO 9	Illustrate the inferential methods relating to the means of normal distributions.	PO 4	1
AHSB12.10	CLO 10	Describe the mapping of normal distribution in real-world problem to analyze the stock market.	PO 4	1
AHSB12.11	CLO 11	Explain multiple random variables and the covariance of two random variables.	PO 2	2
AHSB12.12	CLO 12	Understand the concept of multiple random variables in real-world problems aspects of wireless communication system.	PO 2	2
AHSB12.13	CLO 13	Calculate the correlation coefficient to the given data.	PO 1	3
AHSB12.14	CLO 14	Contrast the correlation and regression to the real-world such as stock price and interest rates.	PO 1	3
AHSB12.15	CLO 15	Calculate the regression to the given data.	PO 1	3
AHSB12.16	CLO 16	Discuss the concept of sampling distribution of statistics and in particular describe the behavior of the sample mean.	PO 1, PO 2	3
AHSB12.17	CLO 17	Understand the foundation for hypothesis testing.	PO 1, PO 2	3
AHSB12.18	CLO 18	Summarize the concept of hypothesis testing in real-world problem to selecting the best means to stop smoking.	PO 1, PO 2	3
AHSB12.19	CLO 19	Apply testing of hypothesis to predict the significance difference in the sample means.	PO 1, PO 2	3
AHSB12.20	CLO 20	Apply testing of hypothesis to predict the significance difference in the sample proportions.	PO 1, PO 2	3
AHSB12.21	CLO 21	Use Student t-test to predict the difference in sample means.	PO 1	3
AHSB12.22	CLO 22	Apply F-test to predict the difference in sample variances.	PO 1	3
AHSB12.23	CLO 23	Understand the characteristics between the samples using Chi-square test.	PO 1	3

3 = High; 2 = Medium; 1 = Low

X. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1	3												1		
CLO 2		2													
CLO 3	3												1		
CLO 4	3												1		
CLO 5		2													
CLO 6		2													
CLO 7		2													
CLO 8		2													
CLO 9				1											
CLO 10				1											
CLO 11		2											1		
CLO 12		2											1		
CLO 13	3														
CLO 14	3														
CLO 15	3														
CLO 16	3	2											1		
CLO 17	3	2											1		
CLO 18	3	2											1		
CLO 19	3	2											1		
CLO 20	3	2											1		
CLO 21	3	2													
CLO 22	3	2													
CLO 23	3	2													

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO 1	SEE Exams	PO 1	Assignments	-	Seminars	PO 2
Laboratory Practices	-	Student Viva	-	Mini Project	-	Certification	-
Term Paper	PO 4						

XII. ASSESSMENT METHODOLOGIES - INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feedback
✘	Assessment of Mini Projects by Experts		

XIII. 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.	
Text Books:	
1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons Publishers, 9th Edition, 2014. 2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43rd Edition, 2012.	
Reference Books:	
1. S. C. Gupta, V. K. Kapoor, "Fundamentals of Mathematical Statistics", S. Chand & Co., 10th Edition, 2000. 2. N. P. Bali, "Engineering Mathematics", Laxmi Publications, 9th Edition, 2016. 3. Richard Arnold Johnson, Irwin Miller and John E. Freund, "Probability and Statistics for Engineers", Prentice Hall, 8th Edition, 2013.	

XIV. COURSE PLAN:

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

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Define the concept of probability and its applications	CLO 1	T2:26.3 R2:21.37
2-3	Describe the concept of conditional probability	CLO 2	R2:21.48
4-5	Describe the Concept of Baye's Theorem	CLO 2	T2:26.6 R2:21.50
6-7	Describe the concept of Random variables, Contrast discrete Random variables and also calculate the mean and variance of discrete Random variables, probability distribution	CLO 3	T2:26.7 R2:21.51
8-9	Recall the continuous probability function	CLO 3	T2:26.8 R2:21.52
10-11	Identify mathematical expectation	CLO 3	T2:26.10
12-13	Recall characteristics of the Binomial Distribution and find mean , variance	CLO 5	T2:26.14 R2:21.55
14-15	Recognize cases where Poisson Distribution could be appropriate model to find mean and variance	CLO 7	T2:26.15 R2:21.58
16-18	Apply Normal Distributions find the probability over a set of values, mean and variance	CLO 9	T2:26.16 R2:21.61
19-20	Recognize the limitation of correlation as a summary of bivariate data.	CLO 13	T2:25.12 R2:21.24
21-22	Interpret the correlation between the bivariate data by allotting ranks.	CLO 13	T2:25.16 R2:21.29
23	Define the concept of least squares estimation in linear regression	CLO 15	T2:25.14 R2:21.31
24-25	Estimate the linear model to a bivariate data to the lines regression	CLO 15	T2:25.14 R2:21.33
26-27	Recognize the multiple correlation and regression of bivariate data	CLO 11	R2:21.33
28	Recall the sampling distribution of the sample mean in general situation	CLO 16	T2:27.2 R2:21.64
29	Distinguish between a population and a sample and between parameters & statistics	CLO 16	T2:27.2
30	Recall the sampling distribution and define standard error	CLO 16	T2:27.2 R2:21.67
31-33	Recall the sampling distribution of the sample mean in general situation	CLO 16	T2:27.2
34	Understand the foundation for classical inference involving hypothesis testing and two types of errors possible	CLO 17	T2:27.3 R2:21.71
35	Explain level of significance confidence interval	CLO 17	T2:27.4 R2:21.68
36	Identify the confidence interval with single mean	CLO 19	T2:27.7 R2:21.74
37	Identify the confidence interval with difference between the mean	CLO 19	T2:27.12 R2:21.75
38	Identify the confidence interval with difference between the proportions	CLO 20	T2:27.8 R2:21.72
39	Identify the confidence interval with difference between the proportions	CLO 20	T2:27.8 R2:21.73
40-41	Recall the definition of a t-statistics in terms of statistics of sample from a normal distribution	CLO 21	T2:27.14 R2:21.78
42	Apply the definition of F-distribution	CLO 22	T2:27.19 R2:21.814

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
43	Apply the definition of χ^2 –Distribution	CLO 23	T2:27.12 R2:21.82
44-45	Apply χ^2 -square distribution of goodness of fit	CLO 23	T2:27.18 R2:21.82

XV. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs
1	To improve standards and analyze the concepts.	Seminars	PO 1	PSO 1
2	Conditional probability, Sampling distribution, correlation, regression analysis and testing of hypothesis	Seminars / NPTEL	PO 4	PSO 1
3	Encourage students to solve real time applications and prepare towards competitive examinations.	NPTEL	PO 2	PSO 1

Prepared By:
Ms. P Srilatha, Assistant Professor

HOD, FRESHMAN ENGINEERING

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTOR

Course Title	**SEMICONDUCTOR PHYSICS**				
Course Code	AHSB13				
Programme	B.Tech				
Semester	II	CSE | IT			
Course Type	Foundation				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	3	1.5
Chief Coordinator	Ms. S Charvani, Assistant Professor				
Course Faculty	Dr. P Koteshwar Rao, Professor Dr. Y Veeraswamy, Professor Mr. K Sai Baba, Assistant Professor				

I. COURSE OVERVIEW:

The course matter is divided into five modules covering duly-recognized areas of theory and study. This course develops abstract and critical reasoning by studying mathematical and logical proofs and assumptions as applied in basic physics. The topics include quantum mechanics, semiconductors, opto electronic devices, magnetism, dielectrics, lasers and fiber optics. The course helps students to gain knowledge of basic principles and appreciate the diverse real-time applications in technological fields in respective branches.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
-	-	-	Basic principles of semiconductors

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Semiconductor Physics	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	Chalk & Talk	✔	Quiz	✔	Assignments	✘	MOOCs
✔	LCD / PPT	✔	Seminars	✘	Mini Project	✔	Videos
✘	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 emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 1), with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

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 centre. 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 section XI.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		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	Presentation on real-world 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	2	Term paper
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	Seminars

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		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	Seminar
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.	-	-
PSO 3	**Successful Career and Entrepreneurship:** The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies.	-	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Enrich knowledge in principles of quantum mechanics and semiconductors.
II	Develop strong fundamentals of electronic and optoelectronic materials.
III	Enrich knowledge about measuring resistivity, conductivity and other parameters.
IV	Correlate principles and applications of lasers and fiber optics.

IX. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AHSB13.01	CLO 1	Recall the basic principles of physics and apply these concepts of physics in solving the real-time problems.	PO 1, PO 2	3
AHSB13.01	CLO 2	Acquire knowledge about fundamentals in quantum mechanics.	PO 1	3
AHSB13.01	CLO 3	Interpretation of dual nature of matter wave concept using Davisson & Germer's experiment.	PO 1	3
AHSB13.01	CLO 4	Estimate the energy of the particles using Schrödinger's wave equation and apply it to particle in potential box.	PO 1	3
AHSB13.01	CLO 5	Understand the band structure of a solid and Classify materials as metals**,** insulators, or semiconductors, and sketch a schematic band diagram for each one.	PO 1	3
AHSB13.01	CLO 6	Recollect the conductivity mechanism involved in semiconductors and calculate carrier concentrations.	PO 1	3
AHSB13.01	CLO 7	Acquire knowledge about fundamentals in semiconducting devices	PO 1	3
AHSB13.01	CLO 8	Understand the basics of a p-n junction and construction of optoelectronic devices like LED, photo diode, solar cell.	PO 1, PO 2	3
AHSB13.01	CLO 9	Recollect the concept of electric polarization and classify dielectric materials.	PO 1	2
AHSB13.01	CLO 10	Recollect the concept of magnetization and classify magnetic materials.	PO 1	3
AHSB13.01	CLO 11	Apply different laws of radiation to understand the phenomenon behind production of light.	PO 1	3
AHSB13.01	CLO 12	Understand the basic principles involved in the production of Laser light and also Real-time applications of lasers.	PO 2, PO 5	2
AHSB13.01	CLO 13	Recollect basic principle, construction, types and attenuation of optical fibers.	PO 1	3
AHSB13.01	CLO 14	Understand the importance of optical fibers in real-time communication system.	PO 5	2

3 = High; 2 = Medium; 1 = Low

X. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1	3	2											1		
CLO 2	3														
CLO 3	3														
CLO 4	3														

CLO 5	3														
CLO 6	3														
CLO 7	3														
CLO 8	3	2													
CLO 9		2													
CLO 10	3														
CLO 11	3														
CLO 12		2			1								1		
CLO 13	3														
CLO 14					1								1		

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO 1	SEE Exams	PO 1	Assignments	-	Seminars	PO 5
Laboratory Practices	-	Student Viva	-	Mini Project	-	Certification	-
Term Paper	PO 1						

XII. ASSESSMENT METHODOLOGIES - INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feedback
✘	Assessment of Mini Projects by Experts		

XIII. SYLLABUS

Module-I	**QUANTUM MECHANICS**
Introduction to quantum physics, Black body radiation, Planck's law, Photoelectric effect, Compton effect, De-Broglie's hypothesis, Wave-particle duality, Davisson and Germer experiment, Time-independent Schrodinger equation for wave function, Born interpretation of the wave function, Schrodinger 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 effect, Construction and working of LED, Photo detectors, PIN, Avalanche photodiode, Solar cell.	

Module-IV	ENGINEERED ELECTRIC AND MAGNETIC MATERIALS
Polarization, Permittivity, Dielectric constant, Internal field in solids, Clausius Mosotti equation, Ferroelectricity, Piezoelectricity, Pyroelectricity. Magnetization, 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 lasers, Spontaneous and stimulated emission of radiation, Metastable state, Population inversion, Lasing action, Ruby laser, Semiconductor diode laser and applications of lasers. Principle and construction of an optical fiber, Acceptance angle, Numerical aperture, Types of optical fibers (Single mode, multimode, step index, graded index), Attenuation in optical fibers, Optical fiber communication system with block diagram.	
Text Books:	
1. Dr. K. Vijaya Kumar, Dr. S. Chandralingam, "Modern Engineering Physics", Chand & Co. New Delhi, 1st Edition, 2010. 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. R. K. Gaur, S. L. Gupta, "Engineering Physics", Dhanpat Rai Publications, 8th Edition, 2001 3. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Gupta on NPTEL. 4. O. Svelto, "Principles of Lasers", Springer Science & Business Media, 2010	

XIV. COURSE PLAN:

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

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Introduction to quantum physics	CLO 2	T2:5.5 R1:1.12.1
2	Black body radiation	CLO 2	T2:5.6 R1:1.12.3
3	Planck's law, Photoelectric effect, Compton effect	CLO 2	T2:5.10 R1:1.15
4	De-Broglie's hypothesis, Wave-particle duality	CLO 3	T2:5.15 R1:1.16
5	Davisson and Germer experiment	CLO 3	T2:5.17 R1:1.13.1
6	Time-independent Schrodinger equation for wave function	CLO 4	T2:5.18 R1:1.13.2
7	Born interpretation of the wave function	CLO 4	T2:5.19 R1:1.13.3
8	Schrodinger equation for one dimensional problems–particle in a box.	CLO 4	T2:5.20 R1:1.17.1
9	Bloch's theorem for particles in a periodic potential, Kronig-Penney model (Qualitative treatment)	CLO 5	T2:5.24 R1:1.17.3
10	Kronig-Penney model (Qualitative treatment)	CLO 5	T2:6.1 R1:2.3
11	Origin of energy bands	CLO 5	T2:6.3 R1:2.6.1
12	Types of electronic materials: metals, semiconductors, and insulators	CLO 5	T2:6.5 R1:2.6.2
13	Intrinsic semiconductors Carrier concentration	CLO 6	T2:7.3 R1:2.8

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
14	Intrinsic semiconductors Carrier concentration	CLO 6	T2:7.5,7.6 R1:2.9.2
15	Extrinsic semiconductors, Carrier concentration	CLO 6	T2:7.7 R1:2.10
16	Extrinsic semiconductors, Carrier concentration	CLO 6	T2:7.7 R2:2.10
17	Dependence of Fermi level on carrier-concentration and temperature	CLO 6	T2:7.11 R2:2.10.2
18	Carrier generation and recombination, Hall effect	CLO 6	T2:7.11 R2:2.32
19	Carrier generation and recombination, Carrier transport: diffusion and drift, Direct and indirect band gaps	CLO 7	T2:7.11 R2:2.10
20	p-n junction, V-I characteristics	CLO 7	T2:7.12 R2:2.10.3
21	Energy Band diagram, Biasing of a junction	CLO 8	T2:7.12 R2:2.10.3
22	Photo voltaic effect, Construction and working of LED	CLO 8	T2:7.13 R1:2.10.4
23	Photo detectors, PIN, Avalanche photodiode	CLO 8	T2:7.14 R1:2.10.6
24	Solar cell	CLO 8	T2:7.15 R1:2.10.7
25	Polarization, Permittivity, Dielectric constant	CLO 9	T1:7.15 R2:2.10.7
26	Internal field in solids, Clausius Mosotti equation	CLO 9	T1:7.15 R2:2.10.7
27	Ferro electricity	CLO 9	T1:7.15 R2:2.10.7
28	Piezoelectricity, Pyroelectricity	CLO 9	T1:7.15 R2:2.10.7
29	Magnetization, Permeability, Susceptibility	CLO 10	T1:16.9 R2:8.11.1
30	Classification of dia, para and ferro magnetic materials on the basis of magnetic moment	CLO 10	T1:16.9 R2:8.11.2
31	Domain theory of Ferro magnetism on the basis of hysteresis curve	CLO 10	T1:16.8 R2:8.12.1
32	Introduction and Characteristics of lasers	CLO 11	T1:15.2 R4:8.2
33	Spontaneous and stimulated emission of radiation	CLO 11	T2:15.7 R4:8.3.3
34	Metastable state, Population inversion, Lasing action	CLO 11	T2:15.13 R4:8.7.2
35	Ruby laser	CLO 12	T2:15.13 R4:8.7.2
39	He-Ne laser and applications of lasers	CLO 12	T2:15.16 R1:8.7.3
40	Introduction and Principle and construction of an optical fiber	CLO 13	T1:11.9 R2:12.24
41	Acceptance angle, Numerical aperture	CLO 13	T1:11.9 R3:12.25
42	Types of optical fibers (Single mode, multimode, step index, graded index)	CLO 13	T1:3.2 R3:3.2
43	Attenuation in optical fibers	CLO 13	T1:3.3.1 R3:3.2
44	Optical fiber communication system with block diagram.	CLO 14	T2:16.5 R3:8.10

XV. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs
1	Encourage the students to design the working models which are correlated with the syllabus.	Seminars / Laboratory Practices	PO 2	PSO 1
2	Insist the students to collect real- time applications of the basic principles they learn in physics.	Seminars / NPTEL	PO 1	PSO 1
3	Motivate the students to organize the seminars for the awareness of upcoming applications in physics.	Seminars / NPTEL	PO 5	PSO 1

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HOD, FRESHMAN ENGINEERING

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

MECHANICAL ENGINEERING

COURSE DESCRIPTOR

Course Title	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**				
Course Code	AEEB04				
Programme	B.Tech				
Semester	II	ME			
	III	AE			
Course Type	Foundation				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	3	1.5
Chief Coordinator	Mr. N Shivaprasad, Assistant Professor				
Course Faculty	Mr. N Shivaprasad, Assistant Professor Ms. T Saritha Kumari, Assistant Professor				

I. COURSE OVERVIEW:

Electrical and Electronics Engineering course deals with the concepts of electrical circuits, basic law's of electricity, different methods to solve the electrical networks and the instruments to measure the electrical quantities. It also focuses on the construction, operational features of energy conversion devices such as DC and AC machines, Transformers. It also emphasis on basic electronics semiconductor devices and their characteristics and operational features.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
-	-	-	None

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Basic Electrical and Electronics Enigineering	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	Chalk & Talk	✔	Quiz	✔	Assignments	✘	MOOCs
✔	LCD / PPT	✔	Seminars	✘	Mini Project	✔	Videos
✘	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

Theory Course:

Each theory 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 modules 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 emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):

For each theory course the CIA shall be conducted by the faculty / teacher handling the course as given in Table 5. 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).

Table 5: Assessment pattern for Theory Courses

COMPONENT	**THEORY**			**TOTAL MARKS**
Type of Assessment	CIE Exam	Quiz	AAT	
Max. 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. The valuation and verification of answer scripts of CIE exams shall be completed within a week after the conduct of the Examination.

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):

In order to encourage innovative methods while delivering a course, the faculty members are encouraged to use the Alternative Assessment Tool (AAT). This AAT enables faculty to design own assessment patterns during the CIA. The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. If properly applied, the AAT converts the classroom into an effective learning centre. 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.

However, it is mandatory for a faculty to obtain prior permission from the concerned HOD and spell out the teaching/assessment pattern of the AAT prior to commencement of the classes.
The AAT chosen for this course is given in section XI.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		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	Seminar
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	Five Minutes Video
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	Term Paper

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	**Professional Skills:** To produce engineering professional capable of synthesizing and analyzing mechanical systems including allied engineering	1	Seminar

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
	streams.		
PSO 2	**Problem-Solving Skills:** An ability to adopt and integrate current technologies in the design and manufacturing domain to enhance the employability	-	-
PSO 3	**Successful Career and Entrepreneurship:** To build the nation, by imparting technological inputs and managerial skills to become Technocrats.	-	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Understand Kirchhoff laws and their application in series and parallel circuits.
II	Discuss principle and operation of measuring instruments.
III	Analyze the characteristics of alternating quantities, electrical machines.
IV	Illustrate the V-I characteristics of various diodes and bi-polar junction transistor.

IX. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AEEB04.01	CLO 1	Analyze the circuits using Kirchhoff's current and Kirchhoff's voltage law.	PO 1	3
AEEB04.02	CLO 2	Use star delta transformation for simplifying complex circuits.	PO 1	3
AEEB04.03	CLO 3	Generalize operation and principle of measuring instruments.	PO 2	3
AEEB04.04	CLO 4	Demonstrate the working principle of DC motor, DC generator and transformer.	PO 2	3
AEEB04.05	CLO 5	Describe the construction of machines and transformer.	PO 2	2
AEEB04.06	CLO 6	Classify the types of DC machines.	PO 2	2
AEEB04.07	CLO 7	Derive the EMF equation of DC generator, transformer and Torque equation of DC motor.	PO 2	2
AEEB04.08	CLO 8	Discuss the principle of operation of induction motor.	PO 2	2
AEEB04.09	CLO 9	Explain the construction and characteristics of alternator.	PO 4	2
AEEB04.10	CLO 10	Explain the construction and characteristics of 3-phase induction motor.	PO 2	1
AEEB04.11	CLO 11	Compare the operation of half wave, full wave and bridge rectifiers.	PO 4	2
AEEB04.12	CLO 12	Differentiate the operation of Diodes and transistors.	PO 2	2
AEEB04.13	CLO 13	Apply the concept of diodes in converting AC to DC rectification process.	PO 1	2
AEEB04.14	CLO 14	Distinguish the different configurations	PO 4	2

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
		of transistor.		
AEEB04.15	CLO 15	Examine the voltage, current and frequency of electric network using CRO.	PO 1	3
AEEB04.16	CLO 16	Apply the knowledge of electromagnetic laws and basic concepts of electronics.	PO 2	3
AEEB04.17	CLO 17	Process the knowledge and skills for employability and to succeed national and international level competitive examinations.	PO 2	3

3 = High; 2 = Medium; 1 = Low

X. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1	3	3													
CLO 2															
CLO 3		3											1		
CLO 4		3											1		
CLO 5		2											1		
CLO 6		2											1		
CLO 7		2											1		
CLO 8		2											1		
CLO 9				2											
CLO 10		1											1		
CLO 11				2									1		
CLO 12		2											1		
CLO 13	2														
CLO 14				2											
CLO 15	3														
CLO 16		3													
CLO 17		3													

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO 1	SEE Exams	PO 1	Assignments	PO 2	Seminars	PO 2
Laboratory Practices	PO 1	Student Viva	PO 1	Mini Project	-	Certification	-
Term Paper	PO 4						

XII. ASSESSMENT METHODOLOGIES - INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feed Back
✘	Assessment of Mini Projects by Experts		

XIII. SYLLABUS

MODULE -I	**ELECTRICCIRCUITS,ELECTROMAGNETISM AND INSTRUMENTS**	**Classes: 10**
Electrical Circuits: Basic definitions, types of elements, Ohm's Law, resistive networks, inductive networks, capacitive networks, Kirchhoff's Laws, series, parallel circuits and star delta transformations, simple problems, Faradays law of electromagnetic induction; Instruments: Basic principles of indicating instruments, permanent magnet moving coil and moving iron instruments.		
MODULE -II	**DC MACHINES**	**Classes: 10**
DC Machines: Principle of operation of DC generator, EMF equation, principle of operation of DC motors, torque equation, types of DC machines, applications, three point starter.		
MODULE -III	**ALTERNATING QUANTITIES AND AC MACHINES**	**Classes: 08**
Alternating Quantities: Sinusoidal AC voltage, average and RMS values, form and peak factor, concept of three phase alternating quantity; Transformer: Principle of operation, EMF equation, losses, efficiency and regulation. **Three Phase Induction Motor:** Principle of operation, slip, slip torque characteristics, efficiency, applications; Alternator: Principle of operation, EMF Equation, efficiency, regulation by synchronous impedance method.		
MODULE-IV	**SEMICONDUCTOR DIODE AND APPLICATIONS**	**Classes: 09**
Semiconductor Diode: P-N Junction diode, symbol, V-I characteristics, half wave rectifier, full wave rectifier, bridge rectifier and filters, diode as a switch, Zener diode as a voltage regulator.		
MODULE-V	**BIPOLAR JUNCTION TRANSISTOR AND APPLICATIONS**	**Classes: 08**
Bipolar junction: DC characteristics, CE, CB, CC configurations, biasing, load line, transistor as an amplifier.		

Text Books:

1. A Chakrabarti, "Circuit Theory", Dhanpat Rai Publications, 6th Edition, 2004.
2. K S Suresh Kumar, "Electric Circuit Analysis", Pearson Education, 1st Edition, 2013.
3. Willianm Hayt, Jack E Kemmerly S M Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 7th Edition, 2010.
4. J P J Millman, C C Halkias, Satyabrata Jit, "Millman‟s Electronic Devices and Circuits", Tata McGraw Hill, 2nd Edition, 1998.
5. R L Boylestad, Louis Nashelsky, "Electronic Devices and Circuits", PEI / PHI, 9th Edition, 2006.
6. R L Boylestad, Louis Nashelsky, "Electronic Devices and Circuits", PEI / PHI, 9th Edition, 2006.

Reference Books:

1. David A Bell, "Electric Circuits", Oxford University Press, 9th Edition, 2016.
2. U A Bakshi,Atul P Godse "Basic Electrical and Electronics Engineering", Technical Publications, 9th Edition, 2016.
3. A Bruce Carlson, "Circuits", Cengage Learning, 1st Edition, 2008.
4. M Arshad, "Network Analysis and Circuits", Infinity Science Press, 9th Edition, 2016.

XIV. COURSE PLAN:

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

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	**Discuss** the basic definitions of voltage, current, power and energy	CLO 1	T2: 1.2-1.8 R2:1.1
2	**Understand** the concept of Ohm's Law	CLO 1	T2: 1.9 R2:1.5
3	**Discuss** different elements in power systems and sources	CLO 1	T2:1.10 R2:1.2&1.4
4-5	**Describe** voltage-current relationship of resistive networks, inductive networks, capacitive networks	CLO 1	T2: 2.3-2.5 R2:1.6
6	**Explain** Kirchhoff's laws for electrical networks	CLO 1	T2: 1.12 R2:1.14
7-8	**Understand** series, parallel circuits	CLO 1	T2: 2.6 R2:1.7&1.8
9	**Derive** the formula for Star delta and delta star transformations techniques.	CLO 2	T2: 2.7 R2:1.12
10	**Analyze** networks using reduction techniques.	CLO 2	T2: 2.6 R2:1.7&1.8
11	**Understand** the concept of faradays laws	CLO 3	T2: 1.11 R2:6.2
12	**Understand** working of different measuring instruments	CLO 3	T2: 10.4 R2:4.0
13-14	**Understand** working of different measuring instruments	CLO 3	T2: 10.5.1.1 R2:4.0
15-16	**Understand** working of different measuring instruments	CLO 3	T2: 10.5.1.3 R2:4.0
17	**Discuss** what is a DC machine	CLO 4	T2: 7.1 R2:5.2

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
18	**Understand** the working principle of DC machine	CLO 4	T2: 7.6 R2:5.3
19-20	**Demonstrate** the cross section view of a DC machine	CLO 5	T2: 7.2 R2:5.4
21-22	**Derive** the mathematical equation of EMF induced in a DC generator	CLO 7	T2: 7.6.1 R2:5.7
23	**Classify** the types of DC generator	CLO 6	T2: 7.6.3 R2:5.10,5.11,5.12 ,5.13,5.14
24	**Understand** the working principle of DC motor	CLO 4	T2: 7.7 R2:5.16
25	**Classify** the types of DC motor	CLO 6	T2: 7.7.6 R2:5.21,5.22,5.23 ,5.24
26	**Derive** mathematical equation of torque generated in a DC motor	CLO 7	T2:7.7.5 R2:5.20
27	**Understand** the applications of DC motor	CLO 4	T2: 7.7.6.1-7.7.6.3 R2:5.31
28	**Understand** the three point starter	CLO 4	T2: 7.7.7 R2:5.25
29	**Understand** the concepts of alternating quantities	CLO 4	T2: 4.1 R2:2.1
30	**Understand** the representation of sinusoidal quantity and analyzing	CLO 4	T2: 4.5-4.6 R2:2.2
31	**Understand** three phase systems	CLO 4	T2: 5.2.4.1-5.2.4.2 R2:3.2
32	**Understand** the working principle of Transformer	CLO 4	T2: 6.5 R2:602
33	**Derive** mathematical equation of EMF induced in a single phase transformer	CLO 7	T2: 6.6.1 R2:6.6
34-35	**Understand** the percentage efficiency and voltage regulation	CLO 7	T2: 6.9-6.10 R2:6.13&6.15
36	**Understand** the working principle of induction motor	CLO 8	T2: 9.3 R2:7.2
37	**Analyze** the speed torque characteristics	CLO 9	T2: 9.3.1 R2:7.8
38	**Understand** the working principle of Alternator	CLO 9	T2: 8.4 R2:7.11
39-40	**Derive** the mathematical equation of EMF induced in a Alternator	CLO 9	T2: 8.4 R2:7.13
41-42	**Analyze** the percentage efficiency of an alternator.	CLO 9	T2: 8.8 R2:7.16
42-43	**Analyze** the percentage voltage regulation of alternator.	CLO 9	T2: 8.8 R2:7.21
44-47	**Understand** the functioning of P-N Junction diode	CLO 12	T4: 4.11 R2:8.1

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
48–50	**Understand** and analyze P -N diode as half wave rectifier, full wave rectifier, bridge rectifier and filters	CLO 11	T4: 4.23 R2:8.8,8.17,8.18, 8.19
51-53	**Understand** the functioning of Zener diode as a voltage regulator.	CLO 12	T4: 4.19,5.2 R2:8.22.5
54	**Analyze** simple problems on diodes.	CLO 12	T4: 4.23 R2:8.23
55-56	**Understand** the concept of bipolar junction: DC characteristics,	CLO 14	T4: 6.4-6.5 R2:9.1
57-59	**Examine** CE, CB, CC configurations.	CLO 14	T4: 6.6 R2:9.21,9.22,9.23
60	**Analyze** biasing and load line,	CLO 14	T4: 6.3 R2:9.3
61-63	**Model** Transistor as an amplifier	CLO 14	T4: 6.7 R2:9.5
64-65	**Analyze** simple problems on transistors.	CLO 14	T4: 6.6 R2:9.7

XV. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs
1	To improve standards and analyze the concepts.	Seminars	PO 2	PSO 1
2	Voltage - Current relationship for passive elements for different input signals - ramp, saw tooth and triangular.	Seminars / NPTEL	PO 1	PSO 1
3	Resistance color coding	NPTEL	PO 1	PSO 1

Prepared by:
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HOD, FRESHMAN ENGINEERING

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ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE DESCRIPTOR

Course Title	**ELECTRICAL CIRCUIT ANALYSIS**				
Course Code	AEEB02				
Programme	B.Tech				
Semester	I	ECE			
Course Type	Foundation				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	3	1.5
Chief Coordinator	Mr.G Hari Krishna, Assistant Professor, EEE				
Course Faculty	Mr. A Naresh Kumar, Assistant Professor, EEE Mr. G Hari Krishna, Assistant Professor, EEE Mr. A Srikanth, Assistant Professor, EEE Mr. T Mahesh , Assistant Professor, EEE				

I. COURSE OVERVIEW:

This course deals with fundamentals of electrical circuit analysis, basic parameters like resistor, inductor and capacitor, formation of circuit and network, nature of sources to feed the networks, different network reduction techniques to study behavior of networks, single phase AC circuits and their analysis and network theorems for reducing complexity of networks and for easy simplifications. The emphasis of this course is laid on the basic analysis of circuits which includes, transient analysis of DC and AC circuits, two port net work parameters

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
-	-	-	None

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Electrical Circuit Analysis	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	Chalk & Talk	✔	Quiz	✔	Assignments	✘	MOOCs
✔	LCD / PPT	✔	Seminars	✘	Mini Project	✔	Videos
✘	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 emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 1), with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

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 centre. 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 section XI.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		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	Five Minutes Video
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	Seminar
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	Term paper

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	**Professional Skills:** An ability to understand the basic concepts in Electronics & Communication Engineering and to apply them to various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of complex systems	2	Seminar
PSO 2	**Problem-Solving Skills:** An ability to solve complex Electronics and communication Engineering problems, using latest hardware and software tools, along with analytical skills to arrive cost effective and appropriate solutions	-	-
PSO 3	**Successful Career and Entrepreneurship**: An understanding of social awareness & environmental-wisdom along with ethical responsibility to have a successful career and to sustain passion and zeal for real-world applications using optimal resources as an Entrepreneur.	-	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Understand and analyze basic AC and DC electrical circuits.
II	Apply mesh analysis and nodal analysis to solve electrical networks.
III	Illustrate single phase AC circuits and apply steady state analysis to time varying circuits.
IV	Understand the transient response of series and parallel RL, RC and RLC circuits for DC excitations and calculate the two port network parameters.

IX. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AEEB02.01	CLO 1	Define the various nomenclature used to study the characteristics of DC networks.	PO1	3
AEEB02.02	CLO 2	Understand the concept of circuit, classification of elements and types of energy sources.	PO1	3
AEEB02.03	CLO 3	State different laws associated with electrical circuits and apply source transformation technique to determine equivalent resistance and source current.	PO1,PO2	2
AEEB02.04	CLO 4	Apply the network reduction techniques directly and indirectly to calculate quantities associated with electrical circuit	PO2	1
AEEB02.05	CLO 5	Identify the alternating quantities with it instantaneous, average and root mean square values.	PO2	1
AEEB02.06	CLO 6	Demonstrate the impression of reactance, susceptance, impedance and admittance in estimating power of AC circuits.	PO4	2
AEEB02.07	CLO 7	Analyze the steady state behavior of series and parallel RL, RC and RLC circuit with sinusoidal excitation.	PO4	2
AEEB02.08	CLO 8	Design the series and parallel RLC for the required bandwidth, resonant frequency and quality factor.	PO4	1
AEEB02.09	CLO 9	State the faraday's laws of electromagnetic induction used in construction of magnetic circuit.	PO1	1
AEEB02.10	CLO 10	Prove the law of conservation of energy, superposition principle, reciprocity and maximum power transfer condition for the electrical network with DC excitation.	PO4	3
AEEB02.11	CLO 11	Summarize the procedure of thevenin's, norton's and milliman's theorems to reduce complex network into simple equivalent network.	PO4	1
AEEB02.12	CLO 12	Evaluate the transient response of first and second order electric circuits using differential equation approach.	PO2	1
AEEB02.13	CLO 13	Determine the transient response of first and second order electric circuits using laplace	PO2	2

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
		transform technique.		
AEEB02.14	CLO 14	Calculate Z, Y, ABCD, H and image parameters of two port network.	PO4	3
AEEB02.15	CLO 15	Relate various two port parameters and inter relationships between them.	PO4	1
AEEB02.16	CLO 16	Apply the concept of network theorems, switching transient to solve real time world applications.	PO2	2
AEEB02.17	CLO 17	Explore the knowledge and skills of employability to succeed in national and international level competitive examinations.	PO1	3

3 = High; 2 = Medium; 1 = Low

X. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1	3														
CLO 2	3												1		
CLO 3	2	2													
CLO 4		1											1		
CLO 5		1													
CLO 6				2									1		
CLO 7				2									1		
CLO 8				1									3		
CLO 9	1												1		
CLO 10				3									2		
CLO 11				1									2		
CLO 12		1											3		
CLO 13		2											3		
CLO 14				3									2		
CLO 15				1									2		
CLO 16		2											2		
CLO 17	3														

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO 1	SEE Exams	PO 1	Assignments	PO4	Seminars	PO 2
Laboratory Practices	-	Student Viva	-	Mini Project	-	Certification	-
Term Paper	-						

XII. ASSESSMENT METHODOLOGIES - INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feedback
✘	Assessment of Mini Projects by Experts		

XIII. SYLLABUS

Module-I	**INTRODUCTION OF ELECTRICAL CIRCUITS**
Circuit concept:. Basic definitions, Ohm's law at constant temperature, classifications of elements, R, L, C parameters, independent and dependent sources, Kirchhoff's laws, equivalent resistance of series, parallel and series parallel networks. Star to delta and delta to star transformation, mesh analysis and nodal analysis by Kirchhoff's laws, inspection method, super mesh and super node analysis.	
Module-II	**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. Concept of reactance, impedance, susceptance and admittance, rectangular and polar form, concept of power, real, reactive and complex power, power factor. Analysis of single phase ac circuits consisting of R, L, C and RL, RC, RLC combinations (series only).	
Module-III	**MAGNETIC CIRCUITS AND NETWORK THEOREMS (DC)**
Magnetic circuits: Faraday's laws of electromagnetic induction, concept of self and mutual inductance, dot convention, coefficient of coupling, composite magnetic circuit, analysis of series and parallel magnetic circuits, behaviors of series and parallel resonant networks. **Theorems:** Zero current theorem, Tellegen's, superposition, reciprocity, voltage shift theorem, Thevenin's, Norton's, maximum power transfer, Milliman's and compensation theorems for DC excitations.	
Module-IV	**SOLUTION OF FIRST AND SECOND ORDER NETWORKS**
Transient response: Initial conditions, transient response of RL, RC and RLC series circuits with DC excitation, differential equation and Laplace transform approach.	
Module-V	**TWO PORT NETWORK PARAMETERS**
Two port network parameters: Z, Y, ABCD, hybrid and inverse hybrid parameters, conditions for symmetry and reciprocity, inter relationships of different parameters, interconnection (series, parallel and cascade) of two port networks, image parameters.	
Text Books:	
1. A Chakrabarthy, "Electric Circuits", Dhanpat Rai & Sons, 6th Edition, 2010. 2. A Sudhakar, Shyammohan S Palli, "Circuits and Networks", Tata McGraw-Hill, 4th Edition, 2010. 3. M E Van Valkenberg, "Network Analysis", PHI, 3rd Edition, 2014.	

4. Rudrapratap, “Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers”, Oxford University Press, 1 st Edition, 1999.

Reference Books:

1. John Bird, “Electrical Circuit Theory and technology”, Newnes, 2nd Edition, 200
2. C. L. Wadhwa, “Electrical Circuit Analysis including Passive Network Synthesis”, New Age International, 2nd Edition, 2009.
3. David A. Bell, “Electric circuits”, Oxford University Press, 7th Edition, 2009.

XIV. COURSE PLAN:

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

Lecture No	Topic/s to be covered	Course Learning Outcomes (CLOs)	Reference
1	**Understand** the concept of electrical circuits	CLO 1	T1:1.1
2	**Understand** the concept of circuit concept.	CLO 1	T1:1.1
3	**Describe** the voltage, current, power and energy.	CLO 2	T1:1.1
4	**Understand** ohm’s law and its applicability, limitations	CLO 3	T1:1.1
5-6	**Identify** the resistance, inductance and capacitance and their V-I characteristics.	CLO 2	T1:1.1
7-8	**Understand** application of Kirchhoff’s voltage law for electrical networks and evaluate the equivalent circuit parameters	CLO 3	T1:2.1-2.2
9-10	**Understand** application of Kirchhoff’s current laws for electrical networks. .also find out the equivalent circuit parameters	CLO 3	T1:2.3-2.4
11	**Determine** the solution for the network using these techniques.	CLO 4	T1:1.9
12	**Solve** the electrical networks using mesh analysis to determine current, voltage and power in each and every element and of the network.	CLO 4	T1:2.5
13	**Solve** the electrical networks using mesh analysis to determine current, voltage and power in each and every element and of the network.	CLO 4	T1:2.5
14	**Solve** the electrical networks using nodal analysis to determine current, voltage and power in each and every element and of the network.	CLO 4	T1:2.5
15	**Solve** the electrical networks using nodal analysis to determine current, voltage and power in each and every element and of the network.	CLO 4	T1:2.5
16	**Interpret** alternating quantity in terms of mathematical equation.	CLO 5	T1:4.1
17-18	**Understand** the concept of AC quantities	CLO 5	T1:4.1
19	**Understand** the concept of phase and phase difference.	CLO 6	T1:4.1
20	**Determine** the impedance offered by RLC parameters.	CLO 6	T1:4.1
21	**Represent** any alternating quantity in terms of rectangular and polar form.	CLO 5	T1:4.1
22	**Understand** the behavior of series RL circuits with sine input	CLO 7	T1:4.2
23-24	**Understand** the behavior of series RC circuits with sine	CLO 7	T1:4.2,7.1

Lecture No	Topic/s to be covered	Course Learning Outcomes (CLOs)	Reference
	input.		-7.6
25--26	**Understand** the behavior of series RLC circuits with sine input.	CLO 7	T1:4.3, 7.1-7.6
27-28	**Estimate** the power absorbed in AC circuits.	CLO 7	T1:4.4, 7.1-7.6
29-31	**Write** the faradays laws and their usage to write self and mutual inductance.	CLO 9	T1:11.1
32	**represent** the total EMF induced in coil using dot convention.	CLO 9	T1:11.7
33	**Analyze** the behavior of different types magnetic circuits	CLO 9	T1:11.6
34	**Analyze** the behavior of different types magnetic circuits.	CLO 9	T1:11.8
35	**Understand** what electrical resonance is and How it is useful in electrical world.	CLO 8	T1:11.5-11.6
36	**Design and analyze** any complex networks using zero current theorem	CLO 10	T1:3.1
37	**Design, analyze** any complex networks using superposition theorem	CLO 10	T1:3.4
38	**Design, analyze** any complex networks using maximum power transfer theorems	CLO 10	T1:3.7
39-40	**Design, analyze** any complex networks using Thevenin's theorems.	CLO 11	T1:3.2
40-41	**Design, analyze** any complex networks using Norton's theorems.	CLO 11	T1:3.3
42	**Design, analyze** any complex networks using reciprocity theorems.	CLO 10	T1:3.5
43-44	**Design, analyze** any complex networks using compensation and milliman's theorem.	CLO 11	T1:3.6,3.9
45	**Understand** the Transient behavior of R, L and C elements in a circuit.	CLO 12	T1:8.1
46	**Compute** initial conditions for R, L, C elements.	CLO 12	T1:8.2
47-48	**Compute and analyze** Time response for current and voltage in first order R-L circuits using differential equation approach.	CLO 12	T1:8.3
49	**Compute and analyze** Time response for current and voltage in first order RC circuits using differential equation approach.	CLO 12	T1:8.4
50-51	**Compute and analyze** Time response for current and voltage in first order RLC circuits using differential equation approach.	CLO 12	T1:8.6
52	**Compute and analyze** Time response for current and voltage in first order R-L circuits using Laplace transform approach.	CLO 13	T1:9.10-9.11
53	**Compute and analyze** Time response for current and voltage in first order R-C circuits using Laplace transform approach.	CLO 13	T1: 9.10-9.11
54-55	**Compute and analyze** Time response for current and voltage in first order RLC circuits using Laplace transform approach.	CLO 13	T1: 9.16
56	**Interpret** how can parameters useful for computing different Networks	CLO 14	T1:12.1

Lecture No	Topic/s to be covered	Course Learning Outcomes (CLOs)	Reference
57	**Compute** Impedance parameters for two port networks	CLO 14	T1:12.6
58	**Compute** Admittance parameters for two port networks	CLO 14	T1:12.7
59	**Compute** ABCD Parameters for two port networks	CLO 14	T1:12.9
60	**Compute** Hybrid parameters for two port networks	CLO 14	T1:12.8
61	**Formulate** the conditions for Reciprocity and Symmetry	CLO 15	T1:12.10
62-63	**Deduce** the interrelations of different parameters.	CLO 15	T1:12.11
64	**Analyze** the two port network when connected in series	CLO 15	T1:12.13
65	**Analyze** the two port network when connected in parallel	CLO 15	T1:12.13
66	**Analyze** the two port network when connected in cascade	CLO 15	T1:12.13
67-68	**Understand** the image parameters to analyze filters for a two port network.	CLO 14	T1:12.15

XV. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS	RELEVANCE WITH PSOS
1	Mathematical modelling of electrical network using MATLAB.	Seminars /NPTEL	PO1, PO2,PO5	PSO1
2	Interpretation and analyzing of an electrical circuit using graph theory in PC.	Term Paper / NPTEL	PO1, PO2,PO5	PSO1

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ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE DESCRIPTOR

Course Title	**ELECTRICAL CIRCUITS**				
Course Code	AEEB03				
Programme	B.Tech				
Semester	II	EEE			
Course Type	Foundation				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	2	1
Chief Coordinator	**Dr. D Shobha Rani, Professor, EEE**				
Course Faculty	**Dr. D Shobha Rani, Professor, EEE** **Ms. S Swathi, Assistant Professor, EEE**				

I. 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 also emphasis of this course is laid on the basic analysis of circuits which includes three phase circuits. This subject includes Components of LT Switch gear, characteristics for batteries, applications.

II. COURSE PRE-REQUISITES:

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

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Electrical Circuits	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	Chalk & Talk	✔	Quiz	✔	Assignments	✘	MOOCs
✔	LCD / PPT	✔	Seminars	✘	Mini Project	✔	Videos
✘	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 emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 1), with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

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 centre. 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 section XI.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Strength	Proficiency assessed by
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Seminars
PO2	**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	Term paper
PO3	**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	Discussion of real-time applications
PO6	**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.	2	Discussion of real-time applications

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	**Professional Skills:** Able to utilize the knowledge of high voltage engineering in collaboration with power systems in innovative, dynamic and challenging environment, for the research based team work.	-	-
PSO 2	**Problem Solving Skills:** To explore the scientific theories, ideas, methodologies and the new cutting edge technologies in renewable energy engineering, and use this erudition in their professional development and gain sufficient competence to solve the current and future energy problems universally	2	Discussion of real-time applications
PSO 3	**Successful career and entrepreneurship:** To be able to utilize of technologies like PLC, PMC, process controllers, transducers and HMI and design, install, test, maintain power systems and industrial applications.	-	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Understand the basic parameters, formation of circuit and network.
II	Apply different network reduction techniques to solve complex electrical networks and Use network topology technique to solve complex electrical networks.
III	Analyze single phase AC circuits and their behaviour and Summarize the conditions for electrical resonance
IV	Explain the importance of magnetic circuits and their behaviour in electrical engineering and Explain the components of LT switchgear and types of batteries

IX. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AEEB03.1	CLO 1	Define the various nomenclature used to study the DC electrical circuits.	PO1	3
AEEB03.2	CLO 2	Understand the concept of electrical circuit and classify electrical circuits elements	PO1	3
AEEB03.3	CLO 3	List out types of energy sources and describe source transformation technique to determine equivalent resistance and source current.	PO1, PSO2	3
AEEB03.4	CLO 4	Apply network reduction techniques to calculate unknown quantities associated with electrical circuits.	PO1, PO2	3
AEEB03.5	CLO 5	Apply Ohm's law and Kirchhoff's laws to determine equivalent resistance and current/voltage in any branch of a circuit.	PO1	3
AEEB03.6	CLO 6	Discuss the various nomenclatures related with network topology.	PO1	3
AEEB03.7	CLO 7	Formulate incidence, tie-set and cut-set matrix which are used to solve the behavior of complex electrical circuits.	PO1	3
AEEB03.8	CLO 8	Understand the concepts of duality and importance of dual networks.	PO2	3
AEEB03.9	CLO 9	Interpret the alternating quantities with its instantaneous, average and root mean square values.	PO2	3
AEEB03.10	CLO 10	Illustrate the concept of impedance, reactance, admittance, susceptance and conductance.	PO1	3
AEEB03.11	CLO 11	Analyze the steady state behavior of R, L and C elements with sinusoidal excitation.	PO1, PO2	3
AEEB03.12	CLO 12	Analyze the steady state behavior of series and parallel RL, RC and RLC circuits with sinusoidal excitation.	PO2	3
AEEB03.13	CLO 13	Analyze three phase star and delta circuits with different configuration.	PO2	3
AEEB03.14	CLO 14	Understand the concept of Phasor diagram for three phase systems and Discuss the active, reactive and apparent power and power factor in three phase circuits.	PO1, PO2, PO3	3
AEEB03.15	CLO 15	Explain the importance of magnetic circuits and their behaviour in electrical engineering.	PO1	3
AEEB03.16	CLO 16	Study the components of LT switch gear and characteristics different types of batteries.	PO3, PO6, PSO2	3
AEEB03.17	CLO 17	Explore the knowledge and skills of employability to succeed in national and international level competitive examinations.	PO3, PO6	3

3 = High; 2 = Medium; 1 = Low

X. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1	3														
CLO 2	3														
CLO 3	3													2	
CLO 4	3	3													
CLO 5	3														
CLO 6	3														
CLO 7	3														
CLO 8		3													
CLO 9		3													
CLO 10	3														
CLO 11	3	3													
CLO 12		3													
CLO 13		3													
CLO 14	3	3	2												
CLO 15	3														
CLO 16			2			2								2	
CLO 17			2			2									

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES - DIRECT

CIE Exams	PO1, PO2, PO6, PSO2	SEE Exams	PO1, PO2, PO6 PSO2	Assignments	-	Seminars	PO1, PO2, PO6 PS02
Laboratory Practices	-	Student Viva	-	Mini Project	-	Certification	-
Term Paper	PO1, PO2, PO6, PSO2						

XII. ASSESSMENT METHODOLOGIES - INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feedback
✘	Assessment of Mini Projects by Experts		

XIII. SYLLABUS:

Module-I	**INTRODUCTION TO ELECTRICAL CIRCUITS**
Circuit concept: Basic definitions, Ohm's law at constant temperature, classifications of elements, R, L, C parameters, independent and dependent sources, voltage and current relationships for passive elements (for different input signals like square, ramp, saw tooth, triangular and complex), temperature dependence of resistance, tolerance, source transformation, Kirchhoff‟s laws, equivalent resistance of series, parallel and series parallel networks.	
Module-II	**ANALYSIS OF ELECTRICAL CIRCUITS**
Circuit analysis: Star to delta and delta to star transformation, mesh analysis and nodal analysis by Kirchhoff‟s laws, inspection method, super mesh, super node analysis; Network topology: definitions, incidence matrix, basic tie set and basic cut set matrices for planar networks, duality and dual networks.	
Module-III	**SINGLE PHASE AC CIRCUITS AND RESONANCE**
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, concept of reactance, impedance, susceptance and admittance, rectangular and polar form, concept of power, real, reactive and complex power, power factor. Steady state analysis: Steady state analysis of RL, RC and RLC circuits (in series, parallel and series parallel combinations) with sinusoidal excitation; Resonance: Series and parallel resonance, concept of band width and Q factor.	
Module-IV	**MAGNETIC CIRCUITS AND THREE PHASE CIRCUITS**
Magnetic circuits: Faraday's laws of electromagnetic induction, concept of self and mutual inductance, dot convention, coefficient of coupling, composite magnetic circuit, analysis of series and parallel magnetic circuits; Three phase circuits: Star and delta connections, phase sequence, relation between line and phase voltages and currents in balanced systems(both Y&Δ),three phase three wire and three phase four wire systems, analysis of balanced and unbalanced three phase circuits, measurement of active and reactive power	
Module-V	**COMPONENTS OF ELECTRICAL SYSTEMS**
Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, types of wires and cables, Earthing. Types of batteries, Alkaline battery, zinc–carbon battery, dry cell battery, nickel–cadmium battery, lead–acid battery, lithium ion battery, nickel metal hydride battery, important characteristics for batteries, applications, Elementary calculations for energy consumption.	
Text Books:	
1. A Chakrabarthy, "Electric Circuits", DhanipatRai& Sons, 6th Edition, 2010. 2. A Sudhakar, Shyammohan S Palli, "Circuits and Networks", Tata McGraw-Hill, 4th Edition, 2010. 3. M E Van Valkenberg, "Network Analysis", PHI, 3rd Edition, 2014. 4. D.P. Kothari and I.J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 3rd Edition 2010.	
Reference Books:	

1. John Bird, “Electrical Circuit Theory and Technology”, Newnes, 2nd Edition, 2003.
2. C L Wadhwa, “Electrical Circuit Analysis including Passive Network Synthesis”, New Age International, 2nd Edition, 2009.
3. David A Bell, “Electric circuits”, Oxford University Press, 7th Edition, 2009.

XIV. COURSE PLAN:

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

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Discuss the basic definitions like potential, potential difference, charge, current and power	CLO 1	T2:1.1
2	Understand the Ohms’ law at constant temperature and its limitations	CLO 2	T2:1.5
3	Discuss active, passive, linear, non-linear, bilateral, lumped, distributed, unilateral and bilateral elements	CLO 2	T2:1.6
4	Describe voltage and current relations of resistance, inductance and capacitance	CLO 2	T2:1.7
5	Understand the voltage and current relationships for passive elements	CLO 2.	T2:1.7
6	Explain Independent, dependent sources and their symbols	CLO 3	T2:1.9
7	State and explain Kirchhoff’s laws	CLO4	T2:1.12
8	Apply the concept of Kirchhoff's laws in source transformation technique	CLO4	T2:3.1
9	Apply the concept of Kirchhoff's laws in circuit reduction technique	CLO5	T2:1.13
10	Analyze the problems on circuit reduction technique	CLO5	T2:1.15
11	Derive the formula for star to delta transformation technique	CLO4	T2:3.1
12	Derive the formula for delta to star transformation technique	CLO4	T2:3.1
13	Analyze the problems on star to delta transformation technique	CLO4, CLO5	T2:3.1
14	Apply the concept of Kirchhoff's voltage law in mesh analysis	CLO4, CLO5	T2:2.9
15	Apply the concept of Kirchhoff's current law in nodal analysis	CLO4, CLO5	T2:2.12
16	Can solve the electrical networks using nodal analysis to determine current, voltage and power in each element of the network.	CLO4, CLO5	T2:2.15
17	Understand numerical problems on mesh and Super mesh analysis	CLO4, CLO5	T2:2.15
18	Understand problems on mesh and Super mesh analysis	CLO4, CLO5	T2:2.11
19	Understand the fundamentals of network topology and Define graph, sub graph, path, directed graph, tree and co-tree	CLO6	T2:2.1
20	Develop an incidence Analyze numerical problems on incidence matrix using graph theory	CLO7	T2:2.3
21	Develop basic Tie set matrix for planar networks and Analyze numerical problems on basic Tie set matrix for planar networks	CLO7	T2:2.7
22	Develop basic Cut set matrix for planar networks and Analyze numerical problems on basic cut set matrix for planar networks.	CLO7	T2:2.7
23	Explain Duality and Dual networks	CLO8	T2:3.8

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
24	Identify the alternating quantities with it instantaneous, average and root mean square values.	CLO9	T2:4.1
25	Identify the alternating quantities with it instantaneous, average and root mean square values.	CLO9	T2:4.1
26-30	Demonstrate the impression of reactance, suceptance, impedance and admittance in estimating power of AC circuits.	CLO10	T2:4.2
31	Analyze the steady state behavior of series and parallel RL, RC and RLC circuit with sinusoidal excitation	CLO11	T2:4.5
32	Steady state analysis: steady state analysis C circuits with sinusoidal excitation.	CLO12	T2:4.5
33	Analyze the steady state behavior of series and parallel RL, RC and RLC circuit with sinusoidal excitation.	CLO12	T2:4.6
34	Analyze the steady state behavior of series and parallel RL, RC and RLC circuit with sinusoidal excitation.	CLO12	T2:4.7
35	Analyze the steady state behavior of series and parallel RL, RC and RLC circuit with sinusoidal excitation	CLO12	T2:4.8
36	Explain the concept of resonance for series and parallel circuits	CLO12	T2 – 8.13
37	Explain the concept of resonance for series and parallel circuits.	CLO12	T2 – 8.14
38	Explain the concept of resonance for series and parallel circuits.	CLO12	T2 – 8.15
39	Understand the basic formation of magnetic circuit.	CLO15	T1:10.11
40	Analyze the faradays laws and their usage to write self and mutual inductance.	CLO15	T1:10.11
41	Able to represent the total emf induced in coil using dot convention.	CLO15	T1:10.4
42	Can decide the amount of mutual flux linkage between two coils.	CLO15	T1:10.5
43	Behavior of different types magnetic circuits can be analyze.	CLO15	T1:10.15
44	Analyze three phase star and delta circuits with different configuration. Understand the concept of Phasor diagram for three phase systems.	CLO13	T2, 9.3
45-48	Analyze three phase star and delta circuits with different configuration.	CLO13	T2, 9.6; 9.7; 9.9; 9.10
49	Discuss the active, reactive and apparent power and power factor in three phase circuits	CLO14	T2, 9.11
50	Discuss the active, reactive and apparent power and power factor in three phase circuits	CLO14	T2, 9.11
51-52	Analyze three phase star and delta circuits with different configuration. Discuss the active, reactive and apparent power and power factor in three phase circuits.	CLO14	T2, 9.13; 9.15
53	Understand concept of Switch fuse unit, MCB.	CLO16	T3, 10.11
54	Understand concept of ELCB, MCCB.	CLO16	T3, 10.11
55	Understand concept of wiring.	CLO16	T3, 10.12
56	Understand concept of cables.	CLO16	T3, 10.13
57	Understand concept of earthing.	CLO16	T3, 10.14

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
58	Understand concept of Alkaline battery, Zinc–Carbon battery. lead acid battery, lithium ion battery, nickel metal hydride battery.	CLO16	T3, 10.15
59	Understand Characteristics for batteries and Applications of different batteries	CLO16	T3, 10.18
60	Understand concept of elementary calculations for energy consumption.	CLO16	T3, 10.24

XV. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs
1	Analysis of electrical circuits using MATLAB	Seminars and Laboratory Practice	PO2	---
2	Design of electrical circuit using graph theory in PC	Seminars and Laboratory Practice	PO3	PSO2

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