INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

COURSE DESCRIPTOR

Branch	**Computer Science and Engineering**					
Course Title	**Mathematical Foundations of Computer Science**					
Course Code	BCSC01					
Program	M. Tech					
Semester	CSE	I				
Course Type	Core					
Regulation	PG21					
Course Structure	Theory			Practical		
	Lectures	Tutorials	Credits	Laboratory	Credits	
	3	-	3	-	-	
Course Faculty	Dr. K Suvarchala					

I. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
UG	AHSB12	II	Probability and Statistics
UG	ACSB04	III	Discrete Mathematical Structures

II. COURSE OVERVIEW:

The course covers the concepts Probability theory, Sampling Techniques, Statistical Interface, Graph Theory and various applications of Mathematical and statistical concepts in different branches of Computer Science. This course helps the students in gaining the knowledge and apply the mathematical logics to many modern techniques of information technology like machine learning, programming language design etc.

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Mathematical Foundations of Computer Science	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	PPT	✓	Chalk & Talk	✓	Assignments	✓	MOOC
✓	Seminars	✓	Others				

V. EVALUATION METHODOLOGY:

Each theory course will be evaluated for a total of 100 marks, out of which 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of three 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.
30 %	To test the analytical skill of the concept.
20 %	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. CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Assignment and 05 marks for Alternative Assessment Tool (AAT). Two CIE Tests are Compulsory and sum of the two tests, along with the scores obtained in the assignment / AAT shall be considered for computing the final CIA of a student in a given course.

The CIE Tests/Assignment /AAT shall be conducted by the course faculty with due approval from the HOD. Advance notification for the conduction of Assignment/AAT is mandatory and the responsibility lies with the concerned course faculty. CIA is conducted for a total of 30 marks (Table 1), with 25 marks for Continuous Internal Examination (CIE), 05 marks for Quiz/Alternative Assessment Tool (AAT).

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Assignment	AAT	
CIA Marks	25	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 25 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/Alternative Assessment Tool (AAT):

Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are be answered by choosing the correct answer from a given set of choices (commonly four). Marks shall be awarded considering the average of two quizzes for every course. The AAT may include seminars, assignments, term paper, open ended experiments, five minutes video and MOOCs.

VI. COURSE OBJECTIVES:

The students will try to learn:

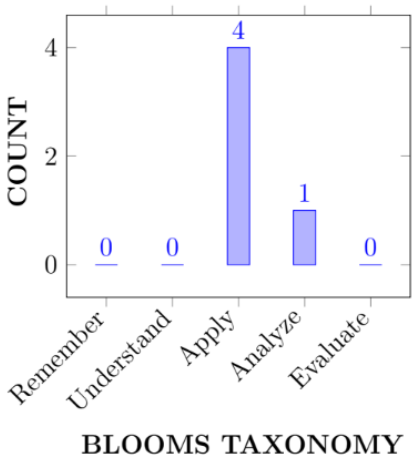
I	Enrich the knowledge of random variables and probability distributions.
II	Apply the concept of correlation and regression to classification problems.
III	Analyse the given data through appropriate test of hypothesis.
IV	Apply the mathematical, statistical techniques to various areas in information technology

VII. COURSE OUTCOMES (COs):

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

CO 1	**Make use of** probability theory and distributions for depicting the expected outcome of possible values in the data generating process/experiment.	Apply
CO 2	**Apply** statistical models based on random sampling data for getting unbiased estimates in performing data analysis.	Apply
CO 3	**Select** regression and multivariate statistical models for solving classification and curve fitting problems in data analysis.	Apply
CO 4	**Infer** appropriate techniques of graphs and combinatorial theory for finding solutions to shortest path and enumeration problems.	Analyse
CO 5	**Identify** appropriate mathematical and statistical techniques for solving applications in emerging areas of Information Technology.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII. PROGRAM OUTCOMES:

Program Outcomes	
PO 1	**I**ndependently carry out research/investigation and development work to solve practical problems.
PO 2	**W**rite and present a substantial technical report/document.
PO 3	**D**emonstrate a degree of mastery in computer science and engineering emerging areas such as data science, cyber security, and application development.
PO 4	**A**pply advanced-level knowledge, techniques, skills, and modern tools in the field of computer science and engineering and its allied areas.
PO 5	**F**unction effectively as a member or leader in diverse teams to carry out development work, and produce solutions that meet the specified needs with frontier technologies in multidisciplinary environments.
PO 6	**E**ngage in life-long learning for continuing education in doctoral-level studies and professional development.

IX. MAPPING OF EACH CO WITH PO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	✓	-	-	✓	✓	✓
CO 2	✓	-	-	✓	✓	-
CO 3	✓	-	-	✓	✓	-
CO 4	✓	-	-	✓	✓	✓
CO 5	✓	-	-	✓	✓	✓

X. COURSE ARTICULATION MATRIX (PO - PSO MAPPING):

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

COURSE OUTCOMES	PROGRAM OUTCOMES					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	0	0	1	1	1
CO 2	2	0	0	1	1	0
CO 3	2	0	0	1	1	0
CO 4	2	0	0	1	1	1
CO 5	2	0	0	1	1	1
TOTAL	10	0	0	5	5	3
AVERAGE	2	0	0	1	1	1

XI. ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminar and term paper	✓
Laboratory Practices	-	Student Viva	-	Mini Project	-

XII. ASSESSMENT METHODOLOGY INDIRECT:

✓	End Semester OBE Feed Back

XIII. SYLLABUS:

MODULE I	**INTRODUCTION – PROBABILITY THEORY**
	Probability mass, density, and cumulative distribution functions, Parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markov chains.
MODULE II	**RANDOM SAMPLES**
	Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood
MODULE III	**STATISTICAL INFERENCE**
	Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis, The problem of over fitting model assessment.
MODULE IV	**GRAPH THEORY**
	Graph Theory: Isomorphism, Planar graphs, graph coloring, Hamilton circuits and Euler cycles. Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems
MODULE V	**COMPUTER SCIENCE AND ENGINEERING APPLICATIONS**
	Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning. Analysis: Analysis of opportunistic routing (Markov Chain) Advanced topics in wireless sensor networks.

TEXT BOOKS

1. John Vince, “Foundation Mathematics for Computer Science”, Springer

REFERENCES BOOKS

1. K Trivedi. “Probability and Statistics with Reliability, Queuing, and Computer Science Applications”. Wiley.
2. M. Mitzenmacher and E. Upfal.” Probability and Computing: Randomized Algorithms and Probabilistic Analysis”. Wiley
3. Alan Tucker, “Applied Combinatorics”, Wiley

WEB REFERENCES

1. https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf
2. https://www.cs.bris.ac.uk/~flach/mlbook/.
3. http://mylovelibrabry.com/emylibraryus/free.php?asin=1466583282.

COURSE PLAN:

The course plan is meant as a guideline. There may probably be changes.

S. No	Topics to be covered	CO’s	Reference
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO-PO Mapping	-	
CONTENT DELIVERY (THEORY)			
1	Probability mass	CO 1	T1:1.1, 1.2
2	Density, Cumulative distribution functions	CO 1	T1:1.1, 1.2

S. No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
3	Parametric families of distributions	CO 1	T1:2.1, 2.2
4	Expected value, variance	CO 1	T1:2.1, 2.2
5	Conditional expectation Applications of the univariate Central Limit Theorem	CO 1	T1:3.1, 3.2, 4.1, 4.2
6	Probabilistic inequalities	CO 1	T1:4
7	Markov chains	CO 1	T1:7,8
8	Random samples	CO 2	T1:2,3
9	Sampling distributions of estimators	CO 2	T1: 5,T3:3
10	Methods of Moments	CO 2	T1:10
11	Maximum Likelihood	CO 2	T1:11, T1:2, T1:4
12	Statistical inference	CO 3	T1:1,2
13	Multivariate statistical models	CO 3	T1:5,6
14	Regression and classification problems	CO 3	R1, R2
15	Principal components analysis	CO 3	R2, R3
16	Problem of over fitting model assessment	CO 3	R1: 3.3.7
17	Graph Theory: Isomorphism, Planar graphs	CO 4	R1:6.1,6.2
18-19	Graph coloring, Hamilton circuits and Euler cycles	CO 4	R1:6.1,6.2
20-21	Permutations with and without repetition	CO 4	T1:11.6
22-23	Combinations with and without repetition	CO 4	T1:11.7
24-25	Specialized techniques to solve combinatorial enumeration problems	CO 4	R1:8.1
26	Data mining, Network protocols	CO 5	T1: 9.1
27	Analysis of Web traffic	CO 5	T1: 1.3
28	Computer security	CO 5	T1: 1.5, R2: 3.4
29	Software engineering	CO 5	R3: 4.3
30	Computer architecture	CO 5	R3: 4.4
31	Operating systems	CO 5	R3: 4.5
32	Distributed systems	CO 5	R2:9.2
33	Bioinformatics	CO 5	R2:9.2
34	Machine learning.	CO 5	R2:9.3
35	Analysis of opportunistic routing (Markov Chain)	CO 5	R1:8.5
36	Advanced topics in wireless sensor networks.	CO 5	R1:8.5
DISCUSSION OF QUESTION BANK			
1	Module – I	CO 1	T1
2	Module – II	CO 2	T1
3	Module – III	CO 3	R1, R2
4	Module – IV	CO 4	R3
5	Module – V	CO 5	R1, R2

Prepared By:
Dr. K Suvarchala, Associate Professor

HOD, CSE

INSTITUTE OF AERONAUTICAL ENGINEERING
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COMPUTER SCIENCE AND ENGINEERING
COURSE DESCRIPTION

Course Title	**ADVANCED DATA STRUCTURES**				
Course Code	BCSC02				
Program	M.Tech				
Semester	I	CSE			
Course Type	Core				
Regulation	IARE - PG21				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	Y	2
Course Coordinator	Dr. J Sireesha Devi, Professor				

I COURSE OVERVIEW:

This course introduces the fundamental concept of data structures and emphasize the importance of data structures in developing and implementing efficient algorithms.Advanced Data Structures are used to store and manage data in an efficient and organized way for faster and easy access and modification of Data.It is designed to provide in-depth critique on the problems of dictionaries,hashtables. Different Hierarchical Data Structures likeTrees and graphs are studiedand their use in various networking, information storage, retrieval areexplained.Different Algorithms for pattern matching and text compression are also introduced

II COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
B.Tech	ACSC03	III	DATA STRUCTURES

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
ADVANCED DATA STRUCTURES	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

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

V EVALUATION METHODOLOGY:

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Component	Theory			Total Marks
Type of Assessment	CIE Exam	Assign-ment	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 25 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/Alternative Assessment Tool (AAT):
Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are be answered by choosing the correct answer from a given set of choices (commonly four). Marks shall be awarded considering the average of two quizzes for every course. The AAT may include seminars, assignments, term paper, open ended experiments, five minutes video and MOOCs.

VI COURSE OBJECTIVES:

The students will try to learn:

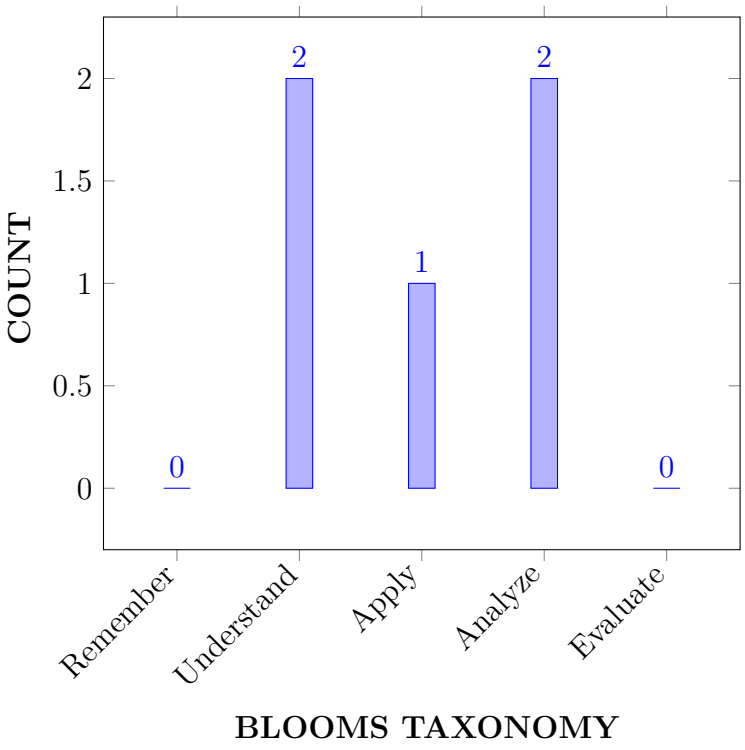
I	Choose appropriate data structures, understand the ADT and use it to design algorithms for a specific problem.
II	Familiarize with the implementation of data structures such as linked lists and binary trees.
III	Familiarize with theimplementationoflinkeddatastructures suchas dictionaries and hash table.
IV	Understand the use of hierarchical data structures like trees and graphs and its use in various algorithms.
V	Understand the use of pattern matching and text compression algorithms.

VII COURSE OUTCOMES:

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

CO 1	**Compare** space and time complexity for determining the performance of an algorithm on varying inputs.	Analyze
CO 2	**Make use of** linear data structures for insertion, deletion, searching an element in a list, dequeue etc.	Apply
CO 3	**Demonstrate** the working of dictionary on a group of objects for updating, retrieval, deletion of elements.	Under-stand
CO 4	**Build** hash table and use collision resolution techniquesforfile systems using open addressing, separate chaining etc.	Under-stand
CO 5	**Examine** the concept of non-linear data structures usingTrees, graphs and their applications.	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO 1	Apply Analyze a problem, identify and define computing requirements, design and implement appropriate solutions	-	CIE / Technical Seminar and Term Paper
PO 2	Solve complex heterogeneous data intensive analytical based problems of real time scenario using state of the art hardware/software tools	2	CIE / Technical Seminar and Term Paper
PO 3	Demonstrate a degree of mastery in computer science and engineering emerging areas such as data science, cyber security and application development	2	-
PO 4	Write and present a substantial technical report/document	2	Technical Seminar and Term Paper
PO 5	Independently carry out research/investigation and development work to solve practical problems	-	-
PO 6	Function effectively on teams to establish goals, plan tasks, meet deadlines, manage risk and produce deliverables	-	-

PO 12	Engage in life-long learning and professional development through self-study, continuing education, professional and doctoral level studies.	-	-

3 = High; 2 = Medium; 1 = Low

IX HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program		**Strength**	**Proficiency Assessed by**
PSO 1	Understand, design and analyse computer programs in the areas related to Algorithms, System Software, Web design, Bigdata, Artificial Intelligence, Machine Learning and Networking.	2	Group discussion/ Short term courses
PSO 2	Focus on improving software reliability, network security and information retrieval systems.	2	Industry exposure
PSO 3	Make use of modern computer tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	2	Group discussion/ Short term courses

3 = High; 2 = Medium; 1 = Low

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

Course Outcomes	Program Outcomes						
	1	2	3	4	5	6	7
CO 1	3						
CO 2	3	2					
CO 3	3						
CO 4	3	2					
CO 5	3	2					
TOTAL	27	6			3		6

XI ASSESSMENT METHODOLOGY DIRECT:

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

XII ASSESSMENT METHODOLOGY INDIRECT:

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

XIII SYLLABUS:

MODULE I	**OVER VIEW OF DATA STRUCTURES**
	Algorithm analysis: Algorithms; Performance analysis: Time complexity and space complexity, asymptoticnotation: Big Oh, omega and thetanotations, complexity analysis examples; Data structures: Linear andnon linear data structures, ADT concept, linear list ADT, stack and queue ADTs, array and linked list representations; Circular queue: Insertion and deletion, dequeue ADT, priority queue ADT, implementation using heaps, insertion in to a max heap, deletion from amax heap, singly linked lists, doubly linked lists, circular linked list.
MODULE II	**DICTIONARIES, HASH TABLES**
	Linear list representation, operations insertion, deletion and searching, hash table representation, hash functions, collision resolution, separate chaining, open addressing, linear probing ,quadratic probing, double hashing, rehashing, extendible hashing.
MODULE III	**TREES AND GRAPHS**
	Trees: Ordinary and binary trees terminology, properties of binary trees, binary tree ADT, representations,recursiveand nonrecursivetraversals,threaded binarytrees. Graphs:Graphsterminology, graphADT,representations, graphtraversals;Searchmethods:DFSandBFS; Applications of Graphs: Minimum cost spanning tree using Kruskal s algorithm, Dijkstra s algorithm forsinglesourceshortestpathproblem

MODULE IV	**SEARCH TREES I**
	Binary search tree: Binary search tree ADT, insertion, deletion and searching operations, finding the parentof a given node, attaining a reference to a node, finding the smallest and largest values in the binary searchtree; Balanced search trees: AVL trees, definition, height of an AVL tree; Operations : Insertion, deletion and searching.
MODULE V	**SEARCH TREES II**
	Red-Black and Splay Trees; B trees: Definition, operations and applications; R trees: Nearest neighbor query, join and range queries; Comparison of search trees; Text compression: Huffman coding and decoding; Pattern matching: KMP algorithm.

TEXTBOOKS

1. EllisHorowitz, SartajSahni, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Universities Press Private Limited, India, 2nd Edition, 2008.
2. G.A.V.Pai, "Data Structures and Algorithms", Tata Mc Graw Hill, New Delhi,1st Edition, 2008.
3. M.A.Weiss, Addison Wesley, "Data Structures and Algorithm Analysis in Java", Pearson Education, 2nd Edition, 2005.

REFERENCE BOOKS:

1. D.Samanta, "Classic Data Structures", Prentice Hall of India Private Limited, 2nd Edition, 2003.
2. Aho, Hopcraft, Ullman, "Design and Analysis of Computer Algorithms", Pearson Education India, 1st Edition, 1998.
3. Goodman, Hedetniemi, "Introduction to the Design and Analysis of Algorithms", Tata McGraw Hill, New Delhi, India, 1st Edition, 2002.

WEB REFERENCES:

1. http://www.tutorialspoint.com/data_structures_algorithms/data_structures_basics.htm
2. http://www.geeksforgeeks.org/b-tree-set-1-introduction-2/

XIV COURSE PLAN:

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

S.No	Topics to be covered	CO's	Reference
1	Algorithms; Performance analysis: Time complexity and space complexity,	CO 1	TB1:1.1-1.3
2	Asymptotic notation: Big Oh, omega and theta notations, complexity analysis examples	CO 1	TB1: 1.3 TB2:2.3-2.4

3	Data structures: Linear and non linear data structures, ADT concept	CO 1	TB3: 3.1
4	Linear list ADT, array representations;	CO 1	TB3: 4.2
5	Linear list linked list representations;	CO 1	TB3: 4.2
6	Stack	CO 1	TB1: 2.1 TB2 4.2
7	Queue adts	CO 1	TB3: 4.2
8	Circular queue: Insertion and deletion	CO 2	TB2-5.3
9	Dequeue ADT	CO 2	TB3: 4.4
10	Priority queue ADT	CO 2	TB1: 2.4
11	Implementation using heaps, insertion into a max heap, deletion from a max heap	CO 2	TB2: 3.6
12	Singly linked lists,	CO 2	TB2: 5.2
13	Doubly linked lists,	CO 2	TB2: 5.3
14	Circular linked list.	CO 2	TB2: 5.4
15	Dictionaries: Linear list representation, operations insertion, deletion and searching	CO 3	TB3: 5.1
16	Hash table representation, hash functions,	CO 3	TB3: 5.2
17	Collision resolution, separate chaining,	CO 3	TB3: 5.3
18	Open addressing, linear probing	CO 3	TB3: 5.4
19	Quadratic probing, double hashing	CO 3	TB3: 5.4
20	Rehashing, extendible hashing	CO 3	TB3: 5.5
21	Trees: Ordinary and binary trees terminology, properties of binary trees, binary tree ADT	CO 4	TB2-8.2 RB5: 6.2
22	Recursive traversals	CO 4	TB2-8.6 RB5: 6.2
23	Non recursive traversals	CO 4	RB5: 6.2
24	Threaded binary trees.	CO 4	TB2-8.7
25	Graphs: Graphs terminology, graph ADT, representations	CO 4	TB2-9.2
26	Graph traversals	CO 4	TB2-9.3 TB3: 9.1
27	Search methods: DFS	CO 4	TB2-9.4
28	Search methods BFS;	CO 4	TB2-9.4
29	Applications of Graphs: Minimum cost spanning tree using Kruskal s algorithm	CO 4	TB2-9.5 TB3: 9.5
30	Dijkstra s algorithm for single source shortest path problem.	CO 4	TB3: 9.3
31	Binary search tree: Binary search tree ADT,	CO 4	TB3: 4.3
32	Insertion, deletion and searching operations	CO 4	TB3: 4.3
33	Finding the parent of a given node, , attaining a reference to a node	CO 4	TB3: 4.3

34	Finding the smallest and largest values in the binary search tree;	CO 4	TB3: 4.3
35	Balanced search trees: AVL trees, definition, height of an AVL tree	CO 5	TB3: 4.4
36	AVL trees Operations : Insertion, deletion and searching.	CO 5	TB3: 4.4
37	Red-Black Definition, operations and applications	CO 5	TB2-12.1
38	Splay Trees: Definition, operations and application	CO 5	TB3: 4.5
39	B trees: Definition, operations	CO 5	TB3: 4.7
40	B trees: application	CO 5	TB2- 11.3
41	R trees: Nearest neighbor query,	CO 5	TB3: 9.3
42	R trees : join and range queries;	CO 5	TB3: 9.4
43	Comparison of search trees	CO 5	TB3: 4.9
44	Text compression: Huffman coding and decoding;	CO 5	TB3:5.3
45	Pattern matching: KMP algorithm.	CO 5	TB35.4
Discussion on Various Topics			
1	Module 1	CO 1	TB1,RF1
2	Module 2	CO 2	TB1,RF1
3	Module 3	CO 3	TB1,RF1
4	Module 4	CO 4	TB1,RF1
5	Module 5	CO 5	TB1,RF1

Signature of Course Coordinator **HOD,CSE**
Dr. J Sireesha Devi, Professor

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Branch	**COMPUTER SCIENCE AND ENGINEERING**				
Course Title	**WIRELESS SENSOR NETWORKS**				
Course Code	BCSC04				
Program	M.Tech				
Semester	I				
Course Type	Elective-I				
Regulation	PG 21				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Dr Y Mohana roopa Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
UG			Computer Networks
UG			Information Security

II COURSE OVERVIEW:

This course helps the students in gaining the knowledge on Wireless Sensor Networks , Architectures,Network Simulators,protocols for WS using communication Architecture security and Routing Protocols for WSN. It will also helps in real time applications applications such as temperatures,sounds,pollution levels,humidity and wind.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Wireless Sensor Networks	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	PPT	✓	Chalk & Talk	✓	Assignments	✓	MOOC
✓	Seminars	x	Others				

V EVALUATION METHODOLOGY:

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of three sub divisions in a question.

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20 %	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 4. CIA is conducted for a total of 30 marks, with 25 marks for Continuous Internal Examination (CIE) and 05 marks for technical seminar and term Paper.

Table 2: Assessment pattern for Theory Courses

Component	Theory		Total Marks
Type of Assessment	CIE Exam	Technical Seminar and Term paper	
CIA Marks	25	05	30

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 9^{th} and 17^{th} week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration, consisting of 5 one mark compulsory questions in part-A and 4 questions in part-B. The student has to answer any 4 questions out of five questions, each carrying 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Technical Seminar and Term Paper:
Two seminar presentations are conducted during I year I semester and II semester. For seminar, a student under the supervision of a concerned faculty member, shall identify a topic in each course and prepare the term paper with overview of topic. The evaluation of Technical seminar and term paper is for maximum of 5 marks. Marks are awarded by taking average of marks scored in two Seminar Evaluations.

VI COURSE OBJECTIVES:

The students will try to learn:

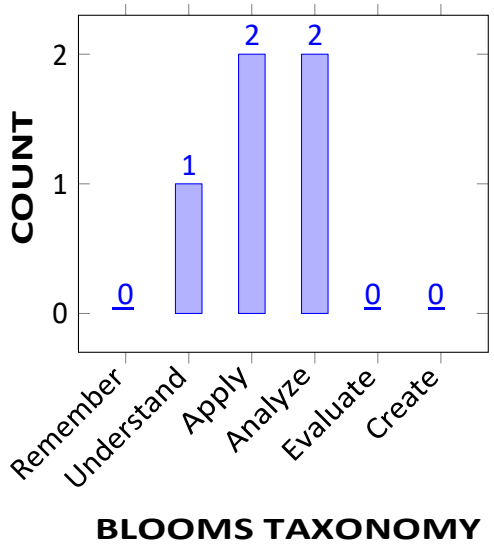
I	The Strategies of wireless sensor networks and network simulator tool.
II	The statistical WSN network simulator tool for understanding and visualization of different network algorithm
III	The various hypotheses and data into actionable predictions.
IV	Routing algorithms along with their strengths and weaknesses used in advanced topics of wireless sensor networks.

VII COURSE OUTCOMES:

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

CO 1	**Summarize** wireless sensor network architetures and its related hardware platforms.	Understand
CO 2	**Demonstrate** the network simulator-3 for simulation experiments of wireless sensor networks.	Apply
CO 3	**Analyze** the performance of Medium Access Control protocols in terms of power consumption, fairness, channel utilization and control packet overhead.	Analyze
CO 4	**Identify** possible attacks and their counter measures for providing security in wireless sensor networks	Apply
CO 5	**Categorize** various routing protocols for improving the performance of the wireless sensor networks.	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	Independently carry out research /investigation and development work to solve practical problems.
PO 2	Write and present a substantial technical report/document
PO 3	Demonstrate a degree of mastery in computer science and engineering emerging areas such as data science, cyber security and application development
PO 4	Identify, formulate, analyze and Design complex engineering problems, and design system components or processes by applying appropriate advanced principles of engineering activities and using modern tools.
PO 5	Engage in life-long learning and professional development through self-study and continuing education in understanding the engineering solutions in global and management principles to manage projects in multidisciplinary environments

Program Outcomes	
PO 6	Function effectively as a member or leader in diverse teams to carry out development work, produce solutions that meet the specified needs with frontier technologies and communicate effectively on complex engineering activities.

IX MAPPING OF EACH CO WITH PO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	✓	✓	✓	✓	✓	✓
CO 2	✓	✓	✓	✓	✓	-
CO 3	-	-	✓	✓	✓	-
CO 4	✓	✓	✓	✓	✓	✓
CO 5	-	-	✓	✓	✓	-

X COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

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

COURSE OUTCOMES	PROGRAM OUTCOMES					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	-	2	2	2	2
CO 2	2	-	2	3	2	2
CO 3	2	-	2	3	2	2
CO 4	2	-	2	3	2	-
CO 5	2	-	2	2	-	-
TOTAL	12	0	13	10	08	1
AVERAGE	6	0	2.5	2.16	1.6	1

XI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminar and term paper	✓
Laboratory Practices	-	Student Viva	-	Mini Project	-

XII ASSESSMENT METHODOLOGY INDIRECT:

✓	**End Semester OBE Feed Back**

XIII SYLLABUS:

MODULE I	**INTRODUCTION TO WIRELESS SENSOR NETWORKS**
	Introduction to Wireless Sensor Networks: Motivations, Applications, Performance metrics, History and Design factors Network Architecture: Traditional layered stack, Cross-layer designs, Sensor Network Architecture Hardware Platforms: Motes, Hardware parameters
MODULE II	**INTRODUCTION TO NS-3**
	Introduction to Network Simulator 3 (ns-3), Description of the ns-3 core module and simulation example
MODULE III	**MEDIUM ACCESS CONTROL PROTOCOL DESIGN**
	Fixed Access, Random Access, WSN protocols: synchronized, duty-cycled Introduction to Markov Chain: Discrete time Markov Chain definition, properties, classification and analysis MAC Protocol Analysis: Asynchronous duty-cycled. X-MAC Analysis (Markov Chain).
MODULE IV	**SECURITY**
	Possible attacks, countermeasures, SPINS, Static and dynamic key distribution
MODULE V	**ROUTING PROTOCOLS**
	Routing protocols: Introduction, MANET protocols Routing protocols for WSN: Resource-aware routing, Data-centric, Geographic Routing, Broadcast, Multicast Opportunistic Routing Analysis: Analysis of opportunistic routing (Markov Chain) Advanced topics in wireless sensor networks.

TEXTBOOKS

1. W. Dargie and C. Poellabauer, “Fundamentals of Wireless Sensor Networks –Theory and Practice”, Wiley 2010
2. KazemSohraby, Daniel Minoli and TaiebZnati, “wireless sensor networks -Technology, Protocols, and Applications”, Wiley Interscience 2007
3. Takahiro Hara,Vladimir I. Zadorozhny, and Erik Buchmann, “Wireless Sensor Network Technologies for the Information Explosion Era”, springer 2010

REFERENCE BOOKS:

1. Kamilo Feher, “Wireless Digital Communications”, PHI, 1st Edition, 1999.
2. Kaveh Pah Laven, P. Krishna Murthy, “Principles of Wireless Networks”, Prentice Hall PTR, 1st Edition, 2002.

WEB REFERENCES:

1. https://en.wikipedia.org/wiki/wireless sensor networks

COURSE WEB PAGE:

1. https://www.udemy.com/course/wireless-sensor-networks-telecommunicationf/

XIV COURSE PLAN:

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

S.No	Topics to be covered	CO’s	Reference

OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO-PO Mapping	-	
CONTENT DELIVERY (THEORY)			
1	Understand wireless sensor networks and applications	CO 1	TB1 1.1
2	Applications of WSN	CO 1	TB1 1.3
3	Performance of WSN	CO 1	TB1 2.1
4	History and design, Network architecture and Layer designs	CO 2	TB1 5.2, 5.5
5	Sensor network, Motes, Hardware parameters	CO 2	TB1 5.5, 5.8
6	Network Simulator	CO 2	TB1 6.1, 6.2
7	Medium Access	CO 3	TB1 6.3
8	Control protocol, WSN protocols.	CO 3	TB1 7.5
9	Synchronized, Duty-cycled	CO 3	TB1 9.1
10	Markov chain, Discrete time Markov Chain definition	CO 4	TB1 12.1
11	Classification of Markov chain	CO 4	TB1 13.1
12	MAC Protocol Analysis	CO 4	TB1 14.1
13	Security, SPINS, Static and dynamic key distribution	CO 4	TB1 21.1
14	Routing Protocols, MANET protocols	CO 4	TB2 2.5
15	Routing protocols for WSN, Data-centric, Geographic Routing	CO 4	TB2 7.1
16	Analysis of opportunistic routing (Markov Chain)	CO 4	TB2 6.1
17	Advanced topics in wireless sensor networks	CO 5	TB2 6.2
18	Applications	CO 5	-TB2 6.4
19	Games	CO 5	TB2 6.5
20	Mobile Information Architecture, Mobile 2.0,	CO 5	TB2 TB2 8.1
21	Mobile Design: Elements of Mobile Design, Tools	CO 5	TB2 10.1
22	Designing Web Interfaces – Drag and Drop	CO 5	TB 3 3.1
23	Direct Selection, Contextual Tools	CO 5	TB3 4.2
24	Overlays, Inlays and Virtual Pages	CO 5	TB3 4.3
25	Process Flow. Case Studies.	CO 5	TB3 4.6
MODULE WISE DISCUSSION ON VARIOUS TOPICS			
1	Module 1	CO 1	TB1,RF1 ,RF2,CWP
2	Module 2	CO 2	TB1,RF1 ,RF2,CWP
3	Module 3	CO3	TB1,RF1 ,RF2,CWP

4	Module 4	CO4	TB1,TB2 RF1,RF2, CWP
5	Module 5	CO 5	TB2,TB3, RF1,RF2, CWP

Signature of Course Coordinator **HOD,CSE**
Dr Y Mohana roopa Professor

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION

Branch	**Computer Science and Engineering**				
Course Title	**DATA SCIENCE**				
Course Code	**BCSC07**				
Programme	**M.Tech**				
Semester	**I**	**CSE**			
Course Type	**Elective-I**				
Regulation	**IARE-PG21**				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	**-**	**3**	**4**	**2**
Course Faculty	**Dr. R. M Noorullah, Professor**				

I. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	-	-	Probability and Statistics	-
UG	-	-	Database Management Systems	-

II. COURSE OVERVIEW:

Data Science encompasses the use of mathematics, statistics, and computer science for studying and evaluating data. This course focuses on extraction of valuable information for strategic decision making, trend analysis and forecasting. It includes the processes derived from data engineering, statistics, programming, social engineering, data warehousing, machine learning and natural language processing

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Data Science	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	PPT	✔	Chalk & Talk	✔	Assignments	✔	MOOCs
✔	Seminars	✘	Others				

V. EVALUATION METHODOLOGY:

Each theory course will be evaluated for a total of 100 marks, out of which 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE).

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses shall be divided into FIVE modules and each module carries equal weightage in termsof marks distribution. The question paper pattern shall be defined below. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of three 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
30 %	To test the analytical skill of the concept
20 %	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.CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Assignment and 05 marks for Alternative Assessment Tool (AAT). **Two CIE Tests are Compulsory** and sum of the two tests, along with the scores obtained in the assignment / AAT shall be considered for computing the final CIA of a student in a given course.

The CIE Tests/Assignment /AAT shall be conducted by the course faculty with due approvalfrom the HOD. Advance notification for the conduction of Assignment/AAT is mandatory and the responsibility lies with the concerned course faculty.

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

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 9th and 17th week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered. The valuation and verification of answer scripts of CIE exams shall be completed within a week after the conduct of the Examination.

Assignment:

To improve the writing skills in the course an assignment will be evaluated for 05 marks. One assignment has to submit at the end of the CIE2 for the questions provided by each course coordinator in that semester. Assignments to be handed in as loose paper collection stapled together at the top left corner. The assignment should be presented as a professional report. It must consist of a cover sheet, content page, and should have an introduction, a body, a conclusion or recommendation, and a reference page.

Alternative Assessment Tool (AAT):

The AAT may includes, concept videos, course related term paper, technical seminar, term paper, paper presentations conducted by reputed organizations relevant to the course etc.

VI. COURSE OBJECTIVES:

The students will try to learn:

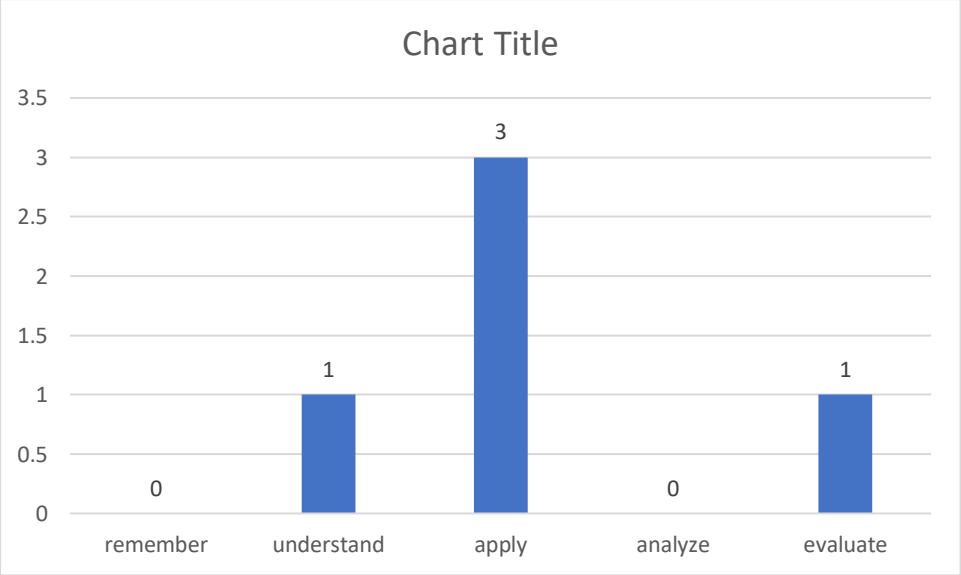
I	The fundamental concepts of data science process and R programming.
II	The programs using R language for understanding and visualization of data with the help of statistical and visualization functions.
III	The various hypotheses for data into actionable predictions.
IV	Various machine learning algorithms along with their strengths and weaknesses.

VII. COURSE OUTCOMES (COs):

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

COs	Description	Bloom's level
CO 1	Make use of various data description functions in R programming to exhibit various stages of data science process.	Apply
CO 2	Identify interfacing packages for handling SQL and NOSQL databases for performing correlation and regression analysis.	Apply
CO3	Evaluate data models for clustering analysis.	Evaluate
CO 4	Solve various real time problems on various hypothesis conditions by using artificial neural networks.	Apply
CO5	Illustrate delivering results through documentation and plots.	Understand

COURSE KNOWLEDGE COMPETENCY LEVEL



BLOOMS TAXONOMY

VIII. PROGRAM OUTCOMES:

	Program Outcomes (POs)
PO1	Independently carry out research/investigation and development work to solve practical problems.
PO2	Write and present a substantial technical report/document.
PO3	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
PO4	Apply advanced-level knowledge, techniques, skills, and modern tools in the field of computer science and engineering and its allied areas.

PO5	Function effectively as a member or leader in diverse teams to carry out development work, and produce solutions that meet the specified needs with frontier technologies in multidisciplinary environments.
PO6	Engage in life-long learning for continuing education in doctoral-level studies and professional development.

IX. MAPING OF EACH CO WITH POs:

Course Outcomes (COs)	Program Outcomes (PO)					
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO6**
CO 1	✓	✓	✓	✓	✓	✓
CO 2	✓	✓	✓	✓	✓	✓
CO 3	✓	✓	✓	✓	✓	✓
CO 4	✓	✓	✓	✓	✓	✓
CO 5	✓	✓	✓	✓	✓	-

X. COURSE ARTICULATION MATRIX (CO - PO MAPPING):

COs and POs are corelated based on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation , 2 being medium correlation and 3 being high correlation.

Course Outcomes (COs)	Program Outcomes (PO)					
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO6**
CO 1	2	2	2	3	3	2
CO 2	2	3	2	3	3	3
CO 3	3	3	2	3	3	3
CO 4	3	3	3	3	3	3
CO 5	2	2	2	3	3	0
TOTAL	**12**	**13**	**11**	**15**	**15**	**11**
AVERAGE	**2.4**	**2.6**	**2.2**	**3**	**3**	**2.2**

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES –DIRECT

CIE Exams	✓	SEE Exams	✓	Seminar and Term Paper	✓
Laboratory Practices	✓	Student Viva	-	Mini Project	-

XII. ASSESSMENT METHODOLOGIES -INDIRECT

✔	End Semester OBE Feedback

XIII. SYLLABUS

MODULE I	INTRODUCTION
Data science process, roles, stages in data science project, working with data from files, working with relational databases, exploring data, managing data, cleaning and sampling for modeling; Introduction to R: Introduction to various data types, numeric, character, date, data frame, array, matrix etc., reading and writing datasets, working with different file types .txt, .csv, outliers, R functions and loops; Summary statistics: Summary, str, aggregate, subset, head, tail; Probability distribution.	
MODULE II	**SQL, NOSQL AND DATA ANALYSIS**
SQL using R, excel and R, introduction to NoSQL, connecting R to NoSQL databases, R with XML, JSON; Correlation analysis; Covariance analysis, ANOVA, forecasting, heteroscedasticity, autocorrelation; Regression analysis: Regression modeling, multiple regression.	
MODULE III	**DATA MODELS**
Choosing and evaluating models, mapping problems to machine learning, evaluating clustering models, validating models. Cluster analysis: K-means algorithm, Naive Bayes memorization methods, unsupervised methods	
MODULE IV	**ARTIFICIAL NEURAL NETWORKS**
Artificial neural networks: Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and the back propagation algorithm, remarks on the back propagation algorithm; Evaluation hypotheses: Motivation, estimation hypothesis accuracy, basics ofsampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning algorithms.	
MODULE V	**DELIVERING RESULTS**
Documentation and deployment, producing effective presentations, introduction to graphical analysis, plot() function, displaying multivariate data, matrix plots, multiple plots in one window, exporting graph, using graphics parameters, case studies.	

Text Books:

1. Nina Zumel, John Mount, “Practical Data Science with R”, Manning Publications, 1stEdition, 2014.
2. William N. Venables, David M. Smith, “An Introduction to R”, Network Theory Limited, 2nd Edition, 2009.
3. Stephen Marsland, “Machine Learning: An Algorithmic Perspective”, Taylor & Francis CRC Press, 2nd Edition, 2011.

Reference Books:

1. G. Jay Kerns, “Introduction to Probability and Statistics Using R”, Youngstown State University, USA, 1 st Edition, 2011.
2. William W Hsieh, “Machine Learning Methods in the Environmental Sciences”, Neural Networks, Cambridge University Press, 1 st Edition, 2009.
3. Chris Bishop, “Neural Networks for Pattern Recognition”, Oxford University Press, 1 st Edition, 1995.

Web References:

1. http://www.tutorialspoint.com/r/
2. https://en.wikipedia.org/wiki/R_programming_language.
3. http://www.r-bloggers.com/how-to-learn-r-2/#h.obx6jyuc9j7t.

Course Web Page:

1. https://staragile.com/in/data-science/

XIV. COURSE PLAN:

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

Lecture No	Topics to be covered	Course Outcomes (COs)	Reference
OBE DISCUSSION			
1	Course Description on Outcome Based Eduction(OBE): Course Objectives, Course Outcomes (CO), Program Outcomes(PO) and CO-PO Mapping:	–	
CONTENT DELIVERY (THEORY)			
1	Introduction to Data Science, roles and projects, stages in data science project	CO 1	T1:1.1, 1.2
2	Working with data from files, working with relational databases	CO 1	T1:2.1, 2.2
3	Exploring data, managing data, cleaning and sampling for modeling	CO 1	T1:3.1, 3.2, 4.1, 4.2
4	Importance of R and R programming, Summary statistics, probability distribution	CO 1	T2: 1.1, 1.3
5	Introduction to R, data types and functions	CO 1	T2:1.1, 1.7
6	Data scientist, terminologies, Reporting and analysis,	CO 1	T2:1.8- 1.10
7	Types NoSQL, SQL, R, ANOVA	CO 2	T2:11.2-11.4
8	XML, JSON	CO 2	T2:11.6
9	Correlation analysis, regression analysis	CO 2	T2:11.7
10	Regression modeling, multiple regression	CO 2	T3:1.4.1
11	Data Models, Choosing and evaluating models, mapping problemsto machine learning	CO 3	T1:6.1,6.2
12	Evaluating and validating	CO 3	T3: 3.3.7
13	Cluster analysis, K-means algorithm, Naive Bayes memorization methods, unsupervised methods	CO 3	T1:8.1, T3: 9.1
14	Introduction to Artificial Neural Networks, neural network representation	CO 4	T3:9.2
15	Appropriate problems for neural network learning	CO 4	T3: 9.3
16	Perceptions, multilayer networks	CO 4	T3: 9.3
17	Problems and algorithms, propagation algorithm, remarks on the back propagation algorithm	CO4	T3:3.1, 3.2
18	Remarks on the back propagation algorithm	CO4	T3:3.2
19	Motivation, estimation hypothesis accuracy	CO4	T3:18.3.4, 18.3
20	Basics of sampling theory, a general approach for deriving confidence intervals	CO 4	T3:4.1
21	Evaluation hypothesis, Learning algorithms	CO 4	T3:18.1
22	Documentation and deployment, producing effective presentations,	CO 5	T3: 15.1
23	Introduction to graphical analysis	CO 5	T3:15.1`
24	Plots, matrix plots, multiple plots in one window	CO 5	T2:5.1, 5.8
25	Exporting graph, using graphics parameters, case studies	CO 5	T2:12.5, 12.7
DISCUSSION ON VARIOUS TOPICS			

1	Module I	CO1	T1, T2, RB1, CWP
2	Module II	CO2	T2, T3, RB1, CWP
3	Module III	CO3	T1, T3, RB1, CWP
4	Module IV	CO4	T3, RB2, RB3, CWP
5	Module V	CO5	T2, T3, RB2, RB3, CWP

Prepared by: **HOD, CSE**

Dr. R. M Noorullah

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

Branch	**COMPUTER SCIENCE AND ENGINEERING**				
Course Title	**ENGLISH FOR RESEARCH PAPER WRITING**				
Course Code	BHSC01				
Program	M.Tech				
Semester	CSE	I			
Course Type	Audit				
Regulation	IARE - PG21				
Course Structure	Theory	Practical			
	Lecture	Tutorials	Credits	Laboratory	Credits
	2	-	0	-	-
Course Faculty	Mr. P Sunil Solomon, Assistant.Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
UG	AHS001	I	English for Communication
UG	ACSB39	VII	Project Work
UG	ACSB40	VIII	Project Work

II COURSE OVERVIEW:

To accomplish this goal, each student will write during the term a 15-20 page research paper. From the development of a thesis statement to the editing of the final draft, the student will compose this research paper under the direction of the course instructor and in consultation with other students in the class. Depending on the topic under development, the student may also work with a faculty advisor in the pertinent discipline—from Umbra or from his/her home institution. Students pursuing honors theses or independent research projects may develop more extended papers to fulfill individual requirements. The course is also available to creative writing students working on projects requiring extended research.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
English For Research Paper Writing	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	PPT	✓	Chalk & Talk	✓	Assignments	**x**	MOOC
x	Seminars	✓	Others				

V EVALUATION METHODOLOGY:

Each theory course will be evaluated for a total of 100 marks, out of which 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). **Semester End Examination (SEE):** The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of three 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
30 %	To test the analytical skill of the concept
20 %	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. CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Assignment and 05 marks for Alternative Assessment Tool (AAT). Two CIE Tests are Compulsory and sum of the two tests, along with the scores obtained in the assignment / AAT shall be considered for computing the final CIA of a student in a given course.

The CIE Tests/Assignment /AAT shall be conducted by the course faculty with due approval from the HOD. Advance notification for the conduction of Assignment/AAT is mandatory and the responsibility lies with the concerned course faculty. CIA is conducted for a total of 30 marks (Table 1), with 25 marks for Continuous Internal Examination (CIE), 05 marks for Quiz/ Alternative Assessment Tool (AAT).

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Assignment	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 25 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/Alternative Assessment Tool (AAT):
Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are be answered by choosing the correct answer from a given set of choices (commonly four). Marks shall be awarded considering the average of two quizzes for every course. The AAT may include seminars, assignments, term paper, open ended experiments, five minutes video and MOOCs.

VI COURSE OBJECTIVES:

The students will try to learn:

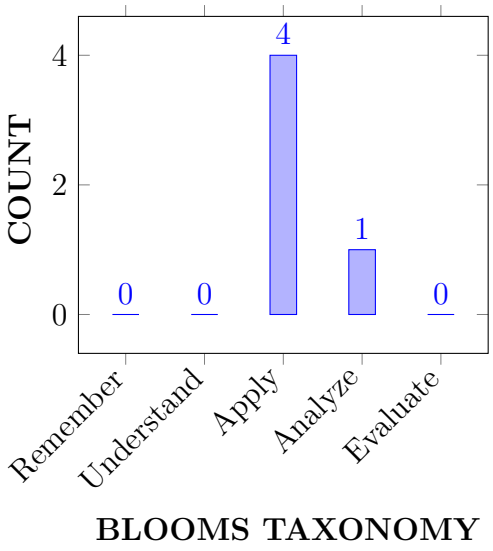
I	How to improve the writing skills and level of readability.
II	The methodology that what to write in each section.
III	The skills needed when writing a Title Ensure the good quality of paper at very first-time submission.

VII COURSE OUTCOMES:

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

CO 1	**Summarise** the key concepts of planning and preparation of the sentences and structuring paragraphs.	Apply
CO 2	**Outline** the key considerations while preparing the abstract of the research topic in specific to findings, headings, criticizing, paraphrasing, and plagiarism.	Apply
CO 3	**Identify** related literature for formulating the problem, methodology, results, and conclusions in research paper.	Analyze
CO 4	**Summarize** the skills required for writing methods, results, discussions and conclusions in research paper.	Apply
CO 5	**Identify** important phrases of research article writing	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1:	**I**ndependently carry out research/investigation and development work to solve practical problems.
PO 2:	**W**rite and present a substantial technical report/document.
PO 3:	**D**emonstrate a degree of mastery in emerging areas of CSE/IT like IoT, AI, Data Analytics, Machine Learning, cyber security, etc.
PO 4:	**A**pply advanced-level knowledge, techniques, skills, and modern tools in the field of computer science and engineering and its allied areas.
PO 5:	**F**unction effectively as a member or leader in diverse teams to carry out development work, and produce solutions that meet the specified needs with frontier technologies in multidisciplinary environments.
PO 6:	**E**ngage in life-long learning for continuing education in doctoral-level studies and professional development.

IX MAPPING OF EACH CO WITH PO(s):

COURSE OUTCOMES	**PROGRAM OUTCOMES**						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	✓	✓	-	✓	✓	-	-
CO 2	✓	✓	-	✓	✓	-	-
CO 3	✓	✓	-	✓	✓	-	-
CO 4	✓	✓	-	✓	✓	✓	-
CO 5	✓	✓	-	-	✓	-	-

X COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

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

COURSE OUTCOMES	**PROGRAM OUTCOMES**						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	2	3	-	2	2	-	-
CO 2	2	3	-	2	2	-	-
CO 3	3	3	-	3	2	-	-
CO 4	3	3	-	3	1	1	-
CO 5	3	3	-	-	1	-	-
TOTAL	13	14	-	10	08	1	-
AVERAGE	2.6	3	-	2.5	1.6	1	-

XI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminar and term paper	✓
Laboratory Practices	-	Student Viva	-	Mini Project	-

XII ASSESSMENT METHODOLOGY INDIRECT:

✓	**End Semester OBE Feed Back**

XIII SYLLABUS:

MODULE I	**PLANNING AND PREPARATION**
	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness
MODULE II	**ABSTRACT**
	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction
MODULE III	**DISCUSSION AND CONCLUSIONS**
	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check. Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.
MODULE IV	**DISCUSSION AND CONCLUSIONS**
	Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.
MODULE V	**QUALITY AND TIME MAINTENANCE**
	Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

TEXTBOOKS

1. Goldbort R, "Writing for Science", Yale University Press. 2011.
2. Adrian Wallwork, "English for Writing Research Papers", Springer New York Dordrecht Heidelberg London, 2011.

REFERENCE BOOKS:

1. Highman N, "Handbook of Writing for the Mathematical Sciences", SIAM Highman's Book.

WEB REFERENCES:

1. http://saba.kntu.ac.ir/eecd/ecourses/Seminar90/2011apers.pdf

E-TEXT BOOKS:

1. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press.

XIV COURSE PLAN:

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

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO-PO Mapping	-	
CONTENT DELIVERY (THEORY)			
1	Planning and Preparation	CO1	T1:1.1, 1.2
2	word Order,Breaking up long sentences	CO1	T1:2.1, 2.2
3	Structuring Pragraphs and Sentences	CO1	T1:3.1, 3.2, 4.1, 4.2
4	Being Concise	CO1	T1:3.1, 3.2, 4.1, 4.2
5	Removing Redundency	CO2	T1: 1.1, 1.3
6	Avoiding Ambiguity and Vagueness	CO2	T1:1.1, 1.7
7	Clarifying Who Did What	CO2	T1:1.1, 1.7
8	Highlighting Your Findings	CO2	T1:1.8-1.10
9	Hedging and Critising	CO2	T1:1.8-1.10
10	Paraphrasing	CO2	T1:11.2-11.4
11	Paraphrasing And Plagarism	CO2	T1:11.2-11.4
12	Sections of a Paper	CO3	T1:11.6
13	Abstracts,Introduction	CO3	T1:11.7
14	Review of the Literature	CO4	T3:1.4.1
15	Methods,Imlementation	CO4	R1:6.1,6.2
16	Results,Discussions,Conclussions,	CO4	R1: 3.3.7
17	The Final Check of the Research Paper.	CO4	R1:8.1, T3: 9.1
18	Key Skills are needed whwn writing a Title, Abstraction and Introduction	CO4	R1:8.1, T3: 9.1
19	Key Skills are needed whwn writing a Review of the Literature.	CO5	R2:9.2
20	Skills are needed when writing the Methods, Results,Discussion and Conclussion	CO5	R2:9.2
21	Useful Phrases and how to ensure paper is as good as it could possibly be the first time submission.	CO5	R2:9.3

DISCUSSION ON VARIOUS TOPICS			
1	MODULE I	CO1	TB1
2	MODULE II	CO2	TB1
3	MODULE III	CO3	TB1
4	MODULE IV	CO4	TB2
5	MODULE V	CO5	TB2

Signature of Course Coordinator **HOD,CSE**
Mr. P Sunil Solomon,Assistant Professor

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Department	**COMPUTER SCIENCE AND ENGINEERING**				
Course Title	**ADVANCED DATA STRUCTURES LABORATORY**				
Course Code	BCSC11				
Program	M.Tech				
Semester	I	CSE			
Course Type	Core				
Regulation	IARE - PG21				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	4	2
Course Coordinator	Dr J Sirisha Devi, Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
-	-	-	-

II COURSE OVERVIEW:

It covers the design and analysis of fundamental data structures and engages learners to use advanced data structures as tools to algorithmically design efficient computer programs that will cope with the complexity of actual applications. This course is essential for image viewer software, music players, multiplayer game using data structures.

III MARKS DISTRIBUTION:

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

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

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

V EVALUATION METHODOLOGY:

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

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

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

Continuous Internal Assessment (CIA):

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

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

Continuous Internal Examination (CIE):

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

1. Experiment Based

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

2. Programming Based

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

VI COURSE OBJECTIVES:

The students will try to learn:

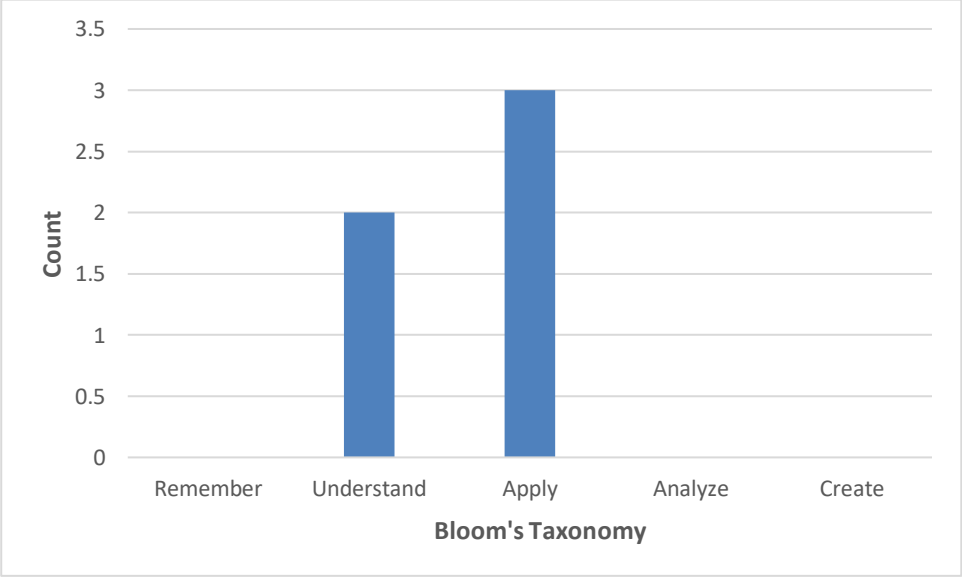
I	The linear and nonlinear data structures and their implementations.
II	Algorithms based on their time and space complexity.
III	Appropriate data structure and algorithm design method for a specific application.
IV	The graph traversals algorithms to solve real-world challenges such as finding shortest paths on huge maps and assembling genomes from millions of pieces.

VII COURSE OUTCOMES:

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

CO 1	Design and analyze a divide and conquer algorithm using data structures and ADT/libraries.	Understand
CO 2	Use stack operations for evaluating mathematical expressions	Apply
CO 3	Demonstrate collision resolution with hashing technique.	Understand
CO 4	Implement graph procedures using disjoint sets.	Apply
CO 5	Make Use of tree traversal algorithms for solving graph applications	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

PO 1	Independently carry out research/investigation and development work to solve practical problems.
PO 2	Write and present a substantial technical report/document.

PO 3	Demonstrate a degree of mastery in computer science and engineering emerging areas such as data science, cyber security, and application development.
PO 4	Apply advanced-level knowledge, techniques, skills, and modern tools in the field of computer science and engineering and its allied areas for solving real-time problems.
PO 5	Function effectively in multidisciplinary environments with the knowledge of frontier technologies by working cooperatively, creatively, and responsively as a member or leader in diverse teams.
PO 6	Engage in life-long learning for continuing education in doctoral-level studies and professional development.

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcome		Strength	Proficiency Assessed by
PO 1	**Independently carry out research/investigation and development work to solve practical problems** 1. Independence and Self-direction in solving practical problems 2. Scope definition and deliverables by referring to related literature 3. Work breakdown structure including resource identification, schedule, and implementation Demonstrate the solution to the stakeholders	4	Lab Exercises, CIE, SEE
PO 2	**Write and present a substantial technical report/document** 1. Clarity, Grammar/Punctuation, References. (Writing) Presentation Style and Clarity in Subject Content. (Presentation)	2	Lab Exercises, CIE, SEE.
PO 3	**Demonstrate a degree of mastery in computer science and engineering emerging areas such as data science, cyber security, and application development** 1. Apply mathematical/statistical models to analyze critically various applications related to Data Science and Cybersecurity. 2. Leverage Machine Learning and Soft computing techniques for the problem-solving in emerging areas such as data science, cyber security.	3	Lab Exercises.
PO 4	**Apply advanced-level knowledge, techniques, skills, and modern tools in the field of computer science and engineering and its allied areas for solving real-time problems.** Identify, design, and develop solutions to real-time problems by using 1. Problem (domain) understanding and system definition 2. Advanced data structures, protocols, and techniques/algorithms 3. Solution/prototype development/implementation with programming constructs/tools 4. Information/data visualization and processing techniques Identification/assessment of vulnerabilities of the	5	Lab Exercises, CIE, SEE.

	system/network using security techniques/algorithms		
PO 5	**Function effectively in multidisciplinary environments with the knowledge of frontier technologies by working cooperatively, creatively, and responsively as a member or leader in diverse teams.** During the classroom periods, in the hands-on labs, and in the design and implementation of projects 1. Knowledge of advanced techniques. 2. Plan tasks and resources, manage risk, and produce deliverables. 3. Meeting deadlines and producing solutions. 4. Work with all levels of people. 5. Interpretation of results in related domains.	5	Lab Exercises, CIE, SEE.
PO 6	**Engage in life-long learning for continuing education in doctoral-level studies and professional development.** **1.** Project management and professional certifications. 2. Start working on higher educational Qualifications. 3. Personal continuing education efforts with keeping current trends in CSE. 4.Sustain with technological, innovation, and industry trends	4	Lab Exercises, CIE, SEE

3 = High; 2 = Medium; 1 = Low

X JUSTIFICATIONS FOR CO–PO MAPPING -DIRECT:

COURSE OUTCOMES	PO'S	Justification for mapping (Students will be able to)	No. of Key Competencies
CO 1	PO 1	**Identify** suitable divide and conquer algorithm for modeling independence and Self-direction solutions to practical problems of stakeholder.	2
	PO 3	**Create** divide and conquer algorithms for problem-solving in emerging areas such as data science, cyber security.	1
	PO 4	**Make use of** appropriate divide and conquer algorithm to problem domain for information processing and visualization.	3
	PO 5	**Demonstrate** the knowledge of divide and conquer algorithms and techniques for interpretation of results in related domains.	2

	PO 6	**Apply** knowledge of divide and conquer algorithms to start working on higher educational Qualifications and Personal continuing education efforts with keeping current trends in CSE.	2
CO 2	PO 1	**Understand** stack operations for mathematical abstractions and independence, Self-direction solutions of practical problems in order to demonstrate solutions to stakeholder.	2
	PO 2	**Describe** stack operations for references as implementation to provide solution in user domains.	1
	PO 3	**Create** stack data structure for problem-solving in emerging areas such as data science, cyber security.	1
	PO 4	**Make use of** stack data structures to problem domain for information processing and visualization.	3
	PO 5	**Demonstrate** the knowledge of stack operations for interpretation of results in related domains.	2
CO 3	PO 1	**Define** the hashing techniques for independence and Self-direction in solving practical problems to demonstrate solutions to stakeholder and to identify the work break down structure, resources for implementation.	3
	PO 2	**Build** strong foundation on collusion resolution for career building by communicating effectively with engineering community.	2
	PO 3	**Create** hash tables and mapping procedure for problem-solving in emerging areas such as data science, cyber security.	1
	PO 4	**Utilize** advanced mapping techniques of hash table for problem domain to apply algorithm for information processing and visualization.	3
	PO 5	**Illustrate** the knowledge of hashing techniques for interpretation of results in related domains.	2
	PO 6	**Make use of** knowledge of hashing techniques to start working on higher educational Qualifications and Personal continuing education efforts with keeping current trends in CSE.	2
CO 4	PO 1	**Utilize** performance analysis of algorithms on graph data structure for identifying solutions to problems of stake holders.	1
	PO 3	**Apply** graph procedures of disjoin sets algorithms to analyze critically various applications related to Data Science and Cybersecurity.	1
	PO 5	**Use** disjoins set operations and union operations for interpretation of results in related domains and visualization.	2
CO 5	PO 1	**Recognize** appropriate tree traversal technique for Independence and Self-direction in solving practical problems to demonstrate solutions to stakeholder.	2
	PO 3	**Make Use of** tree traversal techniques to problem domain and algorithm for information processing and visualization.	3

	PO 4	**Apply** tree traversal techniques to problem domain for information processing and visualization.	3
	PO 5	**Illustrate** knowledge of tree traversal techniques of hashing for interpretation of results in related domains.	1

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

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

XII ASSESSMENT METHODOLOGY DIRECT:

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

XIII ASSESSMENT METHODOLOGY INDIRECT:

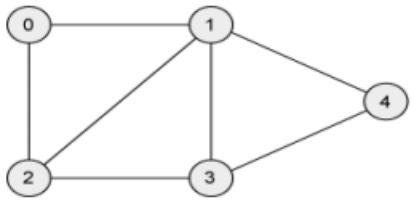
X	Early Semester Feedback	√	End Semester OBE Feedback
X	Assessment of Mini Projects by Experts		

XIV SYLLABUS:

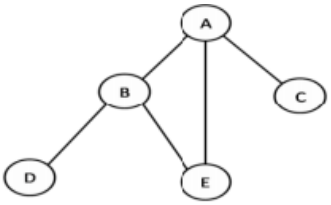
LIST OF EXPERIMENTS	
Week-1	**DIVIDE AND CONQUER - 1**
a. Implement Quick Sort on 1D array of Student structure (contains student name, student_roll_no,total_marks), with key as student_roll_no and count the number of swap performed. b. Implement Merge Sort on 1D array of Student structure (contains student_name, student_roll_no,total_marks), with key as student_roll_no and count the number of swap performed.	
Week-2	**DIVIDE AND CONQUER - 2**
a. Design and analyze a divide and conquer algorithm for following maximum sub-array sum problem: given an array of integer's find a sub-array [a contagious portion of the array] which gives the maximum sum. b. Design a binary search on 1D array of Employee structure (contains employee_name,	

emp_no, emp_salary), with key as emp_no and count the number of comparison happened.	
Week-3	**IMPLEMENTATION OF STACK AND QUEUE**
a. Implement 3-stacks of size 'm' in an array of size 'n' with all the basic operations such as Is Empty(i),Push(i), Pop(i), IsFull(i) where 'i' denotes the stack number (1,2,3), Stacks are not overlapping each other. b. Design and implement Queue and its operations using Arrays	
Week-4	**HASHING TECHNIQUES**
Write a program to store k keys into an array of size n at the location computed using a hash function, loc =key % n, where k<=n and k takes values from [1 to m], m>n. To handle the collisions use the following collision resolution techniques a. Linear probing b. Quadratic probing c. Random probing d. Double hashing/rehashing	
Week-5	**APPLICATIONS OF STACK**
Write C programs for the following: a. Uses Stack operations to convert infix expression into post fix expression. b. Uses Stack operations for evaluating the post fix expression.	
Week-6	**BINARY SEARCH TREE**
Write a program for Binary Search Tree to implement following operations: a. Insertion b. Deletion i. Delete node with only child ii. Delete node with both children c. Finding an element d. Finding Min element e. Finding Max element f. Left child of the given node g. Right child of the given node h. Finding the number of nodes, leaves nodes, full nodes, ancestors, descendants.	
Week-7	**DISJOINT SET OPERATIONS**
a. Write a program to implement Make_Set, Find_Set and Union functions for Disjoint Set Data Structure for a given undirected graph G(V,E) using the linked list representation with simple implementation of Union operation. b. Write a program to implement Make_Set, Find_Set and Union functions for Disjoint Set Data Structure for a given undirected graph G(V,E) using the linked list representation with weighted-union heuristic approach	
Week-8	**GRAPH TRAVERSAL TECHNIQUES**

a. Print all the nodes reachable from a given starting node in a digraph using BFS method.

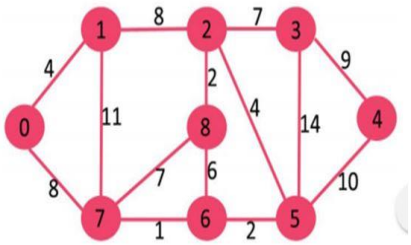


b. Check whether a given graph is connected or not using DFS method.



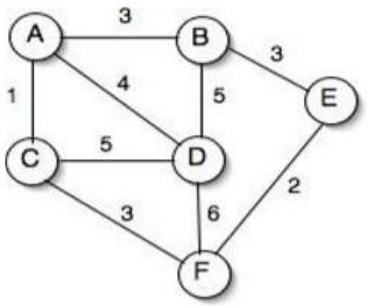
Week-9	SHORTEST PATHS ALGORITHM

From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.



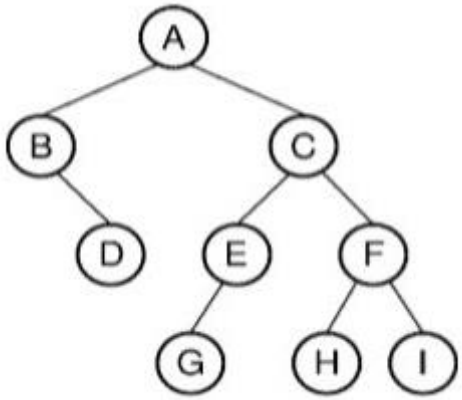
Week-10	MINIMUM COST SPANNING TREE

Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's



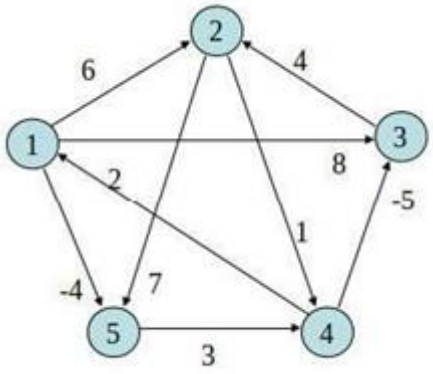
WeeK-11	TREE TRAVESRSALS

Perform various tree traversal algorithms for a given tree.



Week-12	ALL PAIRS SHORTEST PATHS

Implement All-Pairs Shortest Paths Problem using Floyd's algorithm.



	1	2	3	4	5
1	0	6	8	∞	-4
2	∞	0	∞	1	7
3	∞	4	0	∞	∞
4	2	∞	-5	0	∞
5	∞	∞	∞	3	0

XV TEXT BOOKS:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, “Fundamentals of Computer Algorithms”, Universities Press Private Limited, India, 2nd Edition, 2008.

2. G.A.V.Pai, “Data Structures and Algorithms”, Tata McGraw Hill, NewDelhi,1stEdition,2008.

3. M. A. Weiss, Addison Wesley, “Data Structures and Algorithm Analysis in Java”, Pearson Education, 2 nd Edition, 2005.

XVI REFERENCE BOOKS:

1. Kernighan Brian W, Dennis M. Ritchie, “The C Programming Language”, Prentice Hall of India, RePrint, 2008.
2. Balagurusamy E, “Programming in ANSIC”, Tata McGraw Hill, 6th Edition, 2008.
3. Gottfried Byron, “Schaum's Outline of Programming with C”, Tata McGraw Hill, 1st Edition, 2010.
4. Lipschutz Seymour, “Data Structures Schaum's Outlines Series”, Tata McGraw Hill, 3rdEdition, 2014.
5. HorowitzEllis, SatrajSahni,SusanAnderson,Freed,“FundamentalsofDataStructuresinC”,W.H. Freeman Company, 2nd Edition, 2011

XVII COURSE PLAN:

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

S.No	Topics to be covered	CO's	Refer-ence
1	Introduction of data structures.	CO 1	T1:1
2	Design and analyze a divide and conquer algorithm	CO 1	T1:4.9,4.11
3	Implementation stack and queue and its operations using arrays	CO 2	T1:3
4	Understand collision resolution techniques	CO 3	T1:6.6
5	Evaluate postfix expression using stack	CO 2	T1:4.4, T2:10
6	Implement traversals on binary search tree	CO 4	T1:4.6, T2:10
7	Implement Disjoint Set Operations	CO 4	T2:15
8	Implement graph traversal techniques like DFS and BFS	CO 4	T2:18
9	Design a shortest paths algorithm using Dijkstra's algorithm	CO 5	T2: 5.2
10	Minimum Cost Spanning Tree using Kruskal's algorithm	CO 4	T2:18
11	Implement Tree Traversals	CO 5	T2:10
12	All-Pairs Shortest Paths Problem using Floyd's algorithm.	CO 5	T1:2, T2:1

XVIII EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	DFS for a n-ary tree (acyclic graph) represented as adjacency list.
2	AVL tree with duplicate keys.

Signature of Course Coordinator **HOD, CSE**

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

Branch	**COMPUTER SCIENCE AND ENGINEERING**				
Course Title	**DEEP LEARNING**				
Course Code	BCSC05				
Program	M.Tech				
Semester	I	CSE			
Course Type	Core				
Regulation	IARE - PG21				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	0	3		3
Course Coordinator	Dr. Y Mohana Roopa, Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
UG	ACIC08	VI	DATA MINING AND KNOWLEDGE DISCOVERY LABORATORY

II COURSE OVERVIEW:

This course will discuss fundamental concepts in deep learning with emphasis on their applications to computer science. Topics include various search algorithms conventional neural networks, applications of deep learning to NLP and analogy reasoning.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
DEEP LEARNING	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	PPT	✓	Chalk & Talk	✓	Assignments	**x**	MOOC
x	Seminars	✓	Others				

V EVALUATION METHODOLOGY:

Each theory course will be evaluated for a total of 100 marks, out of which 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). **Semester End Examination (SEE):** The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of three 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
30 %	To test the analytical skill of the concept
20 %	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. CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Assignment and 05 marks for Alternative Assessment Tool (AAT). Two CIE Tests are Compulsory and sum of the two tests, along with the scores obtained in the assignment / AAT shall be considered for computing the final CIA of a student in a given course.

The CIE Tests/Assignment /AAT shall be conducted by the course faculty with due approval from the HOD. Advance notification for the conduction of Assignment/AAT is mandatory and the responsibility lies with the concerned course faculty. CIA is conducted for a total of 30 marks (Table 1), with 25 marks for Continuous Internal Examination (CIE), 05 marks for Quiz/ Alternative Assessment Tool (AAT).

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Assign-ment	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 25 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/Alternative Assessment Tool (AAT):
Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are be answered by choosing the correct answer from a given set of choices (commonly four). Marks shall be awarded considering the average of two quizzes for every course. The AAT may include seminars, assignments, term paper, open ended experiments, five minutes video and MOOCs.

VI COURSE OBJECTIVES:

The students will try to learn:

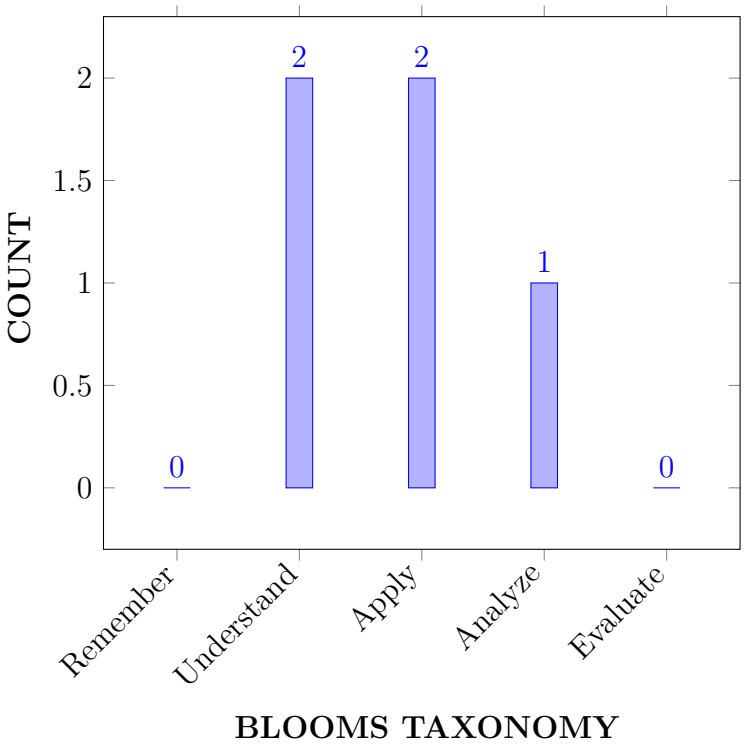
I	Understand complexity of Deep Learning algorithms and their limitations
II	Capable of performing experiments in Deep Learning using real-world data

VII COURSE OUTCOMES:

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

CO 1	**Implement** deep learning algorithms, understand neural networks and traverse the layers ofdat	Apply
CO 2	**Learn** topics such as convolutional neural networks, recurrent neural networks training deepnetworks and high-level interfaces	Apply
CO 3	**Understand** applications of Deep Learning to o Computer Vision.	Under-stand
CO 4	**Understand** and analyze Applications of Deep Learning to NLP	Under-stand
CO 5	**Analyze** and implement deep learning networks in real time applications.	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	Independently carry out research/investigation and development work to solve practical problems.
PO 2	Write and present a substantial technical report/document.
PO 3	Demonstrate a degree of mastery in computer science and engineering emerging areas such as data science, cyber security and application development
PO 4	Apply advanced-level knowledge, techniques, skills, and modern tools in the field of computer science and engineering and its allied areas.
PO 5	Function effectively as a member or leader in diverse teams to carry out development work, and produce solutions that meet the specified needs with frontier technologies in multidisciplinary environments.
PO 6	Engage in life-long learning for continuing education in doctoral-level studies and professional development.

IX MAPPING OF EACH CO WITH PO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	✓	-	-	✓	✓	✓
CO 2	✓	-	-	✓	✓	✓
CO 3	✓	-	-	✓	✓	✓
CO 4	✓	-	-	✓	✓	✓
CO 5	✓	-	-	✓	✓	✓

X COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

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

COURSE OUTCOMES	PROGRAM OUTCOMES					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	-	-	2	3	3
CO 2	3	-	-	2	3	3
CO 3	3	-	-	2	3	3
CO 4	3	-	-	2	3	3
CO 5	3	-	-	2	3	3
TOTAL	15	-	-	10	15	15
AVERAGE	3	-	-	2	3	3

XI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminar and term paper	✓
Laboratory Practices	-	Student Viva	-	Mini Project	-

XII ASSESSMENT METHODOLOGY INDIRECT:

✓	**End Semester OBE Feed Back**

XIII SYLLABUS:

MODULE I	**INTRODUCTION**
	Feed forward Neural networks, Gradient descent and the back propagation algorithm, Unit saturation, the vanishing gradient problem, and ways to mitigate it. RelU Heuristics for avoiding bad local minima, Heuristics for faster training, Nestors accelerated gradient descent, Regularization, Dropout.
MODULE II	**CONVOLUTIONAL NEURAL NETWORKS**
	Architectures, convolution/pooling layers, Recurrent Neural Networks: LSTM, GRU, Encoder Decoder architectures. Deep Unsupervised Learning: Auto encoders, Variational Auto-encoders, Adversarial Generative Networks, Autoencoder and DBM Attention and memory models, Dynamic Memory Models
MODULE III	**APPLICATIONS OF DEEP LEARNING TO COMPUTER VISION**
	Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text withLSTM models, Attention Models for computer vision tasks
MODULE IV	**APPLICATIONS OF DEEP LEARNING TO NLP**
	Introduction to NLP and Vector Space Model of Semantics, Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-of-Wordsmodel (CBOW), Glove, Evaluations and Applications in word similarity.
MODULE V	**ANALOGY REASONING**
	Named Entity Recognition, Opinion Mining using Recurrent Neural Networks: Parsing and Sentiment Analysis using Recursive Neural Networks: Sentence Classification using Convolutional Neural Networks, Dialogue Generation with LSTMs.

TEXTBOOKS

1. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.
2. The Elements of Statistical Learning by T. Hastie, R. Tibshirani, and J. Friedman, Springer.

3. Probabilistic Graphical Models. Koller, and N. Friedman, MIT Press.

REFERENCE BOOKS:

1. Bishop, C, M., Pattern Recognition and Machine Learning, Springer, 2006
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009..
3. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004

WEB REFERENCES:

1. Deep Learning Book, https://www.deeplearningbook.org.
2. https://hastie.su.domains/Papers/ESLII.pdf
3. https://mitpress.mit.edu/9780262013192/probabilistic-graphical-models

COURSE WEB PAGE:

1. https://www.microsoft.com/en-us/research/uploads/prod/2006/01/Bishop-Pattern-Recognition-and-Machine-Learning-2006.pdf

XIV COURSE PLAN:

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

S.No	Topics to be covered	CO's	Reference
	OBE DISCUSSION		
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO-PO Mapping	-	
	CONTENT DELIVERY (THEORY)		
1	Feed forward Neural networks	CO 1	T1:1.1,1.2
2	Gradient descent and the back propagation algorithm, Unit saturation	CO 1	T1:2.1,2.2
3	the vanishing gradient problem, and ways to mitigate it	CO 1	T1:3.1, 3.2, 4.1, 4.2
4	RelU Heuristics for avoiding bad local minima	CO 1	T2:1.1,1.3
5	Heuristics for faster training	CO 1	T2:1.1,1.7
6	, Nestors accelerated gradient descent	CO 1	T2:1.8-1.10
7	Regularization, Dropout	CO 2	T2:11.2-11.4
8	Architectures, convolution/pooling layers	CO 2	T2:11.6
9	Recurrent Neural Networks: LSTM	CO 2	T2:11.7
10	GRU, Encoder Decoder architectures	CO 2	T3:1.4.1
11	Deep Unsupervised Learning	CO2	T1:6.1,6.2
12	Auto encoders, Variational Auto-encoders	CO2	T3: 3.3.7

13	Adversarial Generative Networks	CO2	T1:8.1, T3: 9.1
14	Autoencoder and DBM Attention and memory models	CO3	T3:9.2
15	Dynamic Memory Models	CO 2	T3: 9.3
16	Image segmentation	CO 3	T3: 9.3
17	object detection	CO 3	T3:3.1, 3.2
18	automatic image captioning	CO 3	T3:3.2
19	Image generation with Generative adversarial networks	CO 3	T3:18.3.4, 18.3
20	video to text withLSTM models	CO 3	T3:4.1
21	Attention Models for computer vision tasks	CO 3	T3:18.1
22	Introduction to NLP and Vector Space Model of Semantics	CO 4	T3:15.1
23	Word Vector Representations: Continuous Skip-Gram Model	CO 4	T3:15.1
24	, Continuous Bag-of-Wordsmodel (CBOW)	CO 4	T2:5.1, 5.8
25	Glove, Evaluations and Applications in word similarity	CO 4	T2:12.5,12.7
26	Named Entity Recognition	CO 5	T2:12.5, 12.8
27	Opinion Mining using Recurrent Neural Networks	CO 5	T2:12.5, 12.9
27	Parsing and Sentiment Analysis using Recursive Neural Networks	CO 5	T2:12.5, 12.10
28	Sentence Classification using Convolutional Neural Networks	CO 5	T2:12.5, 12.10
29	Dialogue Generation with LSTMs	CO 5	T2:12.5, 12.10
DISCUSSION ON VARIOUS TOPICS			
1	Module1	CO 1	T1:R1, W1
2	Module2	CO 2	T1:R1, W1
3	Module3	CO 3	T2:R1, W2
4	Module4	CO 4	T2:R1, W2
5	Module5	CO 5	T3:R1, W3

Signature of Course Coordinator **HOD,CSE**
Dr. Y Mohana Roopa, Professor

INSTITUTEOFAERONAUTICALENGINEERING

(Autonomous)

Dundigal,Hyderabad-500043

COURSEDESCRIPTION

Branch	**Computer Science and Engineering**				
Course Title	**Mining Massive Datasets**				
Course Code	BCSC09				
Program	M.Tech				
Semester	CSE	I			
Course Type	Elective				
Regulation	IARE-PG21				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Faculty	Dr. R. M. Noorullah, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
PG	BCSC01	I	MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

II COURSEOVERVIEW:

This course is based on text mining of massive data sets and their applications. Topics include map reduce and the new software stack, applications of similarity search, implementation of stream data, link analysis, handling large data set's, clustering, issues in online advertising, recommendation systems and mining social network graphs

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Mining Massive Dataset	70Marks	30Marks	100

IV DELIVERY/INSTRUCTIONAL METHODOLOGIES:

✓	PPT	✓	Chalk &Talk	✓	Assignments	x	MOOC
x	Seminars	✓	Others				

V EVALUATION METHODOLOGY:

Each theory course will be evaluated for a total of 100 marks, out of which 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). **Semester End Examination (SEE):** The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weight age 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 three subdivisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50%	To test the objectiveness of the concept
30%	To test the analytical skill of the concept
20%	To test the application skill of the concept

Continuous Internal Assessment(CIA):

ForeachtheorycoursetheCIAshallbeconductedbythefaculty/teacherhandlingthecourse.CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination(CIE), 05 marks for Assignment and 05 marks for Alternative Assessment Tool (AAT). Two CIE Tests are Compulsory and sum of the two tests, along with the scores obtained in the assignment / AAT shall be considered for computing the final CIA of a student in a given course.

The CIE Tests/Assignment/AAT shall be conducted by the course faculty with due approval from the HOD. Advance notification for the conduction of Assignment/AAT is mandatory and the responsibility lies with the concerned course faculty.CIA is conducted for a total of 30marks (Table 1), with 25 marks for Continuous Internal Examination (CIE), 05 marks for Quiz/Alternative Assessment Tool(AAT).

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Assignment	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 25 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5marks.Marksareawarded by taking average of marks scored in two CIE exams.

Quiz/Alternative Assessment Tool(AAT):

Two Quiz exams shall be online examination consisting of 25multiple choice questions and are be answered by choosing the correct answer from a given set of choices (commonly four).Marks shall be awarded considering the average of two quizzes for every course.The AAT may include seminars, assignments, term paper, open ended experiments, five minutes video and MOOCs.

VI COURSEOBJECTIVES:

The students will try to learn:

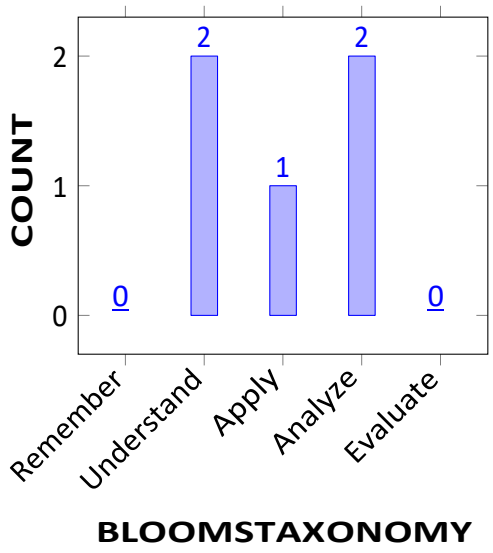
I	This course will cover practical algorithms for solving key problems in mining of massive datasets
II	This course focuses on parallel algorithmic techniques that are used for large datasets
III	This course will cover stream processing algorithms for data streams that arrive constantly, page ranking algorithms for web search, and online advertisement systems that are studied in detail.

VII COURSEOUTCOMES:

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

CO1	Handle massive data using Map Reduce.	Understand
CO2	Develop and implement algorithms for massive data sets and methodologies in the context ofdata mining	Apply
CO3	Understand the algorithms for extracting models and information from large datasets	Understand
CO4	Develop recommendation systems	Apply
CO5	Gain experience in matching various algorithms for particular classes of problems.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO1:	**I**ndependently carry out research/investigation and development work to solve practical problems.
PO2:	**W**rite and present a substantial technical report/document.
PO3:	**D**emonstrateadegreeofmasteryincomputerscienceandengineeringemergingareassuchasdatascience, cyber security, and application development.
PO4:	**A**pply advanced-level knowledge, techniques, skills ,and modern tools in the field of computer science and engineering and its allied areas.
PO5:	**F**unction effectively as a member or leader in diverse teams to carry out development work, and produce solutions that meet the specified needs with frontier technologies in multi disciplinary environments.
PO6:	**E**ngageinlife-longlearningforcontinuingeducationindoctoral-levelstudiesandprofessionaldevelopment.

IX MAPPING OF EACH CO WITHPO(s):

COURSE OUTCOMES	PROGRAMOUTCOMES					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓	-	-	✓	✓	-
CO2	✓	-	-	✓	✓	-
CO3	✓	-	-	✓	✓	-
CO4	✓	-	-	✓	✓	-
CO5	✓	-	-	✓	✓	-

X COURSE ARTICULATION MATRIX(PO–PSOMAPPING):

CO'SandPO'SandCO'SandPSO'Sonthescaleof0to3,0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation.

COURSE OUTCOMES	PROGRAMOUTCOMES					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	-	-	2	1	-
CO2	2	-	-	2	1	-
CO3	2	-	-	2	1	-
CO4	2	-	-	2	1	-
CO5	2	-	-	2	1	-
TOTAL	10	-	-	10	5	-
AVERAGE	2	-	-	2	1	-

XI ASSESSMENT METHODOLOGY DIRECT:

CIEExams	✓	SEE Exams	✓	Seminarandtermpaper	✓
LaboratoryPractices	-	StudentViva	-	MiniProject	-

XII ASSESSMENTMETHODOLOGY INDIRECT:

✓	**End Semester OBE Feed Back**

XIII SYLLABUS:

MODULEI	DATA MINING:
	Introduction-Definition of Data Mining-*Statistical* Limits on Data Mining. Map Reduce and the New Software Stack-Distributed File Systems, Map Reduce, Algorithms Using Map Reduce
MODULEII	SIMILARITY SEARCH:
	Finding Similar Items-Applications of Near-Neighbor Search, Shingling of Documents, Similarity Preserving Summaries of Sets, Distance Measures. Streaming Data: Mining Data Streams-The Stream Data Model, Sampling Data in a Stream, Filtering Streams
MODULEIII	LINK ANALYSIS:
	Page Rank, Efficient Computation of Page Rank, Link Spam. Frequent Item sets-Handling Larger Datasets in Main Memory, Limited-Pass Algorithms, Counting Frequent Items in a Stream. Clustering-The CURE Algorithm, Clustering in Non-Euclidean Spaces, Clustering for Streams and Parallelism.
MODULEIV	ADVERTISING ON THE WEB:
	Issues in On-Line Advertising, On-Line Algorithms, The Matching Problem, The Adwords Problem, Adwords Implementation. Recommendation Systems-A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering, Dimensionality Reduction, The NetFlix Challenge
MODULEV	MINING SOCIAL-NETWORK GRAPHS:
	Mining Social-Network Graphs - Social Networks as Graphs, Clustering of Social-Network Graphs, Partitioning of Graphs, Simrank, Counting Triangles.

TEXTBOOKS

1. Jure Leskovec, Anand Rajaraman, Jeff Ullman, Mining of Massive Datasets, 3 rd Edition.

REFERENCEBOOKS:

1. Jiawei Han & Micheline Kamber , Data Mining – Concepts and Techniques 3rd Edition Elsevier.

2. Margaret H Dunham, Data Mining Introductory and Advanced topics, PEA.

3. Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques,Morgan Kaufmann

WEBREFERENCES:

1. http://i.stanford.edu/~ullman/mining/mining.html

COURSE WEB PAGE:

1. http://www.mmds.org

XIV COURSEPLAN:

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

S.No	Topicstobecovered	CO's	Reference
	OBEDISCUSSION		
1	CourseDescriptiononOutcomeBasedEducation(OBE):CourseObjectives,CourseOutcomes(CO),ProgramOutcomes(PO)andCO-POMapping	-	
	CONTENTDELIVERY(THEORY)		
1	Definition of Data Mining	CO1	TB1:1.1
2	Statistical Limits on Data Mining	CO1	TB1:1.2
3	Map Reduce and the New Software Stack	CO1	TB1:2.0
4	Distributed File Systems	CO1	TB1:2.1
5	Map Reduce	CO1	TB1:2.2
6	Algorithms Using Map Reduce	CO1	TB1:2.3
7	Finding Similar Items	CO2	TB1:3.0
8	Applications of Near-Neighbor Search	CO2	TB1:3.1
9	Shingling of Documents	CO2	TB1:3.2
10	Similarity Preserving Summaries of Sets	CO2	TB1:3.3
11	Distance Measures	CO2	TB1:3.5
12	Mining Data Streams	CO2	TB1:4.0
13	The Stream Data Model	CO2	TB1:4.1
14	Sampling Data in a Stream	CO2	TB1:4.2
15	Filtering Streams	CO2	TB1:4.3
16	Page Rank	CO3	TB1:5.1
17	Efficient Computation of Page Rank,	CO3	TB1:5.2
18	Link Spam	CO3	TB1:5.4
19	Handling Larger Datasets in Main Memory	CO3	TB1:6.3
20	Limited-Pass Algorithms	CO3	TB1:6.4
21	Counting Frequent Items in a Stream	CO3	TB1:6.5

22	The CURE Algorithm	CO3	TB1:7.4
23	Clustering in Non-Euclidean Spaces	CO3	TB1:7.5
24	Clustering for Streams and Parallelism.	CO3	TB1:7.6
25	Issues in On-Line Advertising	CO4	TB1:8.1
26	On-Line Algorithms	CO4	TB1:8.2
27	The Matching Problem	CO4	TB1:8.3
28	The Adwords Problem	CO4	TB1:8.4
28	Adwords Implementation	CO4	TB1:8.5
29	A Model for Recommendation Systems	CO4	TB1:9.1
30	Content-Based Recommendations	CO4	TB1:9.2
31	Collaborative Filtering	CO4	TB1:9.3
32	Dimensionality Reduction	CO4	TB1:9.4
33	The NetFlix Challenge.	CO4	TB1:9.5
34	Social Networks as Graphs	CO5	TB1:10..1
35	Clustering of Social-Network Graphs	CO5	TB1:10.2
36	Partitioning of Graphs	CO5	TB1:10.4
37	Sim rank	CO5	TB1:10.6
38	Counting Triangles	CO5	TB1:10.7
MODULE WISE DISCUSSION ON VARIOUS TOPICS			
1	MODULE – 1	CO1	T1, R1,CSW1
2	MODULE – II	CO2	T1,R2,CSW1
3	MODULE – III	CO3	T1,R2,CSW1
4	MODULE – IV	CO4	T1,R3,CSW1
5	MODULE - V	CO5	T1,R3,CSW1

SignatureofCourseCoordinator **HOD CSE**

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

Branch	**COMPUTER SCIENCE AND ENGINEERING**				
Course Title	**CYBER SECURITY**				
Course Code	BCSC13				
Program	M.Tech				
Semester	II	CSE			
Course Type	Core				
Regulation	IARE- PG21				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3		3
Course Coordinator	Dr. C Madhusudhana Rao, Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
UG	-	-	Computer Networks
UG	-	-	Information Security

II COURSE OVERVIEW:

This course focuses on the planning and execution of security measures to shield an organization's computer systems, networks, and network devices from infiltration and cyber-attacks. It covers topics such as overview of cybercrimes, computer security, cryptography algorithms, internet hacking and cracking, web hacking, cybercrime investigation, digital forensics and certificates, securing databases, laws and acts. This helps to build career opportunities as Cyber Security Analyst, Cyber Security Practitioner, Cyber Defense Analyst and Information Security Engineer in leading IT and Governmental Organizations.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Cyber Security	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	PPT	✓	Chalk & Talk	✓	Assignments	✓	MOOC
x	Seminars	✓	Others	**X**			

V EVALUATION METHODOLOGY:

Each theory course will be evaluated for a total of 100 marks, out of which 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). **Semester End Examination (SEE):** The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of three 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
30 %	To test the analytical skill of the concept
20 %	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. CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Assignment and 05 marks for Alternative Assessment Tool (AAT). Two CIE Tests are Compulsory and sum of the two tests, along with the scores obtained in the assignment / AAT shall be considered for computing the final CIA of a student in a given course.

The CIE Tests/Assignment /AAT shall be conducted by the course faculty with due approval from the HOD. Advance notification for the conduction of Assignment/AAT is mandatory and the responsibility lies with the concerned course faculty. CIA is conducted for a total of 30 marks (Table 1), with 25 marks for Continuous Internal Examination (CIE), 05 marks for Quiz/ Alternative Assessment Tool (AAT).

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Assignment	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 25 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/Alternative Assessment Tool (AAT):
Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are be answered by choosing the correct answer from a given set of choices (commonly four). Marks shall be awarded considering the average of two quizzes for every course. The AAT may include seminars, assignments, term paper, open ended experiments, five minutes video and MOOCs.

VI COURSE OBJECTIVES:

The students will try to learn:

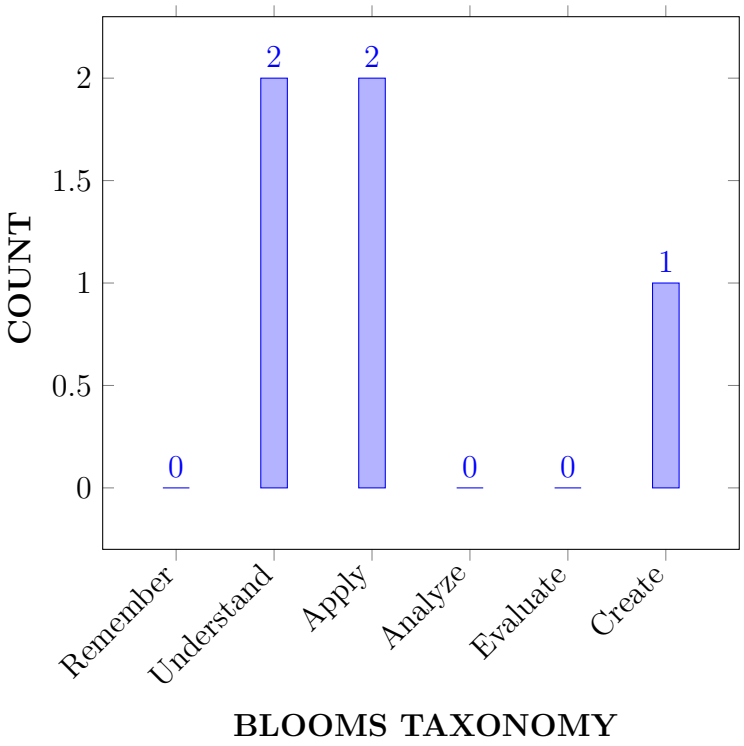
I	Preventing, monitoring, and responding to data breaches and cyber-attacks
II	The security assurance principles of information.
III	The key components of cyber security network architecture.
IV	The cyber security architecture principles.

VII COURSE OUTCOMES:

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

CO 1	**Summarize** web security concepts to overcome cyber crimes	Understand
CO 2	**Make use of** cryptography techniques for protecting systems from unauthorized access and information security.	Apply
CO 3	**Demonstrate** web hacking and cybercrime investigation tools for detecting and recovering in the web domain..	Apply
CO 4	**Identify** digital forensics procedures and policies to manage organizational security risks.	Understand
CO 5	**Recognize** database security concepts and cyber laws for data protection in digital space.	Create

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	Independently carry out research/investigation and development work to solve practical problems.
PO 2	Write and present a substantial technical report/document.
PO 3	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
PO 4	Apply advanced-level knowledge, techniques, skills, and modern tools in the field of computer science and engineering and its allied areas.
PO 5	Function effectively as a member or leader in diverse teams to carry out development work, and produce solutions that meet the specified needs with frontier technologies in multidisciplinary environments.
PO 6	Engage in life-long learning for continuing education in doctoral-level studies and professional development.

IX MAPPING OF EACH CO WITH PO(s):

COURSE OUTCOMES	**PROGRAM OUTCOMES**					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	✓	-	-	✓	✓	✓
CO 2	✓	-	-	✓	✓	✓
CO 3	✓	-	✓	✓	✓	✓
CO 4	✓	-	✓	✓	✓	✓
CO 5	✓	-	✓	✓	✓	✓

X COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

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

COURSE OUTCOMES	**PROGRAM OUTCOMES**					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	-	-	3	1	2
CO 2	2	-	-	3	1	2
CO 3	2	-	3	3	1	2
CO 4	2	-	3	3	1	2
CO 5	2	-	3	3	1	2
TOTAL	10	-	9	15	5	10
AVERAGE	2	-	3	3	1	2

XI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminar and term paper	✓
Laboratory Practices	-	Student Viva	-	Mini Project	-

XII ASSESSMENT METHODOLOGY INDIRECT:

✓	**End Semester OBE Feed Back**

XIII SYLLABUS:

MODULE I	**INTRODUCTION**
	A web security forensic lesson, web languages, introduction to different web attacks, overview of n-tier web applications; Web servers: Apache, IIS, database servers, introduction and overview of cybercrime, nature and scope of cybercrime, types of cybercrime: social engineering, categories of cybercrime, property cybercrime.
MODULE II	**REVIEW OF COMPUTER SECURITY AND CYBER CRIME ISSUES**
	Public key cryptography, RSA, online shopping, payment gateways, unauthorized access to computers, computer intrusions, white collar crimes, viruses and malicious code, internet hacking and cracking, virus attacks, pornography, software piracy, intellectual property, mail bombs, exploitation, stalking and obscenity in internet, digital laws and legislation, law enforcement roles and responses.
MODULE III	**WEB HACKING BASICS AND INVESTIGATION**
	Web hacking basics HTTP and HTTPS URL, web under the cover overview of java security reading the HTML source, applet security, servlets security, symmetric and asymmetric encryptions, network security basics, firewalls and IDS. Investigation: Introduction to cybercrime investigation, investigation tools, e-discovery, digital evidence collection, evidence preservation, e-mail investigation, e-mail tracking, IP tracking, e-mail recovery, hands on case studies; Encryption and Decryption methods, search and seizure of computers, recovering deleted evidences, password cracking
MODULE IV	**DIGITAL CERTIFICATES AND DIGITAL FORENSICS**
	Digital certificates, hashing, message digest, and digital signatures; Digital forensics: Introduction to digital forensics, forensic software and hardware, analysis and advanced tools, forensic technology and practices, forensic ballistics and photography, face, iris and fingerprint recognition, audio video analysis, windows system forensics, Linux system forensics, network forensics.
MODULE V	**SECURING DATABASES, LAWS AND ACTS**

	Basics, secure JDBC, securing large applications, cyber graffiti; Laws and acts: Laws and ethics, digital evidence controls, evidence handling procedures, basics of Indian Evidence Act IPC and CrPC, electronic communication privacy act, legal policies.

TEXTBOOKS

1. Mc Clure, Stuart, Saumil Shah, Shreeraj Shah, —Web Hacking: Attacks and Defense‖, AddisonWesley Professional, Illustrated Edition, 2003.
2. Garms, Jess, Daniel Somerfield, —Professional Java Security‖, WroxPress, Illustrated Edition, 2001.
3. Jon Erickson -Hacking: The Art Of Exploitation, which was published in 2003

REFERENCE BOOKS:

1. Pfleeger, Charles P. and Shari L. Pfleeger. Security in Computing, 4th Edition. Upper Saddle River, NJ: Prentice Hall, 2008
2. Rice, David. Geekonomics: The Real Cost of Insecure Software. Upper Saddle River, NJ: Pearson Education, 2008.
3. Cyber Security Essentials,James Graham, Ryan Olson, Rick Howard, CRC Press
4. Peter Flach, "Machine Learning", Cambridge University Press, 1 st Edition, 2012

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1. Nelson Phillips, EnfingerSteuart, —Computer Forensics and Investigations‖, Cengage Learning, New Delhi,2009.
2. https://www.marwadiuniversity.ac.in/wp-content/uploads/2017/06/01cy102-advancenetworksecurity.pdf
3. https://www.simplilearn.com/tutorials/cyber-security-tutorial/cyber-security-books

COURSE WEB PAGE:

1. https://www.futurelearn.com/courses/introduction-to-cyber-security

XIV COURSE PLAN:

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

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO-PO Mapping	-	
CONTENT DELIVERY (THEORY)			
1	A web security forensic lesson	CO 1	T1:1.1,1.2
2	web languages, introduction to different web attacks	CO 1	T1:2.1,2.2

3	overview of n-tier web applications	CO 1	T1:3.1, 3.2, 4.1, 4.2
4	Web servers:Apache, IIS, database servers, introduction and overview of cybercrime	CO 1	T2:1.1,1.3
5	nature and scope of cybercrime	CO 1	T2:1.1,1.7
6	types of cybercrime: social engineering, categories of cybercrime, property cybercrime	CO 1	T2:1.8-1.10
7	Public key cryptography, RSA, online shopping	CO 2	T2:11.2-11.4
8	payment gateways, unauthorized access to computers	CO 2	T2:11.6
9	computer intrusions, white collar crimes	CO 2	T2:11.7
10	viruses and malicious code, internet hacking and cracking	CO 2	T3:1.4.1
11	virus attacks, pornography, software piracy, intellectual property	CO2	T1:6.1,6.2
12	mail bombs, exploitation, stalking and obscenity in internet	CO2	T3: 3.3.7
13	digital laws and legislation, law enforcement roles and responses	CO2	T1:8.1, T3: 9.1
14	Web hacking basics HTTP and HTTPS URL	CO3	T3:9.2
15	web under the cover overview of java security reading the HTML source, applet security, servlets security, symmetric and asymmetric encryptions, network security basics, firewalls and IDS	CO 3	T3: 9.3
16	Investigation: Introduction to cybercrime investigation, investigation tools, e-discovery, digital evidence collection, evidence preservation	CO 3	T3: 9.3
17	e-mail investigation, e-mail tracking, IP tracking, e-mail recovery, hands on case studies	CO 3	T3:3.1, 3.2
18	Encryption and Decryption methods	CO 3	T3:3.2
19	search and seizure of computers, recovering deleted evidences, password cracking	CO 3	T3:18.3.4, 18.3
20	Digital certificates, hashing, message digest, and digital signatures	CO 4	T3:4.1
21	Digital forensics: Introduction to digital forensics, forensic software and hardware, analysis and advanced tools	CO 4	T3:18.1
22	forensic technology and practices, forensic ballistics and photography, face	CO 4	T3:15.1
23	iris and fingerprint recognition, audio video analysis, windows system forensics	CO 4	T3:15.1
24	Linux system forensics, network forensics	CO 4	T2:5.1, 5.8
25	Basics, secure JDBC, securing large applications, cyber graffiti	CO 5	T2:12.5,12.7

26	Laws and acts: Laws and ethics, digital evidence controls, evidence handling procedures	CO 5	T2:12.5, 12.8
27	basics of Indian Evidence Act IPC and CrPC	CO 5	T2:12.5, 12.9
27	Electronic communication privacy act, legal policies.	CO 5	T2:12.5, 12.10
DISCUSSION ON VARIOUS TOPICS			
1	Module I	CO 1	TB1
2	Module II	CO 2	TB1, TB3
3	Module III	CO 3	TB1, TB3
4	Module IV	CO 4	TB3
5	Module V	CO 5	TB2

Signature of Course Coordinator **HOD,CSE**
Dr. C Madhusudhana Rao, Professor

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

Branch	**COMPUTER SCIENCE AND ENGINEERING**				
Course Title	**Soft Computing**				
Course Code	BCSB14				
Program	M.Tech				
Semester	II	CSE			
Course Type	Core				
Regulation	IARE- PG21				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3		3
Course Coordinator	Mr. N. Rajasekhar, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
PG	-	-	Probability and Statistics
PG	-	-	Design and Analysis of Algorithms

II COURSE OVERVIEW:

Soft computing course provides students with fundamental theory and applications of heuristics, meta heuristics and evolutionary computations. It is used for approximate calculations to provide imprecise but useable solutions to complex problems.This includes intelligence systems, artificial neural network models, fuzzy logic and its inference system, and neuro-fuzzy system.The applications of Soft Computing across different industries such as kinematics, automobile, image processing and data compression, Decision Support System, Power System Analysis and investment and trading.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Soft Computing	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	PPT	✓	Chalk & Talk	✓	Assignments	**x**	MOOC
x	Seminars	✓	Others				

V EVALUATION METHODOLOGY:

Each theory course will be evaluated for a total of 100 marks, out of which 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). **Semester End Examination (SEE):** The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of three 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
30 %	To test the analytical skill of the concept
20 %	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. CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Assignment and 05 marks for Alternative Assessment Tool (AAT). Two CIE Tests are Compulsory and sum of the two tests, along with the scores obtained in the assignment / AAT shall be considered for computing the final CIA of a student in a given course.

The CIE Tests/Assignment /AAT shall be conducted by the course faculty with due approval from the HOD. Advance notification for the conduction of Assignment/AAT is mandatory and the responsibility lies with the concerned course faculty. CIA is conducted for a total of 30 marks (Table 1), with 25 marks for Continuous Internal Examination (CIE), 05 marks for Quiz/ Alternative Assessment Tool (AAT).

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Assign-ment	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 25 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/Alternative Assessment Tool (AAT):
Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are be answered by choosing the correct answer from a given set of choices (commonly four). Marks shall be awarded considering the average of two quizzes for every course. The AAT may include seminars, assignments, term paper, open ended experiments, five minutes video and MOOCs.

VI COURSE OBJECTIVES:

The students will try to learn:

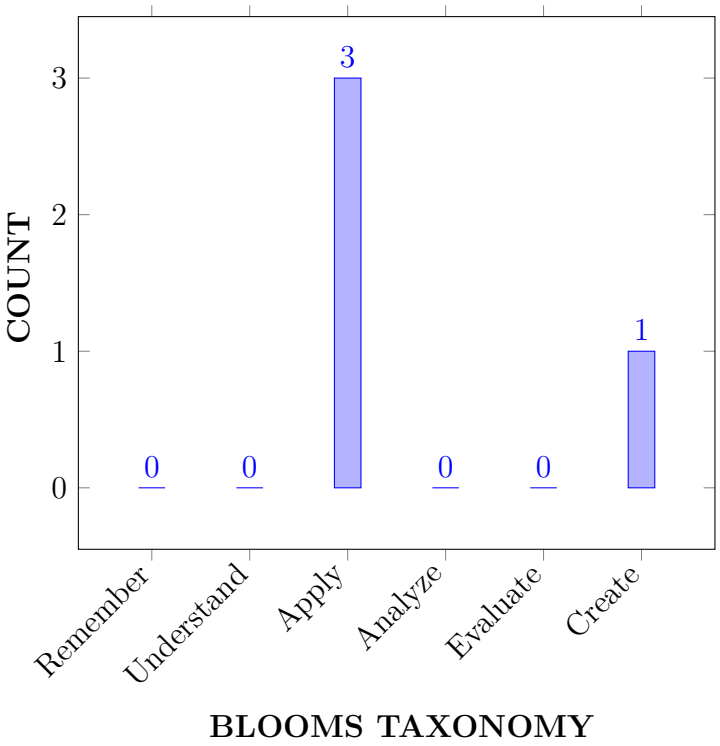
I	The basics of intelligence techniques and methodologies of soft computing that differs from conventional artificial computations.
II	The design and analysis of problem solving using concepts of neural networks, neuro-modeling, several neural networks paradigms and its applications.
III	The concepts of fuzzy logic and inference systems, neuro-fuzzy system, and applications to handle uncertainity in engineering problems..
IV	The soft computing techniques used in different applications for optimization.

VII COURSE OUTCOMES:

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

CO 1	**Recognize** the importance of knowledge representation and processing in intelligent system.	Apply
CO 2	**Describe** the characteristics and constitutes of soft computing for decision making systems.	Analyze
CO 3	**Demonstrate** the models of artificial neural systems or classification problems.	Apply
CO 4	**Apply** the learning rules and its working principle for computer vision and image processing applications.	Apply
CO 5	**Comparee** the importance of auto and hetero associative memories for distinct cases of neural network systems.	Create

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	Independently carry out research/investigation and development work to solve practical problems.
PO 2	Write and present a substantial technical report/document.
PO 3	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
PO 4	Apply advanced-level knowledge, techniques, skills, and modern tools in the field of computer science and engineering and its allied areas.
PO 5	Function effectively as a member or leader in diverse teams to carry out development work, and produce solutions that meet the specified needs with frontier technologies in multidisciplinary environments.
PO 6	Engage in life-long learning for continuing education in doctoral-level studies and professional development.

IX MAPPING OF EACH CO WITH PO(s):

COURSE OUTCOMES	**PROGRAM OUTCOMES**					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	✓	-	-	✓	✓	-
CO 2	✓	-	-	✓	✓	-
CO 3	✓	-	-	✓	✓	-
CO 4	✓	-	-	✓	✓	-
CO 5	✓	-	-	✓	✓	-

X COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

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

COURSE OUTCOMES	**PROGRAM OUTCOMES**					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	-	-	1	1	-
CO 1	2	-	-	1	1	-
CO 1	2	-	-	1	1	-
CO 1	2	-	-	1	1	-
CO 1	2	-	-	1	1	-
TOTAL	10	-	-	5	5	-
AVERAGE	2	-	-	1	1	-

XI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminar and term paper	✓
Laboratory Practices	-	Student Viva	-	Mini Project	-

XII ASSESSMENT METHODOLOGY INDIRECT:

✓	**End Semester OBE Feed Back**

XIII SYLLABUS:

MODULE I	**INTRODUCTION to NEURAL NETWORKS**
	Introduction: Fundamental concept, evolution of neural networks, models of artificial neural networks, important technologies, applications, McCulloch, Pitts Neuron, linear separability, Hebb network; Supervised learning network: Perception networks, adaptive linear neuron, multiple adaptive linear neurons, back propagation network, radial basis function network.
MODULE II	**ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS**
	Associative memory networks: Training algorithms for pattern association, auto associative memory network, hetero associative memory network, bidirectional associative memory, Hopfield networks, iterative auto associative memory network, temporal associative memory network; Unsupervised learning networks: Kohonenself-organizing feature maps, learning vector quantization, counter propagation networks, adaptive resonance theory network.
MODULE III	**FUZZY LOGIC**
	Fuzzy logic: Introduction to classical/crisp sets and fuzzy sets, classical/crisp relations and fuzzy relations, tolerance and equivalence relations, non-iterative fuzzysets. Membership functions: Fuzzification, methods of membership value assignments, defuzzification, and Lambda cuts for fuzzy sets and fuzzy relations, defuzzification methods
MODULE IV	**FUZZY ARITHMETIC**
	Fuzzy arithmetic and fuzzy measures: Fuzzy rule base and approximate reasoning, truth values and tables in fuzzy logic, fuzzy propositions, formation of rules, decomposition and aggregation of rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making, fuzzy logic control systems, fuzzy expert systems
MODULE V	**GENETIC ALGORITHMS**

	Genetic algorithm and search space, general genetic algorithm, operators, generational cycle, stopping condition, constraints, classification, genetic programming, multilevel optimization; Applications: A fusion approach of multispectral images with SAR image for flood area analysis, optimization of travelling salesman problem using genetic algorithm approach, and genetic algorithm based internet search technique, soft computing based hybrid fuzzycontrollers.

TEXTBOOKS

1. J. S. R. Jang, C. T. Sun, E. Mizutani, Neuro, "Fuzzy and Soft Computing", PHI, Pearson Education, 1 st Edition, 2004.
2. 2. S. N. Sivanandan, S. N. Deepa, "Principles of Soft Computing", Wiley India, 2nd Edition, 2007.

REFERENCE BOOKS:

1. S. Rajasekaran, G.A. V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 1 st Edition, 2003
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Mc Graw Hill, 3rd Edition, 1997.
3. Stamatios V.Kartalopoulos "Understanding Neural Networks and Fuzzy Logic Basic Concepts and Applications", IEEE Press, PHI, New Delhi, 2004.

WEB REFERENCES:

1. http://www.sctie.iitkgp.ernet.in/
2. http://www.rkala.in/softcomputingvideos.php
3. http://www.sharbani.org/home2/soft-computing-1
4. http://www.myreaders.info/html/soft-computing.html

XIV COURSE PLAN:

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

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO-PO Mapping	-	
CONTENT DELIVERY (THEORY)			
1	Fundamental concept, evolution of neural networks, models of artificial neural networks	CO 1	T1:1.1,1.2
2	important technologies, applications, McCulloch, Pitts Neuron, linear separability,	CO 1	T1:2.1,2.2

3	Hebb network; Supervised learning network: Perception networks,	CO 1	T1:3.1, 3.2, 4.1, 4.2
4	adaptive linear neuron, multiple adaptive linear neurons,	CO 1	T2:1.1,1.3
5	back propagation network, radial basis function network	CO 1	T2:1.1,1.7
6	tAssociative memory networks: Training algorithms for pattern association, auto associative memory network,	CO 1	T2:1.8-1.10
7	hetero associative memory network, bidirectional associative memory, Hopfield networks, iterative auto associative memory network, tempora	CO 2	T2:11.2-11.4
8	associative memory network; Unsupervised learning networks:	CO 2	T2:11.6
9	Kohonenself-organizing feature maps, learning vector quantization, counter propagation networks, adaptive resonance theory network.	CO 2	T2:11.7
10	Fuzzy logic: Introduction to classical/crisp sets and fuzzy sets,	CO 2	T3:1.4.1
11	lassical/crisp relations and fuzzy relations, tolerance and equivalence relations, non-iterative fuzzysets.	CO2	T1:6.1,6.2
12	Membership functions: Fuzzification, methods of membership value assignments,	CO2	T3: 3.3.7
13	defuzzification, and Lambda cuts for fuzzy sets and fuzzy relations,	CO2	T1:8.1, T3: 9.1
14	defuzzification methods	CO3	T3:9.2
15	Fuzzy arithmetic and fuzzy measures:	CO 3	T3: 9.3
16	Fuzzy rule base and approximate reasoning, truth values and tables in fuzzy logic, fuzzy propositions,	CO 3	T3: 9.3
17	formation of rules, decomposition and aggregation of rules, fuzzy reasoning, fuzzy inference systems,	CO 3	T3:3.1, 3.2
18	fuzzy decision making, fuzzy logic control systems,	CO 3	T3:3.2
19	fuzzy expert systems.	CO 3	T3:18.3.4, 18.3
20	Genetic algorithm and search space,	CO 4	T3:4.1
21	general genetic algorithm, operators, generational cycle, stopping condition, constraints, classification	CO 4	T3:18.1
22	genetic programming, multilevel optimization;	CO 4	T3:15.1
23	optimization of travelling salesman problem using genetic algorithm approach,	CO 4	T3:15.1
24	genetic algorithm based internet search technique	CO 4	T2:5.1, 5.8
25	soft computing based hybrid fuzzycontrollers.	CO 5	T2:12.5,12.7
DISCUSSION ON VARIOUS TOPICS			
1	MODULE 1	CO 1	-
2	MODULE 2	CO 2	-
3	MODULE 3	CO 3	-

4	MODULE 4	CO 4	-
5	MODULE 5	CO 5	-

Signature of Course Coordinator **HOD,CSE**
Mr. N. Rajasekhar, Assistant Professor

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

Branch	**Computer Science and Engineering**				
Course Title					
Course Code	BCSC15				
Program	M.Tech				
Semester	CSE	II			
Course Type	Elective				
Regulation	IARE - PG21				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Faculty	Dr. J Sirisha Devi				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
PG	BCSC01	I	Mathematical Foundations of Computer Science

II COURSE OVERVIEW:

In business intelligence, Data gathering, preparation, analysis, and visualizations are inevitable steps in exploratory analysis. This course includes data gathering and transforming to a standard format, data cleaning, statistical methods, and techniques to perform exploratory analysis. In business environments, it is frequently required to transfer data from databases, perform statistical analysis, and establish business communication with effective visualizations.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Data Preparation and Analysis	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	PPT	✓	Chalk & Talk	✓	Assignments	**x**	MOOC
x	Seminars	✓	Others				

V EVALUATION METHODOLOGY:

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

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Quiz/Alternative Assessment Tool (AAT):
Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are be answered by choosing the correct answer from a given set of choices (commonly four). Marks shall be awarded considering the average of two quizzes for every course. The AAT may include seminars, assignments, term paper, open ended experiments, five minutes video and MOOCs.

VI COURSE OBJECTIVES:

The students will try to learn:

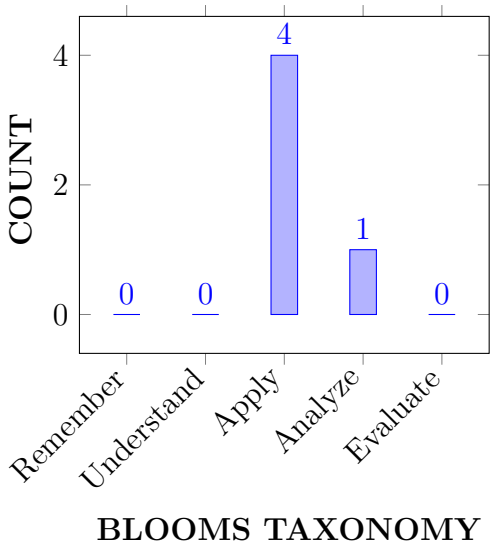
I	The strategies for data gathering and dealing with imperfect real-world data
II	The statistical methods and techniques for exploratory analysis.
III	The various data visualization techniques on complex data in business communication.

VII COURSE OUTCOMES:

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

CO 1	**Select** appropriate data preparation techniquesto transform raw data into a standard format.	Apply
CO 2	**Apply** data cleaning methods on real-time data for usage of data in analytics	Apply
CO 3	**Make use of** statistical methods for performing exploratory analysis.	Apply
CO 4	**Infer** complex data models with respect to time series and geographical data mining.	Analyze
CO 5	**Identify** the effective visualization techniques for data communication	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1:	**I**ndependently carry out research/investigation and development work to solve practical problems.
PO 2:	**W**rite and present a substantial technical report/document.
PO 3:	**D**emonstrate a degree of mastery in computer science and engineering emerging areas such as data science, cyber security, and application development.
PO 4:	**A**pply advanced-level knowledge, techniques, skills, and modern tools in the field of computer science and engineering and its allied areas.
PO 5:	**F**unction effectively as a member or leader in diverse teams to carry out development work, and produce solutions that meet the specified needs with frontier technologies in multidisciplinary environments.
PO 6:	**E**ngage in life-long learning for continuing education in doctoral-level studies and professional development.

IX MAPPING OF EACH CO WITH PO(s):

COURSE OUTCOMES	**PROGRAM OUTCOMES**						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	✓	-	-	✓	✓	-	-
CO 2	✓	-	-	✓	✓	-	-
CO 3	✓	-	-	✓	✓	-	-
CO 4	✓	-	-	✓	✓	-	-
CO 5	✓	-	-	✓	✓	-	-

X COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

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

COURSE OUTCOMES	**PROGRAM OUTCOMES**					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	-	-	1	2	-
CO 2	2	-	-	1	2	-
CO 3	2	-	-	1	2	-
CO 4	2	-	-	1	2	-
CO 5	2	-	-	1	2	-
TOTAL	10	-	-	5	10	-
AVERAGE	2	-	-	1	2	-

XI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminar and term paper	✓
Laboratory Practices	-	Student Viva	-	Mini Project	-

XII ASSESSMENT METHODOLOGY INDIRECT:

✓	**End Semester OBE Feed Back**

XIII SYLLABUS:

MODULE I	**DATA GATHERING**
	Data formats, Parsing and transformation, Scalability, and real-time issues
MODULE II	**DATA PREPARATION**
	Consistency checking, Heterogeneous, and missing data, Data Transformation, and segmentation
MODULE III	**EXPLORATORY ANALYSIS**
	Descriptive and Comparative statistics, Clustering and association, Hypothesis generation
MODULE IV	**VISUALIZATION-1**
	Designing Visualizations, Timeseries, Geolocated data, Correlations, and connections.
MODULE V	**VISUALIZATION-2**
	Hierarchies and networks, interactivity.

TEXTBOOKS

1. Glenn J. Myatt, Making sense of Data: A Practical Guide to Exploratory Data Analysis and Data Mining‖, Wiley publishers, 2007.

REFERENCE BOOKS:

1. D. Pyle, Data Preparation for Data Mining. Morgan Kaufmann, 1999.
2. Ian H. Witten, Eibe Frank. Data Mining: Practical Machine Learning Tools and Techniques (Second Edition) Morgan Kaufmann, 2005.

WEB REFERENCES:

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2. https://aws.amazon.com/what-is/data-preparation/
3. https://www.talend.com/resources/what-is-data-preparation/

COURSE WEB PAGE:

1.

XIV COURSE PLAN:

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

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO-PO Mapping	-	
CONTENT DELIVERY (THEORY)			
1	Data formats	CO1	T1:1.1, 1.2
2	Parsing and Transformation	CO1	T1:2.1, 2.2
3	Scalability	CO1	T1:3.1, 3.2, 4.1, 4.2
4	real-time issues	CO1	T1:3.1, 3.2, 4.1, 4.2
5	Consistency Checking	CO2	T1: 1.1, 1.3
6	Heterogeneous	CO2	T1:1.1, 1.7
7	missing data	CO2	T1:1.1, 1.7
8	Data Transformation	CO2	T1:1.8-1.10
9	segmentation	CO2	T1:1.8-1.10
10	Descriptive statistics	CO2	T1:11.2-11.4
11	comparative statistics	CO2	T1:11.2-11.4
12	Clustering and association	CO3	T1:11.6
13	Hypothesis Generation	CO3	T1:11.7
14	Designing Visualizations	CO4	T3:1.4.1
15	Time series	CO4	R1:6.1,6.2
16	Geolocated data	CO4	R1: 3.3.7
17	Correlations	CO4	R1:8.1, T3: 9.1
18	Connections	CO4	R1:8.1, T3: 9.1
19	Hierarchies	CO5	R2:9.2
20	Networks	CO5	R2:9.2
21	Interactivity	CO5	R2:9.3
DISCUSSION ON OVERVIEW			
1	Data gathering and preparation	-	-
2	Data Cleaning	-	-

3	Exploratory Analysis	-	-
4	Visualization-1	-	-
5	Visualization-2	-	-

Signature of Course Faculty **HOD,CSE**
Dr. J Sirisha Devi, Professor

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

COURSE DESCRIPTION

Branch	**Computer Science and Engineering**				
Course Title	**Internet of things and Applications**				
Course Code	BCSC19				
Program	M.Tech				
Semester	CSE	II			
Course Type	Elective				
Regulation	IARE - PG21				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Faculty	Dr.Y.Mohana Roopa				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
PG	BCSC04	I	Wireless Sensor Networks

II COURSE OVERVIEW:

The Internet of things allows every device to connect the world for exchange of information among the associated devices. It focuses on the concepts of data communication, network protocols, cloud computing and network security fundamental techniques, customs and terms including the basic components of hardware and software. The applications of IoT include home automation, smart parking, smart lighting, and smart phone detection. .

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Internet of things and Applications	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	PPT	✓	Chalk & Talk	✓	Assignments	x	MOOC
x	Seminars	✓	Others				

V EVALUATION METHODOLOGY:

Each theory course will be evaluated for a total of 100 marks, out of which 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). **Semester End Examination (SEE):** The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of three 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
30 %	To test the analytical skill of the concept
20 %	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. CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Assignment and 05 marks for Alternative Assessment Tool (AAT). Two CIE Tests are Compulsory and sum of the two tests, along with the scores obtained in the assignment / AAT shall be considered for computing the final CIA of a student in a given course.

The CIE Tests/Assignment /AAT shall be conducted by the course faculty with due approval from the HOD. Advance notification for the conduction of Assignment/AAT is mandatory and the responsibility lies with the concerned course faculty. CIA is conducted for a total of 30 marks (Table 1), with 25 marks for Continuous Internal Examination (CIE), 05 marks for Quiz/ Alternative Assessment Tool (AAT).

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Assignment	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 25 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/Alternative Assessment Tool (AAT):

Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are be answered by choosing the correct answer from a given set of choices (commonly four). Marks shall be awarded considering the average of two quizzes for every course. The AAT may include seminars, assignments, term paper, open ended experiments, five minutes video and MOOCs.

VI COURSE OBJECTIVES:

The students will try to learn:

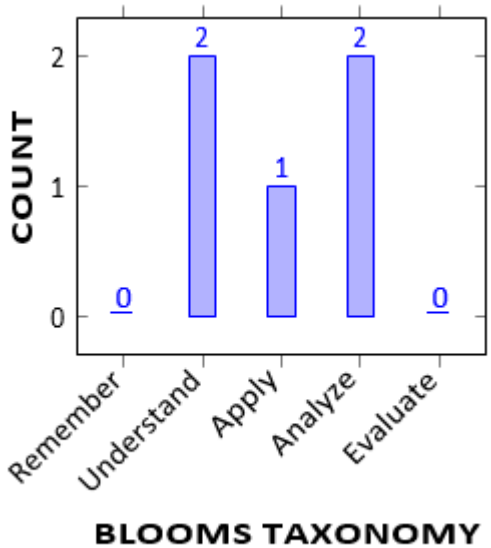
I	The principle and operation of software defined networking and network function virtualization.
II	The knowledge of IoT enabled technologies, security protocols and architectures
III	Python programming skills to move into specific areas – deep learning (DL), data science, machine learning (ML),artificial intelligence (AI) etc. .

VII COURSE OUTCOMES:

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

CO 1	**Summarize** the characteristics and appropriate levels of IoT or reusing of deployed IoT resources across application domains.	Understand
CO 2	**Identify** the necessity of communication models, protocols and API's for accessing data from sensors and actuators tto overcome issues like failure of any connected devices.	Analyze
CO 3	**Compare** Machine to Machine with IoT and identifying the role of SDN,NFV, NETCONFG-YANG for data exchange between devices and management on network.	Apply
CO 4	**Illustrate** architectural reference models and state of the art methodologies in IoT application domains for managing access control of IoT devices.	Understand
CO 5	**Analyze** tdifferent cloud storage models and protocols that are scalable	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1:	**I**ndependently carry out research/investigation and development work to solve practical problems.
PO 2:	**W**rite and present a substantial technical report/document.
PO 3:	**D**emonstrate a degree of mastery in computer science and engineering emerging areas such as data science, cyber security, and application development.
PO 4:	**A**pply advanced-level knowledge, techniques, skills, and modern tools in the field of computer science and engineering and its allied areas.
PO 5:	**F**unction effectively as a member or leader in diverse teams to carry out development work, and produce solutions that meet the specified needs with frontier technologies in multidisciplinary environments.
PO 6:	**E**ngage in life-long learning for continuing education in doctoral-level studies and professional development.

IX MAPPING OF EACH CO WITH PO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	✓	-	-	✓	✓	-
CO 2	✓	-	-	✓	✓	-
CO 3	✓	-	-	✓	✓	-
CO 4	✓	-	-	✓	✓	-
CO 5	✓	-	-	✓	✓	-

X COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

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

COURSE OUTCOMES	PROGRAM OUTCOMES					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	-	-	2	1	-
CO 2	2	-	-	2	1	-
CO 3	2	-	-	2	1	-
CO 4	2	-	-	2	1	-
CO 5	2	-	-	2	1	-
TOTAL	10	-	-	10	5	-
AVERAGE	2	-	-	2	1	-

XI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminar and term paper	✓
Laboratory Practices	-	Student Viva	-	Mini Project	-

XII ASSESSMENT METHODOLOGY INDIRECT:

✓	**End Semester OBE Feed Back**

XIII SYLLABUS:

MODULE I	**INTRODUCTION**
	Definition and characteristics of IoT, physical design of IoT, logical design of IoT, IoT enabling technologies, IoT levels and deployment, domain specific IoTs.
MODULE II	**IOT AND M2M**
	Introduction, M2M, difference between IoT and M2M, software defined networking (SDN) and network Function virtualization (NFV) for IoT, basics of IoT system management with NETCONF-YANG.
MODULE III	**IOT ARCHITECTURE AND TOOLS**
	IoT Architecture: State of the art introduction, state of the art; Architecture reference model: Introduction, reference model and architecture, IoT reference model. IoT Reference model-IoT ecosystem and Business models- Introduction to Protocols of IoT: D2D, D2S, S2S, Introduction to simulation tools.
MODULE IV	**MODELLING TECHNIQUES**
	Introduction to Raspberry Pi interfaces (Serial, SPI, I2C), programming Raspberry PI with Python, other IoT devices.
MODULE V	**IOT PHYSICAL SERVERS AND CLOUD OFFERINGS**
	Introduction to cloud storage models and communication APIs; WAMP: AutoBahn for IoT, Xively cloud For IoT; Case studies illustrating IoT design: Home automation, smart cities, smart environment.

TEXTBOOKS

1. 1. ArshdeepBahga, Vijay Madisetti, “Internet of Things: A Hands-on-Approach”, VPT, 1st Edition, 2014.
2. 2. Matt Richard son,ShawnWallace, “Getting Started with RaspberryPi”, OReilly (SPD), 3rd Edition, 2014.

REFERENCE BOOKS:

1. Derek Molloy, “Exploring Raspberry Pi: Interfacing to the Real World with Embedded Linux” Wiley publishers, 1st Edition, 2020.

WEB REFERENCES:

1. https://www.upf.edu/pra/en/3376/22580.
2. https://www.coursera.org/learn/iot.

COURSE WEB PAGE:

1. https://www.upf.edu/pra/en/3376/22580.

XIV COURSE PLAN:

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

S.No	Topics to be covered	CO's	Reference
	OBE DISCUSSION		
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO-PO Mapping	-	
	CONTENT DELIVERY (THEORY)		
1	Definition and characteristics of IoT	CO1	T1:1.1,1.2
2	physical design of IoT	CO1	T1:2.1,2.2
3	logical design of IoT	CO1	T1:3.1,3.2
4	IoT enabling technologies	CO1	T1:3.1,3.2
5	IoT levels and deployment	CO1	T1:1.1,1.3
6	domain specific IoTs	CO1	T1:1.1, 1.7
7	Introduction	CO2	T1:1.1, 1.7
8	M2M	CO2	T1:1.8-1.10
9	difference between IoT and M2M	CO2	T1:1.8-1.10
10	software defined networking (SDN) and network Function virtualization(NFV) for IoT	CO2	T1:11.2-11.4
11	basics of IoT system management with NETCONF-YANG	CO2	T1:11.2-11.4
12	IoT Architecture: State of the art introduction	CO3	T1:11.6
13	state of the art	CO3	T1:11.7
14	Architecture reference model: Introduction	CO3	T3:1.4.1
15	reference model and architecture	CO3	R1:6.1,6.2
16	IoT reference model	CO3	R1: 3.3.7
17	IoT Reference model-IoT ecosystem and Business models-	CO3	R1:8.1, T3: 9.1
18	Introduction to Protocols of IoT: D2D	CO3	R1:8.1, T3: 9.1
19	D2S, S2S	CO2	R2:9.2
20	Introduction to simulation tools	CO3	R2:9.2
21	Introduction to Raspberry Pi interfaces (Serial, SPI, I2C)	CO4	R2:9.3

22	programming Raspberry PI with Python	CO4	T3:9.1
23	other IoT devices	CO4	T3:9.1
24	Introduction to cloud storage models and communication APIs	CO5	T3:9.1
25	WAMP: AutoBahn for IoT	CO5	T3:9.1
26	Xively cloud For IoT	CO5	T3:9.1
27	Case studies illustrating IoT design	CO5	T3:9.1
28	Home automation	CO6	T3:9.1
28	smart cities	CO6	T3:9.1
29	smart environment	CO6	T3:9.1
DISCUSSION ON VARIOUS TOPICS			
1	Module 1	CO1	TB1,RF1,CWP
2	Module 2	CO2	TB1,RF1,CWP
3	Module 3	CO3	TB1,RF1,CWP
4	Module 4	CO4	TB1,RF1,CWP
5	Module 5	CO5	TB1,RF1,CWP

Signature of Course Coordinator
Dr. Y. Mohana Roopa, Professor

HOD CSE

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

COMPUTER SCIENCE ENGINEERING
COURSE DESCRIPTION

Course Title	**SOFT COMPUTING LABORATORY**				
Course Code	BCSC23				
Program	M.Tech				
Semester	II				
Course Type	Laboratory				
Regulation	PG-21				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	3	2
Course Coordinator	Mr. N. Rajasekhar, Assistant Professor				

I COURSE PRE-REQUISITES:

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

II COURSE OVERVIEW:

This course covers advanced techniques for writing exploits and patching vulnerabilities, taught through an intense, hands-on security laboratory. It deals about the cyber attackers, their tactics, social engineering, and high-profile case studies. This course covers a variety of topics including reverse engineering, exploitation, binary analysis, and web.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Soft Computing Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

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

V EVALUATION METHODOLOGY:

Each lab will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day to day performance and 10 marks for the final internal lab assessment. The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being a internal examiner and another is external examiner, both nominated by the Principal from the panel of experts recommended by Chairman, BOS.
All the drawing related courses are evaluated in line with lab courses. The distribution shall be 30 marks for internal evaluation (20 marks for day–to–day work, and 10 marks for internal tests) and 70 marks for semester end lab examination. There shall be ONE internal test for 10 marks each in a semester.
The emphasis on the experiments is broadly based on the following criteria given in Table: 1

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

Continuous Internal Assessment (CIA):

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

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

Continuous Internal Examination (CIE):

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

1. **Experiment Based**

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

2. **Programming Based**

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

VI COURSE OBJECTIVES:

The students will try to learn:

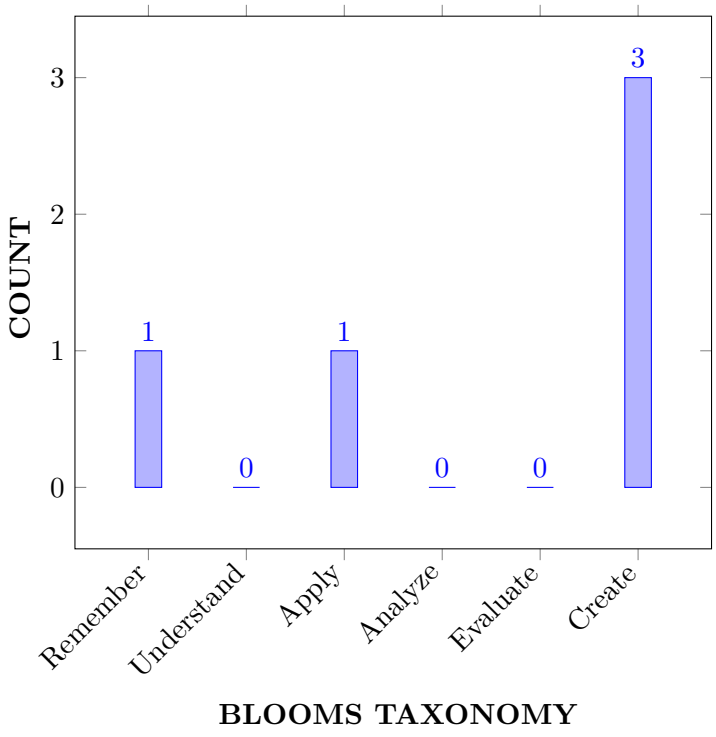
I	The implement of cryptographic algorithms.
II	How to identify, analyze, and remediate computer security breaches.
III	The key cyber security vendors in the marketplace.
IV	The importance of digital signatures algorithms.

VII COURSE OUTCOMES:

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

CO 1	**Develop** an ANN model with or without backpropagation.	Create
CO 2	**Show** fuzzy relations on fuzzy relations to handle uncertainty and solve engineering problems	Remember
CO 3	**Apply** genetic algorithms to optimization problems	Apply
CO 4	**Use the** ANOVA model for analyzing the covariance of data.	Create
CO 5	**Solve** real problems using a soft computing approach.	Create

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	Independently carry out research/investigation and development work to solve practical problems.
PO 2	Write and present a substantial technical report/document.

Program Outcomes	
PO 3	Demonstrate a degree of mastery in computer science and engineering emerging areas such as data science, cyber security, and application development
PO 4	Identify, formulate and solve real-time problems with advanced-level knowledge, techniques, skills, and modern tools in computer science thrust areas.
PO 5	Function effectively in multidisciplinary environments with the knowledge of frontier technologies by working cooperatively, creatively, and responsively as a member or leader in diverse teams.
PO 6	Engage in life-long learning for continuing education in doctoral-level studies and professional development.

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO1	Analyze a problem, identify and define computing requirements, design and implement appropriate solution	2	Laboratory practices, student viva
PO2	Solve complex heterogeneous data intensive analytical based problems of real time scenario using state of the art hardware/software tools	1	Laboratory Practices, student viva
PO 5	Independently carry out research/investigation and development work to solve practical problems	2	Laboratory Practices, student viva
PO 6	To engage in life-long learning and professional development through self-study, continuing education, professional and doctoral level studies.	3	Laboratory Practices, Mini-Project

3 = High; 2 = Medium; 1 = Low

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

COURSE OUTCOMES	PROGRAM OUTCOMES					
	PO 1	PO 2	PO 3	PO4	PO 5	PO 6
CO 1	3	3	3	1	3	2
CO 2	3	3	3	1	3	2
CO 3	3	3	3	1	3	2
CO 4	3	3	3	1	3	2
CO 5	3	3	3	3	3	2

XI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	✓	Student Viva	✓	Certification	-

XII ASSESSMENT METHODOLOGY INDIRECT:

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

XIII SYLLABUS:

WEEK I	**PERCEPTRON**
	Create a perceptron with appropriate number of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights .
WEEK II	**ARTIFICIAL NEAURAL NETWORKS**
	Write a program to implement artificial neural network without back propagation. Write a program to implement artificial neural network with back propagation.
WEEK III	**FUZZY SETS**
	Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform max-min composition on any two fuzzy relations.
WEEK IV	**GENETIC ALGORITHMS**
	Implement travelling sales person problem (TSP) using genetic algorithms.
WEEK V	**COVARIANCE**
	Plot the correlation plot on dataset and visualize giving an overview of relationships among data on soya bins data. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data..
WEEK VI	**DATA FITTING BY REGRESSION**
	Implement linear regression and multi-regression for a set of data points.
WEEK VII	**CRISP MODEL**
	Implement crisp partitions for real-life iris dataset.
WEEK VIII	**PERCEPTRON RULE**
	Write a program to implement Hebb's rule Write a program to implement Delta rule.
WEEK IX	**LOGIC GATES**
	Write a program to implement logic gates.
WEEK X	**CLASSIFICATION**
	Implement SVM classification by Fuzzy concepts.

TEXTBOOKS

1. J. S. R. Jang, C. T. Sun, E. Mizutani, Neuro, "Fuzzy and Soft Computing", PHI, Pearson Education, 1st Edition, 2004.

2. S. N. Sivanandan, S. N. Deepa, "Principles of Soft Computing", Wiley India, 2nd Edition, 2007.

REFERENCE BOOKS:

1. D.K Prathikar, "Soft Computing", Narosa Publishing House, New Delhi, 2008.

XIV COURSE PLAN:

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

S.No	Topics to be covered	CO's	Reference
1	Learning Algorithms and finding final weights .	CO 1	T1:1.1,1.2
2	implement artificial neural network without back propagation.	CO 1	T1:1.1,1.3
3	implement artificial neural network with back propagation.	CO 1	T1:9,1.4
4	Implement Union, Intersection, Complement and Difference operations on fuzzy sets.	CO 1	T1:10.1,1.3
5	plot the Correlation	CO 1	T1:11.1,1.5
6	Implement travelling sales person problem (TSP) using genetic algorithms. .	CO 1	T1:10.1,1.3
7	plot on dataset and visualize	CO 2	T2:11.2-11.4
8	Analysis of covariance: .	CO 3	T2:9.1,1.6
9	Implement linear regression and multi-regression for a set of data points.	CO 2	T2:10.2-11.4
10	Implement crisp partitions for real-life iris dataset.	CO 3	T2:9.2-11.4
11	implement Hebb's rule	CO 3	T1:12,1.9
12	implement Delta rule.	CO 4	T2:1.1,1.5
13	implement logic gates.L	CO 4	T2:8.2-11.4
14	Implement SVM classification by Fuzzy concepts.	CO 4	T2:13.2-11.4

XV EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	Artificial Neural Network
2	Fuzzy sets
3	Covariance
4	LOgic Gates
5	Classification

Signature of Course Coordinator **HOD,CSE**
Mr. N. Rajasekhar, Assistant Professor

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

COMPUTER SCIENCE ENGINEERING
COURSE DESCRIPTION

Course Title	**CYBER SECURITY LABORATORY**				
Course Code	BCSC24				
Program	M.Tech				
Semester	II				
Course Type	Laboratory				
Regulation	PG-21				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	3	2
Course Coordinator	Ms. V Divyavani, Assistant Professor				

I COURSE PRE-REQUISITES:

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

II COURSE OVERVIEW:

This course covers advanced techniques for writing exploits and patching vulnerabilities, taught through an intense, hands-on security laboratory. It deals about the cyber attackers, their tactics, social engineering, and high-profile case studies. This course covers a variety of topics including reverse engineering, exploitation, binary analysis, and web.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Cyber Security Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

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

V EVALUATION METHODOLOGY:

Each lab will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day to day performance and 10 marks for the final internal lab assessment. The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being a internal examiner and another is external examiner, both nominated by the Principal from the panel of experts recommended by Chairman, BOS.
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20 %	Objective	Purpose
20 %	Analysis	Algorithm
20 %	Design	Programme
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Continuous Internal Assessment (CIA):

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

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

Continuous Internal Examination (CIE):

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

1. **Experiment Based**

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

2. **Programming Based**

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

VI COURSE OBJECTIVES:

The students will try to learn:

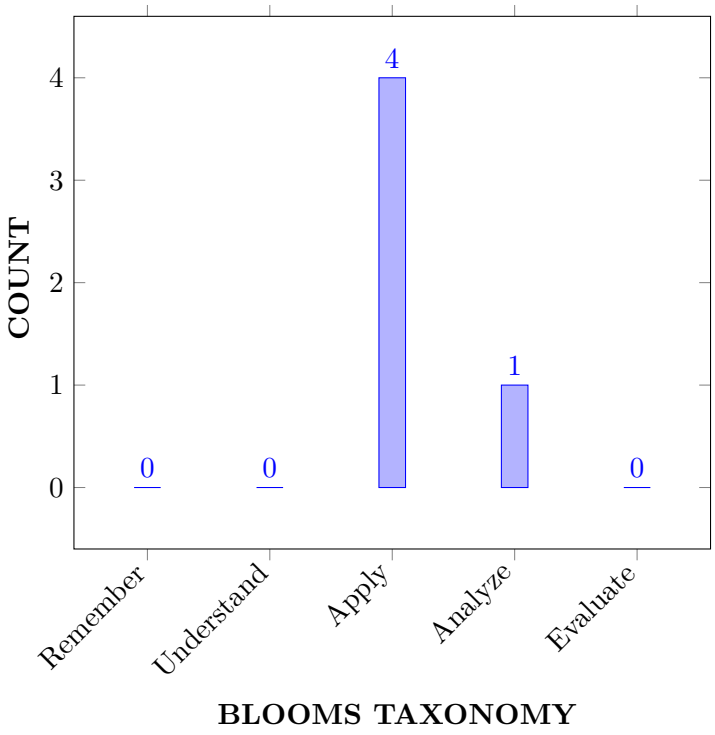
I	The implement of cryptographic algorithms.
II	How to identify, analyze, and remediate computer security breaches.
III	The key cyber security vendors in the marketplace.
IV	The importance of digital signatures algorithms.

VII COURSE OUTCOMES:

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

CO 1	**Implement** encryption and decryption techniques for providing informations security.	Apply
CO 2	**Analyze** the impact of public key cryptosystems for secure exchange of information	Analyze
CO 3	**Construct** a signature scheme using Digital standard.	Apply
CO 4	**Use** hashing and authentication for implementing data integrity.	Apply
CO 5	**Develop** firewall for detecting malicious activity over the network.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	Independently carry out research/investigation and development work to solve practical problems.
PO 2	Write and present a substantial technical report/document.

Program Outcomes	
PO 3	Demonstrate a degree of mastery in computer science and engineering emerging areas such as data science, cyber security, and application development
PO 4	Identify, formulate and solve real-time problems with advanced-level knowledge, techniques, skills, and modern tools in computer science thrust areas.
PO 5	Function effectively in multidisciplinary environments with the knowledge of frontier technologies by working cooperatively, creatively, and responsively as a member or leader in diverse teams.
PO 6	Engage in life-long learning for continuing education in doctoral-level studies and professional development.

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO1	Analyze a problem, identify and define computing requirements, design and implement appropriate solution	2	Laboratory practices, student viva
PO2	Solve complex heterogeneous data intensive analytical based problems of real time scenario using state of the art hardware/software tools	1	Laboratory Practices, student viva
PO 5	Independently carry out research/investigation and development work to solve practical problems	2	Laboratory Practices, student viva
PO 6	To engage in life-long learning and professional development through self-study, continuing education, professional and doctoral level studies.	3	Laboratory Practices, Mini-Project

3 = High; 2 = Medium; 1 = Low

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

COURSE OUTCOMES	PROGRAM OUTCOMES					
	PO 1	PO 2	PO 3	PO4	PO 5	PO 6
CO 1	3	2	2	2	5	2
CO 2	3	2	2	2	5	2
CO 3	3	2	2	2	5	2
CO 4	3	2	2	2	5	2
CO 5	3	2	2	2	5	2

XI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	✓	Student Viva	✓	Certification	-

XII ASSESSMENT METHODOLOGY INDIRECT:

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

XIII SYLLABUS:

WEEK I	**CIPHER ALGORITHM**
	Implementation of symmetric cipher algorithm (AES and RC4) .
WEEK II	**RANDOM NUMBER GENERATION**
	Random number generation using a subset of digits and alphabets.
WEEK III	**RSA ALGORITHM**
	Implementation of RSA based signature system
WEEK IV	**RANDOM NUMBER GENERATION**
	Implementation of Subset sum of numbers
WEEK V	**WEB TRANSACTIONS**
	Implementation of a trusted secure web transaction.
WEEK VI	**HASH ALGORITHM**
	Authenticating the given signature using MD5 hash algorithm
WEEK VII	**DIFFIE-HELLMAN ALGORITHM**
	Implementation of Diffie-Hellman algorithm.
WEEK VIII	**CRYPTOSYSTEM**
	Implementation EIGAMAL cryptosystem
WEEK IX	**PUBLIC KEY SYSTEM**
	Implementation of Goldwasser-Micali probabilistic public key system
WEEK X	**CRYPTOSYSTEM**
	Implementation of Rabin Cryptosystem
WEEK XI	**KERBEROS**
	Implementation of Kerberos cryptosystem
WEEK XII	**FIREWALL IMPLEMENTATION**
	Firewall implementation and testing.

TEXTBOOKS

1. Hacking: A Beginners' Guide to Computer Hacking, Basic Security, And Penetration Testing Author: John Slavio
2. Penetration Testing: A Hands-On Introduction to Hacking Author: Georgia Weidman

REFERENCE BOOKS:

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
2. Principles of Information Security, Whitman, Thomson.

XIV COURSE PLAN:

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

S.No	Topics to be covered	CO's	Reference
1	Understand ciper asymmetric techniques .	CO 1	T1:1.1,1.2
2	Understand AES and RC4 algorithm	CO 1	T1:1.1,1.3
3	Implement Random number	CO 1	T1:9,1.4
4	Implement random number using subset of digits	CO 1	T1:10.1,1.3
5	Implementation of RSA algorithm	CO 1	T1:11.1,1.5
6	Understand RSA algorithm based on signature system .	CO 1	T1:10.1,1.3
7	Understand the implementation of random number generation	CO 2	T2:11.2-11.4
8	Understand web transactions .	CO 3	T2:9.1,1.6
9	Implementation of trusted secure web transaction.	CO 2	T2:10.2-11.4
10	Implementation of hash algorithm	CO 3	T2:9.2-11.4
11	Implementation of signature using MD5	CO 3	T1:12,1.9
12	Implement Diffie hellman algorithm	CO 4	T2:1.1,1.5
13	Implement of EIGAMEL	CO 4	T2:8.2-11.4
14	Implement Rabin Cryptosystem	CO 4	T2:13.2-11.4

XV EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	Cipher Algorithm
2	RSA Algorithm
3	Random Number Generation
4	Cryptosystem .
5	Firewall Implementation

Signature of Course Coordinator **HOD,CSE**
Ms. V Divyavani, Assistant Professor

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

COMPUTER SCIENCE ENGINEERING
COURSE DESCRIPTION

Course Title	**CYBER SECURITY LABORATORY**				
Course Code	BCSC24				
Program	M.Tech				
Semester	II				
Course Type	Laboratory				
Regulation	PG-21				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	-	-	-	3	2
Course Coordinator	Dr. C.Madhusudhana Rao, Professor				

I COURSE PRE-REQUISITES:

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

II COURSE OVERVIEW:

This course covers advanced techniques for writing exploits and patching vulnerabilities, taught through an intense, hands-on security laboratory. It deals about the cyber attackers, their tactics, social engineering, and high-profile case studies. This course covers a variety of topics including reverse engineering, exploitation, binary analysis, and web.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Cyber Security Laboratory	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

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

V EVALUATION METHODOLOGY:

Each lab will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day to day performance and 10 marks for the final internal lab assessment. The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being a internal examiner and another is external examiner, both nominated by the Principal from the panel of experts recommended by Chairman, BOS.
All the drawing related courses are evaluated in line with lab courses. The distribution shall be 30 marks for internal evaluation (20 marks for day–to–day work, and 10 marks for internal tests) and 70 marks for semester end lab examination. There shall be ONE internal test for 10 marks each in a semester.
The emphasis on the experiments is broadly based on the following criteria given in Table: 1

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

Continuous Internal Assessment (CIA):

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

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

Continuous Internal Examination (CIE):

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

1. **Experiment Based**

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

2. **Programming Based**

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

VI COURSE OBJECTIVES:

The students will try to learn:

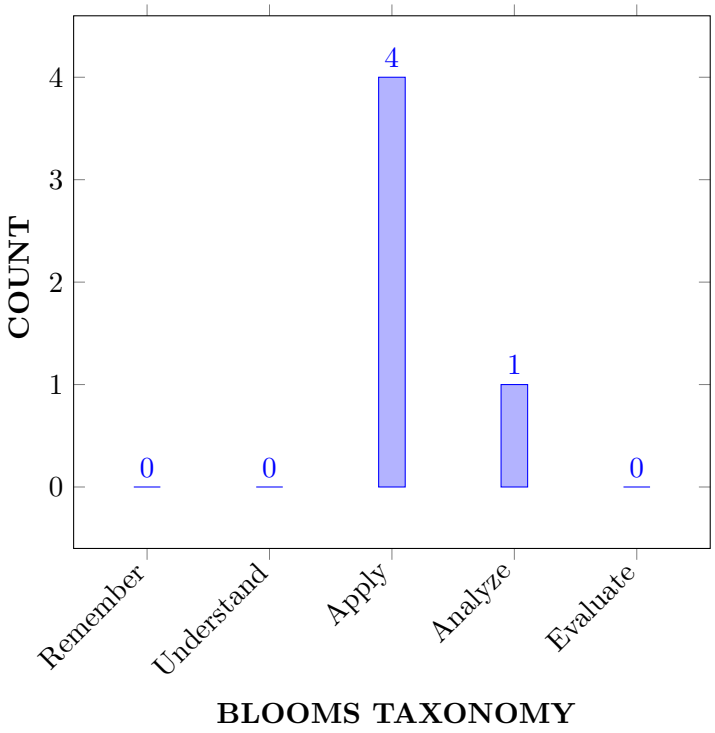
I	The implement of cryptographic algorithms.
II	How to identify, analyze, and remediate computer security breaches.
III	The key cyber security vendors in the marketplace.
IV	The importance of digital signatures algorithms.

VII COURSE OUTCOMES:

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

CO 1	**Implement** encryption and decryption techniques for providing informations security.	Apply
CO 2	**Analyze** the impact of public key cryptosystems for secure exchange of information	Analyze
CO 3	**Construct** a signature scheme using Digital standard.	Apply
CO 4	**Use** hashing and authentication for implementing data integrity.	Apply
CO 5	**Develop** firewall for detecting malicious activity over the network.	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	Independently carry out research/investigation and development work to solve practical problems.
PO 2	Write and present a substantial technical report/document.

Program Outcomes	
PO 3	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
PO 4	Identify, formulate and solve real-time problems with advanced-level knowledge, techniques, skills, and modern tools in computer science thrust areas.
PO 5	Function effectively in multidisciplinary environments with the knowledge of frontier technologies by working cooperatively, creatively, and responsively as a member or leader in diverse teams.
PO 6	Engage in life-long learning for continuing education in doctoral-level studies and professional development.

IX HOW PROGRAM OUTCOMES ARE ASSESSED:

Program		Strength	Proficiency Assessed by
PO1	Analyze a problem, identify and define computing requirements, design and implement appropriate solution	2	Laboratory practices, student viva
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PO 6	To engage in life-long learning and professional development through self-study, continuing education, professional and doctoral level studies.	3	Laboratory Practices, Mini-Project

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

COURSE OUTCOMES	PROGRAM OUTCOMES					
	PO 1	PO 2	PO 3	PO4	PO 5	PO 6
CO 1	3	2	2	2	5	2
CO 2	3	2	2	2	5	2
CO 3	3	2	2	2	5	2
CO 4	3	2	2	2	5	2
CO 5	3	2	2	2	5	2

XI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminars	-
Laboratory Practices	✓	Student Viva	✓	Certification	-

XII ASSESSMENT METHODOLOGY INDIRECT:

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

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	Implementation of Diffie-Hellman algorithm.
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	Implementation of Goldwasser-Micali probabilistic public key system
WEEK X	**CRYPTOSYSTEM**
	Implementation of Rabin Cryptosystem
WEEK XI	**KERBEROS**
	Implementation of Kerberos cryptosystem
WEEK XII	**FIREWALL IMPLEMENTATION**
	Firewall implementation and testing.

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XIV COURSE PLAN:

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2	Understand AES and RC4 algorithm	CO 1	T1:1.1,1.3
3	Implement Random number	CO 1	T1:9,1.4
4	Implement random number using subset of digits	CO 1	T1:10.1,1.3
5	Implementation of RSA algorithm	CO 1	T1:11.1,1.5
6	Understand RSA algorithm based on signature system .	CO 1	T1:10.1,1.3
7	Understand the implementation of random number generation	CO 2	T2:11.2-11.4
8	Understand web transactions .	CO 3	T2:9.1,1.6
9	Implementation of trusted secure web transaction.	CO 2	T2:10.2-11.4
10	Implementation of hash algorithm	CO 3	T2:9.2-11.4
11	Implementation of signature using MD5	CO 3	T1:12,1.9
12	Implement Diffie hellman algorithm	CO 4	T2:1.1,1.5
13	Implement of EIGAMEL	CO 4	T2:8.2-11.4
14	Implement Rabin Cryptosystem	CO 4	T2:13.2-11.4

XV EXPERIMENTS FOR ENHANCED LEARNING (EEL):

S.No	Design Oriented Experiments
1	Cipher Algorithm
2	RSA Algorithm
3	Random Number Generation
4	Cryptosystem .
5	Firewall Implementation

Signature of Course Coordinator **HOD,CSE**
Dr. C.Madhusudhana Rao, Professor

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

Branch	**COMPUTER SCIENCE AND ENGINEERING**				
Course Title	**CYBER SECURITY**				
Course Code	BCSC13				
Program	M.Tech				
Semester	II	CSE			
Course Type	Core				
Regulation	IARE- PG21				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3		3
Course Coordinator	Ms. V Divyavani, Assistant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
UG	-	-	Computer Networks
UG	-	-	Information Security

II COURSE OVERVIEW:

This course focuses on the planning and execution of security measures to shield an organization's computer systems, networks, and network devices from infiltration and cyber-attacks. It covers topics such as overview of cybercrimes, computer security, cryptography algorithms, internet hacking and cracking, web hacking, cybercrime investigation, digital forensics and certificates, securing databases, laws and acts. This helps to build career opportunities as Cyber Security Analyst, Cyber Security Practitioner, Cyber Defense Analyst and Information Security Engineer in leading IT and Governmental Organizations.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Cyber Security	70 Marks	30 Marks	100

IV DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✓	PPT	✓	Chalk & Talk	✓	Assignments	✓	MOOC
x	Seminars	✓	Others	x			

V EVALUATION METHODOLOGY:

Each theory course will be evaluated for a total of 100 marks, out of which 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). **Semester End Examination (SEE):** The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of three 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
30 %	To test the analytical skill of the concept
20 %	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. CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Assignment and 05 marks for Alternative Assessment Tool (AAT). Two CIE Tests are Compulsory and sum of the two tests, along with the scores obtained in the assignment / AAT shall be considered for computing the final CIA of a student in a given course.

The CIE Tests/Assignment /AAT shall be conducted by the course faculty with due approval from the HOD. Advance notification for the conduction of Assignment/AAT is mandatory and the responsibility lies with the concerned course faculty. CIA is conducted for a total of 30 marks (Table 1), with 25 marks for Continuous Internal Examination (CIE), 05 marks for Quiz/ Alternative Assessment Tool (AAT).

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Assignment	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 25 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/Alternative Assessment Tool (AAT):
Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are be answered by choosing the correct answer from a given set of choices (commonly four). Marks shall be awarded considering the average of two quizzes for every course. The AAT may include seminars, assignments, term paper, open ended experiments, five minutes video and MOOCs.

VI COURSE OBJECTIVES:

The students will try to learn:

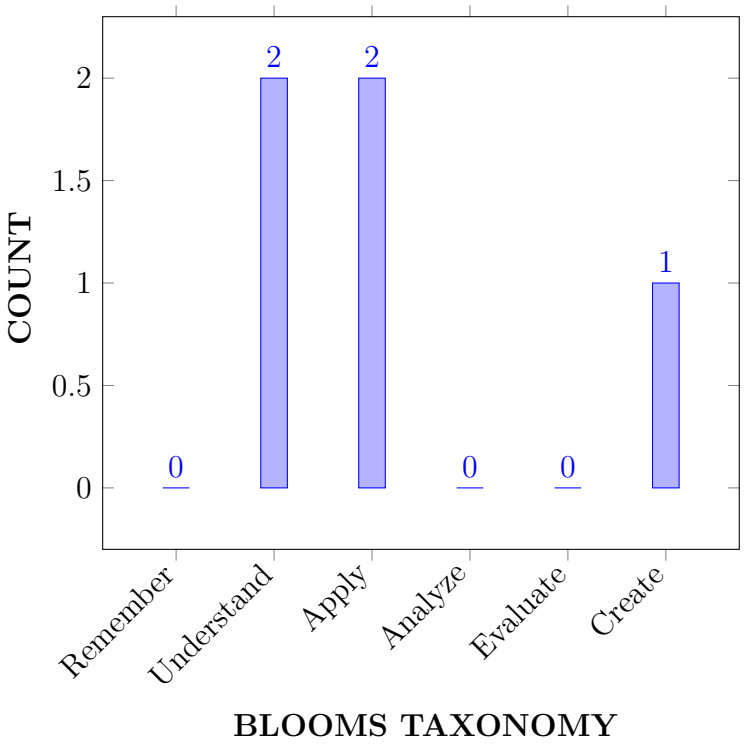
I	Preventing, monitoring, and responding to data breaches and cyber-attacks
II	The security assurance principles of information.
III	The key components of cyber security network architecture.
IV	The cyber security architecture principles.

VII COURSE OUTCOMES:

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

CO 1	**Summarize** web security concepts to overcome cyber crimes	Understand
CO 2	**Make use of** cryptography techniques for protecting systems from unauthorized access and information security.	Apply
CO 3	**Demonstrate** web hacking and cybercrime investigation tools for detecting and recovering in the web domain..	Apply
CO 4	**Identify** digital forensics procedures and policies to manage organizational security risks.	Understand
CO 5	**Recognize** database security concepts and cyber laws for data protection in digital space.	Create

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	Independently carry out research/investigation and development work to solve practical problems.
PO 2	Write and present a substantial technical report/document.
PO 3	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
PO 4	Apply advanced-level knowledge, techniques, skills, and modern tools in the field of computer science and engineering and its allied areas.
PO 5	Function effectively as a member or leader in diverse teams to carry out development work, and produce solutions that meet the specified needs with frontier technologies in multidisciplinary environments.
PO 6	Engage in life-long learning for continuing education in doctoral-level studies and professional development.

IX MAPPING OF EACH CO WITH PO(s):

COURSE OUTCOMES	**PROGRAM OUTCOMES**					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	✓	-	-	✓	✓	✓
CO 2	✓	-	-	✓	✓	✓
CO 3	✓	-	✓	✓	✓	✓
CO 4	✓	-	✓	✓	✓	✓
CO 5	✓	-	✓	✓	✓	✓

X COURSE ARTICULATION MATRIX (PO – PSO MAPPING):

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

COURSE OUTCOMES	**PROGRAM OUTCOMES**					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	-	-	3	1	2
CO 2	2	-	-	3	1	2
CO 3	2	-	3	3	1	2
CO 4	2	-	3	3	1	2
CO 5	2	-	3	3	1	2
TOTAL	10	-	9	15	5	10
AVERAGE	2	-	3	3	1	2

XI ASSESSMENT METHODOLOGY DIRECT:

CIE Exams	✓	SEE Exams	✓	Seminar and term paper	✓
Laboratory Practices	-	Student Viva	-	Mini Project	-

XII ASSESSMENT METHODOLOGY INDIRECT:

✓	**End Semester OBE Feed Back**

XIII SYLLABUS:

MODULE I	**INTRODUCTION**
	A web security forensic lesson, web languages, introduction to different web attacks, overview of n-tier web applications; Web servers: Apache, IIS, database servers, introduction and overview of cybercrime, nature and scope of cybercrime, types of cybercrime: social engineering, categories of cybercrime, property cybercrime.
MODULE II	**REVIEW OF COMPUTER SECURITY AND CYBER CRIME ISSUES**
	Public key cryptography, RSA, online shopping, payment gateways, unauthorized access to computers, computer intrusions, white collar crimes, viruses and malicious code, internet hacking and cracking, virus attacks, pornography, software piracy, intellectual property, mail bombs, exploitation, stalking and obscenity in internet, digital laws and legislation, law enforcement roles and responses.
MODULE III	**WEB HACKING BASICS AND INVESTIGATION**
	Web hacking basics HTTP and HTTPS URL, web under the cover overview of java security reading the HTML source, applet security, servlets security, symmetric and asymmetric encryptions, network security basics, firewalls and IDS. Investigation: Introduction to cybercrime investigation, investigation tools, e-discovery, digital evidence collection, evidence preservation, e-mail investigation, e-mail tracking, IP tracking, e-mail recovery, hands on case studies; Encryption and Decryption methods, search and seizure of computers, recovering deleted evidences, password cracking
MODULE IV	**DIGITAL CERTIFICATES AND DIGITAL FORENSICS**
	Digital certificates, hashing, message digest, and digital signatures; Digital forensics: Introduction to digital forensics, forensic software and hardware, analysis and advanced tools, forensic technology and practices, forensic ballistics and photography, face, iris and fingerprint recognition, audio video analysis, windows system forensics, Linux system forensics, network forensics.
MODULE V	**SECURING DATABASES, LAWS AND ACTS**

	Basics, secure JDBC, securing large applications, cyber graffiti; Laws and acts: Laws and ethics, digital evidence controls, evidence handling procedures, basics of Indian Evidence Act IPC and CrPC, electronic communication privacy act, legal policies.

TEXTBOOKS

1. Mc Clure, Stuart, Saumil Shah, Shreeraj Shah, —Web Hacking: Attacks and Defense‖, AddisonWesley Professional, Illustrated Edition, 2003.
2. Garms, Jess, Daniel Somerfield, —Professional Java Security‖, WroxPress, Illustrated Edition, 2001.
3. Jon Erickson -Hacking: The Art Of Exploitation, which was published in 2003

REFERENCE BOOKS:

1. Pfleeger, Charles P. and Shari L. Pfleeger. Security in Computing, 4th Edition. Upper Saddle River, NJ: Prentice Hall, 2008
2. Rice, David. Geekonomics: The Real Cost of Insecure Software. Upper Saddle River, NJ: Pearson Education, 2008.
3. Cyber Security Essentials,James Graham, Ryan Olson, Rick Howard, CRC Press
4. Peter Flach, "Machine Learning", Cambridge University Press, 1 st Edition, 2012

WEB REFERENCES:

1. Nelson Phillips, EnfingerSteuart, —Computer Forensics and Investigations‖, Cengage Learning, New Delhi,2009.
2. https://www.marwadiuniversity.ac.in/wp-content/uploads/2017/06/01cy102-advancenetworksecurity.pdf
3. https://www.simplilearn.com/tutorials/cyber-security-tutorial/cyber-security-books

COURSE WEB PAGE:

1. https://www.futurelearn.com/courses/introduction-to-cyber-security

XIV COURSE PLAN:

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

S.No	Topics to be covered	CO's	Reference
OBE DISCUSSION			
1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO-PO Mapping	-	
CONTENT DELIVERY (THEORY)			
1	A web security forensic lesson	CO 1	T1:1.1,1.2
2	web languages, introduction to different web attacks	CO 1	T1:2.1,2.2

3	overview of n-tier web applications	CO 1	T1:3.1, 3.2, 4.1, 4.2
4	Web servers:Apache, IIS, database servers, introduction and overview of cybercrime	CO 1	T2:1.1,1.3
5	nature and scope of cybercrime	CO 1	T2:1.1,1.7
6	types of cybercrime: social engineering, categories of cybercrime, property cybercrime	CO 1	T2:1.8-1.10
7	Public key cryptography, RSA, online shopping	CO 2	T2:11.2-11.4
8	payment gateways, unauthorized access to computers	CO 2	T2:11.6
9	computer intrusions, white collar crimes	CO 2	T2:11.7
10	viruses and malicious code, internet hacking and cracking	CO 2	T3:1.4.1
11	virus attacks, pornography, software piracy, intellectual property	CO2	T1:6.1,6.2
12	mail bombs, exploitation, stalking and obscenity in internet	CO2	T3: 3.3.7
13	digital laws and legislation, law enforcement roles and responses	CO2	T1:8.1, T3: 9.1
14	Web hacking basics HTTP and HTTPS URL	CO3	T3:9.2
15	web under the cover overview of java security reading the HTML source, applet security, servlets security, symmetric and asymmetric encryptions, network security basics, firewalls and IDS	CO 3	T3: 9.3
16	Investigation: Introduction to cybercrime investigation, investigation tools, e-discovery, digital evidence collection, evidence preservation	CO 3	T3: 9.3
17	e-mail investigation, e-mail tracking, IP tracking, e-mail recovery, hands on case studies	CO 3	T3:3.1, 3.2
18	Encryption and Decryption methods	CO 3	T3:3.2
19	search and seizure of computers, recovering deleted evidences, password cracking	CO 3	T3:18.3.4, 18.3
20	Digital certificates, hashing, message digest, and digital signatures	CO 4	T3:4.1
21	Digital forensics: Introduction to digital forensics, forensic software and hardware, analysis and advanced tools	CO 4	T3:18.1
22	forensic technology and practices, forensic ballistics and photography, face	CO 4	T3:15.1
23	iris and fingerprint recognition, audio video analysis, windows system forensics	CO 4	T3:15.1
24	Linux system forensics, network forensics	CO 4	T2:5.1, 5.8
25	Basics, secure JDBC, securing large applications, cyber graffiti	CO 5	T2:12.5,12.7

26	Laws and acts: Laws and ethics, digital evidence controls, evidence handling procedures	CO 5	T2:12.5, 12.8
27	basics of Indian Evidence Act IPC and CrPC	CO 5	T2:12.5, 12.9
27	Electronic communication privacy act, legal policies.	CO 5	T2:12.5, 12.10
DISCUSSION OF VARIOUS TOPICS			
1	Module I	CO 1	TB1
2	Module II	CO 2	TB1,TB3
3	Module III	CO 3	TB1,TB3
4	Module IV	CO 4	TB3
5	Module V	CO 5	TB2

Signature of Course Coordinator **HOD,CSE**
Ms. V Divyavanii, Assistant Professor

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

COURSE DESCRIPTION

Branch	**Computer Science and Engineering**				
Course Title	**Research Methodology and IPR**				
Course Code	BHSC11				
Program	M.Tech				
Semester	III				
Course Type	Core				
Regulation	IARE - PG21				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	2	-	2	-	-
Course Coordinator	Dr. Ch Srinivasulu, Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
M.Tech	-	-	-

II COURSE OVERVIEW:

This course provides the basic concepts on research methodology and intellectual property rights. This course emphasis on sampling techniques, data collection, writing Reports, Projects, Dissertations, thesis and articles for publication in academic journals, avail the intellectual property rights of the inventors or owners for their assets like patents on innovative design, copy rights on literary and artistic works, trademark on goods & services and geographical indications on products famous for specific geographical areas.This course makes use of the potential future economic benefits to the intellectual property owner or authorized user.

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Research Methodology and IPR	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

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

V EVALUATION METHODOLOGY:

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

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

be a maximum of two sub divisions in a question.
The expected percentage of cognitive level of the questions is broadly based on the criteria given in below Table.

50%	To test the objectiveness of the concept
30 %	To test the analytical skill of the concept
20 %	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 below table. CIA is conducted for a total of 30 marks, with 25 marks for Continuous Internal Examination (CIE) and 05 marks for Technical Seminar and Term Paper.

Component	Theory		Total Marks
Type of Assessment	CIE Exam	Technical Seminar and Term Paper	
CIA Marks	25	5	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 9^{th} and 17^{th} week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting consisting of 5 one mark compulsory questions in part-A and 4 questions in part-B. The student has to answer any 4 questions out of five questions, each carrying 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Technical Seminar and Term Paper
Two seminar presentations are conducted during I year I semester and II semester. For seminar, a student under the supervision of a concerned faculty member, shall identify a topic in each course and prepare the term paper with overview of topic. The evaluation of Technical seminar and term paper is for maximum of 5 marks. Marks are awarded by taking average of marks scored in two Seminar Evaluations.

VI COURSE OBJECTIVES:

The students will try to learn:

I	The knowledge on sources of research problem, data collection, analysis, and interpretation.
II	The importance of effective technical writing and analysis plagiarism.
III	The new developments in the law of intellectual property rights in order to bring progressive changes towards a free market society.

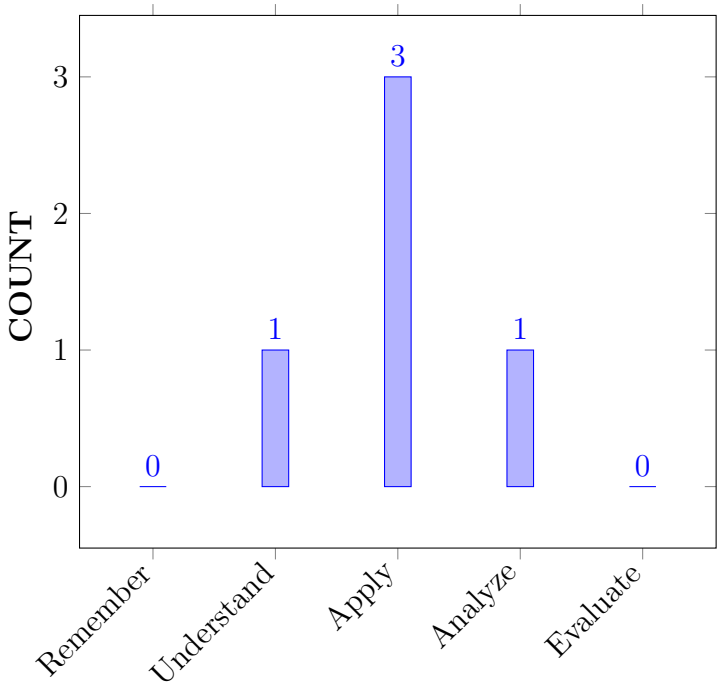
VII COURSE OUTCOMES:

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

CO 1	**Interpret** the technique of determining a research problem for a crucial part of the research study	Understand
CO 2	**Examine** the way of methods for avoiding plagiarism in research	Analyze
CO 3	**Apply** the feasibility and practicality of research methodology for a proposed project	Apply
CO 4	**Make use of** the legal procedure and document for claiming patent of invention.	Apply

CO 5	**Identify** different types of intellectual properties, the right of ownership, scope of protection to create and extract value from IP	Apply

COURSE KNOWLEDGE COMPETENCY LEVEL



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VIII PROGRAM OUTCOMES:

Program Outcomes	
PO 1	Independently carry out research / investigation and development work to solve practical problems.
PO 2	Write and present a substantial technical report / document.
PO 3	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level of higher than the requirements in the appropriate bachelor program.
PO 4	Identify, formulate, analyze and Design complex engineering problems, and design system components or processes by applying appropriate advanced principles of engineering activities and using modern tools.
PO 5	Engage in life-long learning and professional development through self-study and continuing education in understanding the engineering solutions in global and management principles to manage projects in multidisciplinary environments.
PO 6	Function effectively as a member or leader in diverse teams to carry out development work, produce solutions that meet the specified needs with frontier technologies and communicate effectively on complex engineering activities.

IX MAPPING OF EACH CO WITH PO(s):

COURSE OUTCOMES	PROGRAM OUTCOMES					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	✓	✓	-	-	-	✓
CO 2	✓	-	-	-	-	✓
CO 3	✓	✓	-		-	-
CO 4	✓	✓	-		-	-
CO 5	✓	-	-	-		✓

X JUSTIFICATIONS FOR CO – PO MAPPING -DIRECT:

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 1	**PO 1**	**Describe** the steps involved in **problem identification for the research process** with **quality of work** and **demonstrate the solutions**	4
	PO 2	**Demonstrate and communicate** effectively in writing the **research problem** with **clarity** and **subject the knowledge while preparing report**	4
	PO 6	**Describe** the importance of **continuing education efforts through literature, personal development, meeting deadlines** and **producing solutions** in research study	4
CO 2	**PO 1**	**Explain** the methods for avoiding plagiarism in research work for improving the **quality of work, self driven** and **Independence** in research process	3
	PO 6	**Describe** the methods for avoiding plagiarism in research work by **continuing education efforts through literature, manage risk, meeting deadlines** and **producing solutions**	3
CO 3	**PO 1**	**Describe** the steps of **problem identification and implementation** in development of **independence, quality of work** by using research methodology	3
	PO 2	**Demonstrate and communicate effectively in writing** a proposed project with **clarity** and avoid the mistakes in terms of **grammar (writing)** to **subject knowledge while preparing report**	4
CO 4	**PO 1**	**Demonstrate the solutions** and **self driven, independence** in work for copyright and **quality of work** in document	4
	PO 2	**Demonstrate and communicate** effectively in Process of applying **presenting** Patent with clarity and **subject knowledge** of intellectual property management for claiming patent of invention	3

Course Outcomes	PO'S PSO'S	Justification for mapping (Students will be able to)	No. of Key competencies matched.
CO 5	PO 1	**Demonstrate the solutions** to attain the right of ownership and **independence and self driven** for scope of protection	3
	PO 6	**Continuing education efforts through literature, demonstrated ability to work well with a team, meeting deadlines and producing solutions** for licensing and transfer of technology in patent rights	4

XI TOTAL COUNT OF KEY COMPETENCIES FOR CO – PO MAPPING:

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

XII PERCENTAGE OF KEY COMPETENCIES FOR CO – PO

COURSE OUTCOMES	PROGRAM OUTCOMES					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
	6	6	9	10	7	8
CO 1	66.6	66.6	-	-	-	50
CO 2	50	-	-	-	-	37.5
CO 3	50	66.6	-	-	-	-
CO 4	66.6	50	-	-	-	-
CO 5	50	-	-	-	-	50

XIII COURSE ARTICULATION MATRIX (PO MAPPING):

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

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

1 -$5 < C \leq 40\%$ – Low/ Slight

2 - $40\% < C < 60\%$ –Moderate

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

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

COURSE OUTCOMES	PROGRAM OUTCOMES					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 3	2	3	-	-	-	-
CO 4	3	2	-	-	-	-
CO 5	2	-	-	-	-	2
Total	12	8	-	-	-	5
Average	2.4	1.6	-	-	-	1

XIV ASSESSMENT METHODOLOGY-DIRECT:

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

XV ASSESSMENT METHODOLOGY-INDIRECT:

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

XVI SYLLABUS:

MODULE I	**INTRODUCTION**
	Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations
MODULE II	**RESEARCH ETHICS**
	Effective literature studies approaches, analysis Plagiarism, Research ethics.
MODULE III	**RESEARCH PROPOSAL**
	Effective technical writing, how to write report, Paper Developing a Research Proposal. Format of research proposal, a presentation and assessment by a review committee
MODULE IV	**PATENTING**
	Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT
MODULE V	**PATENT RIGHTS**
	Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs

TEXTBOOKS

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science and engineering students".
2. C R Kothari, "Research Methodology: Methods and techniques", New age international limited publishers, 1990 .
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"

REFERENCE BOOKS:

1. Halbert, "Resisting Intellectual Property", Taylor and Francis Ltd , 2007.
2. Mayall , "Industrial Design", McGraw Hill, 1992.
3. Niebel , "Product Design", McGraw Hill, 1974.

WEB REFERENCES:

1. Robert P. Merges, Peter S. Menell, Mark A. Lemley Age", 2016 , " Intellectual Property in New Technological Age", 2016
2. T. Ramappa, "Intellectual Property Rights Under WTO" S. Chand 2008
3. Peter-Tobias stoll, Jan busche, Katrianarend- WTO- Trade –related aspects of IPR-Library of Congress

COURSE WEB PAGE:

https://lms.iare.ac.in/index?route=course/details&course_id=367

XVII COURSE PLAN:

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

S.No	Topics to be covered	CO's	Reference
	OBE DISCUSSION		
0	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO-PO Mapping		
	CONTENT DELIVERY (THEORY)		
1	Introduction, Definition, types of research	CO 1	T1:2.1
2	Meaning of research problem	CO 1	T1:2.1
3	Sources of research problem	CO 1	T1:2.3
4	Criteria characteristics of good research problem	CO 1	T1:2.3.1
5	Research process	CO 1	T1:7.2
6	Research design	CO 1	T1:7.3
7	Errors in selecting a research problem	CO 1	T1:7.4
8	Scope and objectives of research problem	CO 1	T1:2.3
9	Approaches of investigation of solutions for research problem	CO 1	T1:7.4
10	Data collection	CO 1	T1:8.1
11	Analysis and interpretation of data	CO 1	T1:8.1.1
12	Necessary instrumentation's	CO 1	T1:8.1.1

13	Effective literature studies approaches	CO 2	T1:8.2
14	Literature	CO 2	T1:8.2
15	Literature review	CO 2	T1:8.2
16	Literature review techniques	CO 2	T1:8.2
17	Literature studies	CO 2	T1:8.2
18	Introduction to ethics, Importance of ethics	CO 2	T1:8.2
19	Ethical issues in conducting research	CO 2	T1:8.3
20	Principles of research ethics	CO 2	T1:8.4
21	Analysis	CO 2	T1:8.5
22	Plagiarism- types of plagiarism	CO 2	T1:8.6
23	Tips to avoid plagiarism	CO 2	T1:9.1
24	Other ethical issues	CO 2	T1:9.2, 9.3
25	Interpretation, Interpretation Techniques and precautions	CO 2	T2:9.3.4
26	Writing of report and steps involved	CO 3	T2:7.1
27	Layout of research report	CO 3	T2:7.2
28	Types of reports	CO 3	T2:7.3
29	Paper developing a research proposal	CO 3	T2:7.4
30	Format of research proposal	CO 4	T2:8.3
31	Presentation of report	CO 4	T2:8.4
32	Summary of findings	CO 4	T3:8.5
33	Assessment by review committee	CO 4	T3:8.6
34	Technical appendixes	CO 4	T3:8.6
35	Logical analysis of the subject matter	CO 4	T3:8.6
36	Statement of findings and recommendations	CO 4	T3:8.6
37	Introduction, Nature of Intellectual Property	CO 5	T3:10.1-10.6
38	Types of intellectual Property rights	CO 5	T3:10.1-10.6
39	Patents	CO 5	T3:11.10
40	Designs	CO 5	T3:11.10
41	Trademarks and copyrights: Definition, classification of trademarks	CO 5	T3:11.10
42	Process of Patenting and Development	CO 5	T3:11.14
43	Technical research, innovation, patenting	CO 5	T3:11.15
44	Developments in patenting	CO 5	T3:11.17
45	Patent Trademark Organization	CO 5	T3:11.17
46	International Organization, Agencies and Treaties	CO 5	T3:11.17
47	International scenario, international cooperation on Intellectual property	CO 5	T3:11.19
48	Procedure for grant of patents	CO 5	T3:11.21
49	procedure of copyright	CO 5	T1:8.1-8.3; R2: 7.4-7.5

50	Patenting under PCT, Provisional patent application	CO 5	T1-8.1-8.1.7
51	Patent protection for the invention	CO 5	T1-8.1-8.1.7
52	Patent Rights	CO 5	T3:12.1
53	Scope of Patent Rights	CO 5	T3:12.1
54	Licensing and transfer of technology	CO 5	T3:12.1
55	Patent information and databases	CO 5	T3:12.4
56	Geographical Indications	CO 5	T3:12.4
57	New Developments in IPR: Administration of Patent System	CO 5	T3:12.7
58	New developments in IPR, IPR of Biological Systems and Computer Software etc	CO 5	T3:12.10
59	Traditional knowledge Case Studies	CO 5	T3:12.13
60	IPR and IITs.	CO 5	T3:12.15
DISCUSSION ON VARIOUS TOPICS			
61	Module – I	CO 1	T1:2.1-2.3
62	Module – II	CO 2	T1:8.2
63	Module – IIIl	CO 3, CO 4	T3:8.3; R2: 7.4-7.5
64	Module – IV	CO 5	T3:10.1-10.6
65	Module – V	CO 5	T3:12.1-12.15

Signature of Course Coordinator **HOD,CSE**
Dr. Ch Srinivasulu, Professor

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

COMPUTER SCIENCE AND ENGINEERING
COURSE DESCRIPTION

Department	**COMPUTER SCIENCE AND ENGINEERING**				
Course Title	**MOBILE APPLICATIONS AND SERVICES**				
Course Code	BCSB22				
Program	M.Tech				
Semester	III				
Course Type	Core				
Regulation	PG-21				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	0	3	-	-
Course Coordinator	Mr. N Rajasekar, Assitant Professor				

I COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
UG	-	-	-

II COURSE OVERVIEW:

The Mobile Applications and Services course focuses on the development and design of mobile applications for various platforms, such as iOS and Android. This course provides an overview of the technologies, tools, and best practices used in mobile app development..

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIE Examination	Total Marks
Moblie Application and Service	70 Marks	30 Marks	100

IV CONTENT DELIVERY / INSTRUCTIONAL METHODOLOGIES:

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

V EVALUATION METHODOLOGY:

Each theory course will be evaluated for a total of 100 marks, out of which 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of three sub divisions in a question. .

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

Percentage of Cognitive Level	Blooms Taxonomy Level
50 %	To test the objectiveness of the concept
30 %	To test the analytical skill of the concept
20 %	To test the application skill of the concept

Continuous Internal Assessment (CIA):
Two CIE exams shall be conducted at the end of the 9th and 17th week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration, consisting of 5 one mark compulsory questions in part-A and 4 questions in part-B. The student has to answer any 4 questions out of five questions, each carrying 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

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

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively. 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.

Technical Seminar and Term Paper:
Two seminar presentations are conducted during I year I semester and II semester. For seminar, a student under the supervision of a concerned faculty member, shall identify a topic in each course and prepare the term paper with overview of topic. The evaluation of Technical seminar and term paper is for maximum of 5 marks. Marks are awarded by taking average of marks scored in two Seminar Evaluations.

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

VI COURSE OBJECTIVES:

The students will try to learn:

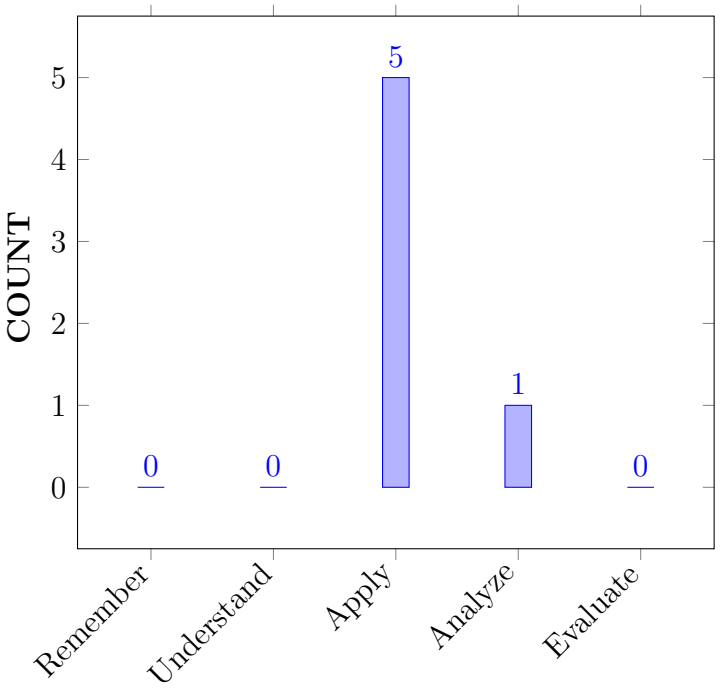
I	Understand the three main mobile platforms and their ecosystems, namely Android, iOS, and Phone Gap / Web OS and designing and develop mobile applications using a chosen application development framework
II	Explores emerging technologies and tools used to design and implement.
III	Explore the techniques for deploying and testing mobile applications, and for enhancing their performance and scalability account of communications via network by wireless connectivity.
IV	Prepare mobile application for multimedia and learn about additional issue like security, hacking etc.,

VII COURSE OUTCOMES:

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

CO 1	**Summarize** Select suitable software tools and APIs for the development of a particular mobile application	Apply
CO 2	**Make use of** Use Intents to dial a number or to send SMS Broadcast Receivers. .	Apply
CO 3	**Choose** Create a file and reading data from files using Persistent Storage	Apply
CO 4	**Summarize** Use a content provider for inserting, deleting, retrieving and updating data using SQlite	Understand
CO 5	**Construct** Choose an appropriate application development to design, write and test small interactive programs for mobile devices.	Apply
CO 6	**Compare** various networking models (OSI, TCP/IP) in terms of design parameters and communication modes.	Analyze

COURSE KNOWLEDGE COMPETENCY LEVEL



VIII PROGRAM OUTCOMES:

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

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

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

X COURSE ARTICULATION MATRIX (PO / PSO MAPPING):

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

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

XI ASSESSMENT METHODOLOGY-DIRECT:

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

XII ASSESSMENT METHODOLOGY-INDIRECT:

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

XIII SYLLABUS:

MODULE I	INTRODUCTION TO MOBILE COMPUTING
	Introduction: Introduction to Mobile Computing, Introduction to Android Development Environment, Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development Android User.

MODULE II	**MOBILE COMPUTING -MORE ON UIS**
	More on UIs: VUIs and Mobile Apps, Text-to-Speech Techniques, Designing the Right UI, Multichannel and Multimodal UIs, . Storing and Retrieving Data, Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider
MODULE III	**NETWORK AND THE WEB:STATE MACHINE**
	Communications via Network and the Web: State Machine, Correct Communications Model, Android Networking and Web, Telephony Deciding Scope of an App, Wireless Connectivity and Mobile Apps, Android Telephony Notifications and Alarms: Performance, Performance and Memory Management, Android Notifications and Alarms, Graphics, Performance and Multithreading, Graphics and UI Performance, Android Graphics
MODULE IV	**PUTTING IT ALL TOGETHER AND MULTIMEDIA**
	Putting It All Together : Packaging and Deploying, Performance Best Practices, Android Field Service App, Location Mobility and Location Based Services Android Multimedia: Mobile Agents and Peer-to-Peer Architecture, Android Multimedia.
MODULE V	**PLATFORMS AND ADDITIONAL ISSUES ,SECURITY AND HACKING**
	Platforms and Additional Issues: Development Process, Architecture, Design, Technology Selection, Mobile App Development Hurdles, Testing, Security and Hacking , Active Transactions, More on Security, Hacking Android.

TEXTBOOKS

1. 1 Wei-Meng Lee, "Beginning Android"4 Application Development", 2012 by John Wiley Sons

REFERENCE BOOKS:

1. http://www.sctie.iitkgp.ernet.in/
2. http://www.rkala.in/softcomputingvideos.php
3. http://www.sharbani.org/home2/soft-computing-1
4. http://www.myreaders.info/html/soft-computing.html

WEB REFERENCES:

1. https://www.futurelearn.com/courses/introduction-to-cyber-security

COURSE WEB PAGE:

XIV COURSE PLAN:

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

S.No	Topics to be covered	CO's	Reference T1: 4.1
OBE DISCUSSION			

1	Course Description on Outcome Based Education (OBE): Course Objectives, Course Outcomes (CO), Program Outcomes (PO) and CO - PO Mapping	-	-
CONTENT DELIVERY (THEORY)			
1	Introduction to Mobile Computing,Introduction to Android Development Environment,	CO1	T1: 1.1
2	Factors in Developing Mobile Applications,	CO1	T1:1.2
3	Generic UI Development Android User	CO1	T1: 1.3
4	More on UIs: VUIs and Mobile Apps	CO1	T1:1.4
5	Text-to-Speech Techniques, Designing the Right UI,	CO1	T1: 1.5
6	Multichannel and Multimodal UIs Storing and Retrieving Data,	CO1	T1:7.1
7	Synchronization and Replication of Mobile Data,Getting the Model Right, Android Storing and Retrieving Data,	CO1	T1: 2.14
8	Communications via Network and the Web: State Machine, Correct Communications Model,	CO1	T1: 8.1
9	Android Networking and Web	CO1	T1: 8.2
10	Telephony Deciding Scope of an App, Wireless Connectivity and Mobile Apps,	CO2	T1: 10.0
11	Android Telephony Notifications and Alarms: Performance, Performance and Memory Management,	CO2	T1: 10.1
12	Android Notifications and Alarms,	CO2	T1: 10.1
13	Graphics, Performance and Multithreading	CO2	T1: 10.2
14	Graphics and UI Performance, Android Graphics	CO2	T1: 10.2
15	Putting It All Together : Packaging and Deploying	CO2	T1: 11.1
16	Performance Best Practices	CO2	T1: 11.2
17	Android Field Service App,	CO2	T1: 11.3
18	Multimedia: Mobile Agents and Peer-to-Peer Architecture,	CO2	T1:15.3
19	Android Multimedia	CO3	T1:19.1
20	Platforms and Additional Issues: Development Process,	CO3	T1: T1:19.1
21	Architecture	CO3	T1:19.1
22	Design, Technology Selection	CO3	T1:19.1
23	Mobile App Development Hurdles	CO3	T1:19.1
24	Testing,	CO3	T1:19.2
25	Security and Hacking ,	CO3	T1:19.2
26	Active Transactions,	CO4	T1:19.1
27	More on Security	CO4	T1:23.0
28	Hacking Android.	CO4	T1:23.1
29	Security and Hacking , More on Security	CO4	T1:23.1
30	Development Process, Platforms and Additional Issues	CO4	T1:23.2
DISCUSSION ON VARIOUS TOPICS			
1	MODULE -I	CO 1	T2:2.1
2	MODULE -II	CO 2	TB1,RF1,CWP
3	MODULE -III	CO 3	TB1,RF1,CWP

4	MODULE -IV	CO 4	TB1,RF1,CWP
5	MODULE -V	CO 5	TB1,RF1,CWP

Signature of Course Coordinator **HOD,CSE**
Mr N Rajasekar, Assitant Professor