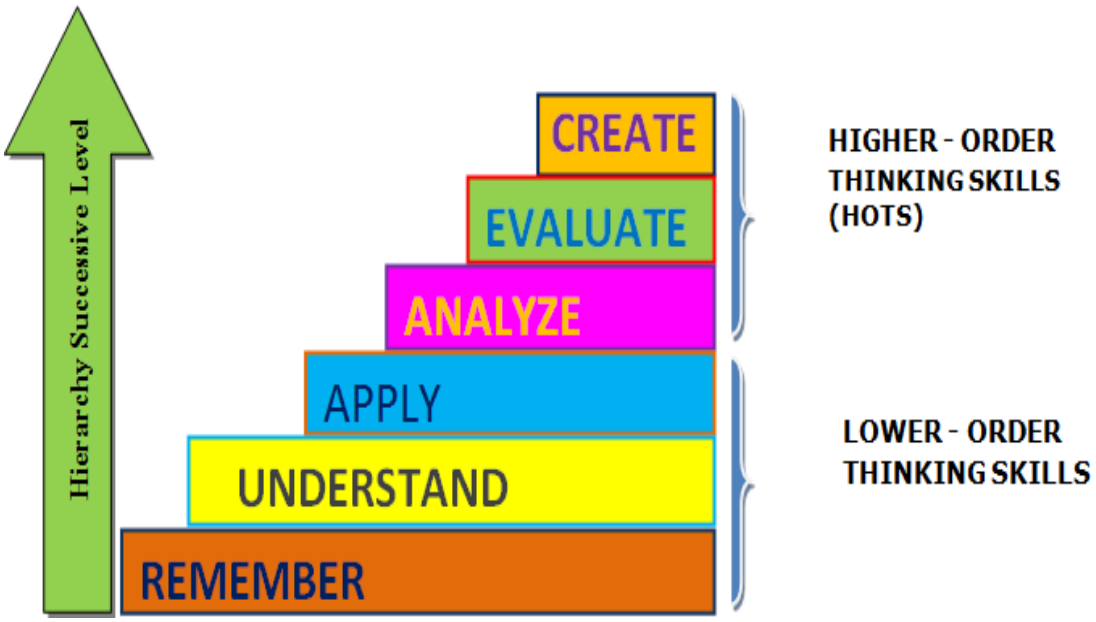
COURSE DESCRIPTOR BOOKLET

M. Tech

COMPUTER SCIENCE ENGINEERING

(Accredited by NBA)

R-18 REGULATIONS



BLOOM'S TAXONOMY OF LEARNING OUTCOMES

.....Moving Towards Perfection in Engineering

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

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

Vision

The Vision of the department is to produce competent graduates suitable for industries and organizations at global level including research and development with Social responsibility.

Mission

To provide an open environment to foster professional and personal growth with a strong theoretical and practical backgroundhaving an emphasis on hardware and software development making the graduates industry ready with social ethics.

Contents

Program Education Objectives and Outcomes

As Per NBA Norms Post June, 2015

Semester: I-I,I-II, II-I,& II-II

Part – I

PROGRAM EDUCATIONAL OBJECTIVES AND OUTCOMES

First version 22 July, 2014

Program Educational Objectives, Program Outcomes and Assessment Criteria (Approved by DAC CSE on 3/9/2014):

Computer Science and Engineering Department Advisory Council: The Computer Science and Engineering Department Advisory Council (CSEDAC) include a diverse group of experts from academic and industry, as well as alumni representation. The Advisory Board meets annually, or as needed, for a comprehensive review of the Computer Science and Engineering Department strategic planning and programs. The Advisory Council meets with administration, faculty and students and prepares a report, which is presented to principal. In each visit, the Department of Computer Science and Engineering responds to the report indicating improvements and amendments to the program.

1. PROGRAM EDUCATIONAL OBJECTIVES, OUTCOMES AND ASSESSMENT CRITERIA

Learning Outcomes, Assessment Criteria

The educational aims of a module are statements of the broad intentions of the teaching team. They indicate the objectives that the teaching team intends to cover and the learning opportunities that are necessary to be available to the student. A learning outcome is a statement that indicates the content that a learner (student) is expected to know, understand and/or be able to do at the end of a period of learning. It is advisable to express learning outcomes with the common prefix:

'On completion of (the period of learning e.g. module), the student is expected to be able to…'

Generally, learning outcomes do not specify curriculum, but more general areas of learning. It is not possible to prescribe precisely how specific a learning outcome statement should be. There is a balance to be struck between the degree of specificity in a learning outcome statement and that achieved by the assessment criteria. If there are too many learning outcomes for a module, then either they are becoming assessment criteria or they are specifying too much curricular detail. The curriculum should be described in the range statement. Too few learning outcomes are unlikely to provide sufficient information on the course. As a guide, there should be between 4 and 8 learning outcomes for a course.

The Program Educational Objectives (PEOs) of the Computer Science and Engineering department are broad statements or road maps describing career and professional objectives that intend the graduates to achieve through this program.

2. M. TECH – COMPUTER SCIENCE AND ENGINEERING PROGRAM

EDUCATIONAL OBJECTIVES

A Post graduate of Institute of Aeronautical Engineering in Computer Science and Engineering discipline should have a successful career in Computer Science and Engineering or a related field, and within three to five years, should attain the following:

PROGRAM EDUCATIONAL OBJECTIVES:

PEO-I	Independently design and develop computer software systems and products based on sound theoretical principles and appropriate software development skills.
PEO-II	Demonstrate knowledge of technological advances through active participation in life-long learning.
PEO-III	Accept to take up responsibilities upon employment in the areas of teaching, research, and software development.
PEO-IV	Exhibit technical communication, collaboration and mentoring skills and assume roles both as team members and as team leaders in an organization.

These objectives are quite broad by intention, as Computer Science and Engineering graduates may seek further education or work in diverse areas. To make these objectives meaningful, they may be demonstrated by performance, actions, or achievements.

i. To prepare the students who will be able to attain a solid foundation in Computer Science and engineering fundamentals with an attitude to pursue continuing education.

- Make the students to understand their aptitude to choose the correct path of study which leads to higher qualifications and heights in the chosen field.
- Should be prepared to undergo rigorous training in their fields of working.
- Be capable of utilizing the solid foundation obtained at institute to apply successfully in solving the real time engineering problems.
- Students need to have creative thinking processes that are acquired through good training to find solutions to engineering problems.

ii. To prepare the students to function professionally in an increasingly international and rapidly changing world due to the advances in technologies and concepts and to contribute to the needs of the society.

- Adoptability and accommodative mind set to suit modern world and changing economies.
- By working hard in the chosen field and sharing the professional experience at different forums within and outside the country.
- Desirable to be a member of various professional societies (IEEE, IETE, ISTE, IE, and etc.) to keep yourself abreast with the state-of-the-art technology.
- Should continue additional education in a broad range of subjects other than engineering may be needed in order to meet professional challenges efficiently and effectively.
- Continuous interaction with educational and research institutions or industrial research labs.
- Have a sound foundation of knowledge within a chosen field and achieve good depth and experience of practice in it.
- Able to relate knowledge within chosen field to larger problems in society and able to appreciate the interaction between science, technology, and society.
- Strong grasp of quantitative reasoning and an ability to manage complexity and ambiguity.
- To conduct research, and design, develop, test and oversee the development of electronic systems for global upliftment.
- Applying scientific knowledge to solve technical problems and develop products and services that benefit the society.
- An electronic engineer shall contribute to the society by research, design and development, testing and evaluation, application by manufacturing, maintenance by service, management and other functions like sales, customer service and etc.

iii. To prepare the students to acquire and exercise excellent leadership qualities, at various levels appropriate to their experience, to address issues in a responsive, ethical, and innovative manner.

- Gives ample opportunity to work in diverse fields to acquire leadership roles in professional circles outside the workplace.
- Should keep in mind that the opportunities may change with the times.
- Should be prepared for creative solo and collaborative brainstorming sessions.
- Be able to inspire the team with selfless motivation and attitude to achieve success.
- Ability to think laterally or at-least have a flexibility of thought and make choices based on the requirement for situation.

iv. To prepare the students who will be able to excel, in their careers by being a part of success and growth of an organization, with which they are associated.

- To achieve this, the focus should not be limited to an engineering curriculum and even to the class room.
- Continuing professional education by attending short term in courses design to update engineering skills.
- A lifelong commitment to learning new and specialized information.
- Should accept first person responsibility and should take the initiative in carrying out the work.
- Should be determined for the duty and dedicated to work and have passion for that.
- Be delight at work with a positive attitude.
- Should be a detailed worker so that one can be relied by the organization.

The department of Computer Science and Engineering periodically reviews these objectives and as part of this review process, encourages comments from all interested parties including current students, alumni, prospective students, faculty those who hire or admit our graduates to other programs members of related professional organizations, and colleagues from other educational Institutions.

3. M. TECH - COMPUTER SCIENCEAND ENGINEERING PROGRAM OUTCOMES

A graduate of the Computer Science and Engineering Program Outcomes will demonstrate:

PROGRAM OUTCOMES:

PO1: Analyze a problem, identify and define computing requirements, design and implement appropriate Solutions

PO2: Solve complex heterogeneous data intensive analytical based problems of real time scenario using State of the art hardware/software tools

PO3: Demonstrate a degree of mastery in emerging areas of CSE/IT like IoT, AI, Data Analytics, Machine Learning, cyber security, etc.

PO4: Write and present a substantial technical report/document

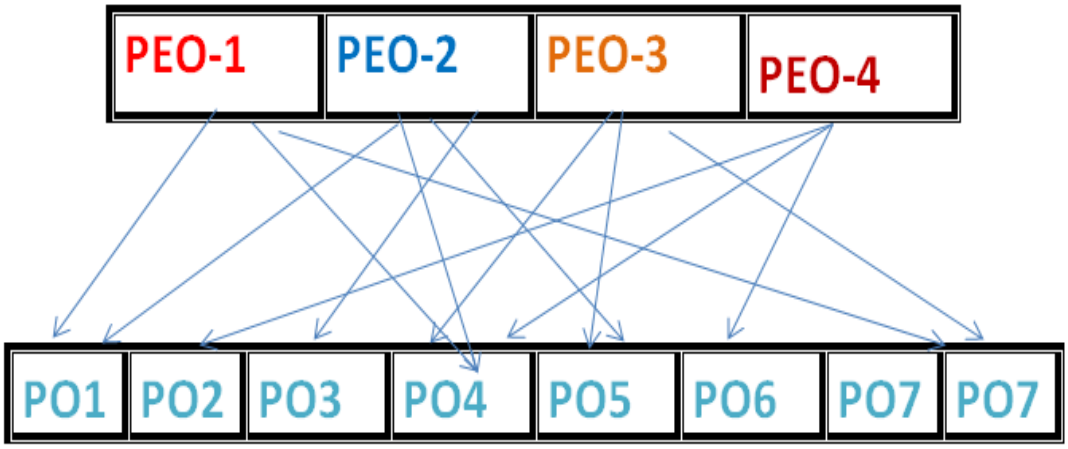
PO5: Independently carry out research/investigation and development work to solve practical problems

PO6: Function effectively on teams to establish goals, plan tasks, meet deadlines, manage risk and Produce deliverables

PO7: Engage in life-long learning and professional development through self-study, continuing education, professional and doctoral level studies.

4. MAPPING OF PROGRAM EDUCATIONAL OBJECTIVES TO PROGRAM OUTCOMES

The following Figure shows the correlation between the PEOs and the POs and PSOs



The following Table shows the correlation between the Program Educational Objectives and the Program Outcomes& Program Specific Outcomes

	Program Educational Objectives		Program Outcomes
I	Students will establish themselves as effective professionals by solving real problems through the use of computer science knowledge and with attention to team work, effective communication, critical thinking and problem solving skills.	**PO1**	Analyze a problem, identify and define computing requirements, design and implement appropriate solutions
		PO2	Solve complex heterogeneous data intensive analytical based problems of real time scenario using state of the art hardware/software tools
II	Students will develop professional skills that prepare them for immediate employment and for life-long learning in advanced areas of computer science and related fields.	**PO3**	Demonstrate a degree of mastery in emerging areas of CSE/IT like IoT, AI, Data Analytics, Machine Learning, cyber security, etc.
		PO4	Write and present a substantial technical report/document
		PO5	Independently carry out research/investigation and development work to solve practical problems
		PO6	Function effectively on teams to establish goals, plan tasks, meet deadlines, manage risk and produce deliverables
III	Students will be provided with an educational foundation that prepares them for excellence, leadership roles along diverse career paths with encouragement to professional ethics and active participation needed for a successful career.	**PO7**	Engage in life-long learning and professional development through self-study, continuing education, professional and doctoral level studies

5. RELATION BETWEEN THE PROGRAM OUTCOMES AND PROGRAM EDUCATIONAL OBJECTIVES

A broad relation between the Program Educational Objectives and the Program Outcomes is given in the following table:

PEOs → / POs ↓	(1) Excellence in Career	(2) Professional Effectiveness And Contribution to Society	(3) Continuing Education	(4) Exercising Leadership
PO1	3		2	3
PO2	3		2	
PO3	2	3	2	
PO4	2	3		
PO5		S	3	
PO6	2	3	3	
PO7	2	3	3	

Relationship between Program Outcomes and Program Educational Objectives
Key: 3 = Highly Related; 2 = Supportive

Note:

- The assessment process can be direct or indirect.
- The direct assessment will be through interim assessment by the faculty or by industry / technology experts.
- The indirect assessment on the other hand could be by students through course outcomes, lab evaluation, department associations, exit interviews, engineering services, GATE etc.
- Frequency of assessment can be once in a semester and justified by the program coordinator.

I SEMESTER

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

Computer Science and Engineering

COURSE DESCRIPTOR

Course Title	**MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE**				
Course Code	**BCSB01**				
Programme	**M.Tech**				
Semester	**I**				
Course Type	**Core**				
Regulation	**R18**				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Practicals**	**Credits**
	3	**-**	**3**	**-**	**-**
Course Faculty	**Mr. P Ravinder, Assistant Professor**				

I. 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.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	AHS010	II	Probability and Statistics	3
UG	AHS013	III	Discrete Mathematical Structures	3

III. MARKS DISTRIBUTION

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

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	LCD / PPT	✔	Seminars	✔	Videos	✔	MOOCs
✘	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

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

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into five units 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 two sub divisions in a question.

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

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

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 1), with 25 marks for Continuous Internal Examination (CIE), 05 marks for Technical Seminar and Term Paper.

Table 1: Assessment pattern for CIA

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 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.

Technical Seminar and Term Paper:
Two seminar presentations and the term paper with overview of topic are conducted during I semester. 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. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		**Strength**	**Proficiency assessed by**
PO 1	Analyze a problem, identify and define computing requirements, design and implement appropriate solutions	3	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	Seminar and Guest Lectures
PO 3	Demonstrate a degree of mastery in emerging areas of CSE/IT like IoT, AI, Data Analytics, Machine Learning, cyber security, etc.	3	Term Paper

PO 4	Write and present a substantial technical report/document	2	Term paper
PO 5	Independently carry out research/investigation and development work to solve practical problems	2	Guest Lecturers
PO 7	Engage in life-long learning and professional development through self-study, continuing education, professional and doctoral level studies	1	MOOCs and Guest Lecturers

3 = High; 2 = Medium; 1 = Low

VII. COURSE OBJECTIVES:

The course should enable the students to:

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

VIII. COURSE OUTCOMES (COs):

Cos	Course Outcome	CLOs	Course Learning Outcome
CO 1	Describe various concepts of probability theory and Distributions.	CLO 1	Understand basic concepts probability theory, mass, density etc.
		CLO 2	Analyse various Distribution Functions and apply to real world problems.
		CLO 3	Identify importance of the Central Limit Theorem, Markov chains
CO 2	Demonstrate sampling distributions of estimators and methods of moments.	CLO 4	Apply random sampling theory and distribution of estimators to various computer science applications
		CLO 5	Describe Methods of Moments and Maximum Likelihood to solve problems
CO 3	Explore statistical inference techniques and apply regression, PCA etc. for classification problems.	CLO 6	Construct and evaluate Regression models for classification problems
		CLO 7	Analyse importance of Principal component analysis in developing predictive models and exploratory data analysis.
		CLO 8	Understand problem of over fitting model and choose correct model.
CO 4	Enrich the knowledge on applications of graph theory and combinatorial problems.	CLO 9	Analyze Euler's and Hamilton rule for a simple connected graph in NP-complete problems.
		CLO 10	Solve discrete probability and set problems using permutations and combination.
		CLO 11	Identify the solution for various combinatorial enumeration problems
CO 5	Identify the applications of mathematical and statistical techniques to emerging areas of Information Technology.	CLO 12	Apply various graph theory concepts in Network protocol design, web traffic analysis and distributed systems
		CLO 13	Understand the basic concepts of Software Engineering, Computer Architecture
		CLO 14	Analyze applications of Statistics in Data mining , machine learning and Bioinformatics
		CLO 15	Understand operating system and distributed system concepts principles.

IX. COURSE LEARNING OUTCOMES(CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to	PO's Mapped	Strength of Mapping
BCSB01.01	CLO 1	Understand basic concepts probability theory, mass, density etc.	PO 1, PO 2	2
BCSB01.02	CLO 2	Analyse various Distribution Functions and apply to real world problems.	PO 1, PO 2	3
BCSB01.03	CLO 3	Identify importance of the Central Limit Theorem, Markov chains	PO 3	3
BCSB01.04	CLO 4	Apply random sampling theory and distribution of estimators to various computer science applications	PO 1, PO 4	3
BCSB01.05	CLO 5	Describe Methods of Moments and Maximum Likelihood to solve problems	PO 1, PO 3	3
BCSB01.06	CLO 6	Construct and evaluate Regression models for classification problems	PO 2, PO 3, PO 7	2
BCSB01.07	CLO 7	Analyse importance of Principal component analysis in developing predictive models and exploratory data analysis.	PO 1, PO 3	3
BCSB01.08	CLO 8	Understand problem of over fitting model and choose correct model.	PO 2, PO 4	2
BCSB01.09	CLO 9	Analyze Euler's and Hamilton rule for a simple connected graph in NP-complete problems.	PO 2, PO 3	3
BCSB01.10	CLO 10	Solve discrete probability and set problems using permutations and combination.	PO 1, PO 3	3
BCSB01.11	CLO 11	Identify the solution for various combinatorial enumeration problems	PO 1	3
BCSB01.12	CLO 12	Apply various graph theory concepts in Network protocol design, web traffic analysis and distributed systems	PO 3, PO 4, PO 5	2
BCSB01.13	CLO 13	Understand the basic concepts of Software Engineering, Computer Architecture	PO 3, PO 7	2
BCSB01.14	CLO 14	Analyze applications of Statistics in Data mining , machine learning and Bioinformatics	PO 3, PO 4, PO 5, PO 7	2
BCSB01 .15	CLO 15	Understand operating system and distributed system concepts principles.	PO 3	2

3 = High; 2 = Medium; 1 = Low

X. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES

Course Outcomes (COs)	Program Outcomes (PO)					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 7
CO 1	3	2	3			
CO 2	3		3	2		
CO 3	3	3	2	2		1
CO 4	3		3			
CO 5			3		2	1

XI. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES

Course Learning Outcomes (CLOs)	Program Outcomes (PO)					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 7
CLO 1	3	1				
CLO 2	2	3				
CLO 3			3			
CLO 4	3			2		
CLO 5	3		2			
CLO 6		3	2			1
CLO 7	3		2			
CLO 8		2		2		
CLO 9		2	3			
CLO 10	3		3			
CLO 11	3					
CLO 12			2	2	2	
CLO 13			3			1
CLO 14			2	3	2	2
CLO 15			3			1

3 = High; 2 = Medium; 1 = Low

XII. ASSESSMENT METHODOLOGIES –DIRECT

CIE Exams	PO1, PO2, PO 3, PO5	SEE Exams	PO1, PO2, PO 3, PO5	Seminar and Term Paper	PO1, PO2, PO 3, PO 4, PO5
Viva	-	Mini Project	-	Laboratory Practices	-

XIII. ASSESSMENT METHODOLOGIES -INDIRECT

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

XIV. SYLLABUS:

UNIT 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.

UNIT II
RANDOM SAMPLES Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood
UNIT III
STATISTICAL INTERFACE Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis, The problem of over fitting model assessment.
UNIT IV
STATIST GRAPH THEORY ICAL INTERFACE 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
UNIT 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
2. K Trivedi. "Probability and Statistics with Reliability, Queuing, and Computer Science Applications". Wiley..
3. M. Mitzenmacher and E. Upfal." Probability and Computing: Randomized Algorithms and Probabilistic Analysis". Wiley
4. Alan Tucker, "Applied Combinatorics", Wiley
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.

XV. COURSE PLAN:

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

Lecture No	Topic Outcomes	Topic/s to be covered	Reference
1-3	Understand basic concepts probability theory, mass, density etc.	Probability mass, density, cumulative distribution functions, Parametric families of distributions	T2:1,5
4-6	Analyse various Distribution Functions and apply to real world problems	Expected value, variance, conditional expectation Applications of the univariate Central Limit Theorem	T2:4
7-8	Identify importance of the Central Limit Theorem, Markov chains	Multivariate Central Limit Theorem, Probabilistic inequalities, Markov chains	T2:7,8
9-13	Apply random sampling theory and distribution of estimators to various computer science applications	Random samples, sampling distributions of estimators	T2:2,3
14-17	Describe Methods of Moments and Maximum Likelihood to solve problems	Methods of Moments and Maximum Likelihood	T2: 5,T3:3
18-21	Construct and evaluate Regression models for classification problems	Statistical inference, Introduction to multivariate statistical models: regression	T2:10
22-26	Analyse importance of Principal component analysis in developing predictive models and exploratory data analysis	Regression and classification problems, Principal components analysis, The problem of over fitting model assessment.	T2:11, T1:2, T3:4
27-31	Analyze Euler's and Hamilton rule for a simple connected graph in NP-complete problems.	Graph Theory: Isomorphism, Planar graphs, graph coloring, Hamilton circuits and Euler cycles	T4:1,2

Lecture No	Topic Outcomes	Topic/s to be covered	Reference
32-36	Identify the solution for various combinatorial enumeration problems	Permutations and Combinations with and without repetition, Specialized techniques to solve combinatorial enumeration problems	T4:5,6
37-41	Analyze applications of Statistics and graph theory in Data mining , machine learning, Networks	Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems	R1, R2
42-45	Apply various graph theory concepts in Network protocol design, web traffic analysis and distributed systems	Bioinformatics, Machine learning. Analysis, Analysis of opportunistic routing (Markov Chain) Advanced topics in wireless sensor networks	R2, R3

Prepared By:
Mr. P Ravinder, Assistant Professor

HOD, CSE

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTOR

Course Title	**ADVANCED DATA STRUCTURES**				
Course Code	**BCSB02**				
Program	**M.Tech**				
Semester	**I**				
Course Type	**Core**				
Regulation	R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	-	3	4	2
Course Faculty	Dr. D Kishore Babu, Professor, CSE				

I. COURSE OVERVIEW:

This course helps the students in gaining knowledge on C programming, applications, mathematical and engineering problems. This includes algorithms, analysis of algorithms, stacks, queues, linked list, binary trees, graphs, balanced search trees and pattern matching. This course is reached to student by power point presentations, lecture notes, and lab involve the problem solving in mathematical and engineering areas.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
-	-	-	C Programming

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Advanced Data Structures	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	LCD / PPT	✔	Seminars	✔	Videos	✔	MOOCs
✘	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

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

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into five units and each unit 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 unit. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

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

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

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 1), with 25 marks for Continuous Internal Examination (CIE), 05 marks for Technical Seminar and Term paper .

Table 1: Assessment pattern for CIA

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 9th and 17th week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Technical Seminar and Term Paper:
Two seminar presentations and the term paper with overview of topic are conducted during I semester. 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. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		**Strength**	**Proficiency assessed by**
PO 1	Analyze a problem, identify and define computing requirements, design and implement appropriate solutions	2	Seminars 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	1	Seminars and Term paper
PO3	Demonstrate a degree of mastery in emerging areas of CSE/IT like IoT, AI, Data Analytics, Machine Learning, cyber security, etc.	2	Seminars and Term paper

Program Outcomes (POs)		Strength	Proficiency assessed by
PO4	Write and present a substantial technical report/document	1	Seminars and Term paper
PO 5	Independently carry out research/investigation and development work to solve practical problems	1	Seminars and Term paper
PO6	Function effectively on teams to establish goals, plan tasks, meet deadlines, manage risk and produce deliverables	2	Seminars and Term paper
PO7	To engage in life-long learning and professional development through self-study, continuing education, professional and doctoral level studies.	3	Seminars and Term paper

3 = High; 2 = Medium; 1 = Low

VII. COURSE OBJECTIVES :

The course should enable the students to:

I	Understand the techniques of algorithm analysis and linear and non linear data structures
II	Explore on different types of data structures to solve variety of problems and compare their performance.
III	Understand the concepts of trees and graphs algorithms.
IV	Illustrate the implementation of linked data structures such as binary and AVL trees.
V	Learn advanced data structures such as Red-black and Splay trees.

VIII. COURSE OUTCOMES (COs):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Describe various, algorithms and analyze time and space complexity and implementation of abstract data types.	CLO 1	Analyze time and space complexity of an algorithm for their performance analysis
		CLO 2	Understand arrays, single and doubly linked lists in linear data structure and tress, graphs in non-linear data structure
		CLO 3	Master a variety of advanced abstract data type (ADT) and their implementations
CO 2	Find the solutions for heap and priority queue and various probing methods	CLO 4	Understand dynamic data structures and relevant standard algorithms
		CLO 5	Design and analyze and Concepts of heap, priority queue
		CLO 6	Analyze probing methods like linear probing and quadratic probing
CO 3	Demonstrate the implementation of hash table,linear list representation and graphs	CLO 7	Understand and implement hash table and linear list representation
		CLO 8	Understand the properties of binary tress and implement recursive and non-recursive traversals
		CLO 9	Understand graphs terminology, representations and traversals in Graphs
CO 4	Explore the shortest paths and implementation of avl trees	CLO 10	Implement Depth First Search and Breath First Searching methods of non – linear data structures and Analyze dijkstra's algorithm for single source shortest path problem
		CLO 11	Implement binary search ADT for finding parent node, smallest and largest values in binary search
		CLO 12	Understand and implement operations and applications of AVL Trees
CO 5	Describe applications of red black trees and	CLO 13	Understand and implement operations and applications of red-black and splay Trees
		CLO 14	Implement Huffman Coding and decoding for text

	implementation of compression		compression
		CLO 15	Possess the knowledge and skills for employability and to succeed in national and international level competitive examinations

IX. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
BCSB02.01	CLO 1	Analyze time and space complexity of an algorithm for their performance analysis	PO4	2
BCSB02.02	CLO 2	Understand arrays, single and doubly linked lists in linear data structure and tress, graphs in non-linear data structure	PO1,PO6	2
BCSB02.03	CLO 3	Master a variety of advanced abstract data type (ADT) and their implementations	PO1	3
BCSB02.04	CLO 4	Understand dynamic data structures and relevant standard algorithms	PO2	3
BCSB02.05	CLO 5	Design and analyze and Concepts of heap, priority queue	PO4	2
BCSB02.06	CLO 6	Analyze probing methods like linear probing and quadratic probing	PO3	1
BCSB02.07	CLO 7	Understand and implement hash table and linear list representation	PO6	2
BCSB02.08	CLO 8	Understand the properties of binary tress and implement recursive and non-recursive traversals	PO3	1
BCSB02.09	CLO 9	Understand graphs terminology, representations and traversals in Graphs	PO3	3
BCSB02.10	CLO 10	Implement Depth First Search and Breath First Searching methods of non – linear data structures and Analyze dijkstra's algorithm for single source shortest path problem	PO3	2
BCSB02.11	CLO 11	Implement binary search ADT for finding parent node, smallest and largest values in binary search	PO3	2
BCSB02.12	CLO 12	Understand and implement operations and applications of AVL Trees	PO5	1
BCSB02.13	CLO 13	Understand and implement operations and applications of red-black and splay Trees	PO6	1
BCSB02.14	CLO 14	Implement Huffman Coding and decoding for text compression	PO2	3
BCSB02.15	CLO15	Possess the knowledge and skills for employability and to succeed in national and international level competitive examinations	PO7	2

3 = High; 2 = Medium; 1 = Low

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

Course Outcomes (COs)	Program Outcomes (PO)					
	PO 1	PO 2	PO 3	PO 5	PO 6	PO 7
CO 1	2	1	1		1	
CO 2		1	1		1	
CO 3	2		2			
CO 4	1			2	2	

CO 5				2	1	2

XI. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES

Course Learning Outcomes (CLOs)	Program Outcomes						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CLO 1				2			
CLO 2	2					2	
CLO 3	3						
CLO 4		3					
CLO 5				2			
CLO 6	1						
CLO 7						2	
CLO 8	1						
CLO 9			3				
CLO 10			2				
CLO 11		2					
CLO 12					1		
CLO 13						1	
CLO 14		3					
CLO 15							2

3 = High; 2 = Medium; 1 = Low

XII. ASSESSMENT METHODOLOGIES–DIRECT

CIE Exams	PO2,PO3, PO4	SEE Exams	PO2,PO3, PO4	Seminars and Term Paper	PO2, PO6	Laboratory Practices	PO5
Student Viva	PO3	Mini Project	PO5				

XIII. ASSESSMENT METHODOLOGIES-INDIRECT

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

XIV. SYLLABUS

UNIT-I	OVERVIEW OF DATA STRUCTURES	Classes: 09
Algorithm analysis: Algorithms; Performance analysis: Time complexity and space complexity, asymptotic notation: Big Oh, omega and theta notations, complexity analysis examples; Data structures: Linear and non linear data structures, ADT concept, linear list ADT, stack and queue ADTs, array and linked list representations; Circular queue: Insertion and deletion, de queue ADT, priority queue ADT, implementation using heaps, insertion into a max heap, deletion from a max heap, singly linked lists, doubly linked lists, circular linked list.		
UNIT-II	**DICTIONARIES, HASH TABLES**	**Classes: 09**
Dictionaries: 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 .		
UNIT-III	**TREES AND GRAPHS**	**Classes: 09**
Trees: Ordinary and binary trees terminology, properties of binary trees, binary tree ADT, representations, recursive and non recursive traversals, threaded binary trees. Graphs: Graphs terminology, graph ADT, representations, graph traversals; Search methods: DFS and BFS; Applications of Graphs: Minimum cost spanning tree using Kruskal's algorithm, Dijkstra's algorithm for single source shortest path problem.		
UNIT-IV	**SEARCH TREES I**	**Classes: 09**
Binary search tree: Binary search tree ADT, insertion, deletion and searching operations, finding the parent of a given node, attaining a reference to a node, finding the smallest and largest values in the binary search tree; Balanced search trees: AVL trees, definition, height of an AVL tree Operations : Insertion, deletion and searching.		
UNIT-V	**SEARCH TREES II**	**Classes: 09**
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.		
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 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 E-Text 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.		

XV. COURSE PLAN:

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

Lecture No	Topic Outcomes	Topics to be covered	Reference
1-2	Understand the performance of algorithms and evaluate their complexities	Algorithm analysis: Algorithms; Performance analysis: Time complexity and space complexity.	T1: 1.1-1.2
3-5	Analyze asymptotic notations of various examples	Asymptotic notation: Big Oh, omega and Theta notations, complexity analysis examples.	T1: 1.3

Lecture No	Topic Outcomes	Topics to be covered	Reference
6-10	Understand linear and non linear data structures	Data structures: Linear and non linear data structures, ADT concept, linear list ADT, stack and queue ADTs, array and linked list representations; Circular queue: Insertion and deletion, de queue ADT, priority queue ADT	T2: 4.1-6.6
11-12	Describe insertion and deletion performed on data structures	Implementation using heaps, insertion into a max heap, deletion from a max heap, singly linked lists, doubly linked lists, circular linked list.	T3: 7.5
13-15	Implementation of dictionaries and representation of hash table	Dictionaries: Linear list representation, operations insertion, deletion and searching, hash table representation.	T1: 5.4-5.7
16-19	Implementing hashing tecniques	Hash functions, collision resolution, separate chaining, open addressing, linear probing, quadratic probing, double hashing, rehashing, extendible hashing.	T2:13.1-13.6
20-22	Understand the properties of binary trees	Trees: Ordinary and binary trees terminology, properties of binary trees, binary tree ADT.	T2:8.1-8.6
23-24	Understand the recursive and non recursive traversals of trees	Recursive and non recursive traversals, threaded binary trees.	T2:8.7-8.8
25-28	Understand the terminology of graphs	Graphs: Graphs terminology, graph ADT, representations, graph traversals; Search methods: DFS and BFS; Applications of Graphs.	T2:9.1-9.4
29-35	Designing shortest paths of graphs using various algorithms	Applications of Graphs: Minimum cost spanning tree using Kruskal's algorithm, Dijkstra's algorithm for single source shortest path problem.	T2:9.5
36-38	Implementing insertion,deletion and searching operations on trees	Binary search tree ADT, insertion, deletion and searching operations, finding the parent of a given node, attaining a reference to a node	T2:10.1-10.2
39-41	Implementing insertion,deletion and searching operations on AVL trees	AVL trees, Operations: Insertion, deletion and searching.	T2:10.3-10.4
42-43	Implementing insertion,deletion and searching operations on Red black and Splay trees	Red black and Splay trees, Operations: Insertion, deletion and searching.	T2:12.1-12.3
44-45	Understand compression techniques	Text compression: Huffman coding and decoding; Pattern matching: KMP algorithm.	T3:10.1

Prepared by:
Dr. D Kishore Babu, Professor, CSE **HOD, CSE**

INSTITUTE OF AERONAUTICAL ENGINEERING

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Dundigal, Hyderabad -500 043

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTOR

Course Title	**WIRELESS SENSOR NETWORKS**				
Course Code	BCSB04				
Programme	M. Tech				
Semester	I	CSE			
Course Type	Elective				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	-	3	-	-
Course Faculty	Dr. Y Mohana Roopa Professor, CSE				

I. COURSE OVERVIEW:

The course introduces the Basic concepts of wireless sensor networks, Architecture of a sensor node, Different sensing scenarios using WSN, Challenges in implementing WSNs, Sensor-web introduction, Types of sensor node behavior, Applications of sensor networks.

II. COURSE PRE-REQUISITES:

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

III. MARKSDISTRIBUTION:

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

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

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

V. EVALUATION METHODOLOGY:

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

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into five units 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 two sub divisions in a question.

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

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

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 1), with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Technical Seminar and Term Paper.

Table 1: Assessment pattern for CIA

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.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Strength	Proficiency assessed by
PO 1	An ability to independently carry out research/investigation and development work to solve practical problems	3	Open ended experiments
PO 3	An ability to analyze a problem, and to identify and define the computing requirements appropriate to its solution.	2	Seminar and Term paper
PO 4	An ability to design, implement and evaluate a computer-based solution to meet a given set of computing requirements in the context of the discipline.	1	Seminar and Term paper

3 = High; 2 = Medium; 1 = Low

VII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Summarize the fundamental knowledge on basics of wireless sensor networks and network simulator tool.
II	Develop programs in network simulator tool for understanding and visualization of different network algorithm.
III	Learn to apply hypotheses and data into actionable predictions.
IV	Understand a range of rooting algorithms along with their strengths and weaknesses.

VIII. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
BCSB04.01	CLO 1	Understand Fundamental concepts of wireless sensor networks and its applications.	PO1; PO3	2
BCSB04.02	CLO 2	Learn about network architecture techniques and find the differences between various types of network architecture.	PO1	2
BCSB04.03	CLO 3	Regain knowledge about the network hardware platforms.	PO4	2
BCSB04.04	CLO 4	Understand network simulators of different types and Explore on core network simulators.	PO1	3
BCSB04.05	CLO 5	Experience in implementation/modification of methods of medium access protocols in WSN.	PO3	2
BCSB04.06	CLO 6	Describe duty-cycled Markov chain models and the skill sets needed to be a network analysis.	PO4	2
BCSB04.07	CLO 7	Understand the concepts of discrete time Markov chain and its applications.	PO4	2
BCSB04.08	CLO 8	Identify the difference between asynchronous duty-cycled and Markov chain analysis.	PO3	1
BCSB04.09	CLO 9	Understand significance of Markov chain models in WSN.	PO1	3
BCSB04.10	CLO 10	Describe the possible attacks in WSN.	PO1; PO4	2
BCSB04.11	CLO 11	Apply basic SPINS concepts for predictive network performance.	PO3	1
BCSB04.12	CLO 12	Identify the difference between static and dynamic key distribution.	PO4	1
BCSB04.13	CLO 13	Identify common approaches used to routing protocols in MANETS.	PO4	1
BCSB04.14	CLO 14	Create effective results of data centric and geographic routing.	PO1	2
BCSB04.15	CLO 15	Understand the advanced topics in wireless sensor networks.	PO1; PO3	2

3 = High; 2 = Medium; 1 = Low

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

(CLOs)	Program Outcomes (POs)				
	PO1	PO2	PO3	PO4	PO5
CLO 1	3		2		
CLO 2	3				
CLO 3				2	
CLO 4	3				
CLO 5			2		
CLO 6				2	
CLO 7				2	
CLO 8			1		
CLO 9	3				
CLO 10	3			1	
CLO 11			2		
CLO 12					
CLO 13				1	
CLO 14	3				
CLO 15	2		2		

3 = High; 2 = Medium; 1 = Low

X. ASSESSMENT METHODOLOGIES–DIRECT

CIE Exams	PO1	SEE Exams	PO3	Seminar and Term paper	PO 1, PO 3, PO 4	Laboratory Practices	PO4
Student Viva	PO4	Mini Project	PO4	Certification	-		

XI. ASSESSMENT METHODOLOGIES-INDIRECT

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

XII. SYLLABUS

UNIT-I	INTRODUCTION TO WIRELESS SENSOR NETWORKING	Classes: 08
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.		
UNIT-II	**INTRODUCTION TO NS-3**	**Classes: 09**
Introduction to Network Simulator 3 (ns-3), Description of the ns-3 core module and simulation example.		
UNIT-III	**MEDIUM ACCESS CONTROL PROTOCOL DESIGN**	**Classes: 10**
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).		
UNIT-IV	**SECURITY**	**Classes: 09**
Possible attacks, countermeasures, SPINS, Static and dynamic key distribution		
UNIT-V	**ROUTING PROTOCOLS**	**Classes: 09**
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.		
Text Books:		
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. 3. Andreaws F. Molisch, "Wireless Communications", Wiley India, 2nd Edition, 2006.		

XIII. COURSE PLAN:

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

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Understand wireless sensor networks and applications	CLO1	T2:1.1
2	Applications of WSN	CLO3	T2:3.4
3	Performance of WSN	CLO3	T2:5.3.1
4-6	History and design, Network architecture and Layer designs	CLO5	T1:1.1.2.1
7-8	Sensor network, Motes, Hardware parameters	CLO5	T2:1.2.1/
9-10	Network Simulator	CLO5	T2:7.2
11-12	Medium Access	CLO4	T1:1.2.7
13	Control protocol, WSN protocols	CLO6	T2:1.1.1
14	Synchronized, Duty-cycled	CLO9	T1:1.1:1.1.1
15	Markov chain, Discrete time Markov Chain definition	CLO8	T1:12.5

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
16	Classification of Markov chain	CLO9	T2:5.4.2
17-18	MAC Protocol Analysis	CLO10	T2:Table 1.2
19-21	Security, SPINS, Static and dynamic key distribution	CLO7	T2:Table 4A.1
22-27	Routing Protocols, MANET protocols	CLO5	T1:6.3.1
28-35	Routing protocols for WSN, Data-centric, Geographic Routing	CLO11	T2:11.4.2
36-38	Analysis of opportunistic routing (Markov Chain)	CLO12	T2:5.3.2
39-45	Advanced topics in wireless sensor networks.	CLO15	T1:6.1

Prepared by:
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COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTOR

Course Title	**FOUNDATIONS OF DATA SCIENCE**				
Course Code	**BCSB06**				
Programme	**M.Tech**				
Semester	**I**				
Course Type	**Elective**				
Regulation	**R18**				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	**-**	**3**	**-**	**2**
Course Faculty	**Dr. G Ramu, Professor, CSE**				

I. COURSE OVERVIEW:

Data Science encompasses the use of mathematics, statistics, and computer science to study and evaluate data. This course is to extract valuable information for use in strategic decision making, product development, trend analysis and forecasting. It includes the processes derived from data engineering, statistics, programming, social engineering, data warehousing, machine learning and natural language processing.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	AHS010	II	Probability and Statistics	4
UG	ACS005	IV	Database Management Systems	4

III. MARKS DISTRIBUTION:

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

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	LCD / PPT	✔	Seminars	✔	Videos	✔	MOOCs
✘	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

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

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into five units 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 two sub divisions in a question.

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

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

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 1), with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Technical Seminar and Term Paper.

Table 1: Assessment pattern for CIA

Component	**Theory**		**Total Marks**
Type of Assessment	**CIE Exam**		**Technical 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 and the term paper with overview of topic are conducted during I semester. 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. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		**Strength**	**Proficiency assessed by**
PO 1	Analyze a problem, identify and define computing requirements, design and implement appropriate solutions.	2	Seminar &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	Seminar& Term paper
PO 3	Demonstrate a degree of mastery in emerging areas of CSE/IT like IoT, AI, Data Analytics, Machine Learning, cyber security, etc.	2	Seminar& Term Paper

PO 5	Independently carry out research/investigation and development work to solve practical problems	2	Seminar & Term Paper
PO 6	Function effectively on teams to establish goals, plan tasks, meet deadlines, manage risk and produce deliverables	1	Seminar & Term Paper

3 = High; 2 = Medium; 1 = Low

VII. COURSE OBJECTIVES:

The course should enable the students to:

I	Summarize the fundamental knowledge on basics of data science and R programming.
II	Develop programs in R language for understanding and visualization of data using statistical functions and plots.
III	Understand a range of machine learning algorithms along with their strengths and weaknesses.
IV	Learn to apply hypotheses and data into actionable predictions.
V	Prepare documentation and present data in the form of graphs for multivariate data

VIII. COURSE OUTCOMES(COs):

CO No.	Description	CLOs	Course Learning Outcome
CO 1	Understand the process and different stages of data science and relevant data descriptions in R	CLO 1	Understand and develop relevant programming abilities
		CLO 2	Understand and intuition of the whole process line of extracting knowledge from data
		CLO 3	Equip with the fundamental knowledge on basics of data science and R programming
CO 2	Illustrate various SQL, NOSQL databases connecting with R and perform correlation and regression analysis	CLO 4	Critically analyze and evaluate variety of NoSQL databases.
		CLO 5	Develop the ability to build and assess data-based models.
		CLO 6	Analyze data analysis and make models using regression analysis
CO3	Evaluate different data models and perform clustering analysis.	CLO 7	Familiarize with variety of machine learning tasks: clustering, dimensionality reduction, regression and classification
		CLO8	Understand how to formalize practical problems using methods of machine learning
CO 4	Solve various real time problems using artificial neural networks techniques and comparing different learning algorithms.	CLO 9	Understand neural networks techniques solve real time problems
		CLO 10	Understand the different learning algorithms
		CLO 11	Chose a appropriate learning Algorisms to solve particular problems

CO5	Explore on various ways to deliver results through documentation and plots of multivariate data and matrix data	CLO 12	Based on delivering results make a documentation for various results sets
		CLO 13	Understand how to plot graphs for multivariate and matrix data

3 = High; 2 = Medium; 1 = Low

IX. COURSE LEARNING OUTCOMES(CLOs):

CLO Code	CLOs	At the end of the course, the student will have the ability to	PO's Mapped	Strength of Mapping
BCS001.01	CLO 1	Understand and develop relevant **programming** abilities	PO 1,PO2	2
BCS001.02	CLO 2	Understand and intuition of the whole process line of extracting knowledge from data	PO 1, PO 2	2
BCS001.03	CLO 3	Equip with the fundamental knowledge on basics of data science and R programming	PO 1, PO 2	2
BCS001.04	CLO 4	Critically analyze and evaluate variety of NoSQL databases.	PO2, PO3	2
BCS001.05	CLO 5	Develop the ability to build and assess Data-based **models**.	PO 2,PO3	2
BCS001.06	CLO 6	Analyze data analysis and make models using regression analysis	PO 1,PO3	1
BCS001.07	CLO 7	Familiarize with variety of machine learning tasks: clustering, dimensionality reduction, regression and classification	PO 1, PO 3 &PO5	2
BCS001.08	CLO 8	Understand how to formalize practical problems using methods of machine learning	PO3, PO5	2
BCS001.09	CLO 9	Understand neural networks techniques solve real time problems	PO 2, PO3	2
BCS001.10	CLO 10	Understand the different learning algorithms	PO 3, PO5	2
BCS001.11	CLO 11	Chose a appropriate learning Algorisms to solve particular problems	PO 3, PO5	1
BCS001.12	CLO 12	Based on delivering results make a documentation for various results sets	PO 3, PO6	2
BCS001.13	CLO 13	Understand how to plot graphs for multivariate and matrix data	PO 3, PO5	1

X. MAPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES

Course Outcomes (COs)	Program Outcomes (PO)				
	PO 1	PO 2	PO 3	PO 5	PO 6
CO 1	2	2			
CO 2	2	2	1		
CO 3		1	2	1	
CO 4		1	1	1	1
CO 5			1	1	1

XI. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES

Course Learning Outcomes (CLOs)	Program Outcomes (PO)				
	PO 1	PO 2	PO 3	PO 5	PO 6
CLO 1	2	2			
CLO 2	2	2			
CLO 3	2	2			
CLO 4	1	2	2		
CLO 5		1	1		
CLO 6	2	2			
CLO 7	2		2		
CLO 8	2		1		
CLO 9	2			1	2
CLO 10	2				2
CLO 11		1			2
CLO 12				1	1
CLO 13				1	1

XII. ASSESSMENT METHODOLOGIES –DIRECT

CIE Exams	PO1, PO3, PO5	SEE Exams	PO1, PO3, PO5	Seminar and Term Paper	PO1, PO2, PO3, PO5
Viva	-	Mini Project	-	Laboratory Practices	-

XIII. ASSESSMENT METHODOLOGIES -INDIRECT

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

XIV. SYLLABUS

UNIT-I	INTRODUCTION	Classes: 10
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.		
UNIT-2	SQL, NOSQL AND DATA ANALYSIS	Classes: 9
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.		

UNIT-3	DATA MODELS	Classes: 08
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		
UNIT-4	**ARTIFICIAL NEURAL NETWORKS**	**Classes: 09**
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 of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning algorithms.		
UNIT-5	**DELIVERING RESULTS**	**Classes: 8**
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, 1st Edition, 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.

Web References:

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

XV. 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
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	T2:7.1, 7.2
3-4	exploring data, managing data, cleaning and sampling for modeling;	CO 1	T1:1.3, 1.4, 1.6
5-6	Importance of R and R programming, Summary statistics, probability distribution	CO 2	T2:1.1, 1.3
7-8	Introduction to R, data types and functions	CO 2	T1:1.1, 1.8
9-11	Data scientist, terminologies, Reporting and analysis,	CO 2	T1:1.1, 1.9
12-14	types NoSQL, SQL, R, ANOVA	CO 2	T2:11.2,11.4
15-16	XML, JSON	CO 2	T2:11.6
17-18	Correlation analysis, regression analysis,	CO 2	T2:117
19-20	Regression modeling, multiple regression.	CO 2	T2:11.8

21-22	Data Models, Choosing and evaluating models, mapping problems to machine learning	CO 3	T1:6.1, 6.2
23-24	Evaluating and validating	CO 3	T2:18.3.4,18.3.4.1
25-26	Cluster analysis, K-means algorithm, Naive Bayes memorization methods, unsupervised methods	CO 3	T3:14.1
27-28	Introduction to Artificial Neural Networks, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks	CO 4	T3:1.2, 1.3
29-30	Problems and algorithms, propagation algorithm, remarks on the back propagation algorithm	CO4	T3:4.2, 4.6
31-33	Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals	CO4	T3:18.3.4,18.3, 4.1
34-35	Evaluation hypothesis, Learning algorithms	CO 4	T3:18.1
36-37	Documentation and deployment, producing effective presentations, introduction to graphical analysis	CO 5	T1: 8.1
38-39	Plots, matrix plots, multiple plots in one window,	CO 5	T2:12.1, 12.4
40-42	exporting graph, using graphics parameters, case studies	CO 5	T2:12.5, 12.8

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

S No	Description	Proposed actions	Relevance with POs
1	Problem reductions, Polynomial time and intractability	Seminars / Guest Lectures/ NPTEL	PO 1, PO 2&PO 4
2	String matching: Knuth-Morris-Pratt, Boyer-Moore, Edit distance, Longest increasing subsequence, Smith-Waterman algorithm	Seminars / Guest Lectures/ NPTEL	PO 2, PO 5
3	Encourage students to write programs based on the taught algorithms to solve problems	Laboratory Practices	PO 1, PO 3, PO 5

Prepared by:
Dr. G Ramu, **Professor, CSE** **HOD, CSE**

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTOR

Course Title	DATA SCIENCE LABORATORY					
Course Code	BCSB06					
Programme	M.Tech					
Semester	II	CSE				
Course Type	Elective					
Regulation	IARE - R18					
Course Structure	**Theory**			**Practical**		
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**	
	-	-	-	4	2	
Course Faculty	**Dr. G Ramu, Professor, CSE**					

I. COURSE OVERVIEW:

The course introduces the concepts of R Programming Language. Moreover the course pays a special attention to solve typical uncertainty problems which are primarily explored by R Programming concepts.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
PG	-	-	-	-

III. MARKS DISTRIBUTION:

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

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	LCD / PPT	✔	Student viva	✔	Mini Project	✘	Videos
✔	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

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

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

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

20 %	To test the preparedness for the experiment.
20 %	To test the performance in the laboratory.
20 %	To test the calculations and graphs related to the concern experiment.
20 %	To test the results and the error analysis of the experiment.
20 %	To test the subject knowledge through viva – voce.

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.

Table 1: Assessment pattern for CIA

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.

Preparation	**Performance**	**Calculations and Graph**	**Results and Error Analysis**	**Viva**	**Total**
2	2	2	2	2	10

VI. HOW PROGRAM OUTCOMES AREASSESSED:

Program Outcomes (POs)		**Strength**	**Proficiency assessed by**
PO 1	An ability to analyze a problem, and to identify and define the computing requirements appropriate to its solution.	3	Laboratory practices, student viva
PO 2	Solve complex heterogeneous data intensive analytical based problems of real time scenario using state of the art hardware/software tools	3	Laboratory practices, student viva
PO 7	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

VII. COURSE OBJECTIVES(COs):

The course should enable the students to:	
I	Explore methods that implements neural network techniques.
II	Practice the fuzzy set relations using different operations.
III	Design Regression techniques for a set of data points.
IV	Capture an appropriate classification model for analytical tasks.

VIII. COURSE LEARNING OUTCOMES(CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength Of Mapping
BCSB12.1	CLO 1		PO 1	3
BCSB12.2	CLO 2		PO 1	3
BCSB12.3	CLO 3		PO 2	2
BCSB12.4	CLO 4		PO 2	3
BCSB12.5	CLO 5		PO 7	3
BCSB12.6	CLO 6		PO 1,PO 2	2
BCSB12.7	CLO 7		PO 1	2
BCSB12.8	CLO 8		PO 1	3

3 = High; 2 = Medium; 1 = Low

IX. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFICOUTCOMES:

Course Learning Outcomes (CLOs)	PO1	PO2	PO7
CLO 1	3		
CLO 2	3		
CLO 3		2	
CLO 4		3	
CLO 5			3
CLO 6	2	3	
CLO 7	2		
CLO 8	3		

3 = High; 2 = Medium; 1 = Low

X. ASSESSMENT METHODOLOGIES –DIRECT

CIE Exams	PO 1, PO 2, PO 7	SEE Exams	PO 1, PO 2, PO 7	Laboratory Practices	PO 1, PO 2, PO 7	Student Viva	PO 1, PO 2
Mini Project	PO7						

XI. ASSESSMENT METHODOLOGIES -INDIRECT

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

XII. SYLLABUS

LIST OF EXPERIMENTS	
Week-1	**R AS CALCULATOR APPLICATION**
a) Using with and without R objects on console b) Using mathematical functions on console c) Write an R script, to create R objects for calculator application and save in a specified location in disk.	
Week-2	**DESCRIPTIVE STATISTICS IN R**
a) Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcars& cars datasets. b) Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset.	
Week-3	**READING AND WRITING DIFFERENT TYPES OF DATASETS**
a) Reading different types of data sets (.txt, .csv) from web and disk and writing in file in specific disk location. b) Reading Excel data sheet in R. c) Reading XML dataset in R.	
Week-4	**VISUALIZATIONS**
a. Find the data distributions using box and scatter plot. b. Find the outliers using plot. c. Plot the histogram, bar chart and pie chart on sample data.	
Week-5	**CORRELATION AND COVARIANCE**
a. Find the correlation matrix. b. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data. c. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data.	
Week-6	**REGRESSION MODEL**
Import a data from web storage. Name the dataset and now do Logistic Regression to find out relation between variables that are affecting the admission of a student in a institute based on his or her GRE score, GPA obtained and rank of the student. Also check the model is fit or not. require (foreign), require(MASS).	
Week-7	**MULTIPLE REGRESSION MODEL**
Apply multiple regressions, if data have a continuous independent variable. Apply on above dataset.	
Week-8	**REGRESSION MODEL FOR PREDICTION**
Apply regression Model techniques to predict the data on above dataset.	
Week-9	**CLASSIFICATION MODEL**
a. Install relevant package for classification. b. Choose classifier for classification problem. c. Evaluate the performance of classifier.	
Week-10	**CLUSTERING MODEL**
a) Clustering algorithms for unsupervised classification. b) Plot the cluster data using R visualizations.	
Reference Books:	
Andrew S. Tanenbaum, "Foundation of Data Science", PHI, 1st Edition, 1994.	
Web References:	
1. www.cs.put.poznan.pl/pawelw/sus/dcs07.doc 2. https://developer.apple.com/library/mac/documentation	
SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 60 STUDENTS: **HARDWARE:**18 numbers of Intel Desktop Computers with 2 GB RAM. **SOFTWARE:** Turbo C/ J2SE	

XIII. COURSEPLAN:

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

Week No.	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Ras Calculator Application	CLO 1	T1:1.1
2	Descriptive Statistics in r	CLO 1, CLO 2	T1:2.3
3	Reading and Writing Different Types of Datasets	CLO 3, CLO 4	T1:4.1
4	Visualizations	CLO 5	T1:5.1
5	Correlation and Covariance	CLO 6	T1:6.1
6	Regression Model	CLO 6	T1:7.1.1
7	Multiple Regresstion Model	CLO 7	T1:12.5
8	Regression Model for Prediction	CLO 1,CLO 2, CLO 8	T1:15.1
9	Classification Model	CLO1	T1:1:1
10	Clustering Model	CLO6	T1:6:1

Prepared by:
Dr. G Ramu, Professor, CSE **HOD, CSE**

II SEMESTER

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

COMPUTER SCIENCE AND ENGINEERING
COURSE DESCRIPTOR

Course Title	**CYBER SECURITY**				
Course Code	BCSB11				
Program	M.Tech				
Semester	II	CSE			
Course Type	Core				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	-	3	-	-
Course Faculty	**Dr.D Kishore Babu, Professor**				

I. COURSE OVERVIEW:

The course covers various web languages, attacks, servers related to cyber crime and forensics. Also learn the basic cyber security concepts and issues in cyber crime, how to identify vulnerabilities/threat in a network system. It also includes cyber crime investigation tools, encryption and decryption methods, security issues related to applets and servlets. It also deals with digital forensics and act / laws of cyber crime.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
-	-	-	Information Security	-

III. MARKS DISTRIBUTION:

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

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	LCD / PPT	✔	Seminars	✔	Videos	✘	MOOCs
✘	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

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

examination.

Semester End Examination (SEE):
The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into five units 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 two sub divisions in a question.

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

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

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 1), with 25 marks for Continuous Internal Examination (CIE), 05 marks for Technical Seminar and Term Paper.

Table 1: Assessment pattern for CIA

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 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.

Technical Seminar and Term Paper:
Two seminar presentations and the term paper with overview of topic are conducted during II semester. 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. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		**Strength**	**Proficiency assessed by**
PO 1	Analyze a problem, identify and define computing requirements, design and implement appropriate solutions.	2	Term Paper
PO 3	Demonstrate a degree of mastery in emerging areas of CSE/IT like IOT, AI, Data Analytics, Machine Learning, cyber security, etc.	2	Term Paper and Guest Lectures
PO 4	Write and present a substantial technical report /document.	3	Seminar and Term Paper
PO 5	Independently carry out research/investigation and development work to solve practical problems.	3	Term Paper
PO 7	To engage in life-long learning and professional development through self-study, continuing education, professional and doctoral level studies.	2	Seminar and Term Paper

3 = High; 2 = Medium; 1 = Low

VII. COURSE OBJECTIVES :

The course should enable the students to:

I	Explain the core information assurance principles.
II	Identify the key components of cyber security network architecture.

III	Apply cyber security architecture principles.
IV	Describe risk management processes and practices.

VIII. COURSE OUTCOMES (COs):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Understand basic concept of cyber security and security mechanisms.	CLO 1	Explain about different types of Web attacks, security mechanisms, and security services.
		CLO 2	Understand basic concept of cyber security, different categories of cyber crime.
CO 2	Illustrate the different intellectual property rights and different security algorithm.	CLO 3	Use different security algorithms and to Identify various cyber crime issues
		CLO 4	Understand the different intellectual property rights and laws of legislation.
CO 3	Explore on web hacking basics and cybercrime investigation tools with case studies.	CLO 5	Describe the concept of security in applets and servlets.
		CLO 6	Solve real time case studies on password cracking, email-recovery etc. Using cyber crime investigation tools
CO 4	Understand about the concept of digital security through digital signature and forensics techniques.	CLO 7	Understand about the concept of digital security through digital signature and forensics to Secure the data.
		CLO 8	Explore on various forensic techniques used to secure data.
CO 5	Explore about electronic communication privacy act and legal policies.	CLO 9	Identify the laws and acts related to cyber crime.
		CLO 10	Demonstrate about electronic communication private act and legal policies.

IX. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
BCSB11.01	CLO 1	Explain about different types of Web attacks, security mechanisms, and security services.	PO1,PO3	2
BCSB11.02	CLO 2	Understand basic concept of cyber security, different categories of cyber crime.	PO1,PO3	3
BCSB11.03	CLO 3	Use different security algorithms and to Identify various cyber crime issues	PO1,PO5	2
BCSB11.04	CLO 4	Understand the different intellectual property rights and laws of legislation.	PO4,PO7	2
BCSB11.05	CLO 5	Describe the concept of security in applets and servlets.	PO3,PO5	3
BCSB11.06	CLO 6	Solve real time case studies on password cracking, email-recovery etc. Using cyber crime investigation tools	PO3,PO5,PO 7	2
BCSB11.07	CLO 7	Understand about the concept of digital security through digital signature and forensics to Secure the data.	PO1,PO5	2
BCSB11.08	CLO 8	Explore on various forensic techniques used to secure data.	PO5,PO4	3
BCSB11.09	CLO 9	Identify the laws and acts related to cyber crime.	PO3,PO7	2
BCSB11.10	CLO 10	Demonstrate about electronic communication private act and legal policies.	PO3,PO5	3

3 = High; 2 = Medium; 1 = Low

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

Course Outcomes (COs)	PO 1	PO 3	PO 4	PO 5	PO 7
CO 1	2	2		1	
CO 2	2		2	2	2
CO 3		3		2	1
CO 4	1		2	2	
CO 5		2		2	2

XI. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES:

Course Learning Outcomes (CLOs)	Program Outcomes				
	PO1	PO3	PO4	PO5	PO7
CLO 1	2	2			
CLO 2	3	2			
CLO 3	2			3	2
CLO 4			2		2
CLO 5		3		3	
CLO 6		2		2	2
CLO 7	2			2	
CLO 8			3	3	
CLO 9		2			2
CLO 10		3		3	

3 = High; 2 = Medium; 1 = Low

XII. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO1,PO3	SEE Exams	PO 1,PO3,PO5	Seminar and Term paper	PO1, PO3, PO4,PO7
Laboratory Practices	-	Viva	-	Mini Project	-

XIII. ASSESSMENT METHODOLOGIES - INDIRECT

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

XIV. SYLLABUS

UNIT-I	INTRODUCTION	Classes: 10
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 cyber crime, nature and scope of cyber crime, types of cyber crime: social engineering, categories of cyber crime, property of cyber crime.		

UNIT-2	REVIEW OF COMPUTER SECURITY AND CYBER CRIME ISSUES	Classes: 08
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.		
UNIT-3	**WEB HACKING BASICS AND INVESTIGATION**	**Classes: 08**
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 cyber crime 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.		
UNIT-4	**DIGITAL CERTIFICATES AND DIGITAL FORENSICS**	**Classes: 09**
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.		
UNIT-5	**SECURING DATABASES, LAWS AND ACTS**	**Classes: 10**
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 private act, legal policies.		
Text Books:		
1. Mc Clure, Stuart, Saumil Shah, Shreeraj Shah, "Web Hacking: Attacks and Defense", Addison Wesley Professional, Illustrated Edition, 2003. 2. Garms, Jess, Daniel Somerfield, "Professional Java Security", Wrox Press, Illustrated Edition, 2001 3. JOHN R. VACCA "Computer Forensics : Computer Crime Scene Investigation", Firewall Media.		
Web References:		
1. Nelson Phillips, Enfinger Steuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi,2009. 2. Kevin Mandia, Chris Prosise, Matt Pepe, "Incident Response and Computer Forensics ", Tata Mc Graw Hill, 3. Robert M Slade, "Software Forensics", Tata Mc Graw Hill, New Delhi, 1st Edition, 2005.		

XV. COURSE PLAN:

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

Lecture No	Topic's to be covered	Course Learning Outcomes (CLOs)	Reference
1 – 3	A web security forensic lesson, web languages, introduction to different web attacks	CLO1	T1:1.1-1.4
4 – 6	Introduction and overview of cyber crime, types of cyber crime: social engineering, categories of cyber crime.	CLO2	T1:2.1-2.4
7 – 9	Public key cryptography, RSA algorithm	CLO3	T1:3.4-3.7
10 – 13	Computer intrusions, white collar crimes, viruses and malicious code, internet hacking and cracking, virus attacks, pornography,	CLO4	T1:3.2-3.4

14 -16	software piracy, intellectual property, mail bombs, exploitation, stalking and obscenity in internet, digital laws and legislation, law enforcement roles and responses.	CLO4	T2:2.3-2.8
17 – 19	Web hacking basics HTTP and HTTPS URL, web under the cover overview of java security reading the HTML source.	CLO5,CLO6	T1:4.1-4.3
20- 22	Applet security, and servlets security.	CLO5,CLO6	T1:5.2-5.6
23 – 25	Introduction to cyber crime investigation, investigation tools, e- discovery, digital evidence collection, evidence preservation	CLO6	T2:4.2-4.6
26 -27	e-mail investigation, e-mail tracking, IP tracking, and e-mail recovery.	CLO6	T2:4.8-4.9
28- 31	Encryption and Decryption methods, search and seizure of computers, recovering deleted evidences, password cracking	CLO6	T1:3.8-3.9
32 – 35	Digital forensics: Introduction to digital forensics, forensic software and hardware analysis and advanced tools.	CLO7	T3:1.3-1.6
35 – 38	Forensic technologies.	CLO7,CLO8	T3:3.1-3.6
39 -- 42	Basics of Indian Evidence Act IPC and CrPC, electronic communication	CLO9,CLO10	T3:4.2-4.3
42 -45	Laws and acts: Laws and ethics, digital evidence controls, evidence handling procedures	CLO9,CLO10	T3:4.4-4.6

Prepared by:
Dr.D Kishore Babu, Professor **HOD, CSE**

INSTITUTE OF AERONAUTICAL ENGINEERING

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Dundigal, Hyderabad -500 043

COMPUTER SCEINCE AND ENGINEERING

COURSE DESCRIPTOR

Course Title	**SOFT COMPUTING**				
Course Code	BCSB12				
Programme	M.Tech				
Semester	II	CSE			
Course Type	Core				
Regulation	IARE – R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	-	3	4	2
Course Faculty	Ms. B Pdmaja, Associate Professor, CSE.				

I. COURSE OVERVIEW:

The course introduces the concepts of neural networks, Evolutionary algorithms and fuzzy logic. Moreover the course pays a special attention to solve typical uncertainty problems which are primarily explored by fuzzy logic concepts. The principle aim of the course is to help students to find out more about appropriate computing techniques and use it for their problem of choice.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
PG	BCSB06	I	Data Science

III. MARKS DISTRIBUTION:

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

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	LCD / PPT	✔	Seminars	✔	Mini Project
✔	Open Ended Experiments				

V. EVALUATION METHODOLOGY:

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

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into five units 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 two sub divisions in a question.

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

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

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 1), with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Technical Seminar and Term Paper.

Table 1: Assessment pattern for CIA

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 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.

Technical Seminar and Term Paper:

Two seminar presentations and the term paper with overview of topic are conducted during I semester. 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. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		**Strength**	**Proficiency assessed by**
PO1	Analyze a problem, identify and define computing requirements, design and implement appropriate solutions	3	Seminar and Term paper
PO2	Solve complex heterogeneous data intensive analytical based problems of real time scenario using state of the art hardware/software tools	3	Seminar and Term paper, student viva
PO4	Write and present a substantial technical report/document.	3	CIE,SEE, Mini project
PO5	Independently carry out research/investigation and development	1	CIE,SEE

Program Outcomes (POs)		Strength	Proficiency assessed by
	work to solve practical problems.		Seminar and Term paper
PO6	Function effectively on teams to establish goals, plan tasks, meet deadlines, manage risk and produce deliverables	3	Mini project,
PO7	Engage in life-long learning and professional development through self-study, continuing education, professional and doctoral level studies.	2	Mini project, Seminar and Term paper

3 = High; 2 = Medium; 1 = Low

VII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Familiarize with soft computing concepts.
II	Understand supervised learning and unsupervised learning networks.
III	Explore the concepts of neural networks and fuzzy logic to solve complex problems
IV	Illustrate the concepts of genetic Algorithms and its applications

VIII. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
BCSB12.1	CLO 1	Understand Fundamental concepts of neural networks and its applications.	PO 5;PO 7	2
BCSB12.2	CLO 2	Learn supervised network techniques and find the differences between various types of learning networks.	PO 1 ;PO 6; PO 7	2
BCSB12.3	CLO 3	Retrieve linear equations and understand back propagation network method.	PO 2	3
BCSB12.4	CLO 4	Understand associative memory networks and Explore on unsupervised learning networks and its types.	PO 5;PO 6	2
BCSB12.5	CLO 5	Understand the concept of regression analysis to find the hidden relations in data.	PO 2	3
BCSB12.6	CLO 6	Understand the classification of unsupervised learning network methods.	PO 6	3
BCSB12.7	CLO 7	Understand the concepts of fuzzy sets and relations and Illustrate the concepts of membership functions.	PO 4	3
BCSB12.8	CLO 8	Identify the difference between iterative and non-iterative fuzzy sets.	PO 1	3
BCSB12.9	CLO 9	Understand methods of defuzzification.	PO 5	1
BCSB12.10	CLO 10	Develop truth tables of fuzzy logic and different representations of formation of fuzzy rules.	PO 4	3
BCSB12.11	CLO11	Understand formation rules and aggregation rules in fuzzy arithmetic	PO 2	2
BCSB12.12	CLO12	Develop fuzzy interface system and fuzzy expert system	PO 6	3
BCSB12.13	CLO13	Understand genetic algorithms, constraints and classifications.	PO 4;PO 6	2
BCSB12.14	CLO14	Understand the fusion approach and illusterate the concept of genetic programming.	PO 5	1

3 = High; 2 = Medium; 1 = Low

IX. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES

Course Learning Outcomes (CLOs)	Program Outcomes					
	PO1	PO2	PO4	PO5	PO6	PO7
CLO 1				2		3
CLO 2	3				2	2
CLO 3		3				
CLO 4				2	2	
CLO 5		3				
CLO 6					3	
CLO 7			3			
CLO 8	3					
CLO 9				1		
CLO 10			3			
CLO 11		2				
CLO 12					3	
CLO 13			2		3	
CLO 14				1		

3 = High; 2 = Medium; 1 = Low

X. ASSESSMENT METHODOLOGIES-DIRECT

CIE Exams	PO 3,PO 4	SEE Exams	PO 3, PO 4	Seminar and Term paper	PO 1,PO 2, ,PO 4, PO 7
Student Viva	PO 2	Mini Project	PO 5,PO 7	Laboratory Practices	-

XI. ASSESSMENT METHODOLOGIES-INDIRECT

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

XII. SYLLABUS:

UNIT-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.	
UNIT-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.
UNIT-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 fuzzy sets.Membership functions: Fuzzification, methods of membership value assignments, defuzzification, Lambda cuts for fuzzy sets and fuzzy relations, defuzzification methods.
UNIT-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.
UNIT-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 fuzzy controllers.
Text Books:
1. J. S. R. Jang, C. T. Sun, E. Mizutani, Neuro, "Fuzzy and Soft Computing", PHI, Pearson Education, 1stEdition, 2004. 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, 1st Edition, 2003. 2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill, 3rd Edition, 1997. 3. Stamatios V. Kartalopoulos "Understanding Neural Networks and Fuzzy Logic Basic Concepts and Applications", IEEE Press, PHI, New Delhi, 2004.

XIII. COURSE PLAN:

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

Lecture No	Topic's to be covered	Course Learning Outcomes (CLOs)	Reference
1-3	Introduction: Fundamental concept, evolution of neural networks, models of artificial neural networks, important technologies, applications, McCulloch, Pitts Neuron.	CLO 1	T2:1.1-1.2
4-6	Linear separability, Hebb network; Supervised learning network: Perception networks, adaptive linear neuron.	CLO 2	T1:2
7-9	Multiple adaptive linear neurons, back propagation network, radial basis function network.	CLO 3	T2:2.1-2.2
10-12	Associative memory networks: Training algorithms for pattern association, auto associative memory network, hetero associative memory network	CLO 4	T1:4
13-16	bidirectional associative memory, Hopfield networks, iterative auto associative memory network, temporal associative memory network;	CLO 5	T1:4

17-19	Unsupervised learning networks: Kohonen self organizing feature maps, learning vector quantization, counter propagation networks, adaptive resonance theory network.	CLO 6	T1: 6
20-22	Fuzzy logic: Introduction to classical/crisp sets and fuzzy sets, classical/crisp relations and fuzzy Relations	CLO 7	T1: 5
23-25	Tolerance and equivalence relations, non-iterative fuzzy sets. Membership functions: Fuzzification	CLO 8	T1:7
26-28	Methods of membership value assignments, defuzzification, Lambda cuts for fuzzy sets and fuzzy relations, defuzzification methods.	CLO 9	T1:10
29-31	Fuzzy arithmetic and fuzzy measures: Fuzzy rule base and approximate reasoning, truth values and tables in fuzzy logic,	CLO 10	T1:8
32-34	fuzzy propositions, formation of rules,decomposition and aggregation of rules, fuzzy reasoning	CLO 11	T1:13
35-37	fuzzy inference systems, fuzzy decision making, fuzzy logic control systems, fuzzy expert systems.	CLO 12	T1:9 T1:14 T1: 17
38-40	Genetic algorithm and search space, general genetic algorithm, operators, generational cycle, stopping condition, constraints, classification	CLO 13	T1:17
41-45	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 fuzzy controllers.	CLO 14	T1:16

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