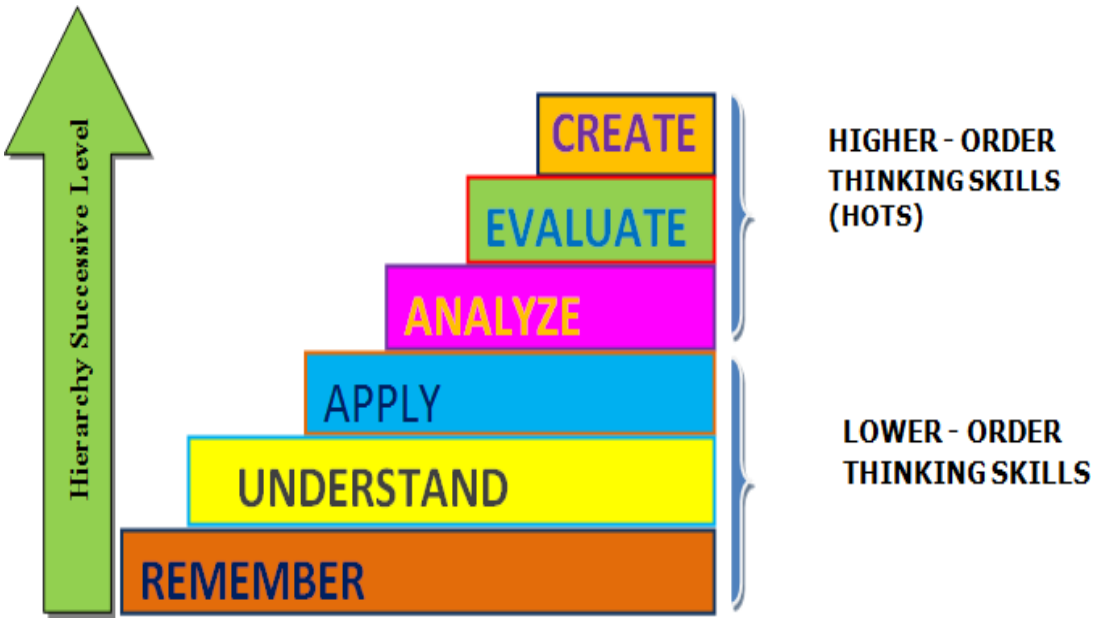
COURSE DESCRIPTOR BOOKLET

M. Tech

COMPUTER SCIENCE ENGINEERING

(Accredited by NBA)

R-16 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.

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Program Education Objectives and Outcomes

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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 two to four 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

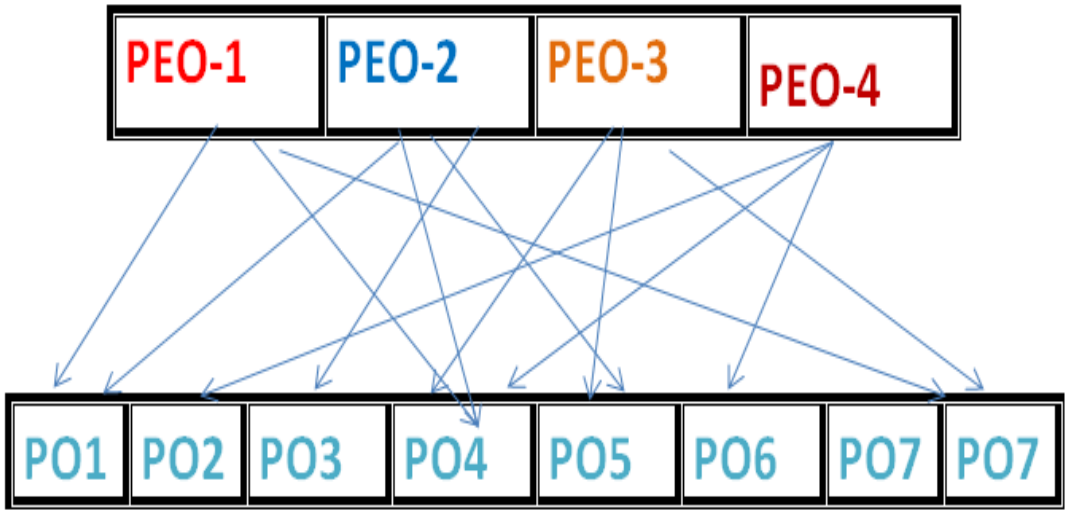
PO5: Independently carry out research/investigation and development work to solve practical problems

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,	**PO1**	Analyze a problem, identify and define computing requirements, design and implement appropriate solutions

	critical thinking and problem solving skills.	**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	**FOUNDATIONS OF DATA SCIENCE**				
Course Code	**BCS001**				
Programme	**M.Tech**				
Semester	**I**				
Course Type	**Core**				
Regulation	**R16**				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	**-**	**3**	**-**	**2**
Course Faculty	**Dr M Madhu Bala,Professor**				

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,PO2, PO3, PO5,PO6	SEE Exams	PO1,PO2, PO3, PO5,PO6	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	PO 1, PO 2&PO 4
2	String matching: Knuth-Morris-Pratt, Boyer-Moore, Edit distance, Longest increasing subsequence, Smith-Waterman algorithm	Seminars	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 M Madhu Bala, Professor **HOD, CSE**

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

Computer Science and Engineering
COURSE DESCRIPTOR

Course Title	**DATA STRUCTURES AND PROBLEM SOLVING**			
Course Code	**BCS002**			
Programme	**M.Tech**			
Semester	**I**			
Course Type	**Core**			
Regulation	**R16**			
Course Structure	**Theory**		**Practical**	
	Lectures	**Tutorials**	**Practicals**	**Credits**
	3	**-**	**-**	**3**
Course Faculty	**Dr. Y Mohana Roopa, Professor**			

I. COURSE OVERVIEW:

The course focuses on basic and essential topics in data structures, including dictionaries, hash tables, recursion, binary trees, and red–black trees and splay trees. Mainly the course identifies the most useful data structures in use in modern programming and each will be presented with exercises for building, visualizing, and manipulating that structure.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	-	-	Data Structures	-

III. MARKSDISTRIBUTION

Subject	SEE Examination	CIA Examination	Total Marks
Data Structures and Problem Solving	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	LCD / PPT	✔	Seminars and term paper	✔	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	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	3	Videos, seminar and 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	MOOCs, seminar and term paper
PO 5	Independently carry out research/investigation and development work to solve practical problems	2	Seminar and term paper
PO 7	Engage in life-long learning and professional development through self-study, continuing education, professional and doctoral level studies	2	MOOCs

3 = High; 2 = Medium; 1 = Low

VII. COURSE OBJECTIVES:

The course should enable the students to:

I	Learn the basic techniques of algorithm analysis along with performance measurement.
II	Demonstrate a familiarity with ADT concepts and their implementation.
III	Implementation of linear data structure and non linear data structure mechanisms.
IV	Demonstrate various tree and graph traversal algorithms
V	Analyze and choose appropriate data structure to solve problems in real world.

VIII. COURSE OUTCOMES (COs):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Understand the concepts and implementation of Linear and Nonlinear data structures	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
CO 2	Explore on linear data structure implementation with dictionaries and hash functions	CLO 3	Understand dynamic data structures and relevant standard algorithms
		CLO 4	Master a variety of advanced abstract data type (ADT) and their implementations
CO 3	Describe nonlinear data structure and implement with trees and graphs for real time applications	CLO 5	Understand graphs terminology, representations and traversals in Graphs
		CLO 6	Learn the concepts of ordinary and binary trees with recursive and non recursive traversals
CO 4	Explore on various binary search tree operations	CLO 7	Implement Depth First Search and Breath First Searching methods of non –linear data structures
		CLO 8	Analyze dijkstra's algorithm for single source shortest path problem for minimum cost spanning trees
CO 5	Illustrate various applications on self-balancing binary search trees.	CLO 9	Implement binary search ADT for finding parent node, smallest and largest values in binary search
		CLO 10	Understand and implement operations and applications of red-Black and splay Trees

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
BCS002.01	CLO 1	Analyze time and space complexity of an algorithm for their performance analysis	PO 1	3
BCS002.02	CLO 2	Analyze time and space complexity of an algorithm for their performance analysis	PO1;PO2 ;PO5	2
BCS002.03	CLO 3	Understand dynamic data structures and relevant standard algorithms	PO 1, PO 3	3
BCS002.04	CLO 4	Master a variety of advanced abstract data type (ADT) and their implementations	PO 2	3
BCS002.05	CLO 5	Understand graphs terminology, representations and traversals in Graphs	PO1;PO 3	3
BCS002.06	CLO 6	Learn the concepts of ordinary and binary trees with recursive and non recursive traversals	PO 1	2
BCS002.07	CLO 7	Implement Depth First Search and Breath First Searching methods of non –linear data	PO 1, PO 3	3

		structures		
BCS002.08	CLO 8	Analyze dijkstra's algorithm for single source shortest path problem for minimum cost spanning trees	PO 1	3
BCS002.09	CLO 9	Implement binary search ADT for finding parent node, smallest and largest values in binary search	PO 2;PO5	3
BCS002.10	CLO 10	Understand and implement operations and applications of red-Black and splay Trees	PO 1;PO7	3

3 = High; 2 = Medium; 1 = Low

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

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

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

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

3 = High; 2 = Medium; 1 = Low

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
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
UNIT II
Dictionaries: Linear list representation, operations insertion, deletion and searching, hashtable representation, hash functions, collision resolution, separate chaining, open addressing, linear probing, quadratic probing, double hashing, rehashing, extendible hashing.
UNIT III
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
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 AVLtree; Operations : Insertion, deletion and searching.
UNIT V
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. John Vince, "Foundation Mathematics for Computer Science", Springer.
2. K. Trivedi. "Probability and Statistics with Reliability, Queuing, and Computer Science Applications". Wiley.
REFERENCES:
1. https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf.
2. https://www.cs.bris.ac.uk/~flach/mlbook/.

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
1-2	Analyze time and space complexity of an algorithm for their performance analysis	Algorithm analysis: Algorithms; Performance analysis: Time complexity and space complexity.	T1: 1.1-1.5
2-5	Analyze time and space complexity of an algorithm	asymptotic notation: Big Oh, omega and theta notations, complexity	T1: 2.1-2.8

Lecture No	Topic Outcomes	Topic/s to be covered	Reference
	for their performance analysis	analysis examples.	
6-10	Analyze time and space complexity of an algorithm for their performance analysis	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.	T1: 3.1-3.6
11-12	Analyze time and space complexity of an algorithm for their performance analysis	Implementation using heaps, insertion into a max heap, deletion from a max heap, singly linked lists, doubly linked lists, circular linked list.	T1: 5.1-5.3
13-15	Analyze time and space complexity of an algorithm for their performance analysis	Dictionaries: Linear list representation, operations insertion, deletion and searching, hash table representation.	T1: 5.4-5.7
16-19	Master a variety of advanced abstract data type (ADT) and their implementations	hash functions, collision resolution, separate chaining, open addressing,linear probing, quadratic probing, double hashing, rehashing, extendiblehashing.	T2:5.1-5.5
20-22	Understand and implement operations and applications of red-Black and splay Trees	Trees: Ordinary and binary trees terminology, properties of binarytrees, binary tree ADT.	T2:10.2.3
23-26	Understand and implement operations and applications of red-Black and splay Trees	Recursive and non recursive traversals, threaded binary trees.	T1:8.1-8.4
24-28	Understand graphs terminology, representations and traversals in Graphs	Graphs: Graphs terminology, graph ADT, representations, graph traversals; Search methods: DFS and BFS; Applications of Graphs.	T2:9.1-9.6
29-35	Understand graphs terminology, representations and traversals in Graphs	Applications of Graphs: Minimum cost spanning tree using Kruskal‟s algorithm, Dijkstra‟s algorithm for single source shortest path problem.	T1:11.1-11.4
33-40	Implement binary search ADT for finding parent node, smallest and largest values in binary search	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.	T1:20.1-20.7
41-45	Implement binary search ADT for finding parent node, smallest and largest values in binary search	Balanced search trees: AVL trees, definition, height of an AVL tree; Operations : Insertion, deletion and searching	T1:20.8-20.9
47-55	Implement binary search ADT for finding parent node, smallest and largest values in binary search	Red-Black and Splay Trees; B trees: Definition, operations and applications; R trees: Nearest neighborquery, joinand range queries; Comparison of searchtrees.	T3:25.1-20.3
56-60	Implement Huffman Coding and decoding for text compression	Text compression: Huffman coding and decoding; Pattern matching: KMP algorithm.	T3:28.1-28.7

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

S No	Description	Proposed Actions	Relevance with POs
1	Implementation on Red / Black Tress	Seminars / Guest Lectures / NPTEL	PO 1, PO 7

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COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTOR

Course Title	**HIGH PERFORMANCE ARCHITECTURE**				
Course Code	**BCS003**				
Programme	M.Tech				
Semester	I	CSE			
Course Type	**Core**				
Regulation	IARE - R16				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	4	-	4	--	--
Course Faculty	**Mr. P Ravinder, Assistant Professor**				

I. COURSE OVERVIEW:

The Present course concentrates on developing basic understanding about various activities that are involved in increasing the performance of a compiler, the compiling issues for various parallel architecture, transformation techniques for code parallelization and to understand memory management and scheduling for parallel machines. This course enables the student to acquire necessary skills for optimizing compiler performance, and it focuses on all activities involved in data dependence and various data dependences testing methodologies.. In this course students will gain a broad understanding of the discipline of compiling for scalar, super scalar, vector and parallel processors. Student can implement and get knowledge about development of the software and hardware gains knowledge of loop normalization, ZIV, SIV and MIV testing and their appropriate application. A general understanding of fine grained and enhancing fine grained by loop distribution, coarse grained and enhancing coarse grained by privatization, handling control flow by using if- conversion and improving register usage.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
-	-	-	Adavanced Computer Architecture	-
-	-	-	Compiler Design	-

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
High Performance Architecure	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 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 AREASSESSED:

	Program Outcomes (POs)	**Strength**	**Proficiency assessed by**
PO 1	Analyze a problem, identify and define computing requirements, design and implement appropriate solutions	2	CIE, SEE, Seminar andTerm 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 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	CIE, SEE, Seminar and Term Paper
PO 4	Write and present a substantial technical report/document	2	Seminar and Term Paper

3 = High; 2 = Medium; 1 = Low

VII. COURSE OBJECTIVES(COs):

The course should enable the students to:

1	Understand dependence analysis concepts for high performance compilers.
2	Familiar with the concepts of dependence testing.
3	Understand fine grained and course grained parallelism
4	Understand the memory management and scheduling for code parallelization.
5	Optimizing register re-usage by loop carried and independence performance.

VIII. COURSE OUTCOMES(CLOs):

	Course Outcome	CLOs	Course Learning Outcome
CO1	Understand dependence analysis concepts for high performance compilers.	CLO 1	Understand the key concerns that are common to improve the performance of compiler and describe Compiling for scalar, super scalar, VLIW, vector and parallel processor
		CLO 2	Memorizing Bernstein's condition to execute parallel processing and describe the concept of Data Dependence, types and loop carried and loop independent dependence.
		CLO 3	Understand Loop normalization parallelization vectorization and scalar renaming simple dependence testing and subscript portioning.
CO2	Familiar with the concepts of dependence testing.	CLO 4	Describe the concept of single subscript and multiple induction variable tests and to understand the importance of Delta test in testing coupled group
		CLO 5	Understand the concept more powerful and multiple simple test, to describe the overall dependence testing.
CO3	Understand fine grained and course grained parallelism	CLO 6	Memorize fine grained and enhancing fine grained by using loop distribution and loop interchange for vectorization.
		CLO 7	Describe the course grained and enhancing by using privatization and loop interchange for parallelization.
CO4	Understand the memory management and scheduling for code parallelization.	CLO 8	Describe how to handle control flow by using if-conversion, memory hierarchy used in parallelization for improving performance.
		CLO 9	Understand the concepts of scalar register allocation,cache memory management and scalar replacement techniques to optimizing compilers.
		CLO 10	Understand the concept of unroll-and-jam, cache blocking and perfecting in increasing performance of parallel architecture.
CO5	Optimizing register re-usage by loop carried and independence performance.	CLO 11	Understand to improving register usage by scalar register allocation and concept of data dependence for register reuse.
		CLO 12	Understand loop carried and loop dependent reuse in increasing performance of a compiler.
		CLO 13	Describe pruning dependence graph in register reuse to improve performance and dependence spanning multiple iterations and loop inter change for register reuse.

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
BCS003.01	CLO 1	Understand the key concerns that are common to improve the performance of compiler and describe Compiling for scalar, super scalar, VLIW, vector and parallel processor	PO1, PO3	1
BCS003.02	CLO 2	Memorizing Bernstein's condition to execute parallel processing and describe the concept of Data Dependence, types and loop carried and loop independent dependence.	PO1, PO3	1
BCS003.03	CLO 3	Understand Loop normalization parallelization vectorization and scalar renaming simple dependence testing and subscript portioning.	PO1, PO3	2
BCS003.04	CLO 4	Describe the concept of single subscript and multiple induction variable tests and to understand the importance of Delta test in testing coupled group	PO1, PO3	2
BCS003.05	CLO 5	Understand the concept more powerful and multiple simple test, to describe the overall dependence testing.	PO1, PO3, PO4	2
BCS003.06	CLO 6	Memorize fine grained and enhancing fine grained by using loop distribution and loop interchange for vectorization.	PO1, PO3	1
BCS003.07	CLO 7	Describe the course grained and enhancing by using privatization and loop interchange for parallelization.	PO1, PO3	1
BCS003.08	CLO 8	Describe how to handle control flow by using if-conversion, memory hierarchy used in parallelization for improving performance.	PO1, PO2, PO3	2
BCS003.09	CLO 9	Understand the concepts of scalar register allocation, cache memory management and scalar replacement techniques to optimizing compilers.	PO1, PO3	1
BCS003.10	CLO 10	Understand the concept of unroll-and-jam, cache blocking and perfecting in increasing performance of parallel architecture.	PO1, PO2, PO3	1
BCS003.11	CLO 11	Understand to improving register usage by scalar register allocation and concept of data dependence for register reuse.	PO1, PO2, PO3	2
BCS003.12	CLO 12	Understand loop carried and loop dependent reuse in increasing performance of a compiler.	PO1, PO2, PO3, PO4	2
BCS003.13	CLO 13	Describe pruning dependence graph in register reuse to improve performance and dependence spanning multiple iterations and loop inter change for register reuse.	PO1, PO2, PO3, PO4	2

3 = High; 2 = Medium; 1 = Low

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

Course Outcome	PO 1	PO 2	PO 3	PO 4
CO 1	1		2	
CO 2	2		2	2
CO 3	1		1	

CO 4	1	2	1	
CO 5	2	2	2	2

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

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

3 = High; 2 = Medium; 1 = Low

XII. ASSESSMENT METHODOLOGIES –DIRECT

CIE Exams	PO1,PO2, PO3, PO4	SEE Exams	PO1,PO2, PO3, PO4	Seminar and Term Paper	PO1, PO2, PO3, PO4
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	PARALLEL AND VECTOR ARCHITECTURES	Classes: 10
Compiling for scalar pipeline, compiling for vector pipeline, super scalar and VLIW processors, compiling for multiple issue processors, processor parallelism, Bernstein's conditions. The role of dependence, Dependence analysis: Concept of dependence, classification of dependences, dependence in loop, deppendence distance, dependence direction, loop carried and loop independent dependences, level of loop carried dependence. Simple dependence testing, vectorization and parallelization. Preliminary transformations required to make dependence testing more accurate, loop normalization, scalar data flow analysis, induction variable substitution, scalar renaming.		
UNIT-2	**DEPENDENCE TESTING**	**Classes: 9**
Dependence Testing: Introduction, background and terimnology, dependence testing overview, subscript partitioning, merging direction vectors, single-subscript dependence tests, ZIV test, SIV test, MIV test, testing in coupled groups-the Delta test, more powerful multiple subscript test, an empirical study, putting it all together..		
UNIT-3	**FINE-GRAINED AND COARSE-GRAINED PARALLELISM**	**Classes: 08**
Fine-Grained parallelism: Enhancing fine-grained parallelism using loop distribution. Use of loop interchange for vectorization, scalar and array renaming, use of loop skewing. Coarse-Grained parallelism: Enhancing coarse-grained parallelism using privatization and scalar expansion, loop alignment, loop fusion, use of loop interchange for parallelization.		
UNIT-4	**HANDLING CONTROL FLOW**	**Classes: 09**
Types of branches: if-conversion. Management of Memory Hierarchy: scalar register allocation and management of cache memory. Topics include scalar replacement, unroll-and-jam, loop alignment, cache blocking and perfecting.		
UNIT-5	**IMPROVING RESGISTER USAGE**	**Classes: 9**
Improving Register Usage: Introduction, scalar register allocation, data dependence for register reuse, loop carried and loop independent reuse, a register allocation example, scalar replacement, pruning the dependence graph, simple replacement, handling loop carried dependences, dependence spanning multiple iterations, eliminating scalar copies, loop interchange for register reuse		
Text Books:		
1. Allen and Kennedy, " Optimizing compilers for Modern Architectures", Morgan-Kaufman, 1st edition, 2001. 2. Wolfe, High Performance Compilers for Parallel Computing, Addison-Wesley, 1st edition, 1996.		
Web References:		
1. Banerjee, " Dependence Analysis", Kluwer Academic Publishers, 1st edition, 1997. 2. Wolfe, Optimizing Super Compilers for Supercomputers, MIT Press. 3. Zima and Chapman, Super Compilers for parallel and Vector Computers. ACM Press.		

XV. 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	Compiling for scalar pipeline, compiling for vector pipeline, super scalar and VLIW processors.	CLO 1	T1: 1.1-1.5
2	compiling for multiple issue processors, processor parallelism	CLO 1	T1: 1.1-1.7
3- 4	Bernstein's conditions and Dependence analysis	CLO 2	T1: 2.1-2.8
5-7	loop carried and loop independent dependences, Simple dependence testing	CLO 2	T1: 3.1-3.6
8-10	loop normalization, scalar data flow analysis, induction variable substitution, scalar renaming.	CLO 3	T1: 5.1-5.3

11-13	Dependence Testing, ZIV test, SIV test, MIV test,	CLO 4	T1: 5.4-5.7
14-15	the Delta test, more powerful multiple subscript test	CLO 5	T2:5.1-5.5
16-17	Fine-Grained parallelism	CLO 6	T1:8.1-8.4
17-19	Use of loop interchange for vectorization	CLO 6	T1:9.1-9.6
20-22	scalar and array renaming, use of loop skewing	CLO 6	T1:9.1-9.6
23-26	Coarse-Grained parallelism, loop fusion	CLO 7	T1:11.1-11.4
27-32	use of loop interchange for parallelization, Types of branches: if-conversion.	CLO7, CLO8	T1:20.1-20.7
33-37	unroll-and-jam, loop alignment, cache blocking and perfecting.	CLO 9, CLO 10	T1:20.8-20.9
38-41	scalar register allocation, data dependence for register reuse	CLO 11	T1:25.1-20.3
42-44	loop carried and loop independent reuse, a register allocation example, scalar replacement	CLO 11, CLO12	T1:28.1-28.7
45-49	loop carried dependences, dependence spanning multiple iterations	CLO 12	T1:23.1-23.8
50-56	eliminating scalar copies, loop interchange for register reuse	CLO13	T1:24.1-23.6

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

S No	Description	Proposed actions	Relevance with POs
1	Advanced compiler Design Techniques	Seminars / Guest Lectures/ NPTEL	PO3, PO4
2	Application of Parallel processing and optimization principles	Seminars / Guest Lectures/ NPTEL	PO3, PO4
3	Study about Super Computer performance and their architectures	Seminars / Guest Lectures/ NPTEL	PO3, PO4

Prepared by:
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COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTOR

Course Title	**ADVANCED WEB TECHNOLOGIES**				
Course Code	**BCS204**				
Programme	M.Tech				
Semester	I	CSE			
Course Type	**Core**				
Regulation	IARE - R16				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	-	3	--	--
Course Faculty	**Dr. K Rajendra Prasad, Professor**				

I. COURSE OVERVIEW:

Advanced Web Technologies encompasses the use of Overview of HTML,classes in CSS and computer science to study and evaluate JDBC. This course is to extract valuable information for use in XML parsing with DOM and SAX parsers in java, AJAX programming with JSP/Servest,. It includes the processes derived from Web services interoperability creating java and .Net client applications for an axis web service

II. COURESE PRE- REQUISTIES

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

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Advanced Web Technologies	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 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 AREASSESSED:

	Program Outcomes (POs)	**Strength**	**Proficiency assessed by**
PO 1	Analyze a problem, identify and define computing requirements, design and implement appropriate solutions	1	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	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.	1	Seminar
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	1	Seminar and Term Paper
PO 6	Function effectively on teams to establish goals, plan tasks, meet deadlines, manage risk and produce deliverables	1	Seminar

PO 7	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(COs):

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.

VIII. COURSE OUTCOMES:

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Illustrate on client-side technologies to design web pages	CLO 1	Understand about Overview of HTML and classes in CSS, development of Variables, arrays, methods and string manipulation
		CLO 2	Describe Browser/Document Object Model and accessing elements by ID, objects in JavaScript and JavaScript, handling timer events, JQuery
		CLO 3	Obtain basic knowledge of servlets:Lifecycle of a servlet and reading request and initialization parameters, Session tracking
CO 2	Explore on servlet, cookies and database connectivity in JSP	CLO 4	Learn about Using cookies and sessions, steps involved in deploying an application, database access with JDBC and connection pooling;
		CLO 5	Understand Introduction to XML: XML parsing with DOM and SAX parsers in java, AJAX programming with JSP/Servlets, creating XML http object for various browsers, sending request, processing response data and displaying it, introduction to hibernate
CO 3	Apply various constructs, sharing sessions and implicit objects in JSP application development.	CLO 6	Acquired knowledge on JSP application development: Types of JSP constructs
		CLO 7	Using user defined classes with jsp: UseBean tag, accessing a database from a JSP.
CO 4	Construct MVC architecture with struts framework for web applications	CLO 8	Understand Introduction to MVC architecture and anatomy of a simple struts application
		CLO 9	Understand various struts configuration file, presentation layer with jsp, jsp bean, html and logic tag libraries, struts controller class,
		CLO 10	Describe the multivariate data and basic graphical analysis.
CO 5	Explore on web services and service-oriented architecture	CLO 11	Apply basic using form data in actions, page forwarding, validation frame work, internationalization.
		CLO 12	Understand Overview of service oriented architecture SOA concepts, key service characteristics, technical benefits of a SOA; Introduction to web services: The definition of web services, basic operational model of web services,
		CLO 13	Describe to Web services interoperability creating java and .Net client applications for an

			axis web service; Note: the reference platform for the course will be open source products apache tomcat application server, MySQL database, Hibernate and Axis

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
BCS204.01	CLO 1	Understand about Overview of HTML and classes in CSS, development of Variables, arrays, methods and string manipulation	PO 3, PO 5	2
BCS204.02	CLO 2	Describe Browser/Document Object Model and accessing elements by ID, objects in JavaScript and JavaScript, handling timer events, JQuery	PO 1, PO 4,	2
BCS204.03	CLO 3	Obtain basic knowledge of servlets:Lifecycle of a servlet and reading request and initialization parameters, Session tracking	PO 4, PO 5	1
BCS204.04	CLO 4	Learn about Using cookies and sessions, steps involved in deploying an application, database access with JDBC and connection pooling;	PO 4, PO 6, PO 7	1
BCS204.05	CLO 5	Understand Introduction to XML: XML parsing with DOM and SAX parsers in java, AJAX programming with JSP/Servlets, creating XML http object for various browsers, sending request, processing response data and displaying it, introduction to hibernate	PO 1, PO 3, PO 7	2
BCS204.06	CLO 6	Acquired knowledge on JSP application development: Types of JSP constructs	PO3,PO 4, PO 5	1
BCS204.07	CLO 7	Using user defined classes with jsp: UseBean tag, accessing a database from a JSP.	PO 6, PO 7	2
BCS204.08	CLO 8	Understand Introduction to MVC architecture and anatomy of a simple struts application	PO 3, PO 4	1
BCS204.09	CLO 9	Understand various struts configuration file, presentation layer with jsp, jsp bean, html and logic tag libraries, struts controller class,	PO 5, PO 7	1
BCS204.10	CLO 10	Describe the multivariate data and basic graphical analysis.	PO 1, PO 4	1
BCS204.11	CLO 11	Apply basic using form data in actions, page forwarding, validation frame work, internationalization.	PO 6, PO 7	1
BCS204.12	CLO 12	Understand Overview of service oriented architecture SOA concepts, key service characteristics, technical benefits of a SOA; Introduction to web services: The definition of web services, basic operational model of web services,	, PO 5, PO 7	2
BCS204.13	CLO 13	Describe to Web services interoperability creating java and .Net client applications for an axis web service; Note: the reference platform for the course will be open source products apache tomcat application server, MySQL database, Hibernate and Axis	PO 3, PO 4	2

3 = High; 2 = Medium; 1 = Low

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

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

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES –DIRECT

CIE Exams	PO1,PO2,PO3, PO4,PO5 PO6, PO7	SEE Exams	PO1,PO2,PO3, PO4,PO5 PO6, PO7	Seminar and Term Paper	PO1, PO2, PO3, PO7
Viva	-	Mini Project	-	Laboratory Practices	-

XII. ASSESSMENT METHODOLOGIES -INDIRECT

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

XIII. SYLLABUS

UNIT-I	CLIENT SIDE TECHNOLOGIES	Classes: 10
Overview of HTML: Common tags for text formatting, lists, tables, images, forms, frames etc., XHTML cascading style sheets, linking to HTML pages, classes in CSS, general CSS statements for text, table, list and page formatting; Introduction to JavaScripts: Variables, arrays, methods and string manipulation, Browser/Document Object Model, accessing elements by ID, objects in JavaScript, dynamic HTML with JavaScript and with CSS, form validation with JavaScript, handling timer events, JQuery..		
UNIT-2	INTRODUCTION TO JAVA SERVLETS	Classes: 9

Introduction to servlets: Lifecycle of a servlet, reading request and initialization parameters, writing output to response, mime types in response; Session tracking: Using cookies and sessions, steps involved in deploying an application, database access with JDBC and connection pooling; Introduction to XML: XML parsing with DOM and SAX parsers in java, AJAX programming with JSP/Servlets, creating XML http object for various browsers, sending request, processing response data and displaying it, introduction to hibernate

UNIT-3	INTRODUCTION TO JSP	Classes: 08

JSP application development: Types of JSP constructs (directives, declarations, expressions, code snippets), generating dynamic content, exception handling, implicit JSP objects, conditional processing, sharing data between JSP pages, sharing session and application data.
Using user defined classes with jsp: UseBean tag, accessing a database from a JSP.

UNIT-4	INTRODUCTION TO STRUTS FRAMEWORK	Classes: 09

Introduction to MVC architecture, anatomy of a simple struts application, struts configuration file, presentation layer with jsp, jsp bean, html and logic tag libraries, struts controller class, using form data in actions, page forwarding, validation frame work, internationalization.

UNIT-5	SERVICE ORIENTED ARCHITECTURE AND WEB SERVICES	Classes: 9

Overview of service oriented architecture: SOA concepts, key service characteristics, technical benefits of a SOA; Introduction to web services: The definition of web services, basic operational model of web services, basic steps of implementing web services; Core fundamentals of SOAP: SOAP message structure, SOAP encoding, SOAP message exchange models; Describing web services: Web services life cycle, anatomy of WSDL; Introduction to axis installing axis web service framework, deploying a java web service on axis; Web services interoperability creating java and .Net client applications for an axis web service; Note: the reference platform for the course will be open source products apache tomcat application server, MySQL database, Hibernate and Axis

Text Books:

1. Chris Bates, "Web Programming, Building Internet Applications", Wiley Dreamtech, 3rd Edition, 2014.
2. Herbert Schildt, "The Complete Reference Java", TMH, 7th Edition, 2006.
3. Hans Bergsten, "Java Server Pages", O'Reilly, 3rd Edition, 2003.
4. Richard Hightower, "Professional Jakarta Struts - James Goodwill", Wrox Publishers, 1st Edition, 2003
5. R. Nagappan, R. Skoczylas, R. P. Sriganesh, "Developing Java Web Services", Wiley India, 3rd Edition, 2008.
6. Eric Newcomer, Greg Lomow, "Understanding SOA with Web Services" , Pearson, 1st Edition, 2009.

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.

Web References:

1. https://www.goodreads.com/book/show/3729666-web-programming
2. https://www.ftp://ftp.bupt.edu.cn
3. https://www.dl.acm.org/citation

E-Text Books:

1. https://books.google.co.in/books/about/WEB_PROGRAMMING_BUILDING_INTERNET_APPLIC. html
2. http://iiti.ac.in/people/~tanimad/JavaTheCompleteReference.pdf
3. http://se.csie.dyu.edu.tw/lairrol/files/JAVAEC/O'Reilly.pdf

XIV. COURSE PLAN:

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

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Introduction and Overview of HTML: Common tags for text formatting, lists, tables, images, forms, frames etc., XHTML cascading style sheets, linking to HTML pages, classes in CSS, Browser/Document Object Model, accessing elements by ID, events,	CLO 1	T1:1.1, 1.2
2	Study about general CSS statements for text, table, list and page formatting; Introduction to JavaScripts: Variables, arrays, methods and string manipulation,	CLO 2	T2:7.1, 7.2
3- 4	Introduction of objects in JavaScript, dynamic HTML with JavaScript and with CSS, form validation with JavaScript, handling timer	CLO 2	T1:1.3, 1.4, 1.6
5-7	Introduction to servlets: Lifecycle of a servlet, reading request and initialization parameters, writing output to response,	CLO 3	T2:1.1, 1.3
8-10	Study in response; Session tracking: Using cookies and sessions, steps involved in deploying an application, database access with JDBC and connection pooling; Introduction to XML	CLO 5	T1:1.1, 1.8
11-13	XML parsing with DOM and SAX parsers in java,	CLO 4	T2:11.2, 11.4
14-15	AJAX programming with JSP/Servlets, creating XML	CLO 5	T2:11.6
16-17	http object for various browsers, sending request, processing response data and displaying it, introduction to hibernate.	CLO 6	T1:1.7
17-19	JSP application development: Types of JSP constructs (directives, declarations, expressions, code snippets),	CLO 7	T1:6.1, 6.2
20-22	Generating dynamic content, exception handling, implicit JSP objects, conditional processing, sharing data between JSP pages, sharing session and application data.	CLO 9	T2:18.3.4, 18.3.4.1
23-26	Introduction to MVC architecture, anatomy of a simple struts application, struts configuration file,	CLO 8	T3:14.1
27-32	presentation layer with jsp, jsp bean, html and logic tag libraries,	CLO 7	T3:1.2, 1.3
33-37	struts controller class, using form data in actions, page forwarding,	CLO 11	T3:4.2, 4.6
38-41	validation frame work, internationalization.	CLO 9	T3:18.3.4, 18.3, 4.1
42-44	Introduction to MVC architecture, anatomy of a simple struts application,.	CLO 9	T3:18.1
45-49	struts configuration file, presentation layer with jsp, jsp bean, html and logic tag libraries,	CLO 12, CLO 10	T1: 8.1
50-56	struts controller class, using form data in actions, page forwarding, validation frame work, internationalization	CLO13	T2:12.1, 12.4

XV. 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 3
2	String matching: Knuth-Morris-Pratt, Boyer-Moore, Edit distance, Longest	Seminars / Guest Lectures/ NPTEL	PO 2, PO 5

	increasing subsequence, Smith-Waterman algorithm		
3	Encourage students to write programs based on the taught algorithms to solve problems	Laboratory Practices	PO 1, PO 3, PO 4

Prepared by:
Dr. K Rajendra Prasad, Professor **HOD, CSE**

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Computer Science and Engineering

COURSE DESCRIPTOR

Course Title	**BIG DATA ANALYTICS**			
Course Code	**BCS212**			
Programme	**M.Tech**			
Semester	**I**			
Course Type	**Elective**			
Regulation	**R16**			
Course Structure	**Theory**		**Practical**	
	Lectures	**Tutorials**	**Practicals**	**Credits**
	3	**-**	**-**	**-**
Course Faculty	**Ms. B Padmaja, Associate Professor**			

I. COURSE OVERVIEW:

Big data is a field that treats ways to analyze, systematically extract information from, or otherwise deal with data sets that are too large or complex to be dealt with by traditional data processing application software. Data with many rows offer greater statistical power, while data with higher complexity i.e., more attributes or columns may lead to a higher false discovery rate. Big data challenges include capturing data, data storage, data analysis, search, sharing, transfer, visualization, querying, updating, information privacy and data source.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
-	-	-	Database Management Systems	-
-	-	-	Big Data and Business Analytics	-

III. MARKS DISTRIBUTION

Subject	SEE Examination	CIA Examination	Total Marks
Big Data Analytics	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	1	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	Seminar
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

PO 5	Independently carry out research/investigation and development work to solve practical problems	1	Term paper and Seminar
PO 7	Engage in life-long learning and professional development through self-study, continuing education, professional and doctoral level studies	2	Term paper and Seminar

3 = High; 2 = Medium; 1 = Low

VII. COURSE OBJECTIVES:

The course should enable the students to:

I	Understand about big data
II	Learn the analytics on big data
III	Explore on map reduce fundamentals

VIII. COURSE OUTCOMES (COs):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Understand importance and role of data, classifications, challenges of analytics and knowledge extraction	CLO 1	Understand what Big Data, importance and various sources of data
		CLO 2	Ability to understand elements of big data, distributed and parallel computing
		CLO 3	Demonstrate conceptually how Big Data is stored on cloud
		CLO 4	Examine data scientists and terminologies that are used in data environments
		CLO 5	Describe how Big Data can be analysed to extract knowledge from basically available soft state eventual consistency (BASE)
CO 2	Describes text analytics, analysis and development, various analytical tools.	CLO 6	Distinguish between different types of BIG DATA analytical approaches and tools.
		CLO 7	Elucidate the framework of map reduce and techniques to optimize map reduce jobs.
CO 3	Explore map reduce framework, role of HBase in big data, HDFS file system	CLO 8	Understand the architecture of HDFS files, file system types, commands and packages.
		CLO 9	Explain the HBase architecture, operations, combining HBase and HDFS.
CO 4	Demonstrate NoSQL, hadoop, distributed challenges, HDFS demons and various big data technologies	CLO 10	Interpret NoSQL, Hadoop, RDBMS versus hadoop, Distributed computing challenges
		CLO 11	Outline the history of hadoop overview, use case of hadoop and hadoop distributors.
		CLO 12	Illustrate about HDFS daemons, managing resources and applications with hadoop YARN
CO 5	Explain text mining, sentiment analysis, web analytics and mobile analytics	CLO 13	Identify the importance of social media and key elements of social media
		CLO 14	Classify the text mining process, sentiment analysis, mobile analytics and web analytics.
		CLO 15	Compare the types of results from mobile analytics and applications for mobile analytics.

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
BCS212.01	CLO 1	Understand what Big Data, importance and various sources of data	PO 3	2

BCS212.02	CLO 2	Ability to understand elements of big data, distributed and parallel computing	PO 1, PO 2	1
BCS212.03	CLO 3	Demonstrate conceptually how Big Data is stored on cloud	PO 3, PO 5	2
BCS212.04	CLO 4	Examine data scientists and terminologies that are used in data environments	PO 5, PO 7	1
BCS212.05	CLO 5	Describe how Big Data can be analysed to extract knowledge from basically available soft state eventual consistency (BASE)	PO 1	2
BCS212.06	CLO 6	Distinguish between different types of BIG DATA analytical approaches and tools.	PO 1, PO 2	1
BCS212.07	CLO 7	Elucidate the framework of map reduce and techniques to optimize map reduce jobs.	PO 3	2
BCS212.08	CLO 8	Understand the architecture of HDFS files, file system types, commands and packages.	PO 3, PO 5	1
BCS212.09	CLO 9	Explain the HBase architecture, operations, combining HBase and HDFS.	PO 3, PO 2	1
BCS212.10	CLO 10	Interpret NoSQL, Hadoop, RDBMS versus hadoop, Distributed computing challenges	PO 5, PO 7	2
BCS212.11	CLO 11	Outline the history of hadoop overview, use case of hadoop and hadoop distributors.	PO 1	2
BCS212.12	CLO 12	Illustrate about HDFS daemons, managing resources and applications with hadoop YARN	PO 2, PO 5, PO 7	1
BCS212.13	CLO 13	Identify the importance of social media and key elements of social media	PO 1, PO 2	1
BCS212.14	CLO 14	Classify the text mining process, sentiment analysis, mobile analytics and web analytics.	PO 2, PO 7	1
BCS212.15	CLO 15	Compare the types of results from mobile analytics and applications for mobile analytics.	PO 3, PO 5, PO 7	1

3 = High; 2 = Medium; 1 = Low

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

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

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

Course Learning Outcomes (CLOs)	Program Outcome (PO)				
	PO 1	PO 2	PO 3	PO 5	PO 7
CLO 1			2		

CLO 2	1	1			
CLO 3			2	2	
CLO 4				1	1
CLO 5	2				
CLO 6	1	1			
CLO 7			2		
CLO 8			1	1	
CLO 9		1	1		
CLO 10				2	2
CLO 11	2				
CLO 12		1		1	2
CLO 13	1	1			
CLO 14		2			1
CLO 15			1	1	1

3 = High; 2 = Medium; 1 = Low

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
DATA MANAGEMENT
Data management: Introduction to big data; history of data management: Design data architecture and manage the data for analysis, understand various sources of data like sensors/signal/GPS, structuring big data, elements of big data, big data analytics, distributed and parallel computing for big data, example export all the data onto cloud ex. AWS/Rackspace etc; Big data analytics: Introduction, classification of analytics, greatest challenges that prevent business from capitalizing big data, top challenges facing big data, big data analytics importance, data science; Data scientist, terminologies used in big data environments, basically available soft state eventual consistency (BASE), open source analytics tools.
UNIT II
BIG DATA ANALYTICAL APPROACHES AND TOOLS
Understanding analytics and big data: Comparing reporting and analysis, types of analytics, points to consider during analysis, developing an analytic team, understanding text analytics; Analytical approach and tools to analyze data: Analytical approaches, history of analytical tools, introducing popular

analytical tools, comparing various analytical tools.
UNIT III
MAP REDUCE AND HBASE
Understanding map reduce fundamentals and HBase: The map reduce framework, techniques to optimize map reduce jobs, uses of map reduce, role of HBase in big data processing; Storing data in Hadoop: Introduction of HDFS, architecture, HDFS files, file system types, commands, org.apache.hadoop.io package, HDF, HDFS high availability. Introduction to HBase: Architecture, storing big data with HBase, interacting with the hadoop ecosystem, HBase in operations programming with HBase, installation, combining HBase and HDFS.
UNIT IV
HADOOP
Big data technology landscape and hadoop: NoSQL, Hadoop, RDBMS versus hadoop, distributed computing challenges, history of hadoop, hadoop overview; use case of hadoop, hadoop distributors, HDFS, HDFS daemons, read, write, replica processing of data with hadoop, managing resources and applications with hadoop YARN.
UNIT V
SOCIAL MEDIA ANALYTICS AND TEXT MINING
Social media analytics and text mining: Introducing social media, key elements of social media, text mining, understanding text mining process, sentiment analysis, performing social media analytics and opinion mining on tweets; Mobile analytics: Introducing mobile analytics, define mobile analytics, mobile analytics and web analytics, types of results from mobile analytics, types of applications for mobile analytics, introducing mobile analytics tools.
TEXT BOOKS:
1 Seema Acharya, Subhasinin Chellappan, "Big Data and Analytics", Wiley Publications, 2nd Edition, 2014.
2 DT Editorial Services, "Big Data", Dream Tech Press, 2nd Edition, 2015.
3 Albright, Winston, "Business Analytics", Cengage Learning, 6th Edition, 2015.
REFERENCES:
1 Rajiv Sabherwal, Irma Becerra- Fernandez, "Business Intelligence –Practice, Technologies and Management", John Wiley, 1st Edition, 2011.
2 Lariss T. Moss, Shaku Atre, "Business Intelligence Roadmap", Addison-Wesley It Service, 2nd Edition, 2011.
3 Yuli Vasiliev, "Oracle Business Intelligence: The Condensed Guide to Analysis and Reporting", Shroff Publishers and Distributers, 2nd Edition, 2012.

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	Discuss Data management	Introduction to Big Data, history	T1:1.1
2	Define distributed and parallel computing for big data	Importance, Purpose, Examples	T1:1.3
3- 5	Explain Big data analytics	Classifications, Challenges, Importance	T1:1.3.1
4	Discuss data science	Data scientist, terminologies	T1:2.2,2.3
6-9	Understanding analytics and big data	Reporting and analysis, types	T1:2.3.1
10-11	Understanding text analytics	History, Analytical approaches	T1:2.2
12-13	Understanding map reduce	Fundamentals, Map reduce framework, techniques	T2:4.1
14	Discuss HBase	role of HBase in big data, Storing data	T2:4.3
15-17	Define HDFS	Introduction, architecture, file system types, commands	T1:4.1
18-25	Explain HBase	Architecture, storing, operations, installation, combining HBase and	T2:4.4

Lecture No	Topic Outcomes	Topic/s to be covered	Reference
		HDFS	
26-27	Discuss Big data technology	NoSQL, Hadoop, RDBMS versus hadoop	T3:2.1
28-31	Define landscape and hadoop	Distributed computing challenges, history of hadoop, hadoop overview	T3:2.7
32-35	Discuss HDFC	Daemons, Read, Write, Replica Processing	T1:6.1
36	Define managing resources	Applications with hadoop YARN	T1:6.2
37-49	Define Social media analytics	Introduction, key elements	T1:6.5
50-55	Understanding text mining	text mining process, sentiment analysis, opinion mining on tweets	T1:7.1
56-60	Discuss Mobile analytics	Introducing, web analytics, Types, Applications	T1:7.2

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

S No	Description	Proposed Actions	Relevance with POs
1	HBase	Seminars / Guest Lectures / NPTEL	PO 1, PO 2, PO 3
2	HDFS, NoSQL	Work Shops/ Guest Lectures / NPTEL	PO 2, PO 3

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

1. Should companies embrace big data? Which ones (start-ups, big-companies, tech companies, retail, health care)? And how? Using vendors, outsourcing or by hiring employees? And how do you measure ROI on big data? Should they use redundant data to consolidate KPI's?
2. What do you consider to be big data? I tend to think of big data as anything 10 times larger (in terms of megabytes per day) than the maximum you are used to. Also, sparse data might not be as big as they look, can be costly to process. Is there a price per megabyte, for big data storage, big data transfers, and big data analytics?
3. What kind of training do you recommend for future data scientists? Any specific program in mind?
4. How to get university professors more involved in teaching students how to process real live, big data sets? Should curricula be adapted, outdated material removed, new material introduced?
5. Besides Hadoop-like and graph database environments, do you see other technology that would made data plumbing easier for big data?
6. Can you tell me 5 business activities that would benefit most from big data, and 5 that would benefit least?

Prepared By:
Ms. B Padmaja, Associate Professor **HOD, CSE**

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

Computer Science and Engineering

COURSE DESCRIPTOR

Course Title	**Embedded C**				
Course Code	BES001				
Programme	M. Tech				
Semester	I	CSE			
Course Type	Core				
Regulation	IARE - R16				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	-	3	3	2
Course Faculty	Dr. M Ramesh Babu, professor				

I. COURSE OVERVIEW:

This course provides the basic knowledge over the programming and functionality of the basic embedded systems. It also provides the information about the techniques for switches . This course is intended to describe the object oriented programming with C and Embedded C. It also meets the real time constraints.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
-	-	-	Computer programming	-
-	-	-	Embedded systems	-

III. MARKSDISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Embedded systems	70 Marks	30 Marks	100 Marks

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

√	CHALK & TALK	√	QUIZ	√	ASSIGNMENTS	√	MOOCs
√	LCD / PPT	√	SEMINARS	√	MINI PROJECT	X	VIDEOS
X	OPEN ENDED EXPERIMENTS						

V. EVALUATION METHODOLOGY:

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

Semester End Examination (SEE):

The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into five 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**
PO 1	Analyze a problem, identify and define computing requirements, design and implement appropriate solutions	2	Technical Seminar and Term Paper
PO 2	Solve complex heterogeneous data intensive analytical based problems of real time scenario using state of the art hardware/software tools	2	Technical Seminar and 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.	3	Technical Seminar and Term Paper
PO 4	Write and present a substantial technical report/document	2	Technical Seminar and Term Paper
PO 6	Function effectively on teams to establish goals, plan tasks, meet deadlines, manage risk and produce deliverables	2	Technical Seminar and Term Paper

3 = High; 2 = Medium; 1 = Low

VII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Understand embedded C and use it for programming embedded system.
II	Apply techniques for data transfer between I/O ports and memory.

III	Apply object oriented programming for designing embedded system.
IV	Use timers to generate time delay

VIII. COURSE OUTCOMES (COs):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Understand the basic knowledge about embedded processor and hardware and software interrupts	CLO 1	Understanding the basic concepts of Embedded C.
		CLO 2	Understanding the basic concept of interfacing and interrupts
		CLO 3	Understanding the basic of 8051 architecture
CO 2	Understand the basic embedded programming concepts in C and assembly language	CLO 4	Analyze the programming on switches
		CLO 5	Analysis of processor scheduling real time.
		CLO 6	Understanding the programming language tools.
CO 3	Illustrate various tasks in real time operating systems including inter-task communication and software development tool	CLO 7	Understanding the basic concepts of coding on embedded C.
		CLO 8	Applications of software on real time constraints
CO 4	Explore on various testing concepts on real time applications.	CLO 9	Analyze the programming on object oriented
		CLO 10	Understanding the testing concepts on real time applications
CO 5	Apply embedded programming concepts on case study	CLO 11	Understanding the basic concepts on software architecture
		CLO 12	Understanding the real time concepts using case study.

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
BES001.01	CLO 1	Understanding the basic concepts of Embedded C.	PO1,PO6	2
BES001.02	CLO 2	Understanding the basic concept of interfacing and interrupts	PO2,PO6	3
BES001.03	CLO 3	Understanding the basic of 8051 architecture	PO1,PO3	3
BES001.04	CLO 4	Analyse the programming on switches	PO2,PO4	3
BES001.05	CLO 5	Analysis of processor scheduling real time.	PO3,PO4	3
BES001.06	CLO 6	Understanding the programming language tools.	PO3,PO6	3
BES001.07	CLO 7	Understanding the basic concepts of coding on embedded C.	PO3,PO4	3
BES001.08	CLO 8	Applications of software on real time constraints	PO2,PO6	2
BES001.09	CLO 9	Analyse the programming on real time constraints	PO3,PO6	3
BES001.10	CLO 10	Understanding the testing concepts on real time	PO3,PO4	3

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
		applications		
BES001.11	CLO 11	Understanding the basic concepts on software architecture	PO4	3
BES001.12	CLO 12	Understanding the real time concepts using case study	PO1,PO2,PO3	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 6
CO 1		1	1		
CO 2		1	1		1
CO 3	2		2		1
CO 4	1			2	
CO 5				2	

3= High; 2 = Medium; 1 = Low

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

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

XII. ASSESSMENT METHODOLOGIES–DIRECT

CIE Exams	PO1, PO2,PO3, PO4, PO6	SEE Exams	PO1, PO2,PO3, PO4, PO6	Seminar and Term Paper	PO1,PO2,PO3, PO4, PO6
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	

PROGRAMMING EMBEDDED SYSTEMS IN C

Introduction, what is an embedded system, which processor should you use, which programming language should you use, which operating system should you use, how do you develop embedded software, conclusions; Introduction, what's in a name, the external interface of the standard 8051, reset requirements, clock frequency and performance, memory issues, I/O pins, timers, interrupts, serial interface, power consumption ,conclusions.

UNIT-II	

SWITCHES

Introduction, basic techniques for reading from port pins; Example: Reading and writing bytes, example: Reading and writing bits (simple version), Example: Reading and writing bits (generic version), The need for pull-up resistors, Dealing with switch bounce, Example: Reading switch inputs (basic code), example: counting goats, conclusions.

UNIT-III	

ADDING STRUCTURE TO THE CODE

Introduction, object oriented programming with C, the project header (MAIN.H), the port header (PORT.H); Example: Restructuring the „Hello Embedded World‟ example, Example: Restructuring the goat-counting example, further examples and conclusions.

UNIT-IV	

MEETING REAL-TIME CONSTRAINTS

Introduction, creating hardware delays using Timer 0 and Timer 1, example: Generating a precise 50 ms delay, example: Creating a portable hardware delay, Why not use Timer 2? The need for timeout mechanisms, creating loop timeouts and example: Testing loop timeouts, example: A more reliable switch interface, Creating hardware timeouts, example: Testing a hardware timeout, conclusions.

UNIT-V	

CASE STUDY: INTRUDER ALARM SYSTEM

Introduction, The software architecture, key software components used in this example, running the program, the software, conclusions.

Text Books:

1. Michael J. Pont, "Embedded C", Pearson Education, 2nd Edition, 2008.

Reference:

1.Nigel Gardner, "The Microchip PIC in CCS C", Ccs Inc, 2nd Revision Edition, 2002.

Reference E-Text Books:

1. http://www.keil.com/forum/5973/
2.http://nptel.ac.in/courses/Webcourse,contents/IIT%20Kharagpur/Embedded%20systems/New_index1.html
3. http://nptel.iitg.ernet.in/courses/Elec_Engg/IIT%20Delhi/Embedded%20Systems%20(Video).htm
4. http://freevideolectures.com/Course/2999/Embedded-Systems-I/5

XV. COURSE PLAN:

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

Lecture No	Topic Outcomes	Topic/s to be covered	Reference
1-3	Understand the concepts of embedded system.	Introduction, what is an embedded system	T1:1.1, 1.2
4-6	Understand the concepts of operating system.	which processor should you use, which programming language should you use	T1:2.1
7-9	Design the programming on embedded system	which operating system should you use how do you develop embedded software	T1:2.2, 2.3
10-13	Understand the standard the concepts of 8051	key software components used in this example the external interface of the standard 8051	T1:4.1, 4.2, 4.3
14-16	Analyze the clock functions and I/O	reset requirements, clock frequency and performance memory issues, I/O pins, timers, interrupts	T1:4.2, 4.4
17-20	Analyze the concepts of interface and port pins	serial interface, power consumption ,conclusions Introduction, basic techniques for reading from port pins	T1: 5.1, 5.2
21-22	Design the example programming and basic concepts of pull-up resistor	Example programs on Reading and writing bytes, Reading and writing bits simple version Reading and writing bits, The need for pull-up resistors	T1:6.1, 6.2, 6.4
23-27	Understand the basic of switch and c programming	Dealing with switch bounce, Example: Reading switch inputs (basic code) Introduction, object oriented programming with C the project header (MAIN.H), the port header (PORT.H);	T1:7.2, 7.3, 7.4
28-36	Design the example programming on goat counting	Restructuring the Hello Embedded World Restructuring the goat-counting example, further examples and conclusions	T1:8.1, 8.3
37-40	Understand the basic concepts of timer and testing the hardware.	Introduction, creating hardware delays using Timer 0 and Timer 1 Generating a precise 50 ms delay, example: Creating a portable hardware delay, Why not use Timer 2? Creating hardware timeouts, example: Testing a hardware timeout, conclusions	T1:5.3
41-45	Understand the basic concepts of software architecture.	Introduction, The software architecture key software components used in this example	T1:5.5, 5.6, 5.7

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

S No	Description	Proposed Actions	Relevance with POs
1	Real time programming software architecture	Seminars / Guest Lectures / NPTEL	PO 1, PO 4, PO 3
2	Design concepts of embedded c	Work Shops/ Guest Lectures / NPTEL	PO 5, PO 2

Prepared by:
Dr. M Ramesh Babu, Professor, ECE **HOD, CSE**

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTOR

Course Title	FOUNDATION OF DATA SCIENCE					
Course Code	BCS101					
Programme	M.Tech					
Semester	II	CSE				
Course Type	Core					
Regulation	IARE - R16					
Course Structure	**Theory**			**Practical**		
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**	
	-	-	-	4	2	
Course Faculty	Dr. M. Madhu Bala, 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	Understand R programming concepts	PO 1	3
BCSB12.2	CLO 2	Implement IRIS data set using sample datasets	PO 1	3
BCSB12.3	CLO 3	Illustrating the way of reading and writing data using XML concepts	PO 2	2
BCSB12.4	CLO 4	Visualizing the data using graphical representation	PO 2	3
BCSB12.5	CLO 5	Analysis of covariance data	PO 7	3
BCSB12.6	CLO 6	Implementing logistic regression models to fit the data	PO 1,PO 2	2
BCSB12.7	CLO 7	Implementing multi regression model	PO 1	2
BCSB12.8	CLO 8	Analyzing the data using prediction	PO 1	3
BCSB12.9	CLO 9	Differentiating text classification methods	PO 7	3
BCSB12.10	CLO 10	Exploring the applications of Unsupervised learning	PO 7	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		
CLO 9			3
CLO 10			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	R 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. M. Madhu Bala, Professor, CSE **HOD, CSE**

II SEMESTER

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

COMPUTER SCIENCE AND ENGINEERING
COURSE DESCRIPTOR

Course Title	**DISTRIBUTED OPERATING SYSTEMS**			
Course Code	**BCS004**			
Programme	**M.Tech**			
Semester	**II**			
Course Type	**Core**			
Regulation	**R16**			
Course Structure	**Theory**		**Practical**	
	Lectures	**Tutorials**	**Laboratory**	**Credits**
	3	**--**	**-**	**2**
Course Faculty	**Mr. P Ravinder, Assistant Professor**			

I. COURSE OVERVIEW:

As distributed computer systems become more pervasive, so does the need for understanding how their operating systems are designed and implemented. Andrew S. Tanenbaum's Distributed Operating Systems fulfills this need. Representing a revised and greatly expanded Part II of the best-selling Modern Operating Systems, it covers the material from the original book, including communication, synchronization, processes, and file systems, and adds new material on distributed shared memory, real-time distributed systems, fault-tolerant distributed systems, andATM networks. It also contains four detailed case studies: Amoeba, Mach, Chorus, and OSF/DCE. Tanenbaum's trademark writing provides readers with a thorough, concise treatment of distributed systems.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
-	-	-	Operating Systems & Computer Networks	-

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Distributed Operating Systems	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	LCD / PPT	✔	Seminars	✔	Videos	✔	MOOCs
✔	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:

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 lab assessment during day today performance, 10 marks for final internal lab assessment.

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.

V. 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 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 Term Paper
PO 4	Write and present a substantial technical report/document.	2	Seminar and Term Paper
PO 5	Independently carry out research/investigation and development work to solve practical problems	1	Seminar and Term Paper
PO 6	Function effectively on teams to establish goals, plan tasks, meet deadlines, manage risk and produce deliverables	2	Seminar and Term Paper
PO 7	Engage in life-long learning and professional development through self-study, continuing education, professional and doctoral level studies.	1	Seminar and Term Paper

3 = High; 2 = Medium; 1 = Low

VI. COURSE OBJECTIVES :

The course should enable the students to:	
I	Understand the concepts of resource sharing, multitasking, multiprocessing in distributed Environment
II	Resource allocation and deadlock detection and avoidance techniques
III	Design and Implement Distributed applications using Technologies like RPC, threads. And learn How to store data in distributed file system.
IV	Understand How Distributed Shared Memory is managed.
V	Understand the case studies on MACH OS and implement new case studies

VII. COURSE OUTCOMES (COs):

CO No.	Description	CLOs	Course Learning Outcome
CO 1	Understand the distributed system goals, design issues and communication in client/server and group	CLO 1	Understand how the communication in distributed environment takes place
		CLO 2	Understand The Remote Procedure Calls And Group Communication in Distributed Systems
CO 2	Illustrate the concepts of synchronization, mutual exclusion and deadlocks in distributed systems..	CLO 3	Analyze the Synchronization in Distributed System and Clock synchronization;
		CLO 4	Understand the distributed deadlock prevention and distributed deadlock detection.
		CLO 5	Understand The deadlock in distributed systems
CO 3	Explore on the concepts of processors allocation and scheduling in distributed System	CLO 6	Understand different processes and processors running in distributed systems
		CLO 7	Understand The Distributed File System Design And distributed file system implementation
CO 4	Describe the distributed shared memory concepts using page based and distributed shared memory	CLO 8	Understand the real time distributed systems consistency models
		CLO 9	Understand the distributed shared memory process concept.
CO 5	Illustrate the process management in MACH and Unix operating systems.	CLO 10	Understand the process communication in MACH.
		CLO 11	Understand the system management in MACH operating system

		CLO 12	Understand and analyze Unix emulation in MACH.

3= High; 2 = Medium; 1 = Low

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
BCS004.01	CLO 1	Understand how the communication in distributed environment takes place	PO1,PO2	2
BCS004.02	CLO 2	Understand the remote procedure calls and group communication in distributed systems	PO 1 PO2	2
BCS004.03	CLO 3	Analyze the synchronization in distributed system and clock synchronization;	PO 1, PO2	2
BCS004.04	CLO 4	Understand the distributed deadlock prevention and distributed deadlock detection.	PO 2, PO4	2
BCS004.05	CLO 5	Understand the deadlock in distributed systems	PO2,PO5	2
BCS004.06	CLO 6	Understand different processes and processors running in distributed systems	PO1,PO5	1
BCS004.07	CLO 7	Understand The distributed file system design and distributed file system implementation	PO1,PO3	1
BCS004.08	CLO 8	Understand the real time distributed systems consistency models	PO1, PO6	1
BCS004.09	CLO 9	Understand the distributed shared memory process concept.	PO5,PO6	1
BCS004.10	CLO 10	Understand the process communication in MACH.	PO5,PO7	2
BCS004.11	CLO 11	Understand the system management in MACH operating system	PO6,PO7	2
BCS004.12	CLO 12	Understand and analyze Unix emulation in MACH.	PO5,PO7	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 4	PO 5	PO 6	PO 7
CO 1	2	2				
CO 2	2	2				
CO 3	2	2				
CO4			2	2	2	
CO 5			1	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 4	PO 5	PO 6	PO 7
CLO 1	2	2				

CLO 2	2	2			1	
CLO 3		2	2			1
CLO 4		1		1		
CLO 5	1			1		
CLO 6	1			1		
CLO 7	1		1			
CLO 8	1		1			
CLO 9	1				1	
CLO 10					2	2
CLO 11					2	2
CLO 12				2		2

3= High; 2 = Medium; 1 = Low

XII. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO1, PO2, PO4, PO5, PO6, PO7	SEE Exams	PO1, PO2,PO4, PO5,PO6, PO7	Seminars and Term Paper	PO2, PO4, PO5, PO6, PO7
Laboratory Practices	-	Student 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:08
Introduction: Introduction to distributed System, goals of distributed system, hardware and software concepts, design issues; Communication in distributed system: Layered protocols, ATM networks, client – server model, remote procedure calls and group communication; Middleware and Distributed Operating Systems.		
UNIT-II	**MUTUAL EXCLUSION AND DEADLOCK IN DISTRIBUTED SYSTEMS**	Classes: 10
Synchronization in Distributed System: Clock synchronization, mutual exclusion, election algorithm, the bully algorithm, ring algorithm, atomic transactions, deadlock in distributed systems, distributed deadlock prevention, distributed deadlock detection.		
UNIT-III	**PROCESSES AND PROCESSORS**	Classes: 08
Processes and Processors in distributed systems: Threads, System models, Processors Allocation, Scheduling in Distributed System; Real Time Distributed Systems. Distributed file system design, distributed file system implementation, trends in distributed file systems.		
UNIT-IV	**DISTRIBUTED SHARED MEMORY**	Classes: 08
Distributed shared memory: what is shared memory, consistency models, page based distributed shared memory, shared variables and distributed shared memory.		
UNIT-V	**MACH**	Classes: 08
Case study MACH: Introduction to MACH, process management in MACH, communication in MACH, UNIX emulation in MACH.		

XV. COURSE PLAN:

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

Lecture No	Topic Outcomes	Topic/s to be covered	Reference
1	Understand the concept of distributed System	Introduction to distributed System	T1:2.1
2	Understand the concept hardware and software concepts	goals of distributed system, hardware and software concepts	T1:2.3
3	understand the communication in distributed system:	design issues; Communication in distributed system:	T1:2.3.1
4	understand the different layers , ATM networks	Layered protocols, ATM networks, client – server model,	T1:2.3.1
4-5	understand the remote procedure calls	remote procure calls	T1:2.3.1
6-7	understand the group communication in distributed systems	group communication in distributed operating systems.	T1:7.2,7.3
8-9	understand the Middleware and Distributed Operating Systems	Middleware and Distributed Operating Systems.	T1:2.3.1
10-11	Understanding the Clock synchronization	Synchronization in Distributed System: Clock synchronization	T1:10.3.1
12	Understand the mutual exclusion concept	Mutual Exclusion	T1:11.2,
13-14	Understand the algorithms in DOS	Election algorithm, Bully algorithm,	T1:11.3
15	Understand the algorithms in DOS	Ring algorithm	T1:11.4
16	Understand the atomic transactions	Atomic transactions	T1:11.5
17-18	Understand deadlock in distributed systems	Deadlock in distributed systems	T1:11.6
19	Understand the concept of distributed deadlock prevention	Distributed deadlock prevention	T1:12.1-4
20	Understand the distributed deadlock detection.	Distributed deadlock detection.	T1:12.4-5
21-22	understand the processors	Processes and Processors in distributed systems:	T1:13.3.2, 13.4.1
23-24	Understand the threads and system models	Threads, System models	T2:17.1.1, 17.1.3
25-26	understand the concept of processors allocation	Processors Allocation	T1:18.1, 18.2.1
27-28	Understanding the scheduling in DOS	Scheduling in Distributed System	T2:18.3.4
29	Understand real time OS in DOS environment	Real Time Distributed Systems.	T1:22.12
30	Understand the Distributed file system design	Distributed file system design,	T3:18.4
31	Understand the distributed file system implementation	distributed file system implementation	T3:23.1.1
32	Understand the Trends in distributed file systems.	Trends in distributed file systems.	T3:18.3.4, 18.3, 4.1
33	Understand the distributed shared memory	Distributed shared memory	T2:24.2
34-35	Understand consistency models	Consistency Models	T2:24.3

36	Understand the page **based** distributed shared memory	page based distributed shared memory	T2:24.4
37	Understand the case studies	Case study MACH: Introduction to MACH, ,.	T3:24.5,
38-39	Understand the case studies	process management in MACH	T3:24.6
40-41	Understand the case studies	communication in MACH	T3:24.7
42	Understand the case studies	UNIX emulation in MACH	T3:24.8

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

S.No.	Description	Proposed actions	Relevance with POs
1	To Improve Security Distributed File Systems	Seminars	PO 1, PO 4
2	Fault tolerance reliable publish-subscribe communication ,fault tolerance in shared data spaces	Seminars / NPTEL	PO 4, PO5
3	Encourage students to solve real time problems of real time distributed operating systems	NPTEL	PO 2

Prepared by:
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Computer Science and Engineering

COURSE DESCRIPTOR

Course Title	**ADVANCED DATABASE MANAGEMENT SYSTEM**			
Course Code	**BCS005**			
Programme	**M.Tech**			
Semester	**II**			
Course Type	**Core**			
Regulation	**R16**			
Course Structure	**Theory**		**Practical**	
	Lectures	**Tutorials**	**Practicals**	**Credits**
	3	**-**	**-**	**-**
Course Faculty	**Dr. K Rajendra Prasad, Professor**			

I. COURSE OVERVIEW:

This course introduces the core principles and techniques required in the design and implementation of database systems. This introductory application-oriented course covers the relational database systems RDBMS - the predominant system for business, scientific and engineering applications at present. It includes Entity-Relational model, Normalization, Relational model, Relational algebra, and data access queries as well as an introduction to SQL. It also covers essential DBMS concepts such as: Transaction Processing, Concurrency Control and Recovery. It also provides students with theoretical knowledge and practical skills in the use of databases and database management systems in information technology applications

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
-	-	-	Fundamentals of database, Programming Concepts	-

III. MARKS DISTRIBUTION

Subject	SEE Examination	CIA Examination	Total Marks
Advanced Database Management System	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	1	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	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.	1	Seminar
PO 5	Independently carry out research/investigation and development work to solve practical problems	2	Seminar
PO 6	Function effectively on teams to establish goals, plan tasks, meet deadlines, manage risk and produce deliverables	1	Term paper, Seminar
PO 7	Engage in life-long learning and professional development through self-study, continuing education, professional and	2	Term paper, Seminar

	doctoral level studies		

3 = High; 2 = Medium; 1 = Low

VII. COURSE OBJECTIVES:

The course should enable the students to:

I	Design databases using data models
II	Query and manage databases
III	Distinguish between centralized and distributed databases.
IV	Implement applications involving complex transaction processing.
V	Do query evaluation and query optimization

VIII. COURSE OUTCOMES (COs):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Design database models using ER and explore on design constraints in relational models	CLO 1	Outline the history of Data base Systems, applications and file system
		CLO 2	Identify different data Models like ER Model, relational model, other models
		CLO 3	Understand the structure data types, operations on structured on structured data, encapsulation and ADTS, inheritance.
CO 2	Find the solutions for various database problems by using OO/OR database, sequential and parallel query operations	CLO 4	Demonstrate the challenges and implementation, database design for ORDBMS
		CLO 5	Illustrate the architectures of Parallel databases and Parallel Query Evaluation.
CO 3	Explore distributed database design framework, distributed query processing	CLO 6	Distinguish the features of distributed databases and centralized databases
		CLO 7	Understand the levels of transparency, reference architecture for DDB, types of data fragmentation.
		CLO 8	Elucidate the distributed database access primitives, Integrity constraints in distributed databases.
CO 4	Illustrate the issues involved in distributed database design and query processing.	CLO 9	Describe the framework for distributed database design, the design of database fragmentation and allocation of fragments.
		CLO 10	Examine the equivalence of transformations for queries, transforming global queries into fragment queries, distributed grouping and aggregation functions, parametric queries.
CO 5	Understand query optimization framework in distributed databases and explore on information retrieval (IR)systems	CLO 11	Compare the join queries and general queries. Non-join queries in a distributed DBMS.
		CLO 12	Demonstrate the indexing for text search, web search engine, managing text in a DBMS
		CLO 13	Select a data model for XML, Querying XML data, and efficient evaluation of XML queries.

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
BCS005.01	CLO 1	Outline the history of Data base Systems, applications and file system	PO 1	1
BCS005.02	CLO 2	Identify different data Models like ER Model, relational model, other models	PO 2, PO 6	1
BCS005.03	CLO 3	Understand the structure data types, operations on structured on structured data, encapsulation and ADTS, inheritance.	PO 1, PO 3	2
BCS005.04	CLO 4	Demonstrate the challenges and implementation, database design for ORDBMS	PO 2, PO 6	2
BCS005.05	CLO 5	Illustrate the architectures of Parallel databases and Parallel Query Evaluation.	PO 3	1
BCS005.06	CLO 6	Distinguish the features of distributed databases and centralized databases	PO 1	1
BCS005.07	CLO 7	Understand the levels of transparency, reference architecture for DDB, types of data fragmentation.	PO 1, PO 3	2
BCS005.08	CLO 8	Elucidate the distributed database access primitives, Integrity constraints in distributed databases.	PO 1, PO 3	1
BCS005.09	CLO 9	Describe the framework for distributed database design, the design of database fragmentation and allocation of fragments.	PO 5, PO 6	2
BCS005.10	CLO 10	Examine the equivalence of transformations for queries, transforming global queries into fragment queries, distributed grouping and aggregation functions, parametric queries.	PO 1, PO 6	1
BCS005.11	CLO 11	Compare the join queries and general queries. Non-join queries in a distributed DBMS.	PO 6, PO 7	1
BCS005.12	CLO 12	Demonstrate the indexing for text search, web search engine, managing text in a DBMS	PO 5, PO 7	2
BCS005.13	CLO 13	Select a data model for XML, Querying XML data, and efficient evaluation of XML queries.	PO 5, PO 7	2

3 = High; 2 = Medium; 1 = Low

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

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

3 = High; 2 = Medium; 1 = Low

XII. ASSESSMENT METHODOLOGIES –DIRECT

CIE Exams	PO1, PO2, PO3, PO5, PO6, PO7	SEE Exams	PO1, PO2, PO3, PO5, PO6, PO7	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 History of Data base Systems. Data base System Applications, data base System VS file System; Data Models: ER Model, relational model, other models; Database Languages: DDL, DML; Introduction to the Relational Model: Integrity constraint over relations, Enforcing integrity constraints, querying relational data, logical data base design; Introduction to Views: Destroying, altering tables and views; Introduction of object database systems: Structured data types, operations on structured data, encapsulation and ADTS, Inheritance.
UNIT II
ORDBMS Database design for ORDBMS, ORBMS implementation and challenges, OODBMS, comparison of RDBMS, OODBMS and ORDBMS. Introduction to Parallel databases, architectures for parallel

databases, Parallel Query Evaluation: Data partitioning and parallelizing sequential operator evaluation code, parallelizing individual operations, and parallel query optimization.
UNIT III
DISTRIBUTED DATABASES Introduction to distributed databases: Features of distributed databases vs centralized databases, Why distributed databases. DDBMS: Levels of transparency, reference architecture for DDB, types of data fragmentation, distribution transparency for read-only and update applications, distributed database access primitives, Integrity constraints in distributed databases.
UNIT IV
DISTRIBUTED DATABASE DESIGN Distributed database design: framework for distributed database design, the design of database fragmentation, allocation of fragments; Distributed Query processing: Equivalence of transformations for queries, transforming global queries into fragment queries, distributed grouping and aggregation functions, parametric queries.
UNIT V
QUERY OPTIMIZATION A framework for query optimization, join queries and general queries. Non-join queries in a distributed DBMS, joins in a distributed DBMS, cost based query optimization. DBMS Vs IR systems, Introduction to Information retrieval, Indexing for text search, web search engine, managing text in a DBMS, a data model for XML, Querying XML data, and efficient evaluation of XML queries.
TEXT BOOKS:
1. Raghuramakrishnan and Johannes Gehrke, "Database Management Systems", 3rd Edition, TMH, 2006.
2. S Ceri and G Pelagatti, "Distributed databases principles and systems", 1st Edition, TMH, 2008.
REFERENCES:
1. Silberschatz, Korth, "Database System Concepts", 6th Edition, TMH, 2010.
2. Elmasri R, Navathe S B, Somayajulu D V L N, and Gupta S K, "Fundamentals of Database Systems", 5th Edition, Pearson Education, 2009.
3. C. J. Date, "Introduction to Database Systems", 8th Edition, Pearson Education, 2009.

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 the basic concepts of databases and different types of data models, languages	Introduction: History of Data base Systems. Database System Applications, data base System VS file System; Data Models: ER Model, relational model, other models; Database Languages: DDL, DML.	T1:1.1, 1.2
4-6	**Describe** overall architecture of DBMS	Introduction to the Relational Model: Integrity constraint over relations, Enforcing integrity constraints, querying relational data, logical data base design.	T1:2.1
7-9	Understand the basic concepts of object database systems.	Introduction to Views: Destroying, altering tables and views; Introduction of object database systems: Structured data types, operations on structured data, encapsulation and ADTS, Inheritance.	T2:2.2, 2.3
10-13	Understand the basic concepts of ORDBMS, ORBMS and Parallel databases	Database design for ORDBMS, ORBMS implementation and challenges, OODBMS, comparison of RDBMS, OODBMS and ORDBMS. Introduction to Parallel databases, architectures for parallel databases, Parallel Query Evaluation.	T1:4.1, 4.2, 4.3
14-16	Implementing the concept of data portioning and	Data partitioning and parallelizing sequential operator evaluation code, parallelizing	T1:4.2, 4.4

Lecture No	Topic Outcomes	Topic/s to be covered	Reference
	parallel query optimization.	individual operations, and parallel query optimization.	
17-20	Understand the concepts of distributed databases.	Introduction to distributed databases: Features of distributed databases vs centralized databases, Why distributed databases. Models, validating models.	T2: 5.1, 5.2
21-22	Understand the concepts of data fragmentation and data integrity constraints in distributed database.	DDBMS: Levels of transparency, reference architecture for DDB, types of data fragmentation, distribution transparency for read-only and update applications, distributed database access primitives, Integrity constraints in distributed databases.	T2:6.1, 6.2, 6.4
23-27	Develop and execute solutions to solve real-time applications using distributed datable and query processing.	Distributed database design: framework for distributed database design, the design of database fragmentation, allocation of fragments Distributed Query processing: Equivalence of transformations for queries, transforming global queries	T2:7.2, 7.3, 7.4
28-36	Evaluate join queries and general queries in distributed database.	A framework for query optimization, join queries and general queries. non- join queries in a distributed DBMS, joins in a distributed DBMS, cost based query optimization	T2:8.1, 8.3
37-40	Understand the importance and issues Information Retrieval	DBMS Vs IR systems, Introduction to Information retrieval, Indexing for text search, web search engine	T1:5.3
41-45	Understanding the concept of querying XML data.	Managing text in a DBMS, a data model for XML, Querying XML data, and efficient evaluation of XML queries.	T1:5.5, 5.6, 5.7

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

S No	Description	Proposed Actions	Relevance with POs
1	Querying XML data	Seminars / Guest Lectures / NPTEL	PO 1, PO 6, PO 7
2	DDBMS and integrity constraints	Work Shops/ Guest Lectures / NPTEL	PO 5, PO 6

Prepared By:
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Dundigal, Hyderabad -500 043

COMPUTER SCIENCE AND ENGINEERING
COURSE DESCRIPTOR

Course Title	**CYBER SECURITY**				
Course Code	BCS006				
Program	M.Tech				
Semester	II	CSE			
Course Type	Core				
Regulation	IARE - R16				
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

(Autonomous)

Dundigal, Hyderabad -500 043

COMPUTER SCEINCE AND ENGINEERING

COURSE DESCRIPTOR

Course Title	**WEB INTELLIGENT AND ALGORITHM**				
Course Code	BCS201				
Programme	M.Tech				
Semester	II	CSE			
Course Type	Professional Elective				
Regulation	IARE – R16				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	-	3	-	-
Course Faculty	**Dr. G Ramu, Professor, CSE.**				

I. COURSE OVERVIEW:

This course introduces the fundamental concepts as well as practical applications of contemporary artificial intelligence (e.g. incorporating knowledge discovery and data mining, intelligent agents, and social network intelligence) and advanced information technology (e.g. involving wireless networks, ubiquitous devices, social networks, and data/knowledge grids) in the context of Web empowered systems, environments, and activities. In addition, it discusses the techniques and issues central to the development of Web Intelligence (WI) computing systems.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
PG	-	-	-

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Web Intelligent and Algorithm	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**
PO 1	Analyze a problem, identify and define computing requirements, design and implement appropriate solutions	2	CIE, SEE, Seminar and Term paper,

			Student Viva
PO2	Solve complex heterogeneous data intensive analytical based problems of real time scenario using state of the art hardware/software tools	3	CIE, SEE, Seminar and Term paper Student Viva
PO3	Demonstrate a degree of mastery in emerging areas of CSE/IT like IoT, AI, Data Analytics, Machine Learning, cyber security, etc.	2	CIE, SEE, Seminar and Term paper
PO4	Write and present a substantial technical report/document	2	Seminar and Term paper
PO6	Function effectively on teams to establish goals, plan tasks, meet deadlines, manage risk and produce deliverables	2	Mini Project
PO7	Engage in life-long learning and professional development through self-study, continuing education, professional and doctoral level studies.	1	Mini Project

3 = High; 2 = Medium; 1 = Low

VII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Illustrate the fundamental knowledge on web intelligent applications.
II	Summarize the searching and indexing techniques in search engines.
III	Outline the suggestions and recommendations for extracting intelligence from web applications.
IV	Understand the constraint based tag recommender system learning from user interactions.
V	Apply data mining algorithms to recommendation systems.

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
BCS201.1	CLO 1	Identify the major components of an Information Retrieval engine.	PO1	2
BCS201.2	CLO 2	Identify the Semantic Web searching and indexing.	PO1	2
BCS201.3	CLO 3	Build a search engine which indexes and ranks web documents.	PO1; PO2	2
BCS201.4	CLO 4	Understanding various recommendation systems.	PO1; PO2	2
BCS201.5	CLO 5	Identifying various collaborative filtering techniques.	PO 1	2
BCS201.6	CLO 6	Describe the types of suggestions and recommendation systems.	PO2; PO3	2
BCS201.7	CLO 7	Understanding the process of extracting intelligence from various tags.	PO1; PO3	2
BCS201.8	CLO 8	Identifying different types of tags used from user interactions.	PO2	3
BCS201.9	CLO 9	Understand the concept of Hybrid recommender systems.	PO1; PO3	2
BCS201.10	CLO 10	Understanding the basic usage of Constraint based recommender systems.	PO2; PO3; PO4	2
BCS201.11	CLO11	Describe the process of neighborhood based recommendation.	PO2; PO4	2
BCS201.12	CLO 12	Understanding the basic concept of hybrid recommender systems.	PO2; PO4	2
BCS201.13	CLO 13	Understanding the various data mining methods used in recommendation systems.	PO1; PO3	2
BCS201.14	CLO 14	Identifying the process of evaluating recommender	PO1; PO3;	2

		systems.	PO6	
BCS201.15	CLO 15	Describe the concept of adwords problem and semantic web.	PO1; PO3; PO6	2

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	PO3	PO4	PO6	PO7
CLO 1	3					
CLO 2	3					
CLO 3	3	2				
CLO 4	2	3				
CLO 5	3					
CLO 6		3				
CLO 7	3		2			
CLO 8		3				
CLO 9	2		3			1
CLO 10		3	2	1		
CLO 11		3		2		
CLO 12		3		2		
CLO 13	2		3			
CLO 14	3		1		2	
CLO 15	1		3		2	

3 = High; 2 = Medium; 1 = Low

X. ASSESSMENT METHODOLOGIES-DIRECT

CIE Exams	PO1; PO2; PO3	SEE Exams	PO1; PO2; PO3	Seminar and Term paper	PO1; PO2; PO4
Student Viva	PO1; PO2; PO3	Mini Project	PO6	Laboratory Practices	-

XI. ASSESSMENT METHODOLOGIES-INDIRECT

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

XII. SYLLABUS:

UNIT-I	INTRODUCTION AND WEB SEARCHING
Introduction and web searching: Historical perspective, evolution of web 2.0.; Intelligent web applications: Examples, web searching, indexing; Improving search results based on link analysis, introduction to page rank, avoiding dead ends and spider traps, using page rank in asearch engine,	

efficient computation of page rank, topic sensitive page rank, intelligent web crawling, improving search results based on user clicks, ranking documents, precision and recall.	
UNIT-II	**CREATING SUGGESTIONS AND RECOMMENDATIONS**
Creating suggestions and recommendations: Concepts of distance and similarity, collaborative filtering, recommendations based on similar users, recommendations based on similar items, recommendations based on content; Extracting intelligence from content: Blogs, wikis, message boards	
UNIT-III	**LEARNING FROM USER INTERACTIONS**
Learning from user interactions: Extracting intelligence from tags, tag related metadata, tag generation; Leveraging tags: Dynamic navigation, using tag clouds, targeted search, recommendations based on tags constraint based recommender systems, hybrid recommender systems.	
UNIT-IV	**RECOMMENDER SYSTEM TYPES**
Recommender system types: Constraint based recommender systems, neighborhood based recommendation systems and hybrid recommender systems.	
UNIT-V	**DATA MINING METHODS IN RECOMMENDATION SYSTEMS**
Data mining methods in recommendation systems: Classifiers, clustering, association rule mining techniques, explanations in recommender systems, evaluating recommender systems, advertising on the web, on line and off line algorithms, the matching problem, adwords problem, Web 3.0 and the semantic web, the next generation web.	
Text Books:	
1. Haralambos Marmanis, Dmitry Babenko, "Algorithms of the Intelligent Web", Dreamtech Press, 2nd Edition, 2016. 2. Segaran, "Programming Collective Intelligence", O"reilly, 1st Edition, 2007. 3. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, "Introduction to Information.	
Reference Books:	
1. Berners Lee, Godel, Turing, "Thinking on the Web", Wiley Inter Science, 1st Edition, 2009. 2. Gautam Shroff, "Intelligent Web - Search, Smart Algorithms, and Big Data", Oxford University Press, 1st Edition, 2013 3. Haralambos Marmanis, Dmitry Babenko, "Algorithms of the Intelligent Web", Manning Publications, 1st Edition, 2009.	

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 and web searching: Historical perspective, evolution of web 2.0.; Intelligent web applications: Examples, web searching, indexing; Improving search results based on link analysis	CLO 1; CLO 2	T2:1.1-1.2
4-6	Introduction to page rank, avoiding dead ends and spider traps, using page rank in a search engine, efficient computation of page rank	CLO 2	T1:2
7-9	Topic sensitive page rank, intelligent web crawling, improving search results based on user clicks	CLO 2; CLO 3	T2:2.1-2.2
10-13	Ranking documents, precision and recall., recommendations based on similar users	CLO 2; CLO 3	T1:4

14-16	Creating suggestions and recommendations: Concepts of distance and similarity, collaborative filtering	CLO 4; CLO 5	T1:4
17-20	Recommendations based on similar items, recommendations based on content; Extracting intelligence from content: Blogs, wikis, message boards.	CLO 6	T1: 6
20-22	Learning from user interactions: Extracting intelligence from tags, tag related metadata, tag generation	CLO 7; CLO 8	T1: 5
23-25	Leveraging tags: Dynamic navigation, using tag clouds	CLO 9	T1:7
26-28	Targeted search, recommendations based on tags constraint based recommender systems, hybrid recommender systems	CLO 9	T1:10
29-31	Recommender system types: Constraint based recommender systems	CLO 12	T1:8
32-35	Neighborhood based recommendation systems and hybrid recommender systems.	CLO 14	T1:8-13
35-38	Neighborhood based recommendation systems and hybrid recommender systems.	CLO 14	T1: 9-17
38-42	Evaluating recommender systems, advertising on the web, on line and off line algorithms	CLO 15	T1: 17
43-45	The matching problem, adwords problem, Web 3.0 and the semantic web, the next generation web.	CLO 14; CLO 15	T1:16

Prepared by:
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Dundigal, Hyderabad -500 043

COMPUTER SCEINCE AND ENGINEERING

COURSE DESCRIPTOR

Course Title	**SOFT COMPUTING**				
Course Code	BCS208				
Programme	M.Tech				
Semester	II	CSE			
Course Type	Core				
Regulation	IARE – R16				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	-	3	4	2
Course Faculty	Mr. P. Ravinder, Assistant 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

Prepared by:
Mr. P. Ravinder, Assistant Professor, CSE. **HOD, CSE**

INSTITUTE OF AERONAUTICAL ENGINEERING

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Dundigal, Hyderabad -500 043

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTOR

Course Title	**RESEARCH METHODOLOGIES**				
Course Code	**BCS703**				
Programme	**M.Tech**				
Semester	**II**				
Course Type	**Core**				
Regulation	**R16**				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	**-**	**3**	-	-
Course Faculty	**Dr. M Madhu Bala, Professor**				

I. COURSE OVERVIEW:

Fundamental of Research Methodology and Data Collection is an excellent book that has a collection of basic concepts and terminologies in research method. It is filled with good ideas and tips on how to write very good articles that are fit for publication in reputable journals. The author has tried to identify problems encountered by young researchers and also proffered solutions to those problems. She has given detailed tips on how to asses and determine a good article meant for publication in quality journals. Referencing which is a vital part of any research work was fully covered with various styles carefully and painstakingly discussed. Basic concepts on inference which is very vital in most research endeavours were also captured for non-specialists. Detailed write-up on sampling techniques and sample size determination were well written and demonstrated in an excellent manner. The rudiments about data collection including various methods with the merits and demerits were fully covered in this book. This book is not only recommended to anybody engaged in writing Reports, Projects, Dissertations, Thesis and articles for publication in academic journals. It is also recommended to staff and students of all tertiary institutions especially those that want to learn how to become their best in research.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
-	-	-	Probability And Statistics	-

III. MARKSDISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Research Methodologies	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	LCD / PPT	✔	Seminars	✔	Videos	✔	MOOCs
✔	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:

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 lab assessment during day to day performance, 10 marks for final internal lab assessment.

Table 1: Assessment pattern for CIA

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

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

Technical Seminar and Term Paper:
Two seminar presentations 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.	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.	3	Seminar and Term paper
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	Seminar and Term paper
PO 6	Function effectively on teams to establish goals, plan tasks, meet deadlines, manage risk and produce deliverables	3	Seminar and Term paper

3 = High; 2 = Medium; 1 = Low

VII. COURSE OBJECTIVES:

The course should enable the students to:	
I	Identify an appropriate research problem in their interesting domain.
II	Organize and conduct research project.
III	Understand the Preparation of a research project thesis report.
IV	Understand the law of patent and copyrights.
V	Understand the Adequate knowledge on process for filing Patent.

VIII. COURSE OUTCOMES (COs):

COs	Course Outcomes	CLOs	Course Learning Outcomes
CO1	Understand the research process and formulate the research problem.	CLO1	Understand The Different Approaches of Research
		CLO2	Understand the features of good design, types of research design,
CO2	Illustrate various measurement, scaling and estimate hypotheses values in research	CLO3	Understand the forecasting techniques and scale construction techniques
		CLO4	understand the time series analysis, interpolation and extrapolation;
CO3	Explore on various data collection methods and professional attitude, goals and ethics	CLO5	understand the collection of secondary data, cases and schedules .
		CLO6	Professional attitude and goals, concept of excellence, ethics in science and engineering
		CLO7	understand the participation in public debates on scientific issues
		CLO8	understand the famous frauds in science, and case studies.
CO4	Prepare a well-structured research paper and scientific presentations	CLO9	understand the techniques of interpretation, and making scientific presentation
		CLO10	understand the patent laws, patent and

			searching process,
CO5	Explore on various IPR components and process of filing	CLO11	understand the importance of intellectual property rights;
		CLO12	understand the rights to perform the, copy right ownership issues

3 = High; 2 = Medium; 1 = Low

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
BCS004.01	CLO 1	Understand The Different Approaches of Research	PO1,PO2	3
BCS004.02	CLO 2	Understand the features of good design, types of research design,	PO 1 PO2	3
BCS004.03	CLO 3	Understand the forecasting techniques and scale construction techniques	PO 2, PO4	3
BCS004.04	CLO 4	understand the time series analysis, interpolation and extrapolation;	PO1,PO 2 &PO4	3
BCS004.05	CLO 5	understand the collection of secondary data, cases and schedules .	PO2,PO5	2
BCS004.06	CLO 6	Professional attitude and goals, concept of excellence, ethics in science and engineering	PO1,PO5	3
BCS004.07	CLO 7	understand the participation in public debates on scientific issues	PO 1,PO3	3
BCS004.08	CLO 8	understand the famous frauds in science, and case studies.	PO1,PO4 & PO6	3
BCS004.09	CLO 9	understand the techniques of interpretation, and making scientific presentation	PO4,PO5 &PO6	3
BCS004.10	CLO 10	understand the patent laws, patent and searching process,	PO4,PO5, &PO6	2
BCS004.11	CLO 11	understand the importance of intellectual property rights;	PO 5,PO6	3
BCS004.12	CLO 12	understand the rights to perform the, copy right ownership issues	PO 5,PO6	3

3 = High; 2 = Medium; 1 = Low

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

Course Outcomes (COs)	Program Outcomes				
	PO1	PO2	PO4	PO5	PO6
CO 1	3	3			
CO 2	3	3	3		
CO 3	3		3	3	
CO 4			3	3	3
CO 5				3	3

XI. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO 1,PO 2 , PO4, PO5, PO6	SEE Exams	PO 1,PO 2 , PO4, PO5, PO6	Seminars and term paper	PO 6
Laboratory Practices	-	Student 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: 07**
Definition, types of research, research approaches, research process, validity and reliability in research, features of good design, types of research design, and basic principles of experimental Design.		
UNIT-II	**MEASUREMENT AND SCALING TECHNIQUES**	**Classes: 08**
Errors in measurement, tests of sound measurement, scaling and scale construction techniques, Forecasting techniques, time series analysis, interpolation and extrapolation.		
UNIT-III	**METHODS OF DATA COLLECTION**	**Classes: 06**
Primary data, questionnaire and interviews, collection of secondary data, cases and schedules. Professional attitude and goals, concept of excellence, ethics in science and engineering, some Famous frauds in science, case studies.		
UNIT-IV	**INTERPRETATION OF DATA AND REPORT WRITING**	**Classes: 07**
Layout of a research paper, techniques of interpretation, making scientific presentation at conferences and popular lectures to semi technical audience, participating in public debates on Scientific issues.		
UNIT-V	**INTRODUCTION TO INTELLECTUAL PROPERTY**	**Classes: 9**
Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights; Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law; Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer.		

XV. COURSE PLAN:

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

Lecture No	Topic Outcomes	Topic/s to be covered	Reference
1	Understand the concept of types of research	Definition, types of research	T1:2.1
2	Understand the various Research Approaches	Research Approaches	T1:2.3
3	understand Research process, validity and reliability in research	Research process, validity and reliability in research	T1:2.3.1

4	understand the Features of good design	Features of good design	T1:7.2
5	Understanding the Types of research design	Types of research design	T1:7.3
6	Understand the Basic principles of experimental design	Basic principles of experimental design	T1:7.4
7	Understand the various types Errors in measurement	Errors in measurement	T1:7.5
8-9	Understand the tests of sound measurement	tests of sound measurement	T1:8.1
10-11	Understand the scaling and scale construction techniques	scaling and scale construction techniques	T1:8.2
12-13	Understand the forecasting techniques	Forecasting techniques	T1:8.3
14	Understand the concept of time series analysis	time series analysis	T1:8.4
15	Interpolation and extrapolation	Interpolation and extrapolation.	T1:8.5
16	understand the Primary data, questionnaire and interviews	Primary data, questionnaire and interviews	T1:8.6
17-18	Understand the collection of secondary data, cases and schedules	collection of secondary data, cases and schedules	T1:9.1
19	understand the Professional attitude and goals	Professional attitude and goals	T1:9.2, 9.3
20	Understanding the scheduling in DOS concept of excellence	concept of excellence	T2:9.3.4
21	Understand real time OS in DOS environment	ethics in science and engineering	T1:9.5
22	Understand the some famous frauds in science	some famous frauds in science	T2:7.1
23	Understand the Case studies	Case studies	T2:7.2
24	Understand the Layout of a research paper	Layout of a research paper	T2:7.3
25	techniques of interpretation	techniques of interpretation	T2:7.4
26	Understand techniques of interpretation	techniques of interpretation	T2:8.3
27	Understand the making scientific presentation at conferences	making scientific presentation at conferences	T2:8.4
28	Understand the popular lectures to semi technical audience	popular lectures to semi technical audience	T3:8.5
29	Understand the participating in public debates on Scientific issues	participating in public debates on Scientific issues.	T3:8.6
30	Understand the types of intellectual property	Introduction, types of intellectual property	**T3:10.7**
31	Understand the international organizations ,agencies and treaties	international organizations ,agencies and treaties	**T3:10.8**
32	Understand the importance of intellectual property rights	importance of intellectual property rights;	**T3:10.9**
33	understand the Law of copy rights, rights of reproduction	Law of copy rights: Fundamental of copy right law, originality of material,	**T3:11.7**

		rights of reproduction	
34	understand the rights to perform the work publicly, copy right ownership issues	rights to perform the work publicly, copy right ownership issues	**T3:11.7.1**
35	understand copy right registration, notice of copy right	copy right registration, notice of copy right	**T3:11.7.2**
36	understand the international copy right law; Law of patents: Foundation of patent law, patent searching process,	international copy right law; Law of patents: Foundation of patent law, patent searching process,	**T3:11.8**
37	understand the ownership rights and transfer	ownership rights and transfer	**T3:12.1-2**

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

S NO	Description	Proposed actions	Relevance with POs	Relevance with PSOs
1	gain the functionality of Chi-square Test	Seminars	PO 1, PO 4	PSO 1
2	Analysis of Variance and Covariance	Seminars / NPTEL	PO 4, PO5	PSO 1
3	Encourage students to gain the concepts of Hypotheses-I (Parametric or 184 Standard Tests of Hypotheses)	NPTEL	PO 2	PSO 1

Prepared by:
Dr. M Madhu Bala, Professor **HOD, CSE**

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTOR

Course Title	**DISTRIBUTED OPERATING SYSTEM LABORATORY**				
Course Code	BCS102				
Programme	M.Tech				
Semester	II	CSE			
Course Type	Core				
Regulation	IARE - R16				
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 concept of main design view of Operating systems. It makes the students to get exposure on usage of various operating systems. And enable them to Design modern distributed system components.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	-	-	Operating systemLaboratory	2

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Distributed Operating system Laboratory	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	Understand the design aspects of operating system
II	Exposure on usage of various operating systems
III	Design modern distributed system components.

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
BCSB102.1	CLO 1	Demonstrate the Conceptual model of Cpu scheduling algorithm.	PO 1	3
BCSB102.2	CLO 2	Identify and understand the methods used in file allocation strategies	PO 1	3
BCSB102.3	CLO 3	Analyze and understand the operations on process management	PO 2	2
BCSB102.4	CLO 4	implementation on file organization strategies	PO 2	3
BCSB102.5	CLO 5	Explore on Deadlock avoidance techniques.	PO 7	3
BCSB102.6	CLO 6	Analyze and understand deadlock avoidance algorithrm.	PO 1,PO 2	2
BCSB102.7	CLO 7	Demonstrate page replacement algorithrmtechniques	PO 1	2
BCSB102.8	CLO 8	Implement shared memory and semaphore concepts for inter process communication	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	CPU SCHEDULING ALGORITHMS
Simulate the following CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority	
Week-2	FILE ALLOCATION STRATEGIES
. Simulate all file allocation strategies a) Sequential b) Indexed c) Linked	
Week-3	PROCESS MANAGEMENT
Implement process strategies: creation of child, zombie, orphan process	
Week-4	FILE ORGANIZATION STRATEGIES
Implement file organization strategies a) single level b) Two level c) Hierarchical	
Week-5	DEAD LOCK AVOIDANCE
Simulate Bankers Algorithm for Dead Lock Avoidance	
Week-6	DEAD LOCK PREVENTION
Simulate Bankers Algorithm for Dead Lock Prevention	
Week-7	PAGE REPLACEMENT ALGORITHMS
Simulate all page replacement algorithms a) FIFO b) LRU c) LFU	
Week-8	SHARED MEMORY AND SEMAPHORE
Implement shared memory and semaphore concepts for inter process communication	
Reference Books:	
1. Andrew S. Tanenbaum, "Distributed Operating System", PHI, 1st Edition, 1994.	
Web References:	
1. https://ldrp.ac.in/images/syllabus/BEComputer/8023%20soft%20computing.pdfhttp://itmgoi.in/download/CSE%20&%20IT/Soft%20Computing%20IT%2 0(IT-802).pdf. 2. http://mirlab.org/jang/book/	
SOFTWARE AND HARDWARE REQUIREMENTS FOR 18 STUDENTS: SOFTWARE: Turbo C/ J2SE HARDWARE: 18 numbers of Intel Desktop Computers with 2 GB RAM	

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	CPU SCHEDULING ALGORITHMS	CLO 1	T1:1.1
2	FILE ALLOCATION STRATEGIES	,CLO 2	T1:2.3
3	PROCESS MANAGEMENT	CLO 3	T1:4.1
4	FILE ORGANIZATION STRATEGIES	CLO 4	T1:5.1
5	DEAD LOCK AVOIDANCE	CLO 5	T1:6.1
6	DEAD LOCK PREVENTION	CLO 6	T1:7.1.1
7	PAGE REPLACEMENT ALGORITHMS	CLO 7	T1:12.5

8	SHARED MEMORY AND SEMAPHORE	CLO 8	T1:15.1

Prepared by:
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COMPUTER SCIENCE AND ENGINEERING
COURSE DESCRIPTOR

Course Title	**DISTRIBUTED OPERATING SYSTEM LABORATORY**				
Course Code	BCS102				
Programme	M.Tech				
Semester	II	CSE			
Course Type	Core				
Regulation	IARE - R16				
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 concept of main design view of Operating systems. It makes the students to get exposure on usage of various operating systems. And enable them to Design modern distributed system components.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	-	-	Operating systemLaboratory	2

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Distributed Operating system Laboratory	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	Understand the design aspects of operating system
II	Exposure on usage of various operating systems
III	Design modern distributed system components.

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
BCSB102.1	CLO 1	Demonstrate the Conceptual model of Cpu scheduling algorithm.	PO 1	3
BCSB102.2	CLO 2	Identify and understand the methods used in file allocation strategies	PO 1	3
BCSB102.3	CLO 3	Analyze and understand the operations on process management	PO 2	2
BCSB102.4	CLO 4	implementation on file organization strategies	PO 2	3
BCSB102.5	CLO 5	Explore on Deadlock avoidance techniques.	PO 7	3
BCSB102.6	CLO 6	Analyze and understand deadlock avoidance algorithrm.	PO 1,PO 2	2
BCSB102.7	CLO 7	Demonstrate page replacement algorithrmtechniques	PO 1	2
BCSB102.8	CLO 8	Implement shared memory and semaphore concepts for inter process communication	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	CPU SCHEDULING ALGORITHMS
Simulate the following CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority	
Week-2	FILE ALLOCATION STRATEGIES
. Simulate all file allocation strategies a) Sequential b) Indexed c) Linked	
Week-3	PROCESS MANAGEMENT
Implement process strategies: creation of child, zombie, orphan process	
Week-4	FILE ORGANIZATION STRATEGIES
Implement file organization strategies a) single level b) Two level c) Hierarchical	
Week-5	DEAD LOCK AVOIDANCE
Simulate Bankers Algorithm for Dead Lock Avoidance	
Week-6	DEAD LOCK PREVENTION
Simulate Bankers Algorithm for Dead Lock Prevention	
Week-7	PAGE REPLACEMENT ALGORITHMS
Simulate all page replacement algorithms a) FIFO b) LRU c) LFU	
Week-8	SHARED MEMORY AND SEMAPHORE
Implement shared memory and semaphore concepts for inter process communication	
Reference Books:	
1. Andrew S. Tanenbaum, "Distributed Operating System", PHI, 1st Edition, 1994.	
Web References:	
1. https://ldrp.ac.in/images/syllabus/BEComputer/8023%20soft%20computing.pdfhttp://itmgoi.in/download/CSE%20&%20IT/Soft%20Computing%20IT%2 0(IT-802).pdf. 2. http://mirlab.org/jang/book/	
SOFTWARE AND HARDWARE REQUIREMENTS FOR 18 STUDENTS: SOFTWARE: Turbo C/ J2SE HARDWARE: 18 numbers of Intel Desktop Computers with 2 GB RAM	

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	CPU SCHEDULING ALGORITHMS	CLO 1	T1:1.1
2	FILE ALLOCATION STRATEGIES	,CLO 2	T1:2.3
3	PROCESS MANAGEMENT	CLO 3	T1:4.1
4	FILE ORGANIZATION STRATEGIES	CLO 4	T1:5.1
5	DEAD LOCK AVOIDANCE	CLO 5	T1:6.1
6	DEAD LOCK PREVENTION	CLO 6	T1:7.1.1
7	PAGE REPLACEMENT ALGORITHMS	CLO 7	T1:12.5

8	SHARED MEMORY AND SEMAPHORE	CLO 8	T1:15.1

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