



MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST

Rajarajeswari College of Engineering

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)
#14, Ramohalli Cross, Kumbalagodu, Mysore Road, Bengaluru-560074



Information Science and Engineering

III & IV Semester Scheme and Syllabus

(2024 Scheme)

VISION

To empower young minds through technology, research and innovation, to produce technically competent and socially responsible professionals in higher education.

MISSION

1. To deliver excellence in education through innovative teaching, impactful research, and continuous skill development, preparing students to meet global challenges with technical expertise and ethical responsibility.
2. To foster a transformative learning environment that integrates technology, research and practical experience, empowering students to become skilled professionals and socially conscious leaders.
3. To cultivate a culture of lifelong learning and professional excellence by encouraging creativity, research, and community engagement, equipping students with the skills to thrive in a dynamic world.
4. To provide a holistic educational experience that combines advanced technology, hands-on research, and community-focused learning, shaping students into competent, ethical professionals who contribute positively to society.

QUALITY POLICY

Rajarajeswari College of Engineering is committed to imparting quality technical education that nurtures competent, ethical professionals with global relevance. We ensure academic excellence through a dynamic, outcome-based curriculum, experienced faculty, and cutting-edge infrastructure. Continuous improvement is driven by innovation, research and strong industry collaboration. We foster holistic development and a progressive environment that supports lifelong learning, teamwork, and professional growth.

CORE VALUES

Academic Excellence, Integrity, Innovation, Global Competence, Continuous Improvement.

Information Science & Engineering

DEPARTMENT VISION

To excel in Information Science and Engineering by empowering students through innovative education, research and collaboration, shaping them into skilled and socially responsible professionals.

DEPARTMENT MISSION

1. To deliver quality education through innovative teaching, research and practical learning, preparing students to address global challenges.
2. To foster creativity, interdisciplinary knowledge and ethical leadership in a transformative learning environment.
3. To encourage lifelong learning and industry collaboration enabling students to thrive in a dynamic technology-driven world.
4. To nurture socially conscious professionals who contribute meaningfully to society and technological advancement.

PROGRAM OUTCOMES (POs)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems /components / processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modeling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modeling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change.
(WK8)

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Skill and Knowledge:- To apply Basic and Contemporary Science, Engineering Experimental Skills to identify and solve problems in the industry and academia.

PEO2: Lifelong learning:- To establish as Practicing Professionals and sustain Lifelong Learning in the field of Information Technology.

PEO3: Attitudes:- To understand and follow Professional Ethics, Public Policy and Aesthetics to become better IT Professional.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Understand the principles of Information Science and Engineering and enrich knowledge in recent advancements and developments in Information Technology.

PSO2: Competent in programming and computing skills, ability to apply software development methodologies and modelling to solve real world problems in the field of Information Technology.



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Department of Information Science and Engineering

Scheme of Teaching and Examinations: 2024

(Effective from the Academic Year 2025-26)

Semester: III

S.No	Course Category and Course Code		Course Title	TD / PSB	Teaching Hours / Week & Credits					Examination			
					Lecture	Tutorial	Practical	SDA	Credits	CIE Marks	SEE Duration Hrs	SEE Marks	Total Marks
					L	T	P	S					
1.	BSC	B24MC301	Mathematics- III for CS (Common to CSE, ISE, AIML, CSE(IC), CSD)	Maths	3	0	0	0	3	50	3	50	100
2.	PCC	B24CS302	Data Structures and its applications (Common to CSE, ISE, AIML, CSE(IC), CSD)	CSE	3	0	0	0	3	50	3	50	100
3.	IPCC	B24CS303	Digital Design and Computer Organization (Common to CSE, ISE, AIML, CSE(IC), CSD)	AIML	3	0	2	0	4	50	3	50	100
4.	IPCC	B24CS304	Operating Systems (Common to CSE, ISE, AIML, CSE(IC), CSD)	ISE	3	0	2	0	4	50	3	50	100
5.	PCCL	B24CS305L	Data Structures and its applications Lab (Common to CSE, ISE, AIML, CSE(IC), CSD)	CSE	0	0	2	0	1	50	3	50	100
6.	ESC	B24YY36X	ESC/ETC/PLC - III	AI/CS/IS/IC/CG	3	0	0	0	3	50	3	50	100
7.	UHV	B24SCK307	Social Connect and Responsibility	Any Dept.	0	0	2	0	1	50	3	50	100
8.	AEC/ SEC	B24YY38X	Ability Enhancement Course / Skill Enhancement Course – III (Theory/Lab)	AI/CS/IS/IC/CG	1	0	0	0	1	50	1	50	100
					0	0	2				3		
9.	NCMC	B24NCK39X	National Service Scheme / National Cadet Corps / Physical Education / Yoga/ Music	HSMC	1	0	0		PP	50	-	-	50
TOTAL									20	450		400	850

BSC: Basic Science Course, HSMC: Humanity, Social sciences including Management courses, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, NCMC: Non-Credit Mandatory Course, AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course L: Lecture, T: Tutorial, P: Practical S:SDA- Skill Development Activity, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation, PP/NP: Pass/Not Pass, YY: Programme Code (EC, CS, IS etc), X: 1/2/3/4, K: Indicates Common Course to all the streams of Engineering



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Engineering Science Course /Emerging Technology Course / Programming Language Course (ESC/ETC/PLC) - III			
B24IS361	Object Oriented Programming with Java	B24IS362	Introduction to Data Science
B24IS363	Data Visualization	B24AI364	Web Technologies (Common to CSE, CSE(IC), AIML, ISE)

Ability Enhancement Course / Skill Enhancement Course (AEC/SEC) – III			
B24CG381	Data analytics with Excel (Common to CSD, AIML, ISE)	B24IS382	Project Management with Git
B24CS383	App Development (Common to CSD, CSE, ISE)	B24IS384	R Programming

Non Credit Mandatory Courses (NMC)			
B24NCK391	National Service Scheme (NSS)	B24NCK392	National Cadet Corps (NCC)
B24NCK393	Physical Education (PE)	B24NCK394	Yoga (YOG)
B24NCK395	Music		

All students have to register for any one of the courses namely National Service Scheme (NSS), NCC/Physical Education (PE), Yoga (YOG) and Music with the concerned coordinator of the course during the first week of III/IV/V/VI semesters. Colleges are required to submit the Continuous Internal Evaluation (CIE) marks for the activities completed by students under selected course each semester. The students should be allowed to engage in different activities/courses each semester. For example, a student who participates in sports in the 3rd semester could choose to undertake NSS in the next semester and Yoga in another semester. This approach aligns with the student-centric focus of the National Education Policy (NEP) 2022 and helps distribute the workload related Physical Education/NCC/NSS/Yoga/Music of more evenly across different departments. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. **These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.**

Dean-Academics

Principal



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Semester: IV

S.No	Course Category and Course Code		Course Title	TD / PSB	BOE	Teaching Hours / Week & Credits					Examination			
						Lecture	Tutorial	Practical	SDA	Credits	CIE Marks	SEE Duration Hrs	SEE Marks	Total Marks
						L	T	P	S					
1.	PCC	B24MC401	Discrete Mathematics and Graph Theory (Common to CSE, CSD, ISE, AIML)	Maths	Maths	3	0	0	0	3	50	3	50	100
2.	PCC	B24CS402	Database Management Systems (Common to CSE, ISE, AIML, CSE(IC), CSD)	CSE	CSE	3	0	0	0	3	50	3	50	100
3.	IPCC	B24IS403	Advanced JAVA	ISE	ISE	3	0	2	0	4	50	3	50	100
4.	IPCC	B24CG404	Design and Analysis of Algorithms (Common to CSE, ISE, AIML, CSE(IC), CSD)	CG	CG	3	0	2	0	4	50	3	50	100
5.	PCCL	B24CS405L	Database Management Systems Lab (Common to CSE, ISE, AIML, CSE(IC), CSD)	CSE	CSE	0	0	2	0	1	50	3	50	100
6.	ESC	B24YY46X	ESC/ETC/PLC - IV	AI/CS/IS/ IC/CG	ISE	3	0	0	0	3	50	3	50	100
7.	UHV	B24UHK407	Universal Human Values	Any Dept.	Any Dept.	1	0	0	0	1	50	1	50	100
8.	AEC/ SEC	B24YY48X	Ability Enhancement Course / Skill Enhancement Course – III (Theory/Lab)	AI/CS/IS/ IC/CG	AI/CS/IS/ IC/CG	1	0	0	0	1	50	1	50	100
						0	0	2				3		
9.	NCMC	B24NCK49X	National Service Scheme / National Cadet Corps / Physical Education / Yoga/ Music	HSMC	HSMC	1	0	0		PP	50		-	50
TOTAL										20	450		400	850

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Engineering Science Course /Emerging Technology Course / Programming language Course (ESC/ETC/PLC) - IV			
B24IS461	Introduction to Cyber Security	B24IS462	System Programming
B24IS463	Capacity planning for IT (Common to CSE, ISE, CSD)	B24CS464	Green IT and Sustainability

Ability Enhancement Course / Skill Enhancement Course (AEC/SEC) – IV			
B24CS481	Microsoft Power BI (Common to CSE, CSE(IC), CSD, AIML, ISE)	B24CS482	DevOps (Common to CSE, CSE(IC), CSD, AIML, ISE)
B24IS483	Multimedia and Animation (Common to CSD, CSE, ISE)	B24IS484	Distributed Computing

Non Credit Mandatory Courses (NMC)			
B24NCK491	National Service Scheme (NSS)	B24NCK492	National Cadet Corps (NCC)
B24NCK493	Physical Education (PE)	B24NCK494	Yoga
B24NCK495	Music		

All students have to register for any one of the courses namely National Service Scheme (NSS), NCC/Physical Education (PE), Yoga (YOG) and Music with the concerned coordinator of the course during the first week of III/IV/V/VI semesters. Colleges are required to submit the Continuous Internal Evaluation (CIE) marks for the activities completed by students under selected course each semester. The students should be allowed to engage in different activities/courses each semester. For example, a student who participates in sports in the 3rd semester could choose to undertake NSS in the next semester and Yoga in another semester. This approach aligns with the student-centric focus of the National Education Policy (NEP) 2022 and helps distribute the workload related Physical Education/NCC/NSS/Yoga/Music of more evenly across different departments. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities.

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Dean-Academics

Principal



III - Semester Syllabus

SEMESTER-III			
MATHEMATICS-III FOR CS			
Category: BSC			
(Common to CSE, ISE, AIML, CSE(IC), CSD)			
Course Code	: B24MC301	CIE	: 50 Marks
Teaching Hours L : T : P	: 3:0:0	SEE	: 50 Marks
Total Hours	: 45(T)	Total	: 100 Marks
Credits	: 3	SEE Duration	: 3 Hrs

Course Objectives	
1.	To introduce the concept of random variables, probability distributions, specific discrete and continuous distributions with practical application in Computer Science Engineering and social life situations.
2.	To understand and analyze the probabilistic relationship between multiple random variables and determining relationships like co-variance and correlation.
3.	To Provide the principles of statistical inferences and the basics of hypothesis testing with emphasis on some commonly encountered hypotheses.
4.	To Determine whether an input has a statistically significant effect on the system's response through ANOVA testing.

Module-1: Probability Distributions	No. of Hours
Review of basic probability theory. Random variables (discrete and continuous), probability mass and density functions. Mathematical expectation, mean and variance. Binomial, Poisson and normal distributions- problems (derivations for mean and standard deviation for Binomial and Poisson distributions only)-Illustrative examples. Exponential distribution.	9
Module-2: Joint probability distribution & Markov Chain	No. of Hours
Joint Probability distribution for two discrete random variables, expectation, covariance and correlation. Markov Chain: Introduction to Stochastic Process, Probability Vectors, Stochastic matrices, Regular stochastic matrices, Markov chains, Higher transition probabilities, Stationary distribution of Regular Markov chains and absorbing states.	9
Module-3: Statistical Inference 1	No. of Hours
Introduction, sampling distribution, standard error, testing of hypothesis, levels of significance, test of significances, confidence limits, simple sampling of attributes, test of significance for large samples, comparison of large samples.	9
Module-4 :Statistical Inference 2	No. of Hours
Sampling variables, central limit theorem and confidences limit for unknown mean. Test of Significance for means of two small samples, students distribution, Chi-square distribution as a test of goodness of fit. F-Distribution.	9
Module-5 :Design of Experiments & ANOVA	No. of Hours
Principles of experimentation in design, Analysis of completely randomized design, randomized block design. The ANOVA Technique, Basic Principle of ANOVA, One-way ANOVA, Two-way ANOVA, Latin-square Design, and Analysis of Co-Variance.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain the basic concepts of probability, random variables, probability distribution.
CO2	Apply suitable probability distribution models for the given scenario.
CO3	Apply the notion of a discrete-time Markov chain and n-step transition probabilities to solve the given problem.
CO4	Use statistical methodology and tools in the engineering problem-solving process and compute the confidence intervals for the mean of the population.
CO5	Compute the confidence intervals for the mean of the population. Apply the ANOVA test related to engineering problems.



Text Books	
1.	Ronald E. Walpole, Raymond H Myers, Sharon L Myers & Keying Ye “Probability & Statistics for Engineers & Scientists”, Pearson Education, 9 th edition, 2017.
2.	Peter Bruce, Andrew Bruce & Peter Gedeck “Practical Statistics for Data Scientists” O’Reilly Media, Inc., 2 nd edition 2020.

Reference Text Books	
1.	Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons, 9 th Edition, 2006.
2.	B. S. Grewal “Higher Engineering Mathematics”, Khanna publishers, 44 th Ed., 2021.
3.	G Haribaskaran “Probability, Queuing Theory & Reliability Engineering”, Laxmi Publication, Latest Edition, 2006

Web links and Video lectures (e-Resources)	
1.	https://nptel.ac.in/courses/12286025
2.	VTU EDUSAT PROGRAMME – 20
3.	http://www.class-central.com/subject/math(MOOCs)

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

- Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
- Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
- Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
- Total marks scored (30+20 = 50 marks).
- The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

- The question paper shall be set for 100 marks and duration of SEE is 3 hours.
- The question paper will have two parts: Part-A and Part-B.
- Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
- Part-B** contains total 10 questions.
- Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
- Students should answer five full questions, selecting one full question from each module.
- Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	1	-	-	-	-	1	-	2
CO2	3	3	2	1	-	-	-	-	1	-	2
CO3	3	3	2	1	-	-	-	-	1	-	2
CO4	3	3	2	1	-	-	-	-	1	-	2
CO5	3	3	2	1	-	-	-	-	1	-	2

Level 3 - High, Level 2 - Moderate, Level 1 - Low



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SEMESTER-III			
DATA STRUCTURES AND ITS APPLICATIONS			
Category: PCC			
(Common to CSE, ISE, AIML, CSE(IC), CSD)			
Course Code	: B24CS302	CIE	: 50 Marks
Teaching Hours L : T : P	: 3:0:0	SEE	: 50 Marks
Total Hours	: 45(T)	Total	: 100 Marks
Credits	: 3	SEE Duration	: 3 Hrs

Course Objectives	
1.	Explain fundamentals of data structures and their applications essential for programming/problem solving.
2.	Apply stack, Queue and recursion operations to solve real world problems.
3.	Illustrate linear representation of data structures: Stack, Queues, Lists, Trees and Graphs.
4.	Demonstrate sorting and searching algorithms.
5.	Find suitable data structure during application development/Problem Solving.

Module – 1: Introduction	No. of Hours
Introduction: Data Structures, Classifications (Primitive & Non Primitive), Data structure Operations, Review of Arrays, Structures, Self-Referential Structures, and Unions. Pointers and Dynamic Memory Allocation Functions. Representation of Linear Arrays in Memory, Dynamically allocated arrays. Array Operations: Traversing, inserting, deleting, searching, and sorting. Multidimensional Arrays, Polynomials and Sparse Matrices. Strings: Basic Terminology, Storing, Operations and Pattern Matching algorithms. Programming Examples.	9
Module – 2: Stacks, Queues and Recursion	No. of Hours
Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix expression. Recursion - Factorial, GCD, Fibonacci Sequence, Tower of Hanoi, Ackerman's function. Queues: Definition, Array Representation, Queue Operations, Circular Queues, Circular queues using Dynamic arrays, Dequeues, Priority Queues, A Mazing Problem. Multiple Stacks and Queues. Programming Examples.	9
Module – 3: Linked Lists	No. of Hours
Linked Lists: Definition, Representation of linked lists in Memory, Memory allocation; Garbage Collection. Linked list operations: Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues. Applications of Linked lists – Polynomials, Sparse matrix representation. Programming Examples	9
Module – 4: Trees	No. of Hours
Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Additional Binary tree operations. Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, Searching, Application of Trees-Evaluation of Expression, Programming Examples	9
Module – 5 Graphs	No. of Hours
Graphs: Definitions, Terminologies, Matrix and Adjacency List Representation Of Graphs, Elementary Graph operations, Traversal methods: Breadth First Search and Depth First Search. Sorting and Searching: Insertion Sort, Radix sort, Address Calculation Sort. Hashing: Hash Table organizations, Hashing Functions, Static and Dynamic Hashing. Files and Their Organization: Data Hierarchy, File Attributes, Text Files and Binary Files, Basic File Operations, File Organizations and Indexing	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Use different types of data structures, operations and algorithms
CO2	Apply searching and sorting operations on files
CO3	Use stack, Queue, Lists, Trees and Graphs in problem solving
CO4	Implement all data structures in a high-level language for problem solving.
CO5	Identify the alternative implementations of data structure to solve real world problems

Text Books	
1.	Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2 nd Ed, Universities Press, 2014.
2.	Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1 st Ed, McGraw Hill, 2014.



Reference Text Books	
1.	Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, 2 nd Ed, Cengage Learning, 2014.
2.	Reema Thareja, Data Structures using C, 3 rd Ed, Oxford press, 2012.
3.	Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, 2 nd Ed, McGraw Hill, 2013

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

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1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
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SEMESTER END EXAMINATION (SEE)

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4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
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7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

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CO1	3	1	-	1	1	-	-	1	-	1	2
CO2	2	2	-	1	1	1	-	1	-	2	2
CO3	1	1	-	1	1	-	-	1	-	2	1
CO4	1	1	-	1	1	1	-	1	-	1	1
CO5	1	1	-	1	1	-	-	1	-	1	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low



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SEMESTER-III			
DIGITAL DESIGN AND COMPUTER ORGANIZATION			
Category: IPCC			
(Common to CSE, ISE, AIML, CSE(IC), CSD)			
Course Code	: B24CS303	CIE	: 50 Marks
Teaching Hours L : T : P	: 3:0:2	SEE	: 50 Marks
Total Hours	: 45(T)+15(P)	Total	: 100 Marks
Credits	: 4	SEE Duration	: 3 Hrs

Course Objectives	
1.	To demonstrate the functionalities of binary logic system
2.	To explain the working of combinational and sequential logic system
3.	To realize HDL Verilog programmes
4.	To realize the basic structure of computer system
5.	To illustrate the working of I/O operations and processing unit

Module – 1: Introduction to Digital Design	No. of Hours
Binary Logic, Basic Theorems And Properties Of Boolean Algebra, Boolean Functions, Digital Logic Gates, Introduction, The Map Method, Four-Variable Map, Don't-Care Conditions, NAND and NOR Implementation, Other Hardware Description Language – Verilog Model of a simple circuit. Text book 1: 1.9, 2.4, 2.5, 2.8, 3.1, 3.2, 3.3, 3.5, 3.6, 3.9	9
Module – 2: Combinational Logic	No. of Hours
Introduction, Combinational Circuits, Design Procedure, Binary Adder- Subtractor, Decoders, Encoders, Multiplexers. HDL Models of Combinational Circuits – Adder, Multiplexer, Encoder. Sequential Logic: Introduction, Sequential Circuits, Storage Elements: Latches, Flip-Flops. Text book 1: 4.1, 4.2, 4.4, 4.5, 4.9, 4.10, 4.11, 4.12, 5.1, 5.2, 5.3, 5.4.	9
Module – 3: Basic Structure of Computers	No. of Hours
Functional Units, Basic Operational Concepts, Bus structure, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. Machine Instructions and Programs: Memory Location and Addresses, Memory Operations, Instruction and Instruction sequencing, Addressing Modes. Text book 2: 1.2, 1.3, 1.4, 1.6, 2.2, 2.3, 2.4, 2.5	9
Module – 4: Input/output Organization	No. of Hours
Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access: Bus Arbitration, Speed, size and Cost of memory systems. Cache Memories – Mapping Functions. Text book 2: 4.1, 4.2.1, 4.2.2, 4.2.3, 4.4, 5.4, 5.5.	9
Module – 5: Basic Processing Unit	No. of Hours
Some Fundamental Concepts: Register Transfers, Performing ALU operations, fetching a word from Memory, Storing a word in memory. Execution of a Complete Instruction. Pipelining: Basic concepts, Role of Cache memory, Pipeline Performance. Text book 2: 7.1, 7.2, 8.1	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply the K-Map techniques to simplify various Boolean expressions.
CO2	Design different types of combinational and sequential circuits along with Verilog programs.
CO3	Describe the fundamentals of machine instructions, addressing modes and Processor performance.
CO4	Explain the approaches involved in achieving communication between processor and I/O devices.
CO5	Analyze internal Organization of Memory and Impact of cache/Pipelining on Processor Performance.

Text Books	
1.	M. Morris Mano & Michael D. Ciletti, Digital Design With an Introduction to Verilog Design, 5 th edition, Pearson Education.
2.	Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, 5 th Edition, Tata McGraw Hill.

Web links and Video lectures (e-Resources):	
1.	Web links and Video Lectures (e-Resources): https://cse11-iiith.vlabs.ac.in/



ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

The CIE marks for the theory component of the Integrated Course (IC) shall be 30 marks and for the laboratory component 20 marks.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY COMPONENT OF IC:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes / Weekly test / project work for (20+20) marks, scaled down to **20 marks**.
4. Total marks scored (**30+20 = 50 marks**) scaled down to **25**.

CIE FOR THE PRACTICAL COMPONENT OF IC:

1. On completion of every experiment / program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day.
2. Each experiment is evaluated for 10 marks and scaled down to **5 marks**.
3. Laboratory test at the end of the 15th week of the semester / after completion of all the experiments shall be conducted for **50 marks** and scaled down to **20 marks**.
4. Total marks scored for lab component: **05+20=25 marks**.
5. The minimum marks to be secured in CIE to appear for SEE shall be 10(40% of maximum marks 25) in the theory and 10(40% of Maximum marks 25) in the practical.
6. The laboratory component of the **integrated course** shall be CIE only. However, in SEE, the questions from the practical component shall be included.

Theory				
IA Test	Exam conducted for	Scaled down to	Average of best two tests	Total
IA-1	50	30	30	50/2=25
IA-2	50	30		
IA-3	50	30		
Two Assignments	2×10=20	10	10	
Two Quizzes	2×10=20	10	10	

LAB			
Continuous performance and record writing	Each experiments evaluated for 10 marks	Scaled down to 05 marks	5+20=25
Internal Test + Viva voce	Exam conducted for 50 marks	Scaled down to 20 marks	



SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and carries 20 Marks.
4. **Part-B** contains total 10 questions. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice. Students should answer five full questions, selecting one full question from each module.
5. Students have to answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks.
6. The maximum marks from the practical component to be included in the SEE question paper is **16 marks**.
7. Question papers to be set as per the Blooms Taxonomy levels.

LABORATORY

Practical Component of IPCC (10 Experiments)

Sl. No	Name of the experiments
1.	Given a 4-variable logic expression, simplify it using appropriate technique and simulate the same using basic gates.
2.	Design a 4 bit full adder and subtractor and simulate the same using basic gates.
3.	Design a 2 bit half adder and subtractor and simulate the same using NAND and NOR gates
4.	Given a 4-variable logic expression, simplify it using appropriate technique and simulate the same using Verilog HDL
5.	Design Verilog HDL to implement simple circuits using structural, Data flow and Behavioural model.
6.	Design Verilog HDL to implement Binary Adder-Subtractor – Half and Full Adder, Half and Full Subtractor.
7.	Design Verilog HDL to implement Decimal adder.
8.	Design Verilog program to implement Different types of multiplexer like 2:1, 4:1 and 8:1.
9.	Design Verilog program to implement types of De-Multiplexer.
10.	Design Verilog program for implementing various types of Flip-Flops such as SR, JK and D.

CO-PO Mapping

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	-	-	-	3	1	-	-	1	2
CO2	2	2	-	-	-	2	1	-	-	2	2
CO3	1	1	-	-	-	1	2	-	-	2	1
CO4	1	1	-	-	-	1	2	-	-	1	1
CO5	1	1	-	-	-	1	2	-	-	1	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low



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SEMESTER-III			
OPERATING SYSTEMS			
Category: IPCC			
(Common to CSE, ISE, AIML, CSE(IC), CSD)			
Course Code	: B24CS304	CIE	: 50 Marks
Teaching Hours L : T : P:S	: 3:0:2	SEE	: 50 Marks
Total Hours	: 45(T)+ 15(P)	Total	: 100 Marks
Credits	: 4	SEE Duration	: 3 Hrs

Course Objectives	
1.	Introduce the fundamental concepts of operating systems, their functions, and types.
2.	Explain process management, scheduling algorithms, and inter-process communication.
3.	Describe memory management techniques, including paging, segmentation, and virtual memory.
4.	Illustrate file systems, storage management, and input-output operations.
5.	Explore synchronization mechanisms, deadlocks, and security aspects in operating systems.
6.	Provide insights into modern operating systems such as Linux, Windows, and mobile OS.

Module – 1: Introduction to Operating Systems	No. of Hours
Definition, Purpose, and Evolution of Operating Systems, Types of Operating Systems: Batch, Time-Sharing, Distributed, Real-Time, and Mobile OS, Operating System Structure: Monolithic, Layered, Microkernel, and Hybrid, System Calls and Operating System Services	9
Module – 2: Process Management & CPU Scheduling	No. of Hours
Processes: Concept, Process Control Block (PCB), Process States, Threads: Single vs. Multi-threading, User vs. Kernel Threads, CPU Scheduling: Scheduling Criteria, Preemptive & Non-preemptive Scheduling, Scheduling Algorithms: FCFS, SJF, Priority Scheduling, Round Robin, Multi-Level Queue Scheduling, Inter process Communication (IPC) and Synchronization, Deadlocks: Detection, Prevention, Avoidance (Banker's Algorithm), Recovery	9
Module – 3: Memory Management	No. of Hours
Memory Allocation: Contiguous & Non-Contiguous Allocation, Paging and Segmentation, Virtual Memory: Demand Paging, Page Replacement Algorithms (FIFO, LRU, Optimal), Thrashing and Working Set Model	9
Module – 4: File System & Storage Management	No. of Hours
File Concepts: File Attributes, File Types, File Access Methods, File System Structure: Directory Structure, File Allocation Methods (Contiguous, Linked, Indexed), Disk Scheduling Algorithms: FCFS, SSTF, SCAN, C-SCAN, LOOK, File Protection & Security	9
Module – 5: I/O Systems, Security, and Case Studies	No. of Hours
I/O Hardware, Device Drivers, Interrupt Handling, Security and Protection in Operating Systems, Authentication and Access Control Mechanisms, Case Study: UNIX/Linux, Windows, Android Operating System	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the basic structure, functionalities, and design principles of an operating system.
CO2	Analyze process scheduling techniques and inter-process communication mechanisms.
CO3	Implement memory management techniques such as paging, segmentation, and virtual memory.
CO4	Evaluate file system structures, disk scheduling algorithms, and storage management strategies.
CO5	Apply synchronization techniques to avoid race conditions and deadlocks.

Textbooks	
1.	Abraham Silberschatz, Peter B. Galvin, Greg Gagne-“Operating System Concepts, 10 th Edition, Wiley, 2018”.
2.	William Stallings – “Operating Systems: Internals and Design Principles, 9 th Edition, Pearson, 2018”.



Reference Text Books

1.	Andrew S. Tanenbaum – “Modern Operating Systems, 4 th Edition, Pearson, 2015”.
2.	Dhananjay M.Dhamdhere –“Operating Systems: A Concept-Based Approach, 3 rd Edition, McGraw-Hill, 2017”.
3.	Gary Nutt – “Operating Systems, 3 rd Edition, Pearson, 2004”.

LABORATORY

Practical Component of IPCC (10 Experiments)

Sl. No	Name of the Experiment
1.	Demonstrate how a child process is created using fork() and how it executes a new program using exec()
2.	Create a program where the parent process writes to a pipe and the child reads from it (unidirectional communication).
3.	Use shmget(), shmat(), and semctl() to demonstrate shared memory-based communication between two processes.
4.	Implement both First Come First Serve and Shortest Job First (non-preemptive) scheduling algorithms and compare their performance.
5.	Simulate Round Robin (preemptive) and Priority (non-preemptive or preemptive) scheduling with average time calculations.
6.	Simulate logical to physical address mapping using a page table. Take page number and offset as input.
7.	Demonstrate address translation using segment table consisting of base and limit values.
8.	Simulate a hierarchical file system where users can create, delete, search files and directories (like mkdir, rm, ls).
9.	Simulate the Banker’s Algorithm to determine whether a system is in a safe state for resource allocation.
10.	Write a C program that uses system() calls to run shell commands (e.g., list files, view processes) and parse the output for analysis.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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The CIE marks for the theory component of the Integrated Course (IC) shall be 30 marks and for the laboratory component 20 marks.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY COMPONENT OF IC:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes / Weekly test / project work for (20+20) marks, scaled down to **20 marks**.
4. Total marks scored (**30+20 = 50 marks**) scaled down to **25**.



CIE FOR THE PRACTICAL COMPONENT OF IC:

1. On completion of every experiment / program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day.
2. Each experiment is evaluated for 10 marks and scaled down to **5 marks**.
3. Laboratory test at the end of the 15th week of the semester / after completion of all the experiments shall be conducted for **50 marks** and scaled down to **20 marks**.
4. Total marks scored for lab component: **05+20=25 marks**.
5. The minimum marks to be secured in CIE to appear for SEE shall be 10(40% of maximum marks 25) in the theory and 10(40% of Maximum marks 25) in the practical.
6. The laboratory component of the **integrated course** shall be CIE only. However, in SEE, the questions from the practical component shall be included.

Theory				
IA Test	Exam conducted for	Scaled down to	Average of best two tests	Total
IA-1	50	30	30	50/2=25
IA-2	50	30		
IA-3	50	30		
Two Assignments	2×10=20	10	10	
Two Quizzes	2×10=20	10	10	

LAB			
Continuous performance and record writing	Each experiments evaluated for 10 marks	Scaled down to 05 marks	5+20=25
Internal Test + Viva voce	Exam conducted for 50 marks	Scaled down to 20 marks	

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and carries 20 Marks.
4. **Part-B** contains total 10 questions. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice. Students should answer five full questions, selecting one full question from each module.
5. Students have to answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks.
6. The maximum marks from the practical component to be included in the SEE question paper is **16 marks**.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	-	-	-	-	-	-	-	2
CO2	2	1	2	1	3	-	-	-	-	-	1
CO3	2	1	2	1	2	-	-	-	-	-	1
CO4	2	2	-	-	1	-	-	-	-	-	2
CO5	1	1	2	1	-	-	-	-	-	-	1

Level 3 – High, Level 2 – Moderate, Level 1 -Low



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SEMESTER-III					
DATA STRUCTURES AND ITS APPLICATIONS LAB					
Category: PCCL					
(Common to CSE, ISE, AIML, CSE(IC), CSD)					
Course Code	:	B24CS305L	CIE	:	50 Marks
Teaching Hours L : T : P	:	0:0:2	SEE	:	50 Marks
Total Hours	:	15(P)	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Objectives	
1.	To implement linear data structures such as arrays, stacks, queues, linked lists
2.	To apply suitable data structures for solving various computational problems effectively and efficiently
3.	To implement nonlinear data structures such as trees, and graphs
4.	Apply nonlinear data structure to provide the solution for the given problem
5.	To familiarize students with file handling and explore applications of data structures in real-world scenarios

SL NO	NAME OF THE PROGRAM
1.	Develop a Program in C for the following: a) Declare a calendar as an array of 7 elements (A dynamically Created array) to represent 7 days of a week. Each Element of the array is a structure having three fields. The first field is the name of the Day (A dynamically allocated String), The second field is the date of the Day (A integer), the third field is the description of the activity for a particular day (A dynamically allocated String). b) Write functions create(), read() and display(); to create the calendar, to read the data from the keyboard and to print weeks activity details report on screen.
2.	Develop a Program in C for the following operations on Strings. a. Read a main String (STR), a Pattern String (PAT) and a Replace String (REP) b. Perform Pattern Matching Operation: Find and Replace all occurrences of PAT in STR with REP if PAT exists in STR. Report suitable messages in case PAT does not exist in STR Support the program with functions for each of the above operations. Don't use Built-in functions.
3.	Develop a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX) a. Push an Element on to Stack b. Pop an Element from Stack c. Demonstrate how Stack can be used to check Palindrome d. Demonstrate Overflow and Underflow situations on Stack e. Display the status of Stack f. Exit Support the program with appropriate functions for each of the above operations
4.	Develop a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, % (Remainder), ^ (Power) and alphanumeric operands.
5.	Develop a Program in C for the following Stack Applications a. Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^ . b. Solving Tower of Hanoi problem with n disks
6.	Develop a menu driven Program in C for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX) a. Insert an Element on to Circular QUEUE b. Delete an Element from Circular QUEUE c. Demonstrate Overflow and Underflow situations on Circular QUEUE d. Display the status of Circular QUEUE e. Exit Support the program with appropriate functions for each of the above operations
7.	Develop a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Programme, Sem, PhNo a. Create a SLL of N Students Data by using front insertion. b. Display the status of SLL and count the number of nodes in it c. Perform Insertion / Deletion at End of SLL d. Perform Insertion / Deletion at Front of SLL(Demonstration of stack) e. Exit



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8.	Develop a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: SSN, Name, Dept, Designation, Sal, PhNo a. Create a DLL of N Employees Data by using end insertion. b. Display the status of DLL and count the number of nodes in it c. Perform Insertion and Deletion at End of DLL d. Perform Insertion and Deletion at Front of DLL e. Demonstrate how this DLL can be used as Double Ended Queue. f. Exit
9.	Develop a Program in C for the following operations on Singly Circular Linked List (SCLL) with header nodes a. Represent and Evaluate a Polynomial $P(x,y,z) = 6x^2y^2z - 4yz^5 + 3x^3yz + 2xy^5z - 2xyz^3$ b. Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z) Support the program with appropriate functions for each of the above operations
10.	Develop a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers . a. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2 b. Traverse the BST in Inorder, Preorder and Post Order c. Search the BST for a given element (KEY) and report the appropriate message d. Exit
11.	Develop a Program in C for the following operations on Graph(G) of Cities a. Create a Graph of N cities using Adjacency Matrix. b. Print all the nodes reachable from a given starting node in a digraph using DFS/BFS
12.	Given a File of N employee records with a set K of Keys (4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table (HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are Integers. Develop a Program in C that uses Hash function $H: K \rightarrow L$ as $H(K) = K \text{ mod } m$ (remainder method), and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.

Course Outcomes: At the end of the course, the students will be able to

CO1	Apply the concepts of pointers and structures in problem solving.
CO2	Use different types of linked lists to solve problems.
CO3	Demonstrate stack and queue data structures to solve problems.
CO4	Illustrate the operations performed on tree data structures, hash functions for problem solving.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (CIE)

Component	Scale down to	Total Marks
Conduction of experiments and Record Writing (Each Experiment evaluated for 10 marks)	20	20
Internal Lab Test 1 (After 6 experiments) Exam conduction for 50 marks	15	15
Internal Lab Test 2 (After 6 experiments) Exam conduction for 50 marks	15	15
CIE		50



SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
2. All laboratory experiments are to be included for practical examination.
3. Students can pick one question (experiment) from the questions lot prepared by the examiners.
4. Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
5. Rubrics suggested for SEE, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
6. Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero. The minimum duration of SEE is 03 hours.

CO-PO Mapping

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	-	1	1	-	-	-	-	-	1
CO2	3	1	2	2	1	-	-	-	-	-	-
CO3	3	1	2	1	1	-	-	-	-	-	1
CO4	3	1	-	2	1	-	-	-	-	-	1
CO5	2	1	2	1	2	-	-	-	2	2	-

Level 3 – High, Level 2 – Moderate, Level 1 –Low



SEMESTER-III			
OBJECT ORIENTED PROGRAMMING WITH JAVA			
Category: ESC/ETC/PLC-III			
(Common to ISE,AIML)			
Course Code	:	B24IS361	CIE
Teaching Hours L : T : P	:	2:0:2	SEE
Total Hours	:	30(T)+15(P)	Total
Credits	:	3	SEE Duration
			50 Marks
			50 Marks
			100 Marks
			3 Hrs

Course Objectives	
1.	To learn primitive constructs JAVA programming language.
2.	To understand Object Oriented Programming Features of JAVA.
3.	To gain knowledge on Inheritance, Interfaces and Packages.
4.	To understand Exceptions Handling and Multi-Threaded Programming.
5.	To learn Graphics programming, Swing And JDBC.

Module – 1: Overview of Java Fundamentals	No. of Hours
An Overview of Java: Object oriented programming concepts of Java – characteristics of Java – fundamental programming structure of Java - primitive data types, variables, literals, keywords. Type conversion and casting, arrays. Operators: Arithmetic operators, relational operators, boolean, logical operators, assignment operator, ternary operator. Control and Iterative Statements: Introduction to if statements, switch statement. While, do-while, for loops and nested loops, break, continue statement. Textbook 1: Chapter: 2, 3, 4, 5	6
Module – 2: Classes and Methods	No. of Hours
Introducing Classes: Class fundamentals, declaring objects, assigning object reference variables, introducing methods, constructors, this keyword, garbage collection. Methods and Classes: Overloading methods, objects as parameters, argument passing, returning objects, recursion, access control, understanding static, introducing final, introducing nested and inner classes. Textbook 1: Chapters 6, 7	6
Module – 3: Inheritance, Interfaces and Packages	No. of Hours
Inheritance: Inheritance basics, access specifiers, using super, creating a multilevel hierarchy, method overriding, abstract classes, using final with inheritance, local variable type inference and inheritance. Interfaces: Introduction to interfaces, default interface methods, using static methods in an interface, private interface methods. Packages: Introduction, packages and member access, importing packages. Textbook 1: Chapters 8, 9	6
Module – 4: Exceptions Handling and Multi-Threaded Programming	No. of Hours
Exceptions: Exception-handling fundamentals, exception types, using try and catch, multiple catch clauses, nested try statements, throw, throws, finally, Java's built-in exceptions, creating your own exception. Multi-threaded Programming: Java thread model, main thread, creating single thread and multiple threads, using isAlive() and join(), thread priorities, synchronization, suspending, resuming, and stopping threads. Textbook 1: Chapters 10, 11	6
Module – 5: Graphics programming, Swing and JDBC	No. of Hours
Graphics programming: Basics of Applets- working with 2D shapes - Using color, fonts, and images - Basics of event handling. Swing: Introduction to Swing – layout management - Swing Components. JDBC: Introduction - JDBC Product Components - JDBC Architecture - Case studies. Textbook 1: Chapters 25 – 27	6

LABORATORY**Practical Component of IPCC (10 Experiments)**

Sl. No.	Name of the Experiment
1.	Write a Java program to develop a calculator and to find factorial of a given number.
2.	Write a program to implement matrix addition and multiplication using 2D array.
3.	a) Write a Java program to compute the sum of all prime numbers between 1 and 10 using control structures.



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	b) Use super () to invoke parent class constructor and access parent class members.
4.	Create a class with method overloading to calculate the area of rectangle, circle, and square.
5.	Develop a JAVA program to create an abstract class Shape with abstract methods calculate Area() and Calculate Perimeter(). Create subclasses Circle and Triangle that extend the Shape class and implement the respective methods to calculate the area and perimeter of each shape.
6.	Demonstrate multilevel and multiple inheritance using suitable classes and interfaces.
7.	Create a user-defined package, define a class in the package, and access it from another program.
8.	Develop a JAVA program to raise a custom exception (user defined exception) for divisionByZero using try, catch, throw and finally.
9.	Write a program to illustrate creation of threads using runnable class. (start method start each of the newly created thread. Inside the run method there is sleep() for suspend the thread for 500 milliseconds).
10.	a) Write a Java program to demonstrate an applet with color and shape. b) Write the program to demonstrate AWT and Swing in Java.

Course Outcomes: At the end of the course, the students will be able to

CO1	Understand the object-oriented programming concepts
CO2	Design a class involving data members and methods for the given scenario.
CO3	Apply the concepts of inheritance and interfaces in solving real world problems.
CO4	Use the concept of exception handling and multi-threading in solving complex problem.
CO5	Design an application with AWT and swing components.

Text Books

1.	Java - The Complete Reference, Herbert Schildt, Tata McGraw-Hill, 8 th Edition, 2011.
2.	Core Java: Volume I – Fundamentals Cay S. Horstmann and Gary Cornell, Ninth Edition, Sun Microsystems Press, 2013.
3.	Java SE 8 for Programmers Paul Deitel, Harvey Deitel / Pearson / 3 rd Edition /2015
4.	Understanding Object-oriented programming with Java Timothy Budd / Pearson Education / 2000
5.	The Java Programming Language-A primer Ken Arnold, James Gosling, David Holmes, , 4 th Edition, Prentice Hall

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

The CIE marks for the theory component of the Integrated Course (IC) shall be 30 marks and for the laboratory component 20 marks.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY COMPONENT OF IC:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes / Weekly test / project work for (20+20) marks, scaled down to **20 marks**.
4. Total marks scored (**30+20 = 50 marks**) scaled down to **25**.

CIE FOR THE PRACTICAL COMPONENT OF IC:

1. On completion of every experiment / program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day.



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2. Each experiment is evaluated for 10 marks and scaled down to **5 marks**.
3. Laboratory test at the end of the 15th week of the semester / after completion of all the experiments shall be conducted for **50 marks** and scaled down to **20 marks**.
4. Total marks scored for lab component: **05+20=25 marks**.
5. The minimum marks to be secured in CIE to appear for SEE shall be 10(40% of maximum marks 25) in the theory and 10(40% of Maximum marks 25) in the practical.
6. The laboratory component of the **integrated course** shall be CIE only. However, in SEE, the questions from the practical component shall be included.

Theory				
IA Test	Exam conducted for	Scaled down to	Average of best two tests	Total
IA-1	50	30	30	50/2=25
IA-2	50	30		
IA-3	50	30		
Two Assignments	2×10=20	10	10	
Two Quizzes	2×10=20	10	10	

LAB			
Continuous performance and record writing	Each experiments evaluated for 10 marks	Scaled down to 05 marks	5+20=25
Internal Test + Viva voce	Exam conducted for 50 marks	Scaled down to 20 marks	

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and carries 20 Marks.
4. **Part-B** contains total 10 questions. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice. Students should answer five full questions, selecting one full question from each module.
5. Students have to answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks.
6. The maximum marks from the practical component to be included in the SEE question paper is **16 marks**.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	1	2	-	-	-	2	1	2
CO2	2	3	1	-	1	-	-	-	-	2	-
CO3	1	2	2	2	2	-	-	-	2	1	2
CO4	2	2	3	1	3	-	-	-	-	2	2
CO5	1	2	3	-	2	-	-	-	1	2	-

Level 1-High, Level 2-Moderate, Level 3-Low



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SEMESTER-III			
INTRODUCTION TO DATA SCIENCE			
Category: ESC/ETC/PLC-III			
Course Code	: B24IS362	CIE	: 50 Marks
Teaching Hours L:T:P	: 3:0:0	SEE	: 50 Marks
Total Hours	: 45(T)	Total	: 100 Marks
Credits	: 3	SEE Duration	: 3 Hrs

Course Objectives	
1.	Introduce the fundamental concepts, scope, and real-world applications of Data Science.
2.	Explain data preprocessing techniques, exploratory data analysis, and data visualization methods.
3.	Provide a strong foundation in probability and statistical analysis for data-driven decision-making.
4.	Introduce the basics of machine learning techniques, including supervised and unsupervised learning.
5.	Familiarize students with key tools and programming languages used in Data Science, such as Python, R, and SQL.

Module – 1: Introduction to Data Science	No. of Hours
What is Data Science?, Evolution and Applications of Data Science, Data Science vs. Business Intelligence vs. Machine Learning, Role of a Data Scientist, Data Science Lifecycle, Ethical Issues and Challenges in Data Science.	9
Module – 2: Data Handling & Preprocessing	No. of Hours
Types of Data: Structured, Unstructured, and Semi-structured, Data Collection Techniques (APIs, Web Scraping, Databases), Data Cleaning: Handling Missing Values, Outliers, and Data Imputation, Data Transformation: Normalization, Standardization, and Feature Engineering, Exploratory Data Analysis (EDA) and Data Visualization	9
Module – 3: Probability & Statistics for Data Science	No. of Hours
Descriptive Statistics: Mean, Median, Mode, Variance, Standard Deviation, Probability Theory: Probability Distributions (Normal, Binomial, Poisson), Inferential Statistics: Hypothesis Testing, Confidence Intervals, Correlation and Regression Analysis, Central Limit Theorem and Law of Large Numbers.	9
Module – 4: Introduction to Machine Learning	No. of Hours
Basics of Machine Learning (ML), Supervised Learning vs. Unsupervised Learning, Regression Techniques (Linear Regression, Logistic Regression), Classification Methods (Decision Trees, Naïve Bayes, k-NN), Clustering Techniques (K-Means, Hierarchical Clustering), Model Evaluation Metrics: Accuracy, Precision, Recall, F1-score.	9
Module – 5: Tools for Data Science & Case Studies	No. of Hours
Python for Data Science: Numpy, Pandas, Matplotlib, Scikit-learn, R for Data Science Basics, SQL for Data Querying, Introduction to Big Data and Cloud Platforms (Hadoop, Spark, AWS, Google Cloud), Case Studies: Applications in Healthcare, Finance, Marketing, and Social Media Analytics	9
Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the fundamental principles and lifecycle of Data Science.
CO2	Analyze datasets using various preprocessing, transformation, and visualization techniques.
CO3	Apply probability and statistical concepts to perform data-driven decision-making.
CO4	Implement basic machine learning algorithms for classification, regression, and clustering.
CO5	Utilize programming tools such as Python, R, and SQL to perform data analysis.

Textbooks	
1.	Joel Grus – “ <i>Data Science from Scratch</i> , 2 nd Edition, O'Reilly, 2019”.
2.	Jake VanderPlas - “ <i>Python Data Science Handbook</i> , O'Reilly, 2016”.

Reference Textbooks



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1.	Hadley Wickham – “ <i>R for Data Science</i> , O'Reilly, 2016”
2.	Trevor Hastie – “ <i>The Elements of Statistical Learning</i> , Springer, 2017”.
3.	Aurélien Géron – “ <i>Hands-On Machine Learning with Scikit-Learn, Keras, and Tensor Flow</i> , 2 nd Edition, O'Reilly, 2019”.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	-	-	-	-	-	1
CO2	3	2	-	-	-	-	-	-	-	-	1
CO3	3	3	-	2	-	-	-	-	-	-	2
CO4	3	2	-	-	3	-	-	-	-	-	2
CO5	3	2	-	-	3	-	-	-	-	-	2

Level 3 – High, Level 2 – Moderate, Level 1 -Low



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SEMESTER-III			
DATA VISUALIZATION			
Category: ESC/ETC/PLC-III			
Course Code	: B24IS363	CIE	: 50 Marks
Teaching Hours L : T : P	: 3 : 0 : 0	SEE	: 50 Marks
Total Hours	: 45(T)	Total	: 100 Marks
Credits	: 3	SEE Duration	: 3 Hrs

Course Objectives	
1.	To introduce students to data visualization concepts and techniques.
2.	To enable students to use Python libraries such as Matplotlib, Seaborn, and Plotly for data visualization
3.	To help students analyze and interpret datasets using various graphical representations.
4.	To teach students how to create interactive and dynamic visualizations
5.	To develop students' ability to present data insights effectively using visual tools.

Module – 1: Introduction to Data Visualization	No. of Hours
Importance of data visualization, Basic principles of data visualization, Introduction to Python visualization libraries (Matplotlib, Seaborn, Plotly), Types of data and appropriate visualization techniques, Exploratory Data Analysis (EDA).	9
Module – 2: Matplotlib and Seaborn for Visualization	No. of Hours
Basics of Matplotlib: Line plots, scatter plots, bar charts, histograms, Customizing plots: Labels, legends, color maps, annotations, Introduction to Seaborn: Statistical data visualization, Distribution plots (Histogram, KDE, Boxplot, Violin plot), Categorical plots (Bar plot, Count plot, Swarm plot).	9
Module – 3: Advanced Visualization Techniques	No. of Hours
Heatmaps, Pairplots, and Correlation Matrices, Time-series visualization, Multi-panel plots and subplots, Advanced Seaborn visualizations (FacetGrid, Jointplot, Pairplot), Enhancing aesthetics with themes and color palettes.	9
Module – 4: Interactive Visualizations with Plotly and Bokeh	No. of Hours
Introduction to interactive visualization, Plotly basics: Line plots, scatter plots, bar charts, pie charts, Advanced Plotly: Bubble charts, Treemaps, Sunburst charts, Interactive dashboard creation with Dash and Streamlit, Introduction to Bokeh for web-based visualization.	9
Module – 5: Case Studies and Applications	No. of Hours
Data storytelling and dashboard design, Visualizing real-world datasets (e.g., COVID-19, stock market trends, climate data), Geospatial visualization with Folium and Plotly, Best practices in data visualization, Project: Building a complete data visualization report.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the importance of data visualization in data analysis.
CO2	Apply different visualization techniques using Python libraries.
CO3	Analyze and interpret data trends using charts and plots.
CO4	Create interactive and dynamic visualizations for better data representation.
CO5	Evaluate and present data-driven insights effectively.

Textbooks	
1.	Ben Jones – “Communicating Data with Tableau, O'Reilly”.
2.	Alberto Cairo – “The Truthful Art: Data, Charts, and Maps for Communication, Pearson”.
3.	Jake VanderPlas – “Python Data Science Handbook, O'Reilly”.
4.	Wes McKinney – “Python for Data Analysis, O'Reilly”.
5.	Matplotlib, Seaborn, and Plotly Official Documentation.



ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	-	2	-	-	-	-	-	2
CO2	2	2	3	-	2	-	-	-	-	-	3
CO3	3	3	2	-	2	-	-	-	-	-	2
CO4	3	2	3	-	2	-	-	-	-	-	3
CO5	2	3	3	-	3	-	-	-	-	-	3

Level 3 – High, Level 2 – Moderate, Level 1 -Low



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SEMESTER-III					
WEB TECHNOLOGIES					
Category: ESC/ETC/PLC-III					
(Common to CSE, ISE, CSE(IC), AIML)					
Course Code	:	B24AI364	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	To orient students to Web Programming fundamental.
2.	To develop hands-on skills in building dynamic and interactive web applications using modern web development technologies and frameworks.
3.	To enhance problem-solving abilities and encourage creativity and innovation in designing and implementing web applications.
4.	To Work collaboratively on web development projects to enhance teamwork, communication, and project management skills.
5.	To understand modern web application frameworks and to explore popular development tools and frameworks.

Module – 1: Website Basics, Html 5, Css 3, Web 2.0	No. of Hours
Web Essentials: Clients, Servers and Communication – The Internet – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Drag and Drop – Audio – Video controls - CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations. Bootstrap Framework.	9
Module – 2: Client Side Programming	No. of Hours
Java Script: An introduction to JavaScript–JavaScript DOM Model-Exception Handling-Validation Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files.	9
Module – 3: Server Side Programming	No. of Hours
Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- DATABASE CONNECTIVITY: JDBC.	9
Module – 4: PHP and XML	No. of Hours
An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation. XML: Basic XML- Document Type Definition- XML Schema, XML Parsers and Validation, XSL.	9
Module – 5: Introduction to Angular and Web Applications Frameworks	No. of Hours
Introduction to AngularJS, MVC Architecture, Understanding ng attributes, Expressions and data binding, Conditional Directives, Style Directives, Controllers, Filters, Forms, Routers, Modules, Services; Web Applications Frameworks and Tools – Firebase- Docker- Node JS- React- DjangoUI & UX.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Construct a basic website using HTML and Cascading Style Sheets
CO2	Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.
CO3	Develop server side programs using Servlets and JSP.
CO4	Construct simple web pages in PHP and to represent data in XML format
CO5	Develop interactive web applications.

Textbooks	
1.	Deitel and Deitel and Nieto, Internet and World Wide Web - How to Program, Prentice Hall, 5 th Edition, 2011.
2.	Jeffrey C and Jackson, Web Technologies A Computer Science Perspective, Pearson Education, 2011.
3.	Angular 6 for Enterprise-Ready Web Applications, Doguhan Uluca, 1 st edition, Packt Publishing



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Reference Textbooks	
1.	Stephen Wynkoop and John Burke —Running a Perfect Website, QUE, 2 nd Edition, 1999.
2.	Chris Bates, Web Programming – Building Intranet Applications, 3 rd Edition, Wiley Publications, 2009
3.	Gopalan N.P. and Akilandeswari J., —Web Technology, Prentice Hall of India, 2011.
4.	Angular: Up and Running: Learning Angular, Step by Step, Shyam Seshadri, 1 st edition, O'Reilly
5.	UttamK.Roy, —Web Technologies, Oxford University Press, 2011

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	3	3	3	-	-	-	2	-	3
CO2	3	2	3	2	3	-	-	-	2	-	3
CO3	1	2	2	3	3	-	-	-	1	-	2
CO4	3	3	3	2	3	-	-	-	2	-	3
CO5	2	2	3	1	2	-	-	-	3	-	2

Level 3 - High, Level 2 - Moderate, Level 1 - Low



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SEMESTER-III					
DATA ANALYTICS WITH EXCEL					
Category: AEC/SEC-III					
(Common to AIML,CSD,ISE)					
Course Code	:	B24CG381	CIE	:	50 Marks
Teaching Hours L : T : P	:	0:0:2	SEE	:	50 Marks
Total Hours	:	15(P)	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Objectives	
1.	To Apply analysis techniques to datasets in Excel
2.	Learn how to use Pivot Tables and Pivot Charts to streamline your workflow in Excel
3.	Understand and Identify the principles of data analysis
4.	Become adept at using Excel functions and techniques for analysis
5.	Build presentation ready dashboards in Excel

Sl. No	List of Experiments
1.	Getting Started with Excel: Creation of spread sheets, Insertion of rows and columns, Drag & Fill, use of Aggregate functions.
2.	Working with Data : Importing data, Data Entry & Manipulation, Sorting & Filtering
3.	Working with Data: Data Validation, Pivot Tables & Pivot Charts.
4.	Data Analysis Process: Conditional Formatting, What-If Analysis, Data Tables, Charts & Graphs.
5.	Cleaning Data with Text Functions: use of UPPER and LOWER, TRIM function, Concatenate.
6.	Cleaning Data Containing Date and Time Values: use of DATEVALUE function, DATEADD and DATEDIF, TIMEVALUE functions.
7.	Conditional Formatting: formatting, parsing, and highlighting data in spreadsheets during data analysis.
8.	Working with Multiple Sheets: work with multiple sheets within a workbook is crucial for organizing and managing data, perform complex calculations and create comprehensive reports.
9.	Create worksheet with following fields: Empno, Ename, Basic Pay(BP), Travelling Allowance(TA), Dearness Allowance(DA), House Rent Allowance(HRA), Income Tax(IT), Provident Fund(PF), Net Pay(NP). Use appropriate formulas to calculate the above scenario. Analyse the data using appropriate chart and report the data.
10.	Create worksheet on Inventory Management: Sheet should contain Product code, Product name, Product type, MRP, Cost after % of discount, Date of purchase. Use appropriate formulas to calculate the above scenario. Analyse the data using appropriate chart and report the data.
11.	Create worksheet on Sales analysis of Merchandise Store: data consisting of Order ID, Customer ID, Gender, age, date of order, month, online platform, Category of product, size, quantity, amount, shipping city and other details. Use of formula to segregate different categories and perform a comparative study using pivot tables and different sort of charts.
12.	Generation of report & presentation using Autofilter & macro.

Course Outcomes: At the end of the course, the students will be able to	
CO1	A data analytics with excel course aims to equip individuals with skills to analyze data using Microsoft Excel.
CO2	Aim to study basic statistical analysis.



ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (CIE)

Component	Scale down to	Total Marks
Conduction of experiments and Record Writing (Each Experiment evaluated for 10 marks)	20	20
Internal Lab Test 1 (After 6 experiments) Exam conduction for 50 marks	15	15
Internal Lab Test 2 (After 6 experiments) Exam conduction for 50 marks	15	15
	CIE	50

SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
2. All laboratory experiments are to be included for practical examination.
3. Students can pick one question (experiment) from the questions lot prepared by the examiners.
4. Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
5. Rubrics suggested for SEE, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
6. Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero. The minimum duration of SEE is 03 hours.



SEMESTER-III			
PROJECT MANAGEMENT WITH GIT			
Category: AEC/SEC-III			
Course Code	: B24IS382	CIE	: 50 Marks
Teaching Hours L : T : P	: 1:0:0	SEE	: 50 Marks
Total Hours	: 15(T)	Total	: 100 Marks
Credits	: 1	SEE Duration	: 1 Hr

Course Objectives	
1.	To understand the fundamentals of project management, including scope, time, cost, and quality.
2.	To develop skills in project planning, scheduling, risk management, and execution strategies.
3.	To introduce Agile, Scrum, and traditional project management methodologies.
4.	To equip students with the knowledge of budgeting, resource allocation, and stakeholder management.
5.	To familiarize students with project monitoring, evaluation, and reporting techniques.

Module- 1: Introduction to Project Management	No. of Hours
Definition and Characteristics of a Project, Project Life Cycle & Phases, Project Constraints: Scope, Cost, Time, Quality, Risk, Resources, Role of a Project Manager & Team, Project Selection Methods & Feasibility Studies	3
Module- 2: Project Planning & Scheduling	No. of Hours
Work Breakdown Structure (WBS), Gantt Charts & Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), Resource Allocation & Management, Project Estimation Techniques	3
Module- 3: Agile & Traditional Project Management Methodologies	No. of Hours
Waterfall Model v/s Agile Model, Scrum Framework & Agile Manifesto, Kanban, Extreme Programming (XP), and Lean Project Management, Risk Management Strategies, Project Documentation & Change Control Management	2
Module- 4: Cost, Quality & Risk Management	No. of Hours
Cost Estimation, Budgeting, and Financial Planning, Earned Value Management (EVM) & Cost-Benefit Analysis, Quality Management & Six Sigma in Projects, Risk Identification, Analysis, and Response Strategies, Tools for Risk Management (SWOT, FMEA, Monte Carlo Simulation)	4
Module- 5: Project Execution, Monitoring & Closing	No. of Hours
Project Execution Strategies, Performance Measurement & Key Performance Indicators (KPIs), Project Monitoring & Control Systems, Stakeholder Communication & Reporting, Lessons Learned, Closure & Post-Project Evaluation.	3

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the principles and lifecycle of project management
CO2	Apply project planning and scheduling techniques for effective execution
CO3	Utilize Agile and traditional project methodologies effectively.
CO4	Implement cost, quality, and risk management practices in projects.
CO5	Execute, monitor, and close projects while ensuring quality deliverables

Text Books	
1.	Harold Kerzner - "Project Management: A Systems Approach to Planning, Scheduling, and Controlling"
2.	Ken Schwaber - "Agile Project Management with Scrum"
3.	Rita Mulcahy - "PMP Exam Prep"
4.	Eric Ries - "The Lean Startup"

**ASSESSMENT DETAILS (BOTH CIE AND SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (CIE)**CIE FOR THE THEORY:**

1. Three tests each of 50 marks (Multiple Choice Questions), after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour. The student has to secure a minimum of 35% of the maximum marks meant for SEE.

CO-PO Mapping

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	1	1	2	1	1	1	-	3	2
CO2	2	-	1	1	1	1	1	2	-	3	2
CO3	1	-	1	1	2	1	1	1	-	3	1
CO4	2	-	1	1	2	1	1	1	-	2	1
CO5	1	-	1	1	-	1	1	1	-	2	1

Level 3 – High, Level 2 – Moderate, Level 1 -Low



SEMESTER-III					
APP DEVELOPMENT					
Category: AEC/SEC-III					
(Common to CSE, CSD, ISE)					
Course Code	:	B24CS383	CIE	:	50 Marks
Teaching Hours L : T : P	:	0 : 0 : 2	SEE	:	50 Marks
Total Hours	:	15(P)	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Objectives	
1.	Know the components and structure of mobile application development frameworks like Android /windows /ios.
2.	Understand how to work with various mobile application development frameworks
3.	Learn the basic and important design concepts and issues of development of mobile applications.
4.	Understand the capabilities and limitations of mobile devices.
5.	Write applications for the platforms used, simulate them, and test them on the mobile hardware where possible.

Sl. No	List of Experiments
1.	Develop an application that uses Layout Managers.
2.	Develop an application that uses event listeners.
3.	Develop an application that uses Adapters, Toast.
4.	Develop an application that makes use of database.
5.	Develop an application that makes use of RSS Feed.
6.	Implement an application that implements Multi threading.
7.	Develop a native application that uses GPS location information.
8.	Implement an application that writes data to the SD card.
9.	Implement an application that creates an alert upon receiving a message.
10.	Develop a game application.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Install and configure Android application development tools.
CO2	Design and develop user Interfaces for the Android platform.
CO3	Apply Java programming concepts to Android application development.
CO4	Familiar with technology and business trends impacting mobile applications.
CO5	Competent with the characterization and architecture of mobile applications.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.



CONTINUOUS INTERNAL EVALUATION (CIE)

Component	Scale down to	Total Marks
Conduction of experiments and Record Writing (Each Experiment evaluated for 10 marks)	20	20
Internal Lab Test 1(After 6 experiments) Exam conduction for 50 marks	15	15
Internal Lab Test 2 (After 6 experiments) Exam conduction for 50 marks	15	15
CIE		50

SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
2. All laboratory experiments are to be included for practical examination.
3. Students can pick one question (experiment) from the questions lot prepared by the examiners.
4. Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
5. Rubrics suggested for SEE, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
6. Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero. The minimum duration of SEE is 03 hours.

CO-PO Mapping

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2		3	-	-	-	2	2	2
CO2	2	2	3	2	3	-	-	-	2	2	2
CO3	2	2	2	2	3	-	-	-	2	2	2
CO4	2	2	3	2	3	-	-	-	2	2	2
CO5	2	2	2	2	3	-	-	-	2	2	2

Level 3 - High, Level 2 - Moderate, Level 1 - Low



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SEMESTER-III				
R PROGRAMMING				
Category: AEC / SEC-III				
Course Code	:	B24IS384	CIE	: 50 Marks
Teaching Hours L : T : P	:	0:0:2	SEE	: 50 Marks
Total Hours	:	15(P)	Total	: 100 Marks
Credits	:	1	SEE Duration	: 1 Hr

Course Objectives	
1.	To explore and understand how R and R Studio interactive environment.
2.	To understand the different data Structures, data types in R.
3.	To learn and practice programming techniques using R programming.
4.	To import data into R from various data sources and generate visualizations.
5.	To draw insights from datasets using data analytics techniques.

Sl. No	Experiments
1.	Demonstrate the steps for installation of R and R Studio. Perform the following: a) Assign different type of values to variables and display the type of variable. Assign different types such as Double, Integer, Logical, Complex and Character and understand the difference between each data type. b) Demonstrate Arithmetic and Logical Operations with simple examples. c) Demonstrate generation of sequences and creation of vectors. d) Demonstrate Creation of Matrices e) Demonstrate the Creation of Matrices from Vectors using Binding Function. f) Demonstrate element extraction from vectors, matrices and arrays
2.	Assess the Financial Statement of an Organization being supplied with 2 vectors of data: Monthly Revenue and Monthly Expenses for the Financial Year. You can create your own sample data vector for this experiment) Calculate the following financial metrics: a. Profit for each month. b. Profit after tax for each month (Tax Rate is 30%). c. Profit margin for each month equals to profit after tax divided by revenue. d. Good Months – where the profit after tax was greater than the mean for the year. e. Bad Months – where the profit after tax was less than the mean for the year. f. The best month – where the profit after tax was max for the year. g. The worst month – where the profit after tax was min for the year. Note: a. All Results need to be presented as vectors b. Results for Dollar values need to be calculated with \$0.01 precision, but need to be presented in Units of \$1000 (i.e 1k) with no decimal points c. Results for the profit margin ratio need to be presented in units of % with no decimal point. d. It is okay for tax to be negative for any given month (deferred tax asset) Generate CSV file for the data.
3.	Develop a program to create two 3 X 3 matrices A and B and perform the following operations a) Transpose of the matrix b) addition c) subtraction d) multiplication
4.	Develop a program to find the factorial of given number using recursive function calls.
5.	Develop an R Program using functions to find all the prime numbers up to a specified number by the method of Sieve of Eratosthenes.
6.	The built-in data set mammals contain data on body weight versus brain weight. Develop R commands to: a) Find the Pearson and Spearman correlation coefficients. Are they similar?



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	<p>b) Plot the data using the plot command. Plot the logarithm (log) of each variable and see if that makes a difference</p>																		
7.	<p>Develop R program to create a Data Frame with following details and do the following operations.</p> <table border="1"><thead><tr><th>Item Code</th><th>Item Category</th><th>Item Price</th></tr></thead><tbody><tr><td>1001</td><td>Electronics</td><td>700</td></tr><tr><td>1002</td><td>Desktop Supplies</td><td>300</td></tr><tr><td>1003</td><td>Office Supplies</td><td>350</td></tr><tr><td>1004</td><td>USB</td><td>400</td></tr><tr><td>1005</td><td>CD Drive</td><td>800</td></tr></tbody></table> <p>a) Subset the Data frame and display the details of only those items whose price are greater than or equal to 350. b) Subset the Data frame and display only the items where the category is either “Office Supplies” or “Desktop Supplies” c) Create another Data Frame called “item-details” with three different fields item Code, Item Qty on Hand and Item Reorder Lvl and merge the two frames</p>	Item Code	Item Category	Item Price	1001	Electronics	700	1002	Desktop Supplies	300	1003	Office Supplies	350	1004	USB	400	1005	CD Drive	800
Item Code	Item Category	Item Price																	
1001	Electronics	700																	
1002	Desktop Supplies	300																	
1003	Office Supplies	350																	
1004	USB	400																	
1005	CD Drive	800																	
8.	<p>Let us use the built-in dataset air quality which has Daily air quality measurements in New York, May to September 1973. Develop R program to generate histogram by using appropriate arguments for the following statements.</p> <ol style="list-style-type: none">Assigning names, using the air quality data set.Change colors of the HistogramRemove Axis and Add labels to HistogramChange Axis limits of a HistogramAdd Density curve to the histogram																		
9.	<p>Design a data frame in R for storing about 20 employee details. Create a CSV file named “input.csv” that defines all the required information about the employee such as id, name, salary, start_date, dept. Import into R and do the following analysis.</p> <ol style="list-style-type: none">Find the total number rows & columnsFind the maximum salaryRetrieve the details of the employee with maximum salaryRetrieve all the employees working in the IT Department.Retrieve the employees in the IT Department whose salary is greater than 20000 and write these details into another file “output.csv”																		
10.	<p>Using the built in dataset mtcars which is a popular dataset consisting of the design and fuel consumption patterns of 32 different automobiles. The data was extracted from the 1974 Motor Trend US magazine, and comprises fuel consumption and 10 aspects of automobile design and performance for 32 automobiles (1973-74 models). Format A data frame with 32 observations on 11 variables : [1] mpg Miles/(US) gallon, [2] cyl Number of cylinders [3] disp Displacement (cu.in.), [4] hp Gross horsepower [5] drat Rear axle ratio,[6] wt Weight (lb/1000) [7] qsec 1/4 mile time, [8] vs V/S, [9] am Transmission (0 = automatic, 1 = manual), [10] gear Number of forward gears, [11] carb Number of carburetors</p> <p>Develop R program, to solve the following:</p> <ol style="list-style-type: none">What is the total number of observations and variables in the dataset?Find the car with the largest hp and the least hp using suitable functionsPlot histogram / density for each variable and determine whether continuous variables are normally distributed or not. If not, what is their skewness?What is the average difference of gross horse power(hp) between automobiles with 3 and 4 number of cylinders(cyl)? Also determine the difference in their standard deviations.Which pair of variables has the highest Pearson correlation?																		
11.	<p>Demonstrate the progression of salary with years of experience using a suitable data set (You can create your own dataset). Plot the graph visualizing the best fit line on the plot of the given data points. Plot a curve of</p>																		



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	Actual Values vs. Predicted values to show their correlation and performance of the model. Interpret the meaning of the slope and y-intercept of the line with respect to the given data. Implement using lm function. Save the graphs and coefficients in files. Attach the predicted values of salaries as a new column to the original data set and save the data as a new CSV file.
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Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain the fundamental syntax of R data types, expressions and the usage of the R-Studio IDE
CO2	Develop a program in R with programming constructs: conditionals, looping and functions.
CO3	Apply the list and data frame structure of the R programming language.
CO4	Use visualization packages and file handlers for data analysis.
CO5	Analyze real-time datasets using statistical models and correlation techniques, and visualize results using plots.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (CIE)

Component	Scale down to	Total Marks
Conduction of experiments and Record Writing (Each Experiment evaluated for 10 marks)	20	20
Internal Lab Test 1(After 6 experiments) Exam conduction for 50 marks	15	15
Internal Lab Test 2 (After 6 experiments) Exam conduction for 50 marks	15	15
	CIE	50

SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
2. All laboratory experiments are to be included for practical examination.
3. Students can pick one question (experiment) from the questions lot prepared by the examiners.
4. Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
5. Rubrics suggested for SEE, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
6. Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero. The minimum duration of SEE is 03 hours.



IV - Semester Syllabus

SEMESTER-IV					
DISCRETE MATHEMATICS AND GRAPH THEORY					
Category: PCC					
(Common to CSE, ISE, CSD, AIML)					
Course Code	:	B24MC401	CIE	:	50 Marks
Teaching Hours L: T: P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	To help students understand discrete and continuous mathematical structures
2.	Analyzing and solving combinatorial problems using logical reasoning and creativity
3.	To impart basics of relations and functions
4.	Analyze and solve problems involving graph connectivity
5.	Analyze and solve problems involving tree structures

Module-1: Mathematical Logic	No. of Hours
Statements and notations, Connectives, Truth Tables, Tautology, Equivalence implication, Normal forms, Quantifiers, Universal quantifiers. Rules of inference, Proof of contradiction.	9
Module-2: Relations And Functions	No. of Hours
Relations: Properties of Binary Relations, Equivalence Relation, Transitive closure, Compatibility and Partial ordering relations, Lattices, Hasse diagram. Functions: inverse Function, Composition of functions, Recursive Functions.	9
Module-3: Elementary Combinatorics	No. of Hours
Basis of counting, Combinations & Permutations, With repetitions, Constrained repetitions, Binomial Coefficients, Binomial Multinomial theorems, The principles of Inclusion – Exclusion, Pigeon- hole principles and its applications.	9
Module-4: Fundamental Concepts of Graph	No. of Hours
Basic definitions of graphs and multigraphs adjacency matrices, isomorphism, decompositions, independent sets, graph complements, vertex coloring, chromatic number, important graph like cubes and the Petersen graph. Paths, cycles. Vertex degrees and counting large bipartite sub graphs. Directed graphs: weak connectivity, strong components, Induction and other fundamental proof techniques.	9
Module-5: Trees and Connectivity	No. of Hours
Basics: equivalent characterizations of trees, forests, Spanning trees, Distance and center, Optimization, prims, Kruskal's Theorem and Dijkstra's Theorem, Connectivity, Vertex cuts, separating sets, bonds vertex and edge connectivity, Menger's Theorem, undirected vertex and edge versions.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply concepts of logical reasoning and mathematical proof techniques in proving theorems and statements
CO2	Apply basic counting techniques to solve the combinatorial problems
CO3	Apply the basic concepts of relations, functions and partially order sets for computer representations
CO4	Use the basic concepts of graph theory and some related theoretical problems
CO5	Analyze and solve problems involving tree structures

Text Books	
1.	Ralph P. Grimaldi: "Discrete and Combinatorial Mathematics", 5 th Edition, Pearson Education. 2004.
2.	West, Introduction to Graph Theory, 2 nd edition., Prentice Hall

Reference Text Books	
1.	Ralph P. Grimaldi, B V Ramana: "Discrete Mathematical Structures an Applied Introduction", 5 th Edition, Pearson Education, 2004.
2.	Basavaraj S Anami and Venakanna S Madalli: "Discrete Mathematics – A Concept-based approach", Universities Press, 2016
3.	Kenneth H. Rosen: "Discrete Mathematics and its Applications", 6 th Edition, McGraw Hill, 2007.



Web links and Video lectures (e-Resources)

1. <https://nptel.ac.in/courses/12286025>
2. [VTU EDUSAT PROGRAMME – 20](#)
3. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	1	-	-	-	-	1	-	2
CO2	3	3	2	1	-	-	-	-	1	-	2
CO3	3	3	2	1	-	-	-	-	1	-	2
CO4	3	3	2	1	-	-	-	-	1	-	2
CO5	3	3	2	1	-	-	-	-	1	-	2

Level 3 - High, Level 2 - Moderate, Level 1 - Low



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SEMESTER-IV			
DATABASE MANAGEMENT SYSTEMS			
Category: PCC			
(Common to CSE, ISE, AIML, IOTCSE(IC), CSD)			
Course Code	: B24CS402	CIE	: 50 Marks
Teaching Hours L: T: P	: 3:0:0	SEE	: 50 Marks
Total Hours	: 45(T)	Total	: 100 Marks
Credits	: 3	SEE Duration	: 3 Hrs

Course Objectives	
1.	To introduce the fundamental concepts of database systems and data models, particularly the relational model.
2.	To understand and apply relational algebra and relational calculus for query formulation.
3.	To develop SQL queries for data definition, manipulation, and control.
4.	To understand the concepts of normalization and apply it to improve database design and eliminate anomalies.
5.	To gain knowledge of transaction processing, concurrency control, and recovery techniques to ensure data integrity and consistency.

Module – 1: Introduction to Databases	No. of Hours
Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment. Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets, attributes and structural constraints, Weak entity types, ER diagrams.	9
Module – 2: Relational Model	No. of Hours
Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations. Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping) Examples of Queries in relational algebra. Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping.	9
Module – 3: Structured Query Language (SQL)	No. of Hours
Overview of SQL, Data Definition Commands, Data Manipulation commands, Integrity constraints - key constraints, Domain Constraints, Referential integrity constraints (RIC), Entity integrity constraints (EIC), check constraints, Data Control commands, Transaction Control Commands, aggregate function - group by, having clause SQL-Advance Queries: Views in SQL, Nested and co-related queries, Exists & Not Exists, joins & outer joins, specifying constraints as assertions and action Triggers.	9
Module – 4: Relational & Normalization	No. of Hours
Database Design: Pitfalls in Relational-Database designs, Concept of normalization, Function Dependencies, Normal Forms- 1NF, 2NF, 3NF, multivalued dependency and 4NF, Join dependencies and 5NF, BCNF	9
Module – 5: Transaction Management and Recovery	No. of Hours
Transaction Concept, ACID properties, Transaction States, Implementation of atomicity and durability, Concurrent Executions, Serializability, Concurrency Control Protocols: Lock-based, Timestamp based, Validation Based, Deadlock Handling, Recovery System: Failure classification, Log based recovery, Shadow Paging, ARIES recovery algorithm.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Design an optimized database.
CO2	Design entity relationship for the given scenario.
CO3	Construct SQL queries to perform operations on the database.
CO4	Demonstrate appropriate transaction management and recovery techniques for a given problem..
CO5	Apply indexing mechanisms for efficient retrieval of information from database



Text Books	
1.	Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7 th Edition, 2017, Pearson.
2.	Database management systems, Ramakrishnan, and Gehrke, 3 rd Edition, 2014, McGraw Hill
3.	Elmasri and Navathe, —Fundamentals of Database Systems, 7 th Edition, Pearson education, 2016.

Reference Text Books	
1.	Abraham Silberschatz, Henry F. Korth and S. Sudarshan's Database System Concepts 6 th Edition Tata Mcgraw Hill Education Private Limited
2.	G. K. Gupta —Database Management Systems, 3 rd Edition, McGraw – Hill, 2018
3.	Dr. P.S. Deshpande, SQL and PL/SQL for Oracle 10g, Black Book, Dreamtech Press, 2012

Web links and Video lectures (e-Resources)	
1.	https://www.youtube.com/watch?v=3EJlovevfcA
2.	https://www.youtube.com/watch?v=9TwMRs3qTcU
3.	https://www.youtube.com/watch?v=ZW10Xow304I

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
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3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
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SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

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CO1	3	1	-	-	-	3	1	-	-	1	2
CO2	2	2	-	-	-	2	1	-	-	2	2
CO3	1	1	-	-	-	1	2	-	-	2	1
CO4	1	1	-	-	-	1	2	-	-	1	1
CO5	1	1	-	-	-	1	2	-	-	1	1

Level 3 - High, Level 2 - Moderate, Level 1 - Lo



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SEMESTER-IV			
ADVANCED JAVA			
Category: IPCC			
Course Code	: B24IS403	CIE	: 50 Marks
Teaching Hours L: T: P	: 3:0:2	SEE	: 50 Marks
Total Hours	: 45 (T)+ 15(P)	Total	: 100 Marks
Credits	: 4	SEE Duration	: 3 Hrs

Course Objectives	
1.	Understanding the fundamentals of collection framework
2.	Demonstrate the fundamental concepts of String operations and Swing applications
3.	Design and develop web applications using Java servlets and JSP
4.	Apply database interaction through Java database Connectivity

Module– 1: The collections and Framework	No. of Hours
Collections Overview, The Collection Interfaces, The Collection Classes, accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working with Maps, Comparators, The Collection Algorithms, Arrays, The legacy Classes and Interfaces, Parting Thoughts on Collections.	9
Module– 2: String Handling	No. of Hours
The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, modifying a String, Data Conversion Using valueOf(), Changing the Case of Characters Within a String, joining strings, Additional String Methods, StringBuffer , StringBuilder	9
Module– 3: Memory System and Cache Organization	No. of Hours
Introducing Swing: The Origin of Swing, Swing Is Built on AWT, Two Key Swing Features, The MVC Connection, Components and Containers, The Swing Packages, A Simple Swing Application, Event Handling, Painting in Swing. Exploring Swing: JLabel and ImageIcon, JTextField, The Swing Buttons-JButton, JToggleButton, Check Boxes, Radio Buttons	9
Module– 4: Introducing servlets	No. of Hours
Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Jakarta. Servlet Package; Reading Servlet Parameter; The Jakarta.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking. Java Server Pages (JSP); JSP tags, Variables and Objects, Methods, Control statements, Loops, Request String, Parsing other information, User sessions, Cookies, Session Objects.	9
Module– 5: JDBC Objects	No. of Hours
The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply appropriate collection class/interface to solve the given problem
CO2	Demonstrate the concepts of String operations in Java
CO3	Apply the concepts of Swings to build Java applications
CO4	Develop web based applications using Java servlets and JSP
CO5	Use JDBC to build database applications.

Text Books	
1.	Y. Daniel Liang: Introduction to JAVA Programming, 7 th Edition, Pearson Education, 2007.
2.	Stephanie Bodoff et al: The J2EE Tutorial, 2 nd Edition, Pearson Education, 2004.
3.	Uttam K Roy, Advanced JAVA programming, Oxford University press, 2015.



Web links and Video Lectures	
1.	https://nptel.ac.in/courses/106/105/106105191/
2.	https://nptel.ac.in/courses/106/105/106105225/
3.	https://youtu.be/qGMxs-PbFPk

LABORATORY

Practical Component of IPCC (12 Experiments)

Sl. No	NAME OF THE PROGRAM
1.	Implement a java program to demonstrate creating an Array List, adding elements, removing elements, sorting elements of Array List. Also illustrate the use of to Array() method.
2.	Develop a program to read random numbers between a given range that are multiples of 2 and 5, sort the numbers according to tens place using comparator.
3.	Implement a java program to illustrate storing user defined classes in collection.
4.	Implement a java program to illustrate the use of different types of string class constructors.
5.	Implement a java program to illustrate the use of different types of character extraction, string comparison, string search and string modification methods.
6.	Implement a java program to illustrate the use of different types of String Buffer methods.
7.	Demonstrate a swing event handling application that creates 2 buttons Alpha and Beta and displays the text "Alpha pressed" when alpha button is clicked and "Beta pressed" when beta button is clicked.
8.	A program to display greeting message on the browser "Hello User Name", "How Are You?", accept username from the client using servlet.
9.	A servlet program to display the name, USN, and total marks by accepting student detail
10.	A Java program to create and read the cookie for the given cookie name as "EMPID" and its value as "AN2356".
11.	Write a JAVA Program to insert data into Student DATA BASE and retrieve info based on particular queries(For example update, delete, search etc...).
12.	A program to design the Login page and validating the USER_ID and PASSWORD using JSP and Data Base.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

The CIE marks for the theory component of the Integrated Course (IC) shall be 30 marks and for the laboratory component 20 marks.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY COMPONENT OF IC:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.



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2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes / Weekly test / project work for (20+20) marks, scaled down to **20 marks**.
4. Total marks scored (**30+20 = 50 marks**) scaled down to **25**.

CIE FOR THE PRACTICAL COMPONENT OF IC:

1. On completion of every experiment / program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day.
2. Each experiment is evaluated for 10 marks and scaled down to **5 marks**.
3. Laboratory test at the end of the 15th week of the semester / after completion of all the experiments shall be conducted for **50 marks** and scaled down to **20 marks**.
4. Total marks scored for lab component: **05+20=25 marks**.
5. The minimum marks to be secured in CIE to appear for SEE shall be 10(40% of maximum marks 25) in the theory and 10(40% of Maximum marks 25) in the practical.
6. The laboratory component of the **integrated course** shall be CIE only. However, in SEE, the questions from the practical component shall be included.

Theory				
IA Test	Exam conducted for	Scaled down to	Average of best two tests	Total
IA-1	50	30	30	50/2=25
IA-2	50	30		
IA-3	50	30		
Two Assignments	2×10=20	10	10	
Two Quizzes	2×10=20	10	10	

LAB			
Continuous performance and record writing	Each experiments evaluated for 10 marks	Scaled down to 05 marks	5+20=25
Internal Test + Viva voce	Exam conducted for 50 marks	Scaled down to 20 marks	

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and carries 20 Marks.
4. **Part-B** contains total 10 questions. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice. Students should answer five full questions, selecting one full question from each module.
5. Students have to answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks.
6. The maximum marks from the practical component to be included in the SEE question paper is **16 marks**.
7. Question papers to be set as per the Blooms Taxonomy levels.



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CO-PO Mapping

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	-	1	1	-	1	-	-	1	1
CO2	2	1	-	2	1	-	-	1	-	2	-
CO3	1	1	-	1	1	-	-	-	-	2	-
CO4	1	1	-	1	1	-	-	1	-	1	-
CO5	1	1	-	1	1	-	-	-	-	1	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low



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SEMESTER-IV			
DESIGN AND ANALYSIS OF ALGORITHMS			
Category: IPCC			
(Common to CSE, ISE, AIML, CSE(IC), CSD)			
Course Code	: B24CS404	CIE	: 50 Marks
Teaching Hours L : T : P	: 3:0:2	SEE	: 50 Marks
Total Hours	: 45(T)+15(P)	Total	: 100 Marks
Credits	: 4	SEE Duration	: 3 Hrs

Course Objectives	
1.	To learn the methods for analyzing algorithms and evaluating their performance.
2.	To demonstrate the efficiency of algorithms using asymptotic notations.
3.	To solve problems using various algorithm design methods, including brute force, greedy, divide and conquer, decrease and conquer, transform and conquer, dynamic programming, backtracking, and branch and bound.
4.	To learn the concepts of P and NP complexity classes.
5.	To apply algorithmic techniques in real-world problem solving and enhance logical and analytical thinking

Module – 1: INTRODUCTION	No. of Hours
What is an Algorithm?, Fundamentals of Algorithmic Problem Solving. FUNDAMENTALS OF THE ANALYSIS OF ALGORITHM EFFICIENCY: Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non recursive Algorithms, Mathematical Analysis of Recursive Algorithms. BRUTE FORCE APPROACHES: Selection Sort and Bubble Sort, Sequential Search and Brute Force String Matching.	9
Module – 2 : DECREASE-AND-CONQUER	No. of Hours
BRUTE FORCE APPROACHES: Exhaustive Search (Travelling Salesman problem and Knapsack Problem). DECREASE-AND-CONQUER: Insertion Sort, Topological Sorting. DIVIDE AND CONQUER: Merge Sort, Quick Sort, Binary Tree Traversals, Multiplication of Large Integers and Strassen's Matrix Multiplication	9
Module – 3: TRANSFORM-AND-CONQUER	No. of Hours
Balanced Search Trees, Heaps and Heapsort. SPACE-TIME TRADEOFFS: Sorting by Counting: Comparison counting sort, Input Enhancement in String Matching: Horspool's Algorithm	9
Module – 4: DYNAMIC PROGRAMMING	No. of Hours
Three basic examples, The Knapsack Problem and Memory Functions, Warshall's and Floyd's Algorithms. THE GREEDY METHOD: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and Codes	9
Module – 5: LIMITATIONS OF ALGORITHMIC POWER	No. of Hours
LIMITATIONS OF ALGORITHMIC POWER: Decision Trees, P, NP, and NP-Complete Problems. COPING WITH LIMITATIONS OF ALGORITHMIC POWER: Backtracking (n-Queens problem, Subset-sum problem), Branch-and-Bound (Knapsack problem), Approximation algorithms for NP-Hard problems (Knapsack problem).	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply asymptotic notational method to analyze the performance of the algorithms in terms of time complexity.
CO2	Demonstrate divide & conquer approaches and decrease & conquer approaches to solve computational problems.
CO3	Make use of transform & conquer and dynamic programming design approaches to solve the given real world or complex computational problems
CO4	Apply greedy and input enhancement methods to solve graph & string based computational problems.
CO5	Analyse various classes (P,NP and NP Complete) of problems

Text Books	
1.	Introduction to the Design and Analysis of Algorithms, By Anany Levitin, 3 rd Edition (Indian), 2017, Pearson.



Reference Text Books	
1.	Computer Algorithms/C++, Ellis Horowitz, SatrajSahni and Rajasekaran, 2 nd Edition, 2014, Universities Pres
2.	Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3 rd Edition, PHI.
3.	Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education)

Web links and Video lectures (e-Resources)	
1.	https://www.youtube.com/watch?v=EoIP-WNP-Zc&pp=ygUQI2J0ZWNoZGFhc3ViamVjdA%3D%3D&themeRefresh=1
2.	https://www.youtube.com/watch?v=NqKkxQamroo
3.	https://www.youtube.com/playlist?list=PLxCzCOWd7aiHcmS4i14bI0VrMbZTUvITa

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

The CIE marks for the theory component of the Integrated Course (IC) shall be 30 marks and for the laboratory component 20 marks.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY COMPONENT OF IC:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes / Weekly test / project work for (20+20) marks, scaled down to **20 marks**.
4. Total marks scored (**30+20 = 50 marks**) scaled down to **25**.

CIE FOR THE PRACTICAL COMPONENT OF IC:

1. On completion of every experiment / program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day.
2. Each experiment is evaluated for 10 marks and scaled down to **5 marks**.
3. Laboratory test at the end of the 15th week of the semester / after completion of all the experiments shall be conducted for **50 marks** and scaled down to **20 marks**.
4. Total marks scored for lab component: **05+20=25 marks**.
5. The minimum marks to be secured in CIE to appear for SEE shall be 10(40% of maximum marks 25) in the theory and 10(40% of Maximum marks 25) in the practical.
6. The laboratory component of the **integrated course** shall be CIE only. However, in SEE, the questions from the practical component shall be included.

Theory				
IA Test	Exam conducted for	Scaled down to	Average of best two tests	Total
IA-1	50	30	30	50/2=25
IA-2	50	30		
IA-3	50	30		
Two Assignments	2×10=20	10	10	
Two Quizzes	2×10=20	10	10	



LAB			
Continuous performance and record writing	Each experiments evaluated for 10 marks	Scaled down to 05 marks	5+20=25
Internal Test + Viva voce	Exam conducted for 50 marks	Scaled down to 20 marks	

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and carries 20 Marks.
4. **Part-B** contains total 10 questions. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice. Students should answer five full questions, selecting one full question from each module.
5. Students have to answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks.
6. The maximum marks from the practical component to be included in the SEE question paper is **16 marks**.
7. Question papers to be set as per the Blooms Taxonomy levels.

LABORATORY

Practical Component of IPCC (12 Experiments)

Sl. No	Name of the experiments
1.	Design and implement C/C++ Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm.
2.	Design and implement C/C++ Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm
3.	a. Design and implement C/C++ Program to solve All-Pairs Shortest Paths problem using Floyd's algorithm. b. Design and implement C/C++ Program to find the transitive closure using Warshall's algorithm.
4.	Design and implement C/C++ Program to find shortest paths from a given vertex in a weighted connected graph to other vertices using Dijkstra's algorithm
5.	Design and implement C/C++ Program to obtain the Topological ordering of vertices in a given digraph
6.	Design and implement C/C++ Program to solve 0/1 Knapsack problem using Dynamic Programming method.
7.	Design and implement C/C++ Program to solve discrete Knapsack and continuous Knapsack problems using greedy approximation method.
8.	Design and implement C/C++ Program to find a subset of a given set $S = \{s_1, s_2, \dots, s_n\}$ of n positive integers whose sum is equal to a given positive integer d.
9.	Design and implement C/C++ Program to sort a given set of n integer elements using Selection Sort method and compute its time complexity.
10.	Design and implement C/C++ Program to sort a given set of n integer elements using Quick Sort method



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	and compute its time complexity
11.	Design and implement C/C++ Program to sort a given set of n integer elements using Merge Sort method and compute its time complexity.
12.	Design and implement C/C++ Program for N Queen's problem using Backtracking.

CO-PO Mapping

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	-	2	1	-	-	1	-	1	2
CO2	2	2	-	2	1	-	-	1	-	2	2
CO3	1	1	-	2	1	-	-	-	-	2	1
CO4	1	1	-	2	1	-	-	-	-	1	1
CO5	1	1	-	2	1	-	-	-	-	1	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low



SEMESTER-IV			
DATABASE MANAGEMENT SYSTEMS LAB			
Category: PCCL			
(Common to CSE, CSD, CSE(IC), AIML, ISE)			
Course Code	: B24CS405L	CIE	: 50 Marks
Teaching Hours L : T : P	: 0 : 0 : 2	SEE	: 50 Marks
Total hours	: 15(P)	Total	: 100 Marks
Credits	: 1	SEE Duration	: 3 Hrs

Course Objectives	
1.	To Provide a strong foundation in database concepts, technology, and practice.
2.	To Practice SQL programming through a variety of database problems
3.	To Understand the relational database design principles.
4.	To Demonstrate the use of concurrency and transactions in database.
5.	To Design and build database applications for real world problems.

Sl. No	List of Experiments
PART-A	
1.	Implementation of DDL commands of SQL with suitable examples <ul style="list-style-type: none">● Create● Alter● Drop● Truncate● Rename
2.	Implementation of DML commands of SQL with suitable examples <ul style="list-style-type: none">● Insert● Update● Delete● Select
3.	Implementation of different types of function with suitable examples <ul style="list-style-type: none">● Aggregate Function● Using Parentheses● Column Aliases● Literal Character Strings● Duplicate Row
4.	Implementation of different types of operators in SQL <ul style="list-style-type: none">● Arithmetic Operators● Concatenation Operator● Comparison Operator (=, >, >=, <, <=, <>)● Other Comparison Operator (BETWEEN, IN, LIKE, IS NULL)● Logical Operator (AND, OR, NOT)
5.	Implementation of different types of Joins <ul style="list-style-type: none">● Inner Join● Outer Join<ul style="list-style-type: none">i. Left outer joinii. Right outer joiniii. Full outer Join● Natural Join
6.	Study and Implementation of <ul style="list-style-type: none">● Group By & having clause



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	<ul style="list-style-type: none">• Order by clause• Sorting in Descending & Ascending order
7.	<p>Study & Implementation of different types of constraints.</p> <ul style="list-style-type: none">• Primary Key & Foreign Key Constraints• NOT NULL Constraints• Default 1 Constraints• Check constraints• Domain Constraints• Entity Integrity Constraints• Referential Integrity Constraints
PART-B	
8.	<p>Consider the following schema for a Library Database:</p> <p>BOOK(<u>Book_id</u>, Title, Publisher_Name, Pub_Year) BOOK_AUTHORS(<u>Book_id</u>, Author_Name) PUBLISHER(<u>Name</u>, Address, Phone) BOOK_COPIES(<u>Book_id</u>, Programme_id, No-of_Copies) BOOK_LENDING(<u>Book_id</u>, Programme_id, Card_No, Date_Out, Due_Date) LIBRARY_PROGRAMME(<u>Programme_id</u>, Programme_Name, Address)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none">1. Retrieve details of all books in the library—id, title, name of publisher, authors, number of copies in each Programme, etc.2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017.3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.4. Partition the BOOK table base don year of publication .Demonstrate its working with a simple query.5. Create a view of all books and its number of copies that are currently available in the Library.
9.	<p>Consider the following schema for Order Database:</p> <p>SALESMAN(<u>Salesman_id</u>, Name, City, Commission) CUSTOMER(<u>Customer_id</u>, Cust_Name, City, Grade, Salesman_id) ORDERS(<u>Ord_No</u>, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none">1. Count the customers with grades above Bangalore’s average.2. Find the name and numbers of all salesman who had more than one customer.3. List all the salesman and indicate those who have and don’t have customers in their cities (Use UNION operation.)4. Create a view that finds the salesman who has the customer with the highest order of a day5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.
10.	<p>Consider the schema for Movie Database:</p> <p>ACTOR(<u>Act_id</u>, Act_Name, Act_Gender) DIRECTOR(<u>Dir_id</u>, Dir_Name, Dir_Phone) MOVIES(<u>Mov_id</u>, Mov_Title, Mov_Year, Mov_Lang, Dir_id) MOVIE_CAST(<u>Act_id</u>, <u>Mov_id</u>, Role) RATING(<u>Mov_id</u>, Rev_Stars)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none">1. List the titles of all movies directed by „Hitchcock“.



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	<ol style="list-style-type: none"> 2. Find the movie names where one or more actors acted in two or more movies. 3. List all actors who acted in a movie before 2000 and also in a movie after 2015 (use JOIN operation). 4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title. 5. Update rating of all movies directed by 'Steven Spielberg' to 5.
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Course Outcomes: At the end of the course, the students will be able to	
CO1	Create, Update and query on the database.
CO2	Demonstrate the working of different concepts of DBMS
CO3	Implement SQL commands for database schema creation and modification.
CO4	Apply Primary and Foreign Key constraints to enforce entity integrity and referential integrity
CO5	Explain the purpose and functionality of different types of joins in relational databases

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (CIE)

Component	Scale down to	Total Marks
Conduction of experiments and Record Writing (Each Experiment evaluated for 10 marks)	20	20
Internal Lab Test 1 (After 6 experiments) Exam conduction for 50 marks	15	15
Internal Lab Test 2 (After 6 experiments) Exam conduction for 50 marks	15	15
CIE		50

SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
2. All laboratory experiments are to be included for practical examination.
3. Students can pick one question (experiment) from the questions lot prepared by the examiners.
4. Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
5. Rubrics suggested for SEE, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
6. Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero. The minimum duration of SEE is 03 hours.

CO-PO Mapping

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	3	2	-	-	-	-	1	1
CO2	3	3	3	3	2	-	-	-	-	1	1
CO3	3	3	3	3	2	-	-	-	-	1	1
CO4	3	3	3	3	2	-	-	-	-	1	1
CO5	3	3	3	3	2	-	-	-	-	1	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low



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SEMESTER-IV			
INTRODUCTION TO CYBER SECURITY			
Category: ESC/ETC/PLC-IV			
Course Code	: B24IS461	CIE	: 50 Marks
Teaching Hours L : T : P	: 3 : 0 : 0	SEE	: 50 Marks
Total Hours	: 45(T)	Total	: 100 Marks
Credits	: 3	SEE Duration	: 3 Hrs

Course Objectives	
1.	To introduce the fundamentals of cyber security and cyber threats.
2.	To understand various forms of cyber-attacks and prevention techniques.
3.	To learn the basics of cryptography, network security, and cyber law.
4.	To gain practical awareness of security practices in personal and enterprise settings.

Module – 1: Introduction to Cyber Security	No. of Hours
Basics of cyber security, Security triad: Confidentiality, Integrity, Availability (CIA), Cyber threats and attacks: Malware, Phishing, Social engineering, Ransomware, DDoS, Security goals and principles, Need for cyber security in the modern world.	9
Module – 2: Security Threats and Vulnerabilities	No. of Hours
System and network vulnerabilities, Attack vectors and methods, Threat actors and motivation. Case studies of real-world cyberattacks (e.g., Stuxnet, WannaCry), OWASP Top 10 vulnerabilities.	9
Module – 3: Cryptography Fundamentals	No. of Hours
Symmetric and asymmetric encryption, Hash functions and digital signatures, Public Key Infrastructure (PKI), Secure communication: SSL/TLS, Applications: VPN, Email security, HTTPS.	9
Module – 4: Network and Web Security	No. of Hours
Firewalls, IDS/IPS, Secure protocols (IPSec, SSH), Web application vulnerabilities (SQL Injection, XSS, CSRF), Security in wireless networks, Secure coding practices.	9
Module – 5: Cyber Laws and Ethics	No. of Hours
Overview of Information Technology Act (2000), Amendments, Cybercrime classifications and investigation, Intellectual Property Rights and Digital Piracy, Privacy and data protection laws, Ethical hacking and responsible disclosure	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the fundamental principles of cyber security.
CO2	Identify various cyber threats and countermeasures.
CO3	Apply basic cryptographic techniques for securing data.
CO4	Evaluate security risks in networked systems.
CO5	Demonstrate awareness of cyber laws and ethical practices.

Textbooks	
1.	William Stallings – <i>Cryptography and Network Security: Principles and Practice</i>
2.	Chuck Easttom – <i>Computer Security Fundamentals</i>

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.



CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	-	-	-	-	-	-	-	2
CO2	3	3	3	3	2	-	-	-	-	-	3
CO3	2	3	3	2	-	-	-	-	2	2	3
CO4	-	-	-	-	-	-	-	-	3	3	2
CO5	-	-	-	-	-	-	-	-	3	2	2

Level 3 - High, Level 2 - Moderate, Level 1 - Low



MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST
Rajarajeswari College of Engineering
(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)
Department of Information Science and Engineering

SEMESTER-IV			
SYSTEM PROGRAMMING			
Category: ESC/ETC/PLC-IV			
Course Code	: B24IS462	CIE	: 50 Marks
Teaching Hours L : T : P	: 3:0:0	SEE	: 50 Marks
Total Hours	: 45(T)	Total	: 100 Marks
Credits	: 3	SEE Duration	: 3 Hrs

Course Objectives	
1.	To understand the design and implementation of system software components such as assemblers, loaders, linkers, and macro processors.
2.	To introduce device drivers, operating system interfaces, and system calls.
3.	To explore the internal working of compiler phases.
4.	To understand the various phases of a compiler such as lexical analysis, parsing, syntax-directed translation, symbol table management, and error handling, and distinguish compilers from interpreters.
5.	To examine operating system interfaces, system calls, I/O programming, device programming with shell scripting fundamentals.

Module 1: Introduction to System Software and Assemblers	No. of Hours
System Software vs. Application Software, Overview of system programming tasks, Machine structure and instruction formats, Introduction to Assemblers, Design of a simple assembler (Single pass & Two pass)	9
Module 2: Macro Processors	No. of Hours
Macro instructions and features, Macro definition and expansion, Design of macro processors, Nested macro calls, Conditional macro expansion.	9
Module 3: Loaders and Linkers	No. of Hours
Basic loader functions, Design of an absolute loader, Relocation and linking concepts, Self-relocating programs, Linking loaders, Dynamic linking.	9
Module 4: Compilers and Interpreters	No. of Hours
Phases of a compiler, Lexical analysis and parsing, Syntax-directed translation, Symbol tables and error handling, Differences between compilers and interpreters.	9
Module 5: Operating System Interfaces & Device Drivers	No. of Hours
System calls and their role, I/O programming and device drivers, Interrupts and exceptions, Basic UNIX/Linux system programming, Shell scripting fundamentals.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the components and design of system software.
CO2	Develop simple assemblers and macro processors.
CO3	Analyze and design loader and linker functionalities.
CO4	Explain the functioning of compilers and interpreters.
CO5	Explore system-level programming with operating system interfaces.

Textbooks	
1.	"System Software – An Introduction to Systems Programming" by Leland L. Beck
2.	"System Programming and Operating Systems" by Dhamdhare D. M.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.



CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-				3	3	2
CO2	2	3	2	2	-	-		-	-	2	3
CO3	-	-	-	-	-	-		-	3	3	2
CO4	3	3	2	2	2	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	3	2	2	3

Level 3 – High, Level 2 – Moderate, Level 1 -Low



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Department of Information Science and Engineering

SEMESTER-IV				
CAPACITY PLANNING FOR IT				
Category: ESC/ETC/PLC-IV (Common to CSE, CSD, ISE)				
Course Code	:	B24IS463	CIE	: 50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	: 50 Marks
Total Hours	:	45(T)	Total	: 100 Marks
Credits	:	3	SEE Duration	: 3 Hrs

Course Objectives	
1.	Understand requirement and measurements for capacity planning, measurement and monitoring.
2.	Measurement of data for prediction towards the planning process.
3.	Understand concepts related to deployment, installation, configuration, and management.
4.	Role of virtualization and cloud services in capacity planning.

Module – 1	No. of Hours
Goals, Issues, and Processes: capacity planning, Quick and Dirty Math, Predicting When Your Systems Will Fail, Make Your System Stats Tell Stories, Buying Stuff: Procurement Is a Process, Performance and Capacity: Two Different Animals, The Effects of Social Websites and Open APIs. Setting Goals for Capacity: Different Kinds of Requirements and Measurements, Architecture Decisions.	9
Module – 2	No. of Hours
Measurement: Units of Capacity: Aspects of Capacity Tracking Tools, Applications of Monitoring.	9
Module – 3	No. of Hours
Measurement: API Usage and Its Effect on Capacity, Examples and Reality. Predicting Trends: Riding Your Waves.	9
Module – 4	No. of Hours
Predicting Trends: Procurement, The Effects of Increasing Capacity, Long-Term Trends, Iteration and Calibration. Deployment: Automated Deployment Philosophies, Automated Installation Tools, Automated Configuration.	9
Module – 5	No. of Hours
Virtualization and Cloud Computing: Virtualization, Cloud Computing, Computing Resource Evolutions, Mixed Definitions, Cloud Capacity, Use it or lose it (your wallet), Measuring the clouds, Cloud Case Studies, Cloud Use Case: Anonymous Desktop Software Company.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Identify the requirement and measurements for capacity planning by considering the goal, issues, and processes.
CO2	Explain capacity measurement and monitoring.
CO3	Make use of measurement data for prediction towards overall planning process.
CO4	Explain the concepts related to deployment, installation, configuration, and management.
CO5	Demonstrate how the virtualization and cloud services fit into a capacity plan.

Text Books	
1.	John Allspaw, The Art of Capacity Planning, 2008, O'Reilly

Web links and Video lectures (e-Resources)	
1.	https://www.youtube.com/watch?v=w0cD26CLBA0
2.	https://www.youtube.com/watch?v=5-hhfBXykec
3.	https://www.youtube.com/watch?v=9e4IohiFmZ8&t=63s
4.	https://www.youtube.com/watch?v=qj4ziswupE
5.	https://www.youtube.com/watch?v=jTW79ofC6Go
6.	https://www.youtube.com/watch?v=_pPlanX5wQY



ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	-	1	1	1	-	-	-	-	1	-
CO2	1	-	1	1	1	-	-	-	-	1	-
CO3	1	-	1	1	1	-	-	-	-	1	-
CO4	1	-	1	1	1	-	-	-	-	1	-
CO5	1	-	1	1	1	-	-	-	-	1	-

Level 3 – High, Level 2 – Moderate, Level 1 -Low



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SEMESTER-IV					
GREEN IT AND SUSTAINABILITY					
Category: ESC/ETC/PLC					
(Common to CSE, ISE)					
Course Code	:	B24CS464	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1	Understand challenges for Green ICT and the Industrial Revolution.
2	Illustrate Emerging Technologies and Their Environmental Impact.
3	Learn different aspects of ICT metrics and Systems Engineering for Designing.
4.	Learn the Sustainable Cloud Computing and future aspects.
5.	Explore effects of software design on the sustainability.

Module – 1: Green ICT -History, Agenda, and Challenges Ahead	No. of Hours
Introduction, Industrial Revolution, The Emergence of Information and Communication Technologies, The Agenda and Challenges Ahead.	9
Module – 2: Emerging Technologies and Their Environmental Impact	No. of Hours
Introduction, Number of Connected Devices , Increased , Functionality, Increased Number of Separate Functions , Increased Demand for Speed and Reliability , Obsolescence—The Problem of Backward Compatibility, The Other Side of the Balance Sheet, Videoconference as an Alternative to Business Travel, Dematerialization of Product Chain, Travel Advice/Road Traffic Control, Intelligent Energy Metering , Building Management Systems, Saving IT	9
Module – 3: Measurements and Sustainability	No. of Hours
Introduction, ICT Technical Measures, Ecological Measures and Ethical Consideration, Systems Engineering for Designing Sustainable ICT-Based Architectures.	9
Module – 4: Sustainable Cloud Computing	No. of Hours
Introduction, Challenges in the Use of Cloud Computing As Green Technology, Cloud Computing and Sustainability, Sustainable Applications of Cloud Computing, Technologies Associated With Sustainable Cloud Computing, Future Prospects of Sustainable Cloud Computing, Reflections on Sustainable Cloud Computing Applications.	9
Module – 5: Sustainable Software Design	No. of Hrs
Overview and Scope, Evaluating Sustainability Effects , Sustainability and the Product Life Cycle , Direct Effects: Sustainability During Use, Runtime Energy Consumption Basics , Analyzing the Energy Consumption of an Application , Energy Consumption Reduction Using Physical Properties of Semiconductors, Optimizing the Energy	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Classify the challenges for Green ICT
CO2	Relate the environmental impact due to emerging technologies.
CO3	Demonstrate different aspects of ICT metrics.
CO4	Compare the various parameters related to Sustainable Cloud Computing.
CO5	Interpret the effects of software design on the sustainability.

Textbooks	
1.	Green Information Technology – A Sustainable Approach, Mohammad Dastbaz Colin Pattinson, Babak Akhgar, Elsevier, 2015 Inc
2.	San Murugesan; G. R. Gangadharan, Harnessing Green IT: Principles and Practices, Wiley-IEEE Press

Web links and Video lectures (e-Resources)	
1.	https://www.youtube.com/watch?v=kvn_-mJ2tSo
2.	https://www.youtube.com/watch?v=kxngsYn5N3Y
3.	https://www.youtube.com/watch?v=EgdFi3sCgzU
4.	https://www.brightest.io/sustainability-measurement



5. https://www.youtube.com/watch?v=S2m49Op25Zw
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
• Literature survey/review

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	-	3	1	3	3	3	-	-	-	2
CO2	2	-	3	1	3	3	3	-	-	-	2
CO3	2	-	3	1	3	3	3	-	-	-	2
CO4	2	-	3	1	3	3	3	-	-	-	2
CO5	2	-	3	1	3	3	3	-	-	-	2

Level 3 - High, Level 2 - Moderate, Level 1 - Low



MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST
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Department of Information Science and Engineering

SEMESTER-IV					
MICROSOFT POWER BI					
Category: AEC/SEC-IV					
(Common to CSE, ISE, CSD, AIML, CSE(IC))					
Course Code	:	B24CS481	CIE	:	50 Marks
Teaching Hours L : T : P	:	1:0:0	SEE	:	50 Marks
Total Hours	:	15(P)	Total	:	100 Marks
Credits	:	1	SEE Duration	:	1 Hrs

Course Objectives	
1.	To learn the basics of Microsoft Power BI and its components for data analysis and visualization.
2.	To understand data import and data modeling using Power Query and DAX functions.
3.	To gain experience in using modern BI tools for creating interactive reports and dashboards.
4.	To build data-driven Power BI reports using calculated columns and various visualization techniques.
5.	To design and publish interactive and insightful dashboards for effective business decision making.

Sl. No	List of Experiments
1.	Develop a Power BI report to import data from an Excel file and display it in tabular form.
2.	Develop a Power BI report to clean and transform the given dataset using Power Query Editor by removing null values and changing data types.
3.	Create a table and column chart visualization for the given dataset.
4.	Create a calculated column using DAX to compute total sales from quantity and price.
5.	Create a measure using DAX to calculate total sales and display it using a Card visual.
6.	Develop a Power BI report to visualize category-wise sales using a Pie chart.
7.	Develop a Power BI report to apply filters and slicers for interactive data analysis based on date or category.
8.	Develop a Power BI dashboard with multiple visualizations such as table, column chart, pie chart and card to analyze sales data.
9.	Develop a Power BI report to perform time-based analysis and display monthly sales trend using line chart or column chart.
10.	Develop a Power BI report and publish it to Power BI Service for online access and sharing.
11.	To analyze region-wise sales performance using appropriate visualizations and filters.
12.	Develop a Power BI report to compare product-wise profit and display the results using bar chart and table visualization.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Develop Power BI reports using basic data visualization and transformation techniques.
CO2	Apply DAX functions to perform calculations and data analysis.
CO3	Design interactive dashboards using filters and slicers.
CO4	Analyze time-based and category-wise data using appropriate charts.
CO5	Publish and share reports using Power BI Service.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.



CONTINUOUS INTERNAL EVALUATION (CIE)

Component	Scale down to	Total Marks
Conduction of experiments and Record Writing (Each Experiment evaluated for 10 marks)	20	20
Internal Lab Test 1(After 6 experiments) Exam conduction for 50 marks	15	15
Internal Lab Test 2 (After 6 experiments) Exam conduction for 50 marks	15	15
	CIE	50

SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
2. All laboratory experiments are to be included for practical examination.
3. Students can pick one question (experiment) from the questions lot prepared by the examiners.
4. Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
5. Rubrics suggested for SEE, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
6. Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero. The minimum duration of SEE is 03 hours.

CO-PO Mapping

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	3	-	-	-	-	1	-	1
CO2	2	3	1	2	3	-	-	-	-	-	-	1
CO3	1	2	3	1	3	-	-	-	2	2	-	1
CO4	2	3	2	3	2	-	-	-	-	1	-	1
CO5	1	1	2	1	3	-	-	-	2	3	2	2

Level 3- High, Level 2- Moderate, Level 1-Low



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SEMESTER-IV				
DEVOPS				
Category: AEC/SEC-IV				
(Common to CSE, ISE, AIML, CSE(IC), CSD)				
Course Code	:	B24CS482	CIE	: 50 Marks
Teaching Hours L : T : P	:	0 : 0 : 2	SEE	: 50 Marks
Total Hours	:	15(P)	Total	: 100 Marks
Credits	:	1	SEE Duration	: 3 Hrs

Course Objectives	
1.	To introduce DevOps terminology, definition & concepts
2.	To understand the different Version control tools like Git, Mercurial
3.	To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment)
4.	To understand Configuration management using Ansible
5.	Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems

Sl. No	List of Experiments
1.	Introduction to Maven and Gradle: Overview of Build Automation Tools, Key Differences Between Maven and Gradle, Installation and Setup
2.	Working with Maven: Creating a Maven Project, Understanding the POM File, Dependency Management and Plugins
3.	Working with Gradle: Setting Up a Gradle Project, Understanding Build Scripts (Groovy and Kotlin DSL), Dependency Management and Task Automation
4.	Practical Exercise: Build and Run a Java Application with Maven, Migrate the Same Application to Gradle
5.	Introduction to Jenkins: What is Jenkins? Installing Jenkins on Local or Cloud Environment, Configuring Jenkins for First Use
6.	Continuous Integration with Jenkins: Setting Up a CI Pipeline, Integrating Jenkins with Maven/Gradle, Running Automated Builds and Tests
7.	Configuration Management with Ansible: Basics of Ansible: Inventory, Playbooks, and Modules, Automating Server Configurations with Playbooks, Hands-On: Writing and Running a Basic Playbook
8.	Practical Exercise: Set Up a Jenkins CI Pipeline for a Maven Project, Use Ansible to Deploy Artifacts Generated by Jenkins
9.	Introduction to Azure DevOps: Overview of Azure DevOps Services, Setting Up an Azure DevOps Account and Project
10.	Creating Build Pipelines: Building a Maven/Gradle Project with Azure Pipelines, Integrating Code Repositories (e.g., GitHub, Azure Repos), Running Unit Tests and Generating Reports
11.	Creating Release Pipelines: Deploying Applications to Azure App Services, Managing Secrets and Configuration with Azure Key Vault, Hands-On: Continuous Deployment with Azure Pipelines
12.	Practical Exercise and Wrap-Up: Build and Deploy a Complete DevOps Pipeline, Discussion on Best Practices and Q&A



Course Outcomes: At the end of the course, the students will be able to	
CO1	Demonstrate different actions performed through Version control tools like Git
CO2	Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle.
CO3	Experiment with configuration management using Ansible.
CO4	Demonstrate Cloud-based DevOps tools using Azure DevOps.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (CIE)

Component	Scale down to	Total Marks
Conduction of experiments and Record Writing (Each Experiment evaluated for 10 marks)	20	20
Internal Lab Test 1(After 6 experiments) Exam conduction for 50 marks	15	15
Internal Lab Test 2 (After 6 experiments) Exam conduction for 50 marks	15	15
CIE		50

SEMESTER END EXAMINATION (SEE)

- SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
- All laboratory experiments are to be included for practical examination.
- Students can pick one question (experiment) from the questions lot prepared by the examiners.
- Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
- Rubrics suggested for SEE, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
- Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero. The minimum duration of SEE is 03 hours.

CO-PO Mapping

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	-	3	-	-	-	2	2	2
CO2	2	2	3	2	3	-	-	-	2	2	2
CO3	2	2	2	2	3	-	-	-	2	2	2
CO4	2	2	3	2	3	-	-	-	2	2	2

Level 3 - High, Level 2 - Moderate, Level 1 - Low



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SEMESTER-IV					
MULTIMEDIA AND ANIMATION					
Category: AEC/SEC-IV					
(Common to CSE, CSD, ISE)					
Course Code	:	B24IS483	CIE	:	50 Marks
Teaching Hours L : T : P	:	1:0:0	SEE	:	50 Marks
Total Hours	:	15(T)	Total	:	100 Marks
Credits	:	1	SEE Duration	:	1 Hrs

Course Objectives	
1.	To grasp the fundamental knowledge of Multimedia elements and systems
2.	To get familiar with Multimedia file formats and standards
3.	To learn the process of Authoring multimedia presentations
4.	To learn the techniques of animation in 2D and 3D and for the mobile UI
5.	To explore different popular applications of multimedia

Module – 1: Introduction to Multimedia	No. of Hours
Definitions, Elements, Multimedia Hardware and Software, Distributed multimedia systems, challenges: security, sharing / distribution, storage, retrieval, processing, computing. Multimedia metadata, Multimedia databases, Hypermedia, Multimedia Learning.	3
Module – 2 : Multimedia File Formats and Standards	No. of Hours
File formats – Text, Image file formats, Graphic and animation file formats, Digital audio and Videofile formats, Color in image and video, Color Models. Multimedia data and file formats for the web.	3
Module – 3: Multimedia Authoring	No. of Hours
Authoring metaphors, Tools Features and Types: Card and Page Based Tools, Icon and Object Based Tools, Time Based Tools, Cross Platform Authoring Tools, Editing Tools, Painting and Drawing Tools, 3D Modeling and Animation Tools, Image Editing Tools, audio Editing Tools, Digital Movie Tools, Creating interactive presentations, virtual learning, simulations.	3
Module – 4: Animation	No. of Hours
Principles of animation: staging, squash and stretch, timing, onion skinning, secondary action, 2D, 2 ½ D, and 3D animation, Animation techniques: Key frame, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, vector animation, stop motion, motion graphics, , Fluid Simulation, skeletal animation, skinning Virtual Reality, Augmented Reality.	3
Module – 5: Multimedia Applications	No. of Hours
Multimedia Big data computing, social networks, smart phones, surveillance, Analytics, Multimedia Cloud Computing, Multimedia streaming cloud, media on demand, security and forensics, Online social networking, multimedia ontology, Content based retrieval from digital libraries.	3

Course Outcomes: At the end of the course, the students will be able to	
CO1	Get the bigger picture of the context of Multimedia and its applications
CO2	Use the different types of media elements of different formats on content pages
CO3	Author 2D and 3D creative and interactive presentations for different target multimedia applications.
CO4	Use different standard animation techniques for 2D, 2 1/2 D, 3D applications
CO5	Understand the complexity of multimedia applications in the context of cloud, security, bigdata streaming, social networking, CBIR etc.,

Text Books	
1.	Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, Fundamentals of Multimedia”, Third Edition, Springer Texts in Computer Science, 2021. (UNIT-I, II, III)

Reference Text Books	
1.	John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation, CRC press, 3 rd Edition, 2016.
2.	Gerald Friedland, Ramesh Jain, “Multimedia Computing”, Cambridge University Press, 2018.
3.	Prabhat K. Andleigh, Kiran Thakrar, “Multimedia System Design”, Pearson Education, 1 st Edition, 2015.



ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks (Multiple Choice Questions), after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour. The student has to secure a minimum of 35% of the maximum marks meant for SEE.

CO-PO Mapping

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	-	-	-	3	1	-	-	1	2
CO2	2	2	-	-	-	2	1	-	-	2	2
CO3	1	1	-	-	-	1	2	-	-	2	1
CO4	1	1	-	-	-	1	2	-	-	1	1
CO5	1	1	-	-	-	1	2	-	-	1	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low



MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST
Rajarajeswari College of Engineering
(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)
Department of Information Science and Engineering

SEMESTER-IV			
DISTRIBUTED COMPUTING			
Category: AEC/SEC-IV			
Course Code	: B24IS484	CIE	: 50 Marks
Teaching Hours L : T : P	: 1 : 0 : 0	SEE	: 50 Marks
Total Hours	: 15(T)	Total	: 100 Marks
Credits	: 1	SEE Duration	: 1 Hrs

Course Objectives	
1.	Learn Web tool box and history of web browsers.
2.	Learn HTML, XHTML tags with utilizations.
3.	Know CSS with dynamic document utilizations.
4.	Learn JavaScript with Element access in JavaScript.
5.	Logically plan and develop web pages.

Module – 1: Introduction to Distributed Systems	No. of Hours
Definition and goals of distributed systems, Hardware and software concepts, Types of distributed systems, Design issues and challenges, Examples: Google File System, Hadoop Distributed File System (HDFS), DNS	3
Module – 2: Communication in Distributed Systems	No. of Hours
Interprocess communication, Remote Procedure Call (RPC), Remote Method Invocation (RMI), Message-oriented communication, Stream-oriented communication, Multicast communication.	3
Module – 3: Synchronization and Coordination	No. of Hours
Clock synchronization: Cristian’s algorithm, Berkeley algorithm, Logical clocks: Lamport timestamps, Vector clocks, Mutual exclusion algorithms, Election algorithms, Distributed deadlocks and detection	3
Module – 4: Consistency and Replication	No. of Hours
Data-centric and client-centric consistency models, Replication and replication protocols, Caching mechanisms, Fault tolerance in replication, Quorum-based protocols.	3
Module – 5: Distributed File Systems and Middleware	No. of Hours
File service architecture, Naming in distributed systems, Distributed file system examples: NFS, AFS, Middleware concepts: CORBA, Java RMI, Web services and XML-RPC, SOAP	3

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand fundamental principles and architectures of distributed systems.
CO2	Implement inter-process communication and synchronization methods.
CO3	Design distributed algorithms for coordination and consistency.
CO4	Evaluate fault-tolerant systems and replication models.
CO5	Apply distributed system concepts using modern middleware technologies.

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.



CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks (Multiple Choice Questions), after the completion of the syllabus 40%, 70% and 80% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
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