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

Computer Science and Design

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.

Computer Science and Design

DEPARTMENT VISION

To craft a new generation of innovations who merge technology with design to shape them into skilled and socially responsible professionals.

DEPARTMENT MISSION

1. To deliver the environment to become industry ready professionals, Researchers and Entrepreneurs by offering courses on cutting edge technology and advanced practical courses for the students.
2. Impart high quality experiential learning to get expertise in modern software tools and to cater to the real time requirements of the industry.
3. Inculcate problem solving and team building skills promote lifelong learning to demonstrate with a sense of societal and ethical responsibilities.

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)

PEO-1: Graduates of the program will possess strong educational foundation in mathematics, science, and computer science & engineering necessary for pursuing career and/ or higher studies in computing as well as other allied professions.

PEO-2: Graduates with an interest in, and aptitude for lifelong learning will be engaged in learning, understanding, and applying new ideas and technologies as the field evolves to solve engineering problems, design appropriate computing systems that are technically sound economically viable and socially acceptable and be responsible engineering and computing professionals.

PEO-3: Graduates will be informed leaders, effective communicators who work efficiently with diverse teams, promote and practice appropriate ethical moral and codes.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO-1: Understand, apply, and demonstrate advanced technical skills in problem solving and leadership, as well as an understanding of system integration and the practical technological problems of end users.

PSO-2: An ability to design, implement, and evaluate a software or a software/hardware system, component, or process to meet desired needs within realistic constraints such as memory, runtime efficiency, as well as other socio-economic constraints.

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Department of Computer Science and Design

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)	AI	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	50
8.	AEC /SEC	B24YY38X	Ability Enhancement Course / Skill Enhancement Course – III (Theory/Lab)	AI/CS/IS/IC/CG	1 0	0 0	0 2	0	1	50	1 3	50	100
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			
B24CS361	UNIX Programming (Common to CSE, CSD)	B24IC362	Object Oriented Programming with C++ (Common to CSE, CSD,CSE(IC))
B24CG363	Embedded Systems (Common to CSE, CSD)	B24CG364	Design process and Perspective

Ability Enhancement Course / Skill Enhancement Course (AEC/SEC) – III			
B24CG381	Data Analytic with Excel (Common to CSE, CSD, AIML)	B24CS382	Ethical Hacking (Common to CSE, CSD)
B24CS383	App Development (Common to CSE, CSD, ISE)	B24CG384	Knowledge Engineering (Common to CSE, CSD)

Non Credit Mandatory Courses (NCMC)			
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), Physical Education (PE), National Cadet Corps (NCC), Music and Yoga (YOG) 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/NSS/Yoga/NCC/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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Department of Computer Science and Design

Scheme of Teaching and Examinations: 2024

(Effective from the Academic Year 2025-26)

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	B24CS403	Microcontrollers (Common to CSE, CSD)	CSE	CSE	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	CG	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	0 2	0	1	50	1 3	50	100
9.	NCMC	B24NCK49X	National Service Scheme / National Cadet Corps / Physical Education / Yoga / Music	HSMC	HSMC	1	0	0		0	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) - IV			
B24CS461	Programming in JAVA (Common to CSE, CSD)	B24CG462	Robotic Process Automation (Common to CSE, CSD)
B24IS463	Capacity planning for IT (Common to CSE, CSD, ISE)	B24CG464	Web Programming

Ability Enhancement Course / Skill Enhancement Course (AEC/SEC) – IV			
B24CS481	Microsoft Power BI (Common to CSE, CSD,CSE(IC), ISE, AIML)	B24CS482	DevOps (Common to CSE, CSD,CSE(IC), ISE, AIML)
B24IS483	Multimedia and Animation (Common to CSE, CSD, ISE)	B24CG484	OO Design Pattern Lab

Non Credit Mandatory Courses (NCMC)			
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), Physical Education (PE), National Cadet Corps (NCC), Music and Yoga (YOG) 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/NSS/Yoga/NCC/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**

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, 9th edition, 2017.

2.	Peter Bruce, Andrew Bruce & Peter Gedeck "Practical Statistics for Data Scientists" O'Reilly Media, Inc., 2nd edition 2020.
Reference Text Books	
1.	Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 9th Edition, 2006.
2.	B. S. Grewal "Higher Engineering Mathematics", Khanna publishers, 44th Edition, 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:

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	PO8	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

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, 2nd Edition, Universities Press, 2014.
2.	Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Edition, McGraw Hill, 2014.

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

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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CO-PO Mapping

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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

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, 5th edition, Pearson Education.
2.	Carl Hamacher, ZvonkoVranesic, SafwatZaky, Computer Organization, 5th 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

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, 10th Edition, Wiley, 2018".
2.	William Stallings – "Operating Systems: Internals and Design Principles, 9th Edition, Pearson,2018".
Reference Text Books	
1.	Andrew S. Tanenbaum – " Modern Operating Systems, 4th Edition, Pearson, 2015".
2.	Dhananjay M.Dhamdhere –"Operating Systems: A Concept-Based Approach, 3rd Edition,McGraw-Hill, 2017".
3.	Gary Nutt – "Operating Systems, 3rd 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)

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.

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

SEMESTER-III					
DATA STRUCTURES AND ITS APPLICATIONS LAB **Category: PPCL** **(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
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 operationson Singly Circular Linked List (SCLL) with header nodes a. Represent and Evaluate a Polynomial P(x,y,z) = 6x2y2z-4yz5+3x3yz+2xy5z-2xyz3 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 →L as H(K)=K 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) is50%. 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					
UNIX PROGRAMMING **Category: ESC/ETC/PLC-III** **(Common to CSE, CSD)**					
Course Code	:	B24CS361	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 effective use of Unix concepts, commands and terminology. Identify, access, and evaluate UNIX file system
2.	Explain the fundamental design of the unix operating system
3.	Familiarize with the systems calls provided in the unix environment
4.	Design and build an application/service over the unix operating system
5.	Familiarize with the use of Signals and Daemon Processes

Module – 1: Introduction, Unix files	**No. of Hours**
Introduction: Unix Components/Architecture. Features of Unix. The UNIX Environment and UNIX Structure, Posix and Single Unix specification. General features of Unix commands/ command structure. Command arguments and options. Basic Unix commands such as echo, printf, ls, who, date, passwd, cal, Combining commands. Meaning of Internal and external commands. The type command: knowing the type of a command and locating it. The root login. Becoming the super user: su command. **Unix files:** Naming files. Basic file types/categories. Organization of files. Hidden files. Standard directories. Parent-child relationship. The home directory and the HOME variable. Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames. Directory commands – pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names. File related commands – cat, mv, rm, cp, wc and od commands. Text Book1: Chapter-1, 2, 3, 4, 5	9
Module – 2 : Shell programming	**No. of Hours**
File attributes and permissions: The ls command with options. Changing file permissions: the relative and absolute permissions changing methods. Recursively changing file permissions. Directory permissions. **The shells interpretive cycle:** Wild cards. Removing the special meanings of wild cards. Three standard files and redirection. **Connecting commands:** Pipe. Basic and Extended regular expressions. The grep, egrep. Typical examples involving different regular expressions. **Shell programming:** Ordinary and environment variables. The. profile. Read and read-only commands. Command line arguments. exit and exit status of a command. Logical operators for conditional execution. The test command and its shortcut. The if, while, for and case control statements. The set and shift commands and handling positional parameters. The here (<<) document and trap command. Simple shell program examples. Text Book1: Chapter-6,8,13,14	9
Module – 3: File I/O	**No. of Hours**
Unix Standardization and Implementations: Introduction, Unix Standardization, UNIX System Implementation. **File I/O:** Introduction, File Description, open, create, read, write, close, fcntl functions. **Files and Dictionaries:** mkdir and rmdir functions, reading dictionaries, chdir, fchdir and getcwd functions. Device Special files. **The Environment of a UNIX Process:** Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions. Text Book 2: 2,3,4,7.	9
Module – 4: Process Control	**No. of Hours**
Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions. **Overview of IPC Methods**, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC,	9

Message Queues, Semaphores. **Shared Memory**, Client-Server Properties, Passing File Descriptors, An Open Server-Version 1. Text Book2: Chapter 8, 15,17	
Module – 5: Signals and Daemon Processes	**No. of Hours**
Signals and Daemon Processes: Introduction, Signal Concepts, Signal Functions, SIGCLD Semantics, Kill and Raise functions, Alarm and Pause Functions, Signal Sets, sigprocmask Function, sigpending function, sigaction function, sigsetjmp and siglongjmp functions, sigsuspend function, abort function, system function, sleep, nanosleep and clock_nanosleep functions, sigqueue functions, job-control signals, signal names and numbers. **Daemon Processes:** Introduction, Daemon Characteristics, Coding Rules, Error Logging,Client-Server Model. Text Book 2: Chapter 10, 13	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Demonstrate the basics of Unix concepts and commands.
CO2	Demonstrate the UNIX file system.
CO3	Apply comands to reflect changes in file system.
CO4	Demonstrate IPC and process management.
CO5	Develop an application/service over a Unix system.

Text Books	
1.	Sumitabha Das., Unix Concepts and Applications., 4th Edition., Tata McGraw Hill
2.	W. Richard Stevens: Advanced Programming in the UNIX Environment, 2nd Edition, Pearson Education, 2005

Reference Text Books	
1.	Unix System Programming Using C++ - Terrence Chan, PHI, 1999.
2.	M.G. Venkatesh Murthy: UNIX & Shell Programming, Pearson Education.
3.	Richard Blum, Christine Brenham: Linux Command Line and Shell Scripting Bible, 2nd Edition, Wiley, 2014.

Web links and Video lectures (e-Resources)
1. https://www.youtube.com/watch?v=ffYUfAqEamY
2. https://www.youtube.com/watch?v=Q05NZiYFcD0
3. https://www.youtube.com/watch?v=8GdT53KDIyY
4. https://www.youtube.com/watch?app=desktop&v=3Pga3y7rCgo

LABORATORY

Practical Component of IPCC (10 Experiments)

Sl. No.	List of experiments
1.	Execute the basic Unix commands such as echo, printf, ls, who, date, passwd, cal, Combining commands.
2.	Execute the Directory commands – pwd, cd, mkdir, rmdir commands, the dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names. File related commands – cat, mv, rm, cp, wc and od commands.
3.	a) Write a C/C++ program that outputs the contents of its Environment list b) Write a C / C++ program to emulate the UNIX ln command
4.	Write a C/C++ program which demonstrates interprosses communication between a reader process and a writer process. Use mkfifo, open, read, write and close APIs in your program.
5.	Consider the last 100 bytes as a region. Write a C/C++ program to check whether the region is locked or not. If the region is locked, print pid of the process which has locked. If the region is not locked, lock the region

	with an exclusive lock, read the last 50 bytes and unlock the region.
6.	Write a C/C++ program to illustrate the race condition.
7.	Write a C/C++ program that creates a zombie and then calls system to execute the ps command to verify that the process is zombie.
8.	Write a C/C++ program to avoid zombie process by forking twice.
9.	Write a C/C++ program to implement the system function.
10.	Write a C/C++ program to set up a real-time clock interval timer using the alarm API.

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.

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

SEMESTER-III					
OBJECT ORIENTED PROGRAMMING WITH C++ **Category: ESC/ETC/PLC-III** **(Common to CSE, CSD, CSE(IC))**					
Course Code	:	B24IC362	CIE	:	50 Marks
Teaching Hours L : T : P	:	2:0:2	SEE	:	50 Marks
Total Hours	:	30(T) +15(P)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	To understand object-oriented programming using C++and Gain knowledge about the capability to store information together in an object.
2.	To illustrate the capability of a class to rely upon another class and functions.
3.	To Create and process data in files using file I/O functions
4.	To understand the generic programming features of C++ including Exception handling

Module – 1: An overview of C++:	**No. of Hours**
What is object-Oriented Programming? Introducing C++ Classes, The General Form of a C++ Program. **Classes and Objects:** Classes, Friend Functions, Friend Classes, Inline Functions, Parameterized Constructors, Static Class Members, When Constructors and Destructors are Executed, The Scope Resolution Operator, Passing Objects to functions, Returning Objects, Object Assignment	6
Module - 2 Arrays, Pointers, References, and the Dynamic Allocation Operators:	**No. of Hours**
Arrays of Objects, Pointers to Objects, The Pointer, Pointers to derived types, Pointers to class members. **Functions Overloading, Copy Constructors:** Functions Overloading, Overloading Constructor Functions. Copy Constructors, Default Function Arguments, Function Overloading and Ambiguity.	6
Module – 3: Operator Overloading	**No. of Hours**
Creating a Member Operator Function, Operator Overloading Using a Friend Function, Overloading new and delete **Inheritance:** Base-Class Access Control, Inheritance and Protected Members, Inheriting Multiple Base Classes , Constructors, Destructors and Inheritance, Granting Access, Virtual Base Classes	6
Module – 4: Virtual Functions and Polymorphism	**No. of Hours**
Virtual Functions, The Virtual Attribute is Inherited, Virtual Functions are Hierarchical, Pure Virtual Functions, Using Virtual Functions, Early v/s Late Binding. **Templates:** Generic Functions, Applying Generic Functions, Generic Classes. The type name and export Keywords. The Power of Templates	6
Module – 5: Exception Handling	**No. of Hours**
Exception Handling Fundamentals, Handling Derived-Class Exceptions, Exception Handling Options, Applying Exception Handling. **The C++ I/O System Basics:** C++ Streams, The C++ Classes, Formatted I/O **File I/O:**<fstream> and File Classes, Opening and Closing a File, Reading and Writing Text Files, Detecting EOF.	6

Course Outcomes: At the end of the course, the students will be able to	
CO1	Illustrate the basic concepts of object-oriented programming.
CO2	Design appropriate classes for the given real world scenario.
CO3	Use the knowledge of inheritance for developing optimized solutions
CO4	Apply the concepts of templates and exception handling for the given problem
CO5	Use the concepts of input output streams for file operations

LABORATORY

Practical Component of IPCC (10 Experiments)

Sl. No.	List of experiments
1.	Develop a C++ program to find the largest of three numbers
2.	Develop a C++ program to sort the elements in ascending and descending order.
3.	Develop a C++ program using classes to display student name, roll number, marks obtained in two subjects and total score of student
4.	Develop a C++ program for a bank empolyee to print name of the employee, account_no. & balance. Print invalid balance if amount<500, Display the same, also display the balance after withdraw and deposit.
5.	Develop a C++ program to demonstrate function overloading for the following prototypes. add(int a, int b) add(double a, double b)
6.	Develop a C++ program using Operator Overloading for overloading Unary minus operator.
7.	Develop a C++ program to implement Multiple inheritance for performing arithmetic operation of two numbers
8.	Develop a C++ program using Constructor in Derived classes to initialize alpha, beta and gamma and display corresponding values.
9.	Develop a C++ program to create a text file, check file created or not, if created it will write some text into the file and then read the text from the file.
10.	Develop a C++ program to write and read time in/from binary file using fstream
11.	Develop a function which throws a division by zero exception and catch it in catch block. Write a C++ program to demonstrate usage of try, catch and throw to handle exception.
12.	Develop a C++ program that handles array out of bounds exception using C++.

Text Books	
1.	Herbert schildt, The Complete Reference C++, 4th edition, TMH, 2005

Reference Text Books	
1.	Balagurusamy E, Object Oriented Programming with C++, Tata McGraw Hill Education Pvt.Ltd., Sixth Edition 2016.
2.	Bhave , " Object Oriented Programming With C++", Pearson Education , 2004.
3.	A K Sharma , "Object Oriented Programming with C++", Pearson Education, 2014

Web links and Video lectures (e-Resources)
1. 1. Basics of C++ - https://www.youtube.com/watch?v=BClS40yzssA
2. Functions of C++ - https://www.youtube.com/watch?v=p8ehAjZWjPw
3. https://www.w3schools.com/cpp/cpp_intro.asp
4. https://www.edx.org/course/introduction-to-c-3

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.

CO-PO Mapping

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

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

SEMESTER-III					
EMBEDDED SYSTEMS **Category: ESC/ETC/PLC-III** **(Common to CSE, CSD)**					
Course Code	:	B24CG363	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.	Introductory topics of Embedded System design
2.	Characteristics & attributes of Embedded System
3.	Introduction of Embedded System Software and Hardware development
4.	Embedded Firmware Design Approach
5.	RTOS based Embedded system design

Module – 1:Introduction Of Embedded Systems	**No. of Hours**
Introduction: Embedded Systems and general purpose computer systems, history, classifications, applications and purpose of embedded systems **Chapter 1 – Text 1** **Core of Embedded Systems** : Microprocessors and microcontrollers, RISC and CISC controllers, Big endian and Little endian processors, Application specific ICs, Programmable logic devices, COTS, sensors and actuators, communication interface, embedded firmware, other system components, PCB and passive components **Chapter 2 – Text 1**	9
Module – 2 :Characteristics and Quality Arrtributes	**No. of Hours**
Characteristics and quality attributes of embedded systems: Characteristics, Operational and nonoperational quality attributes, application specific embedded system - washing machine, domain specific – automotive **Chapter 3 & 4 – Text 1**	9
Module – 3:Hardware Software Co Design	**No. of Hours**
Hardware Software Co design and Program Modelling : Fundamental issues in Hardware Software Co-design, Computational models in Embedded System Design **Chapter 7 – Text 1: 7.1, 7.2** Embedded Hardware Design and Development: Analog Electronic Components, Digital Electronic Components, VLSI & Integrated Circuit Design, Electronic Design Automation Tools **Chapter 8 – Text 1: 8.1, 8.2, 8.3, 8.4**	9
Module – 4: Embedded Firmware Design and Development	**No. of Hours**
Embedded Firmware Design and Development: Embedded Firmware Design Approaches, Embedded Firmware Development Languages **Chapter 9 –Text 1: 9.1, 9.2** **Embedded System Development Environments:** Types of files generated on cross compilation (only explanation – programming codes need not be dealt), disassemble/decompliler, Simulators, Emulators and Debugging **Chapter 13 – Text 1: 13.2, 13.3,13.4**	9
Module – 5: Real- Time Operating Systems	**No. of Hours**
Real-time Operating System(RTOS) based Embedded System Design: Operating System basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling **Chapter 10 – Text 1: 10.1 to 10.5**	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain characteristics of Embedded System design
CO2	Acquire knowledge about basic concepts of circuit emulators, debugging and RTOS
CO3	Analyze embedded system software and hardware requirements
CO4	Develop programming skills in embedded systems for various applications.
CO5	Design basic embedded system for real time applications

Text Books	
1.	1. Shibu K V, "Introduction to Embedded Systems", 2nd Edition, McGraw Hill Educatiion

Reference Text Books	
1.	Raghunandan..G.H, Microcontroller (ARM) and Embedded System, Cengage learning Publication,2019
2.	The Insider's Guide to the ARM7 Based Microcontrollers, Hitex Ltd.,1st edition, 2005.
3.	Raj Kamal, Embedded System, Tata McGraw-Hill Publishers, 2nd Edition, 2008.

Web links and Video lectures (e-Resources)
1. NPTL Lectures: https://nptel.ac.in/courses/108102045 Embedded Systems, IIT Delhi, Prof. Santanu Chaudhary
2 http://www.digimat.in/nptel/courses/video/106105193/L01.html
3. http://www.digimat.in/nptel/courses/video/106105159/L01.html

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	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

SEMESTER-III					
DESIGN PROCESS & PERSPECTIVE **Category: ESC/ETC/PLC-III**					
Course Code	:	B24CG364	CIE	:	50 Marks
Teaching Hours L : T : P	:	2:0:2	SEE	:	50 Marks
Total Hours	:	30 (T)+15(P)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	Understand design thinking for visual communication
2.	Understanding to decide on visual compositions
3.	Learn the concepts to communicate created design
4.	Understand the Media Design and Digital Image Printing
5.	Learn the concepts of Design for Interactive Media.

Module – 1: Design thinking for Graphics	**No. of Hrs**
Role of Graphic Design in Society-Elements of Graphic design: Basic elements-relational lements-Intentional Elements– Principles of Graphic Design-Implications and Impact of Graphic Design – Graphic Design Process: Design thinking Definition – Design thinking stages	6
Module – 2: Inspecting and deciding visual elements for design thinking	**No. of Hrs**
Define the problem – Research the problem: Identifying drivers - Information gathering-Target groups – Idea Generation for the problem - Basic design directions-Questions and answers-Themes of thinking - Brainstorming- Deciding elements to design - Sketching and Drawing - Lines, shapes, Negative space/white space, Volumes, Value, Color, Texture- Color: Color Theories-Color wheel - Color Harmonies or Color Schemes- Color Symbolism – Font - Layout	6
Module – 3: Refinement and prototyping design	**No. of Hrs**
Refinement of Design : Thinking in images - Thinking in signs - Appropriation - Humor-Personification - Visual metaphors - Modification - Thinking in words- Thinking in technology – Prototyping - Developing designs - 'Types' of prototype- Vocabulary – Risk management – Implementation: Format - Materials- Finishing – Case study	6
Module – 4: Media and Digital Image Printing	**No. of Hrs**
Digital Imaging and Printing - Advertising Design - Integrated Methods of Advertising -Visuals and Their Voice in Advertising - The Stages of Advertising Design - Logo, and Package Development - Campaign Design–Newspaper Design: Newspaper's Role in Modern Advertising: When to Use Newspaper - The Effect of Newsprint on Design- Sizing Up Newspaper Columns -Say and look of newspaper - Magazine Design	6
Module – 5: Graphic Design for Interactive Media	**No. of Hrs**
Graphic Design for Interactive Media - Graphic Design approach - The Design Components That Make Up a Website - Breaking Down the Parts of a Website - Elements to develop website -Designing with HTML- Creating a simple page – Marking up text and tables – Adding links and images – Creating Forms - Basic concept of CSS: Introduction- Formatting text-colors-background – Responsive Web Design – Web Image Basics – SVG	6

Course Outcomes: At the end of the course, the students will be able to	
CO1	Opportunity to develop essential design thinking skills such as exploring the designed space to identify problem.
CO2	Applying the design thinking process to problems.
CO3	Visualizing design solutions, refining final designs and communicating
CO4	Develop the ability to select methodologies.
CO5	Develop the ability to engage in complex problem solving.

Textbooks	
1.	1 Design Thinking for Visual Communication, Gavin Ambrose, Bloomsbury Publishing,1st Edition, 2017
2.	Advertising Design by MediumA Visual and Verbal Approach, Robyn Blakeman, Taylor and Francis, 1st Edition, 2022
3.	Learning Web Design,JenniferNiederst Robbins, O' Reilley, 5th Edition,2018

Reference Textbooks	
1.	1 David Raizman; History of Modern Design, Prentice Hall,2004
2.	Handbook of Design Thinking, Christian Mueller-Roterberg, Amazon kindle, 2018

PRACTICAL COMPONENT OF IPCC (May cover all / major modules)

Design the given experiments using five phases of design thinking principles. (Max 4 people in a group). Implement various Font, Color, Layout and Typographic design elements in each experiment.

Sl. NO	**Experiments**
1.	Design an UI that can teach mathematics to children of 4-5 years age in school in Rural sector.
2.	Design an UI that can help people to sell their handmade products in metro cities.
3.	Design an UI for a social media website and chat.
4.	Design a publication that support different languages.
5.	Design a publication that tells comic stories
6.	Design an advertisement for mobile company
7.	Design an advertisement for any political party with images
8.	Design an advertisement for electronic products
9.	Design an advertisement for food products
10.	Design an Interactive website for a new Institution.
11.	Design a Blog that publish educational posts.
12.	Design an interactive website for hospital management system.
13.	Design an interactive website for food selling app.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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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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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.

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Two Assignments	**2×10=20**	**10**	**10**	
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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.
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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

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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

SEMESTER-III					
DATA ANALYTIC WITH EXCEL **Category: AEC/SEC-III** **Category: 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.	**Creating Excel Sheets:** Create Excel sheets with Formula and Functions.
3.	**Working with Data** : Importing data, Data Entry & Manipulation, Sorting & Filtering.
4.	**Working with Data**: Data Validation, Pivot Tables & Pivot Charts.
5.	**Data Analysis Process**: Conditional Formatting, What-If Analysis, Data Tables, Charts & Graphs.
6.	**Cleaning Data with Text Functions**: use of UPPER and LOWER, TRIM function, Concatenate.
7.	**Cleaning Data Containing Date and Time Values:** use of DATEVALUE function, DATEADD and DATEDIF, TIMEVALUE functions.
8.	**Conditional Formatting**: formatting, parsing, and highlighting data in spreadsheets during data analysis.
9.	**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.
10.	**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.
11.	**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.
12.	**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.
13.	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) is50%. 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					
ETHICAL HACKING **Category: AEC/SEC-III** **(Common to CSE, CSD)**					
Course Code	:	B24CS382	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.	Understand the basics of ethical hacking, security principles, and legal responsibilities.
2.	Understand hacker techniques and the ethical hacker's approach to countering attacks
3.	Learn techniques to gather information about target systems, networks, and domains.
4.	Learn the importance and methodology of vulnerability assessment and penetration testing
5.	Understand enumeration techniques and perform system exploitation to gain unauthorized access

Module – 1: Introduction to Ethical Hacking	**No. of Hours**
• Ethical Hacking Basics (CIA triad, types of hackers) • The Role of an Ethical Hacker • Introduction to Ethical Hacking Tools • Legal and Ethical Consideration	3
Module – 2: Technical Foundations of Hacking	**No. of Hours**
• The Attacker's Mindset • Ethical Hacking Phases • Components of the Security Stack • Vulnerabilities and Exploits Overview	3
Module – 3: Footprinting and Scanning	**No. of Hours**
• Active v/s Passive Footprinting • Network Scanning Techniques (using Nmap, Zenmap, Netcat) • DNS and WHOIS Information Gathering • Service and OS Fingerprinting	3
Module – 4: Vulnerability Assessment and Penetration Testing (VAPT)	**No. of Hours**
• VAPT Phases (Planning, Discovery, Attack, Reporting) • Vulnerability Scanning with Tools (Nessus, OpenVAS) • Penetration Testing Methodologies (Black-box, White-box, Gray-box) • Report Writing and Risk Rating	3
Module – 5: Enumeration and System Hacking	**No. of Hours**
• Enumeration and System Hacking Enumeration Techniques (NetBIOS, SNMP, LDAP, DNS) • Exploiting System Vulnerabilities (Metasploit, Password Cracking) • Denial of Service(DoS) and Distributed Denial of Service(DDoS)	3

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand different ethical hacking techniques
CO2	Discover vulnerabilities and loopholes in web servers and systems
CO3	Apply ethical hacking knowledge to perform live attacks
CO4	Prepare VAPT reports of the attacks
CO5	Web Application Testing Competence: Identify and exploit web application vulnerabilities, and use tools to test and secure web applications against common attacks.

Text Books	
1.	Certified Ethical Hacker by Michael Gregg (Pearson IT Certification)
2.	Hacking the Hacker by Roger Grimes (Wiley)

Reference Text Books	
1.	Ethical Hacking and Penetration Testing Guide by Rafay Baloch (CRC Press)
2.	Learning Nessus for Penetration Testing by Himanshu Kumar (Packt Publishing)
3.	**Footprinting and Information Gathering** – Methods of reconnaissance, scanning, and collecting information

Web links and Video lectures (e-Resources)
1. **Video**: Ethical Hacking Training Module 1
2. **Video**: Full Ethical Hacking Course - Network Penetration Testing
3. **Video**: Nmap Tutorial | Introduction | Ethical Hacking
4. **Video**: Ethical Hacking Deep Dive: Metasploit, Nmap, and More
5. **Video**: Certified Ethical Hacker Tutorial | Ethical Hacking Tutorial

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.

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) is50%. 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					
KNOWLEDGE ENGINEERING **Category: AEC/SEC-III** **(Common to CSE, CSD)**					
Course Code	:	B24CG384	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 understand the basics of Knowledge Engineering.
2.	To discuss methodologies and modeling for Agent Design and Development.
3.	To design and develop ontologies
4.	To apply reasoning with ontologies and rules.
5.	To understand learning and rule learning

Module – 1: Reasoning under uncertainty	**No. of Hours**
Introduction – Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods - Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning – Knowledge Engineering	3
Module – 2 : Methodology and Modeling	**No. of Hours**
Conventional Design and Development – Development tools and Reusable Ontologies – Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquiry-driven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment – Drill-Down Analysis, Assumption-based Reasoning, and What-If Scenarios.	3
Module – 3: Design and Development	**No. of Hours**
Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching. Design and Development Methodologies – Steps in Ontology Development – Domain Understanding and Concept Elicitation – Modelling-based Ontology Specification.	3
Module – 4: Reasoning with Ontologies and Rules	**No. of Hours**
Production System Architecture – Complex Ontology-based Concepts – Reduction and Synthesis rules and the Inference Engine – Evidence-based hypothesis analysis – Rule and Ontology Matching – Partially Learned Knowledge – Reasoning with Partially Learned Knowledge.	3
Module – 5: Learning and Rule Learning	**No. of Hours**
Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definition of Generalization. Modelling, Learning and Problem Solving – Rule learning and Refinement – Overview – Rule Generation and Analysis – Hypothesis Learning.	3

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the basics of Knowledge Engineering.
CO2	Apply methodologies and modelling for Agent Design and Development
CO3	Design and develop ontologies
CO4	Design and develop ontologies
CO5	Understand learning and rule learning.

Text Books	
1.	Gheorghe Tecuci, DorinMarcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, 1st Edition, 2016. (Unit 1 – Chapter 1 / Unit 2 – Chapter 3,4 / Unit 3 – Chapter 5, 6 / Unit 4 - 7 , Unit 5 – Chapter 8, 9)

Reference Text Books	
1.	Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.
2.	Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018.

3.	John F. Sowa: Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks/Cole, Thomson Learning, 2000
4.	King , Knowledge Management and Organizational Learning , Springer, 2009.
5.	Jay Liebowitz, Knowledge Management Learning from Knowledge Engineering, 1st Edition,2001.

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.
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.

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", 5th Edition, Pearson Education. 2004.
2.	West, Introduction to Graph Theory, 2nd ed., Prentice Hall

Reference Text Books	
1.	Ralph P. Grimaldi, B V Ramana: "Discrete Mathematical Structures an Applied Introduction", 5th 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", 6th 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)

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	PO8	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

SEMESTER-IV					
DATABASE MANAGEMENT SYSTEMS **Category: PCC** **(Common to CSE, ISE, AIML,CSE(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 Quaries:** Views in SQL, Nested and co-related queries, Exists & Not Exists, joins & outer joins , specifiying constratints 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, 7th Edition, 2017, Pearson.
2.	Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill
3.	Elmasri and Navathe, —Fundamentals of Database Systems, 7th Edition, Pearson education, 2016.

Reference Text Books	
1.	Abraham Silberschatz, Henry F. Korth and S. Sudarshan's Database System Concepts 6th Edition Tata Mcgraw Hill Education Private Limited
2.	G. K. Gupta —Database Management Systems, 3rd 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=ZWl0Xow304I

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	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

SEMESTE-IV					
MICROCONTROLLERS **Category: IPCC** **(Common to CSE, CSD)**					
Course Code	:	B24CS403	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.	Understand the fundamentals of ARM-based systems and basic architecture of CISC and RISC.
2.	Familiarize with ARM programming modules along with registers, CPSR and Flags.
3.	Develop ALP using various instructions to program the ARM controller.
4.	Understand the Exceptions and Interrupt handling mechanism in Microcontrollers.
5.	Discuss the ARM Firmware packages and Cache memory polices.

Module – 1: ARM Embedded Systems	**No. of Hours**
The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software. **ARM Processor Fundamentals:** Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table, Core Extensions Textbook1:Chapter1-1.1to1.4,Chapter2-2.1to2.5 RBT: L1, L2, L3	9
Module – 2: Introduction to the ARM Instruction Set	**No. of Hours**
Data Processing Instructions, Branch Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants. Textbook1:Chapter3-3.1to3.6 RBT: L1, L2, L3	9
Module – 3: C Compilers and Optimization	**No. of Hours**
Basic C Data Types, C Looping Structures, Register Allocation, Function Calls, Pointer Aliasing, Portability Issues. Textbook1:Chapter5.1to5.7and5.13 RBT: L1, L2, L3	9
Module – 4: Exception and Interrupt Handling	**No. of Hours**
Exception handling, ARM processor exceptions and modes, vector table, exception priorities, link register offsets, interrupts, assigning interrupts, interrupt latency, IRQ and FIQ exceptions, basic interrupt stack design and implementation. **Firmware:** Firmware and bootloader, ARM firmware suite, Red Hat redboot, Example: sandstone, sandstone directory layout, sandstone code structure. Textbook1:Chapter9.1and9.2,Chapter10 RBT: L1, L2, L3	9
Module – 5: CACHES	**No. of Hours**
The Memory Hierarchy and Cache Memory, Caches and Memory Management Units: CACHE Architecture: Basic Architecture of a Cache Memory, Basic Operation of a Cache Controller, The Relationship between Cache and Main Memory, Set Associativity, Write Buffers, Measuring Cache Efficiency, CACHEPOLICY: Write Policy—Writeback or Writethrough, Cache Line Replacement Policies, Allocation Policy on a Cache Miss. Coprocessor 15 and caches. Textbook1:Chapter12.1to12.4 RBT: L1, L2, L3	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain the ARM Architectural features and Instructions.
CO2	Develop programs using ARM instruction set for an ARM Microcontroller.
CO3	Explain C-Compiler Optimizations and portability issues in ARM Microcontroller.
CO4	Apply the concepts of Exceptions and Interrupt handling mechanisms in developing applications.
CO5	Demonstrate the role of Cache management and Firmware in Microcontrollers.

Text Books:	
1.	Andrew N Sloss, Dominic Symes and Chris Wright, ARM system developers guide, Elsevier, Morgan Kaufman publishers, 2008.

Reference Text Books	
1.	Raghunandan.G.H,Microcontroller(ARM)andEmbeddedSystem,CengagelearningPublication,2019.
2.	Insider'sGuidetotheARM7basedmicrocontrollers,HitexLtd.,1st edition,2005

Web links and Video lectures (e-Resources):
1. Activity Based Learning (Suggested Activities in Class)/ Practical Based Learning Assign the group task to demonstrate the Installation and working of Keil Software.

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 experiment
1.	Using Keil software, observe the various Registers, Dump, CPSR, with a simple Assembly Language Programs (ALP).
2.	Develop and simulate ARM ALP for Data Transfer, Arithmetic and Logical operations (Demonstrate with the help of a suitable program).
3.	Develop an ALP to multiply two16-bitbinarynumbers.
4.	Develop an ALP to find the sumoffirst10integernumbers.
5.	Develop an ALP to find the largest/smallest number in an array of 32numbers.
6.	Develop an ALP to count the number of ones and zeros in two consecutive Memory locations.
7.	Simulate a programin C for ARM microcontroller using KEIL to sort the numbersinascending/descending order using bubblesort.
8.	Simulate a program in C for ARM microcontroller to find factorial of a number.
9.	Simulate a program in C for ARM microcontroller to demonstrate case conversion of characters from upper to lower case and lower to uppercase.
10.	Demonstrate enabling and disabling of Interrupts in ARM.
11.	Demonstrate the handling of divide by zero, Invalid Operation and Overflow exceptions in ARM.

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

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 (contd..): 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 computationa 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, 3rd Edition (Indian), 2017, Pearson.

Reference Text Books	
1.	Computer Algorithms/C++, Ellis Horowitz, SatrajSahni and Rajasekaran, 2nd Edition, 2014, Universities Pres
2.	Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd 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=EolP-WNP-Zc&pp=ygUQI2J0ZWNoZGFhc3ViamVjdA%3D%3D&themeRefresh=1
2. https://www.youtube.com/watch?v=NqKkxQamroo
3. https://www.youtube.com/playlist?list=PLxCzCOWd7aiHcmS4i14bI0VrMbZTUvlTa

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 Warshal'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 = {sl , s2,.....,sn} 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

	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, ISE, AIML, CSE(IC), CSD)**					
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 • Create • Alter • Drop • Truncate • Rename
2.	Implementation of DML commands of SQL with suitable examples • Insert • Update • Delete • Select
3.	Implementation of different types of function with suitable examples • Aggregate Function • Using Parentheses • Column Aliases • Literal Character Strings • Duplicate Row
4.	Implementation of different types of operators in SQL • 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 • Inner Join • Outer Join i. Left outer join ii. Right outer join iii. Full outer Join • Natural Join
	Study and Implementation of

6.	• Group By & having clause • Order by clause • Sorting in Descending & Ascending order
7.	Study & Implementation of different types of constraints. • Primary Key & Foreign Key Constraints • NOT NULL Constraints • Default 1 Constraints • Check constraints • Domain Constraints • Entity Integrity Constraints • Referential Integrity Constraints
	PART-B
8.	Consider the following schema for a Library Database: BOOK(Book_id, Title, Publisher_Name, Pub_Year) BOOK_AUTHORS(Book_id, Author_Name) PUBLISHER(Name, Address, Phone) BOOK_COPIES(Book_id,Programme_id,No-of_Copies) BOOK_LENDING(Book_id,Programme_id,Card_No,Date_Out, Due_Date) LIBRARY_PROGRAMME(Programme_id, Programme_Name, Address) Write SQL queries to 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.	Consider the following schema for Order Database: SALESMAN(Salesman_id, Name, City, Commission) CUSTOMER(Customer_id, Cust_Name, City, Grade, Salesman_id) ORDERS(Ord_No,Purchase_Amt,Ord_Date,Customer_id,Salesman_id) Write SQL queries to 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 day 5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.
10.	Consider the schema for Movie Database: ACTOR(Act_id, Act_Name, Act_Gender) DIRECTOR(Dir_id, Dir_Name, Dir_Phone) MOVIES(Mov_id,Mov_Title,Mov_Year,Mov_Lang, Dir_id) MOVIE_CAST(Act_id, Mov_id, Role) RATING(Mov_id,Rev_Stars)

	Write SQL queries to 1. List the titles of all movies directed by„Hitchcock". 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 b 'Steven Spielber'to 5.

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) is50%. 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

SEMESTER-IV					
PROGRAMMING IN JAVA **Category: ESC/ETC/PLC-IV** **(Common to CSE, CSD)**					
Course Code	:	B24CS461	CIE	:	50 Marks
Teaching Hours L : T : P	:	2:0:2	SEE	:	50 Marks
Total Hours	:	30(T)+15(P)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Objectives	
1.	To learn primitive constructs JAVA programming language.
2.	To introduce the fundamentals of object-oriented programming concepts using Java, including classes, objects, inheritance, and polymorphism.
3.	To develop the ability to write reusable and maintainable code using key OOP principles like encapsulation and abstraction.
4.	To familiarize students with Java syntax, control structures, and exception handling mechanisms.
5.	To provide knowledge of multithreading and file handling to build efficient and robust Java programs.

Module – 1: An Overview of Java	**No. of Hours**
Object-Oriented Programming (Two Paradigms, Abstraction, The Three OOP Principles), Using Blocks of Code, Lexical Issues (Whitespace, Identifiers, Literals, Comments, Separators, The Java Keywords). Data Types, Variables, and Arrays: The Primitive Types (Integers, Floating-Point Types, Characters, Booleans), Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, Introducing Type Inference with Local Variables. Operators: Arithmetic Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses. Control Statements: Java's Selection Statements (if, The Traditional switch), Iteration Statements (while, do-while, for, The For-Each Version of the for Loop, Local Variable Type Inference in a for Loop, Nested Loops), Jump Statements (Using break, Using continue, return). Chapter 2, 3, 4, 5	6
Module – 2: Introducing Classes	**No. of Hours**
Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The 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. Chapter 6, 7	6
Module – 3: Inheritance	**No. of Hours**
Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Executed, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, Local Variable Type Inference and Inheritance, The Object Class. Interfaces: Interfaces, Default Interface Methods, Use static Methods in an Interface, Private Interface Methods. Chapter 8, 9	6
Module – 4: Packages	**No. of Hours**
Packages, Packages and Member Access, Importing Packages. Exceptions: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions. Chapter 9, 10	6
Module – 5: Multithreaded Programming:	**No. of Hours**
The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using isAlive() and join(), Thread Priorities, Synchronization, Interthread Communication, Suspending, Resuming, and Stopping Threads, Obtaining a Thread's State. Enumerations, Type Wrappers and Autoboxing: Enumerations (Enumeration Fundamentals, The values() and valueOf() Methods), Type Wrappers (Character, Boolean, The Numeric Type Wrappers), Autoboxing (Autoboxing and Methods, Autoboxing/Unboxing Occurs in Expressions, Autoboxing/Unboxing Boolean and Character Values). Chapter 11, 12	6

Course Outcomes: At the end of the course, the students will be able to	
CO1	Demonstrate proficiency in writing simple programs involving branching and looping structures.
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 packages and exception handling in solving complex problem
CO5	Apply concepts of multithreading, autoboxing and enumerations in program development

LABORATORY

Practical Component of IPCC (12 Experiments)

Sl. No.	Programming Experiments (Suggested and are not limited to)
1.	Develop a JAVA program to add TWO matrices of suitable order N (The value of N should be read from command line arguments).
2.	Develop a stack class to hold a maximum of 10 integers with suitable methods. Develop a JAVA main method to illustrate Stack operations.
3.	A class called Employee, which models an employee with an ID, name and salary, is designed as shown in the following class diagram. The method raiseSalary (percent) increases the salary by the given percentage. Develop the Employee class and suitable main method for demonstration.
4.	A class called MyPoint, which models a 2D point with x and y coordinates, is designed as follows: • Two instance variables x (int) and y (int). • A default (or "no-arg") constructor that construct a point at the default location of (0, 0). • A overloaded constructor that constructs a point with the given x and y coordinates. • A method setXY() to set both x and y. • A method getXY() which returns the x and y in a 2-element int array. • A toString() method that returns a string description of the instance in the format "(x, y)". • A method called distance(int x, int y) that returns the distance from this point to another point given (x, y) coordinates • An overloaded distance(MyPoint another) that returns the distance from this point to the give MyPoint instance (called another) • Another overloaded distance() method that returns the distance from this point to the origin (0,0) Develop the code for the class MyPoint. Also develop a JAVA program (called TestMyPoint) to test all the methods defined in the class.
5.	. Develop a JAVA program to create a class named shape. Create three sub classes namely: circle, triangle and square, each class has two member functions named draw () and erase (). Demonstrate polymorphism concepts by developing suitable methods, defining member data and main program.
6.	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.
7.	Develop a JAVA program to create an interface Resizable with methods resize Width (int width) and Resize Height(int height) that allow an object to be resized. Create a class Rectangle that implements the Resizable interface and implements the resize methods.
8.	Develop a JAVA program to create an outer class with a function display. Create another class inside the outer class named inner with a function called display and call the two functions in the main class.

9.	Develop a JAVA program to raise a custom exception (user defined exception) for Division By Zero using try, catch, throw and finally.
10.	Develop a JAVA program to create a package named mypack and import & implement it in a suitable class.
11.	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).
12.	Develop a program to create a class My Thread in this class a constructor, call the base class constructor, using super and start the thread. The run method of the class starts after this. It can be observed that both main thread and created child thread are executed concurrently

Text Books	
1.	Java: The Complete Reference, 12th dition, by Herbert Schildt, November 2021, McGraw-Hill, ISBN: 9781260463422

Reference Text Books	
1.	Programming with Java, 6th Edition, by E Balagurusamy, Mar-2019, McGraw Hill Education, ISBN: 9789353162337.
2.	Thinking in Java, Fourth Edition, by Bruce Eckel, Prentice Hall, 2006 (https://sd.blackball.lv/library/thinking_in_java_4th_edition.pdf)

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.

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 3 - Low

SEMESTER-IV					
ROBOTIC PROCESS AUTOMATION **Category: ESC/ETC/PLC-IV** **(Common to CSE, CSD)**					
Course Code	:	B24CG462	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 basic concepts of Robotic Process Automation.
2.	To expose to the key RPA design and development strategies and methodologies.
3.	To learn the fundamental RPA logic and structure and real world applications.
4.	To explore the Exception Handling in RPA and version control systems.
5.	To learn to deploy and Maintain the software bots.

Module – 1: INTRODUCTION TO ROBOTIC PROCESS AUTOMATION	**No. of Hours**
Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files.	9
Module – 2 : AUTOMATION PROCESS ACTIVITIES	**No. of Hours**
Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, Ui Explorer, Handling Events	9
Module – 3: APP INTEGRATION, RECORDING AND SCRAPING	**No. of Hours**
App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, Scraping data from website and writing to CSV. Real-World Applications and Use Cases.	9
Module – 4: EXCEPTION HANDLING AND CODE MANAGEMENT	**No. of Hours**
Exception handling, Common exceptions, Version Control Systems, Logging- Debugging techniques, Collecting crash dumps, Error reporting. Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques.	9
Module – 5: DEPLOYMENT AND MAINTENANCE	**No .of Hours**
Covers publishing bots using publish utilities, deploying and managing bots via orchestration servers, configuring control bots, handling license management, managing updates, exploring RPA vendors including open-source tools, and understanding future trends in RPA.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the fundamental concepts and architecture of Robotic Process Automation (RPA).
CO2	Design and develop basic RPA workflows using industry-standard tools and methodologies.
CO3	Apply logical structures and RPA components to solve real-world automation problems.
CO4	Handle exceptions and manage versions effectively within RPA solutions.
CO5	Deploy, monitor, and maintain software bots using orchestration servers and best practices.

Text Books	
1.	Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, Packt Publishing, 2018.
2.	Tom Taulli , “The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems”, Apress publications, 2020.

Reference Text Books	
1.	Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018

2.	Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018
3.	A Gerardus Blokdyk, "Robotic Process Automation Rpa A Complete Guide ", 2020

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

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

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	:	3Hrs

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=qj4ziswxupE
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

SEMESTER-IV					
WEB PROGRAMMING **Category: ESC/ETC/PLC-IV**					
Course Code	:	B24CG464	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.	Designing user friendly and connect to database.

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.	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.	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, 5th 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, 1st edition, Packt Publishing

Reference Textbooks	
1.	Stephen Wynkoop and John Burke ―Running a Perfect Website‖, QUE, 2nd Edition,1999.
2.	Chris Bates, Web Programming – Building Intranet Applications, 3rd 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, 1st edition, O'Reilly
5.	UttamK.Roy, ―Web Technologies‖, Oxford University Press, 2011

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

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

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) is50%. 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

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 b 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) is50%. 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

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

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 Video file 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: Keyframe, 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, 21/2D, 3D applications
CO5	Understand the complexity of multimedia applications in the context of cloud, security, big data streaming, social networking, CBIR etc.,
Text Books	
1.	Ze-NianLi, MarkS. Drew, JiangchuanLiu, Fundamentals of Multimedia", 3rd 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, 3rd Edition, 2016.
2.	GeraldFriedland,RameshJain,"MultimediaComputing",CambridgeUniversityPress,2018.
3.	PrabhatK.Andleigh,KiranThakrar,"MultimediaSystemDesign",PearsonEducation,1stEdition,2015.

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 (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.

SEMESTER-IV					
OO DESIGN PATTERN LAB **Category: AEC/SEC-IV**					
Course Code	:	B24CG484	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	:	3Hrs

Course Objectives	
1.	To introduce students to the fundamental principles and concepts of design patterns and their role in object-oriented software development.
2.	To equip students with the skills to identify and apply the most appropriate design patterns to solve common software design problems.
3.	To develop the ability to analyze the advantages and disadvantages of different design patterns in real-world applications.
4.	To provide hands-on experience in implementing various design patterns using object-oriented programming languages.

Sl. No	**List of Experiments**
1.	Design and implement Shape Factory class that generates different types of Shape objects (Circle, Square, Rectangle) based on input parameters using Factory Design Pattern.
2.	Design and Implement an Abstract Factory class to create families of related or Dependent objects with respect to decathlon store without specifying their concrete classes using Abstract Factory.
3.	Design and implement a complex object like a House using a step-by-step Builder pattern, allowing different representations of the house (wooden, brick, etc.).
4.	Design and Implement to Extend a Coffee object with dynamic features (e.g., milk, sugar, whipped cream) using Decorators.
5.	Design and Implement a Logger class ensuring a single instance throughout the application
6.	Design and implement an Adapter Pattern for a Music System.
7.	Design and Implement an Observer pattern for an ewsagency to notify subscribers of updates.
8.	Design and Implement a Façade pattern for home theatre system.
9.	Design and Implement a Template Method for Document Processing (word, pdf, excel)
10.	Design and Implement weather monitoring system that notifies multiple display devices whenever the weather conditions change that follows the Observer Design Pattern.
11.	Design and Implement a Proxy pattern to control access to an object (e.g., a protected resource or remote service).
12.	Design and Implement a Mediator pattern to manage communication between a set of objects (e.g., chat room with multiple participants).

Course Outcomes: At the end of the course, the students will be able to	
CO1	Design the model for the given problem using UML concepts and notations.
CO2	Develop the solution for the given real world problem using design patterns.
CO3	Analyze the results and produce substantial written documentation.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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