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

Artificial Intelligence & Machine Learning

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.

Artificial Intelligence & Machine Learning

DEPARTMENT VISION

To bring out the competent and socially responsible engineers in the field of AI&ML Education, Research and Innovation.

DEPARTMENT MISSION

1. To Inculcate, the integration process of concepts in AI&ML domain.
2. To equip AI&ML graduates with skills to meet Industry and Societal challenges by skill enhanced training.
3. To promote Research and ethical culture through interaction for broader application in AIML domain.

PROGRAM OUTCOMES (POs)

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

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

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

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

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

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

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

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

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

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

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

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Develop competent profession in the field of Artificial Intelligence and Machine Learning towards advanced skills in solving contemporary problems.

PEO2: Pursue their professional on technical and progress towards Research and Entrepreneurship.

PEO3: Progress as skilled in team and adapting leadership qualities and ethical values as per the society.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Design and develop AI&ML Solution, through modern engineering tools and Programming Language, Technical skills in presenting modern insights.

PSO2: Ability to adapt continues changing AI&ML domain for innovative challenges.

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Department of Artificial Intelligence & Machine Learning

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	100
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			
B24IS361	Object Oriented Programming with Java	B24AI362	Data Analytics with R
B24AI363	Python Programming for Data Science	B24AI364	Web Technologies (Common to CSE, CSE(IC), ISE, AIML)

Ability Enhancement Course / Skill Enhancement Course (AEC/SEC) – III			
B24CG381	Data Analytics with Excel (Common to , CSD, ISE, AIML)	B24AI382	Project Management with Git
B24AI383	Ethics and Public Policy for AI	B24AI384	PHP Programming

Non Credit Mandatory Courses (NCMC)			
B24NCK391	National Service Scheme (NSS)	B24NCK392	National Cadet Corps (NCC)
B24NCK393	Physical Education (PE)	B24NCK394	Yoga
B24NCK395	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 Artificial Intelligence & Machine Learning

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	B24AI403	Principles of Artificial Intelligence	AI	AI	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	AI	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		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) - IV			
B24AI461	Unix System Programming	B24IC462	Optimization Techniques (Common to CSE(IC), AIML)
B24AI463	Java for Mobile Applications	B24AI464	Algorithmic Game Theory

Ability Enhancement Course / Skill Enhancement Course (AEC/SEC) – IV			
B24CS481	Microsoft Power BI (Common to CSE, CSD,CSE(IC), ISE, AIML)	B24CS 482	DevOps (Common to CSE, CSD,CSE(IC), ISE, AIML)
B24AI483	MongoDB	B24AI 484	MERN

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 Ed., 2021.
3.	G Haribaskaran "Probability, Queuing Theory & Reliability Engineering", Laxmi Publication, Latest Edition, 2006

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

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

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 – In-order, post-order, 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 Ed, Universities Press, 2014.
2.	Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.

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

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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, Zvonko Vranesic, 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	:	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: PCCL** **(Common to CSE, ISE, AIML, CSE(IC), CSD)**					
Course Code	:	B24CS305L	CIE	:	50 Marks
Teaching Hours L : T : P	:	0:0:2	SEE	:	50 Marks
Total Hours	:	15(P)	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

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

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

7.	Develop a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Programme, Sem, PhNo a. Create a SLL of N Students Data by using front insertion. b. Display the status of SLL and count the number of nodes in it c. Perform Insertion / Deletion at End of SLL d. Perform Insertion / Deletion at Front of SLL(Demonstration of stack) e. Exit
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	Use the Binary search tree and graph data structures to solve problems.
CO5	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					
OBJECT ORIENTED PROGRAMMING WITH JAVA **Category: ESC/ETC/PLC-III** **(Common to AIML,ISE)**					
Course Code	:	B24IS361	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 concepts and characteristics of Java
2.	To know the principles of packages, inheritance, exceptions and interfaces.
3.	To develop a java application with threads and generics classes
4.	To design and build simple Graphical User Interfaces
5.	To build applications using java programming for real-world applications.

Module – 1: Oop in Java & Inheritance	**No. of Hours**
Object Oriented Programming Concepts - OOP in Java – Characteristics of Java –Fundamental Programming Structures in Java – Defining classes in Java – Comments, Data Types, Variables, Operators, Control Flow, Arrays - constructors, methods -access specifies - static members – Packages- Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- Strings. Textbook 1: Chapters 1 – 3.	6
Module – 2: Exception Handling and I/O	**No. of Hours**
Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements-Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files - abstract classes and methods - final methods and classes Textbook 1: Chapters 4 – 5	6
Module – 3: Interfaces and Multithreading	**No. of Hours**
Interfaces – defining an interface, implementing interface, differences between classes and interfaces - extending interfaces - Object cloning -inner classes-Differences between multithreading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads - Generic Programming. Textbook 1: Chapters 6 , 8	6
Module – 4: WT and Event Driven Programming	**No. of Hours**
AWT Event Hierarchy- Components - Graphics programming – Applets-Frame –working with 2D shapes - Using color, fonts, and images - Basics of event handling - event handlers - adapter classes - actions - mouse events - Introduction to Swing – layout management - Swing Components – Windows –Menus – Dialog Boxes Textbook 1: Chapters 9-10	6
Module – 5: Networking and JDBC	**No. of Hours**
Networking Basics - The Networking Classes and Interfaces - TCP/IP Client Sockets- URL - TCP/IP Server Sockets - Datagrams - A Relational Database Overview – JDBC Introduction - JDBC Product Components - JDBC Architecture - Case studies. Textbook 1: Chapters 15 – 17	6

LABORATORY

Practical Component of IPCC (10 Experiments)

Sl. No.	**List of experiments**
1.	a) Write a Java program that uses **all primitive data types**, **arithmetic operators**, and **displays the results** and Implement **if-else**, **switch-case**, **for-loop**, and **while-loop** in a calculator or factorial program. b) Write a Java program to compute the sum of all prime numbers between 1 and N using control structures.
2.	a) Write a program to implement matrix addition and multiplication using 2D arrays.

	b) Create a class with **method overloading** to **calculate the area** of a rectangle, circle, and square. c) Write a program to demonstrate constructor chaining (calling one constructor from another within the same class)
3.	a) Write a program to demonstrate **constructor overloading** using a class with **default and parameterized constructors**. b) Write a program to implement a bank account system using static members to track the number of accounts
4.	a) Write a program to **demonstrate access specifiers**: private, public, protected, and default. b) Write a program to demonstrate data hiding using private members and accessing them using getters and setters.
5.	Create a class Shape with subclasses Rectangle and Circle. Demonstrate runtime polymorphism using method overriding.
6.	Create a **user-defined package**, define a class in the package, and access it from **another program**
7.	a) Demonstrate **single inheritance** using **protected** data members. b) Use super () to invoke **parent class constructor** and access parent class members.
8.	a) Write a program to demonstrate **multilevel inheritance** b) Use abstract class and abstract methods to define a generic Vehicle class and derive Car and Bike subclasses.
9.	a) Write a program to read a string and perform operations like **length**, **substring**, and **concatenation**. b) Write a program to count the number of words, vowels, and consonants in a given string.
10.	a) Write a program to **reverse a string** and **check if it is a palindrome or not**. b) Write a program to Use runtime polymorphism to display area of various shapes (square, rectangle, circle).
11.	a) Write a program to demonstrate use of **StringBuffer** to perform **insert**, **delete**, and **append** operations. b) Write a program to remove duplicate characters from a string.
12.	Write a program to implement a simple text encryption program using character shifting (Caesar Cipher logic).

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the object oriented programming concepts
CO2	Solve real world problems using reusable and error free code.
CO3	Design and Develop distributed applications
CO4	Implement window based applications using event handling mechanisms.
CO5	Communicate effectively with the technical community.

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

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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

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

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY COMPONENT OF IC:

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

CIE FOR THE PRACTICAL COMPONENT OF IC:

1. On completion of every experiment / program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day.
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	3	3	3	-	-	3	3	-	2
CO2	3	2	3	3	3	-	-	3	3	-	2
CO3	3	2	3	3	3	-	-	3	3	-	2
CO4	3	2	3	3	3	-	-	3	3	-	2
CO5	3	2	3	3	3	-	-	3	3	-	2

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

SEMESTER-III					
DATA ANALYTICS WITH R **Category: ESC/ETC/PLC-III**					
Course Code	:	B24AI362	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 Gain the knowledge of R Programming Concepts.
2.	To Explain the concepts of Data Visualization.
3.	To Explain the concept of Statistics in R.
4.	To Work with R charts and Graphs.
5.	To equip with foundational knowledge and enabling them to analyze and interpret real-world data effectively.

Module – 1	**No. of Hours**
Basics of R Introducing R, Initiating R, Packages in R, Environments and Functions, Flow Controls, Loops, Basic Data Types in R, Vectors Chapter 1: 1.1 to 1.7 Chapter 2: 2.1,2.2	6
Module – 2	**No. of Hours**
Basics of R Continued Matrices and Arrays, Lists, Data Frames, Factors, Strings, Dates and Times Chapter 2: 2.3,2.4,2.5,2.6,2.7.2.8.1,2.8.2	6
Module – 3	**No. of Hours**
Data Preparation Datasets, Importing and Exporting files, Accessing Databases, Data Cleaning and Transformation Chapter 3: 3.1,3.2,3.3,3.4	6
Module – 4	**No. of Hours**
Graphics using R Exploratory Data Analysis, Main Graphical Packages, Pie Charts, Scatter Plots, Line Plots, Histograms, Box Plots, Bar Plots, Other Graphical packages Chapter 4: 4.1 to 4.9	6
Module – 5	**No. of Hours**
Statistical Analysis using R Basic Statistical Measures, Normal distribution, Binomial distribution, Correlation Analysis, Regression Analysis-Linear Regression Analysis of Variance Chapter 5: 5.1, 5.3, 5.4, 5.5, 5.6.1, 5.7	6

Course Outcomes: At the end of the course, the students will be able to	
CO1	Describe the structures of R Programming.
CO2	Understanding of R data structures including matrices, arrays, lists, data frames
CO3	Illustrate the basics of Data Preparation with real world examples.
CO4	Apply the Graphical Packages of R for visualization
CO5	Apply various Statistical Analysis methods for data analytics.

Text Books	
1.	R Programming: An Approach to Data Analytics, G. Sudhamathy and C. Jothi Venkateswaran, MJP Publishers, 2019

Reference Text Books	
1.	An Introduction to R, Notes on R: A Programming Environment for Data Analysis and Graphics. W. N. Venables, D.M. Smith and the R Development Core Team. Version 3.0.1 (2013-05-16)
2.	Cotton, R. (2013). Learning R: A Step by Step Function Guide to Data Analysis. 1st edition. O'Reilly Media Inc

Web links and Video lectures (e-Resources)
1. URL: https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf 2. http://www.tutorialspoint.com/r/r_tutorial.pdf 3. https://users.phhp.ufl.edu/rlp176/Courses/PHC6089/R_notes/intro.html 4. https://cran.r-project.org/web/packages/explore/vignettes/explore_mtcars.html 5. https://www.w3schools.com/r/r_stat_data_set.asp 6. https://rpubs.com/BillB/217355

LABORATORY

Practical Component (12 Experiments)

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

5.	Develop an R Program using functions to find all the prime numbers up to a specified number by the method of Sieve of Eratosthenes.
6.	The built-in data set mammals contain data on body weight versus brain weight. Develop R commands to: a) Find the Pearson and Spearman correlation coefficients. Are they similar? b) Plot the data using the plot command. c) Plot the logarithm (log) of each variable and see if that makes a difference.
7.	Let us use the built-in dataset air quality which has Daily air quality measurements in New York, May to September 1973. Develop R program to generate histogram by using appropriate arguments for the following statements. a) Assigning names, using the air quality data set. b) Change colors of the Histogram c) Remove Axis and Add labels to Histogram d) Change Axis limits of a Histogram e) Add Density curve to the histogram
8.	Design a data frame in R for storing about 20 employee details. Create a CSV file named "input.csv" that defines all the required information about the employee such as id, name, salary, start_date, dept. Import into R and do the following analysis. a) Find the total number rows & columns b) Find the maximum salary c) Retrieve the details of the employee with maximum salary d) Retrieve all the employees working in the IT Department. e) Retrieve the employees in the IT Department whose salary is greater than 20000 and write these details into another file "output.csv"
9.	Using the built in dataset mtcars which is a popular dataset consisting of the design and fuel consumption patterns of 32 different automobiles. The data was extracted from the 1974 Motor Trend US magazine, and comprises fuel consumption and 10 aspects of automobile design and performance for 32 automobiles (1973-74 models). Format A data frame with 32 observations on 11 variables : [1] mpg Miles/(US) gallon, [2] cyl Number of cylinders [3] disp Displacement (cu.in.), [4] hp Gross horsepower [5] drat Rear axle ratio,[6] wt Weight (lb/1000) [7] qsec 1/4 mile time, [8] vs V/S, [9] am Transmission (0 = automatic, 1 = manual), [10] gear Number of forward gears, [11] carb Number of carburetors
10.	Demonstrate the progression of salary with years of experience using a suitable data set (You can create your own dataset). Plot the graph visualizing the best fit line on the plot of the given data points. Plot a curve of Actual Values vs. Predicted values to show their correlation and performance of the model. Interpret the meaning of the slope and y-intercept of the line with respect to the given data. Implement using lm function. Save the graphs and coefficients in files. Attach the predicted values of salaries as a new column to the original data set and save the data as a new CSV file.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY COMPONENT OF IC:

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

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

SEMESTER-III					
PYTHON PROGRAMMING FOR DATA SCIENCE **Category: ESC/ETC/PLC-III**					
Course Code	:	B24AI363	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 Python constructs and use them to build the programs.
2.	To analyze different conditional statements and their applications in programs.
3.	To learn and use basic data structures in python language.
4.	To learn and demonstrate array manipulations by reading data from files.
5.	To understand and use different data in a data analytics context.

Module – 1: Introduction to python	**No. of Hours**
Elements of python language, python block structure, variables and assignment statement, data types in python, operations, simple input/output print statements, formatting print statement. Text Book 1: Chapter 3 (3.2, 3.3, 3.4, 3.6, 3.7, 3.9 and 3.10)	9
Module – 2: Decision structure	**No. of Hours**
Forming conditions, if statement, the if-else and nested if-else, looping statements: introduction to looping, python built in functions for looping, loop statements, jump statement. Text Book 1: Chapter 4 (4.2 to 4.6) , Chapter 5 (5.1 to 5.4)	9
Module – 3: Lists	**No. of Hours**
Lists, operation on list, Tuples: introduction, creating, indexing and slicing, operations on tuples. sets: creating, operation in sets, introduction dictionaries, creating, operations, nested dictionary, looping over dictionary. Text Book 1: Chapter 7 (7.2 to 7.3) , Chapter 8 (8.1 to 8.4) and Chapter 9(9.1 to 9.3, 9.7 to 9.12)	9
Module – 4: The NumPy Library	**No. of Hours**
Ndarray: the heart of the library, Basic operations, indexing, slicing and iterating, conditions and boolean arrays, array manipulation, general concepts, reading and writing array data on files. The pandas Library: an introduction to Data structure, other functionalities on indexes, operations between data structures, function application and mapping	9
Module – 5: The pandas	**No. of Hours**
Reading and Writing data: i/o API tools, CSV and textual files, Reading data in CSV or text files, reading and writing HTML files, reading data from XML files, Microsoft excel files, JSON data, Pickle python object serialization. Pandas in Depth: data manipulation: data preparation, concatenating data transformation discretization binning, permutation, string manipulation, data aggregation group iteration. Text Book 2: Chapter 5 and Chapter 6	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Describe the constructs of python programming programs.
CO2	Use looping and conditional constructs to build programs.
CO3	Apply the concept of data structure to solve the real world problem
CO4	Use the NumPy constructs for matrix manipulations
CO5	Apply the Panda constructs for data analytics.

Text Books	
1.	1. S. Sridhar, J. Indumathi, V.M. Hariharan “Python Programming” Pearson publishers, 1st edition 2023. 2. Fabio Nelli, “Python Data Analytics”, Apress, Publishing, 1st Edition, 2015. Reference Book:

Reference Text Books	
1.	1. Paul Deitel and Harvey deitel,”Intro to Python for Computer Science and Data science”, 1st edition Pearson Publisher 2020.

Web links and Video lectures (e-Resources)
● Nptel: Introduction to Python for Data Sciencehttps://www.youtube.com/watch?v=tA42nHmmEKw&list=PLh2mXjKcTPSACrQxPM2_1Ojus 5HX88ht7

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 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	-	-	1	1	-	1	-	1	1
CO2	2	2	-	-	1	1	-	2	-	2	1
CO3	1	1	-	-	1	1	-	1	-	2	1
CO4	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					
WEB TECHNOLOGIES **Category: ESC/ETC/PLC-III** **(Common to CSE,AIML,CSE(IC),AIML)**					
Course Code	:	B24AI364	CIE	:	50 Marks
Teaching Hours L : T : P	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

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

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

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

Textbooks	
1.	Deitel and Deitel and Nieto, Internet and World Wide Web - How to Program, Prentice Hall, 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)

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CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

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

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
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CO2	3	2	3	2	3	-	-	-	2	-	3
CO3	1	2	2	3	3	-	-	-	1	-	2
CO4	3	3	3	2	3	-	-	-	2	-	3
CO5	2	2	3	1	2	-	-	-	3	-	2

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

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

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

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

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

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) 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					
PROJECT MANAGEMENT WITH GIT **Category: AEC**					
Course Code	:	B24AI382	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 familiar with basic command of Git
2.	To create and manage branches
3.	To understand how to collaborate and work with Remote Repositories
4.	To familiar with vision controlling commands
5.	To effectively track project history and resolve merge conflicts during collaboration

Sl. No	**List of Experiments**
1.	**Setting Up and Basic Commands** Initialize a new Git repository in a directory. Create a new file and add it to the staging area and commit the changes with an appropriate commit message
2.	**Creating and Managing Branches** Create a new branch named "feature-branch." Switch to the "master" branch. Merge the "feature-branch" into "master."
3.	**Creating and Managing Branches** Write the commands to stash your changes, switch branches, and then apply the stashed changes.
4.	**Collaboration and Remote Repositories** Clone a remote Git repository to your local machine
5.	**Collaboration and Remote Repositories** Fetch the latest changes from a remote repository and rebase your local branch onto the updated remote branch.
6.	**Collaboration and Remote Repositories** Write the command to merge "feature-branch" into "master" while providing a custom commit message for the merge.
7.	**Git Tags and Releases** Write the command to create a lightweight Git tag named "v1.0" for a commit in your local repository
8.	**Advanced Git Operations** Write the command to cherry-pick a range of commits from "source-branch" to the current branch.
9.	**Analysing and Changing Git History** Given a commit ID, how would you use Git to view the details of that specific commit, including the author, date, and commit message?
10.	**Analysing and Changing Git History** Write the command to list all commits made by the author "JohnDoe" between "2023-01-01" and "2023-12-31."
11.	**Analysing and Changing Git History** Write the command to display the last five commits in the repository's history.
12.	**Analysing and Changing Git History** Write the command to undo the changes introduced by the commit with the ID "abc123"

Course Outcomes: At the end of the course, the students will be able to	
CO1	Use the basics commands related to git repository
CO2	Create and manage the branches
CO3	Apply commands related to Collaboration and Remote Repositories
CO4	Use the commands related to Git Tags, Releases and advanced git operations
CO5	Analyse and change the git history

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					
ETHICS AND PUBLIC POLICY FOR AI **Category: AEC/SEC-III**					
Course Code	:	B24AI383	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 Ethical Framework for a Good AI Society, establishing Rules for trustworthy AI
2.	To Designing ethics for good society
3.	To familiar with Tools, methods and practices for designing AI for social good
4.	To familiar with Innovation and future AI
5.	To understand the Case Study: AI in health care, knowing Regulation and Governance of AI ethics

Module – 1: An Ethical Framework for a Good AI Society	**No. of Hours**
Opportunities, Risks, principles and Recommendations. Establishing the rules for building trustworthy AI Textbook1: Chapter 3, chapter 4	3
Module – 2: Translating principles into practices of digital ethics	**No. of Hours**
Five risks of being Unethical The Ethics of Algorithms: Key problems and Solution How to Design AI for Social Good: Seven Essential Factors Textbook1: Chapter 6, Chapter 8, Chapter 9	3
Module – 3	**No. of Hours**
How to design AI for social good: seven essential factors From What to How: An Initial Review of publicly available AI Ethics tools, Methods and Research to Translate principles into Practices Textbook1: Chapter 9, Chapter 10	3
Module – 4: Innovating with Confidence	**No. of Hours**
Embedding AI Governance and fairness in financial Services Risk management framework, What the near future of AI could be. Textbook1: Chapter 20, chapter 22	3
Module – 5: Human-AI Relationship	**No. of Hours**
AI and Workforce, Autonomous Machines and Moral Decisions, AI in HealthCare: balancing Progress and Ethics, Regulation and Governance of AI Ethics Textbook2 : Chapter 5,Chapter 8, Chapter 9	3

Course Outcomes: At the end of the course, the students will be able to	
CO1	Describe Ethical Framework for a Good AI Society, establishing Rules for trustworthy AI
CO2	Explain ethics for good society
CO3	Illustrate various Tools, methods and practices for designing AI for social good
CO4	Describe the Innovation and future AI
CO5	Illustrate Regulation and Governance of AI ethics in Healthcare domain.

Text Books	
1.	"Ethics, governance and Policies in Artificial Intelligence", Author-Editor : Luciano Floridi, Springer, 1st Edition 2021, vol 144, Oxford Internet Institute, University of ixford, UK, ISSN 0921-8599, e-ISSN 2542-8349 Philosophical Studies series, ISBN 978-3-030-81906-4 e-ISBN 978-3-030-81907-1, ://doi.orghttps/10.1007/978-3-030-81907-1, 2021.
2.	"Ethics and AI: Navigating the Moral Landscape of Digital Age", Author: Aaron Aboagye,

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 mark. 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					
PHP Programming **Category: AEC/SEC-III**					
Course Code	:	B24AI384	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 the PHP syntax, elements, and control structures
2.	To make use of PHP Functions and File handling
3.	To illustrate the concept of PHP arrays and OOPs
4.	Design and implement pattern matching and replacement functionality in PHP
5.	To Generate dynamic web pages using PHP

Sl. No	**List of Experiments**
1.	a. Develop a PHP program to calculate areas of Triangle and Rectangle. b. Develop a PHP program to calculate Compound Interest.
2.	Demonstrating the various forms to concatenate multiple strings Develop program(s) to demonstrate concatenation of strings: (i) Strings represented with literals (single quote or double quote) (ii) Strings as variables (iii) Multiple strings represented with literals (single quote or double quote) and variables (iv) Strings and string variables containing single quotes as part string contents (v) Strings containing HTML segments having elements with attributes
3.	a. Develop a PHP Program(s) to check given number is: (i) Odd or even (ii) Divisible by a given number (N) (iii) Square of a another number b. Develop a PHP Program to compute the roots of a quadratic equation by accepting the coefficients. Print the appropriate messages.
4.	a. Develop a PHP program to find the square root of a number by using the newton's algorithm. b. Develop a PHP program to generate Floyd's triangle.
5.	a. Develop a PHP application that reads a list of numbers and calculates mean and standard deviation. b. Develop a PHP application that reads scores between 0 and 100 (possibly including both 0 and 100) and creates a histogram array whose elements contain the number of scores between 0 and 9, 10 and 19, etc. The last "box" in the histogram should include scores between 90 and 100. Use a function to generate the histogram.
6.	a. Develop PHP program to demonstrate the date() with different parameter options. b. Develop a PHP program to generate the Fibonacci series using a recursive function.
7.	Develop a PHP program to accept the file and perform the following (i) Print the first N lines of a file (ii) Update/Add the content of a file

8.	Develop a PHP program to read the content of the file and print the frequency of occurrence of the word accepted by the user in the file
9.	Develop a PHP program to filter the elements of an array with key names. Sample Input Data: 1st array: ('c1' => 'Red', 'c2' => 'Green', 'c3' => 'White', c4 => 'Black') 2nd array: ('c2', 'c4') Output: Array ([c1] => Red [c3] => White)
10.	Develop a PHP program that illustrates the concept of classes and objects by reading and printing employee data, including Emp_Name, Emp _ID, Emp_Dept, Emp_Salary, and Emp_DOJ.
11.	a. Develop a PHP program to count the occurrences of Aadhaar numbers present in a text. b. Develop a PHP program to find the occurrences of a given pattern and replace them with a text.
12.	Develop a PHP program to read the contents of a HTML form and display the contents on a browser.

NOTE: Necessary HTML elements (and CSS) can be used for designing the experiments.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply basic concepts of PHP to develop web program
CO2	Develop programs in PHP involving control structures
CO3	Develop programs to handle structured data (object) and data items (array)
CO4	Develop programs to access and manipulate contents of files
CO5	Use super-global arrays and regular expressions to solve real world problems

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	-	-	-	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

IV - Semester Syllabus

SEMESTER-IV					
DISCRETE MATHEMATICS AND GRAPH THEORY **Category: ESC/ETC/PLC-IV** **(Common to CSE, CSD, ISE, AIML)**					
Course Code	:	B24CS401	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 Graphs	**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 edition, 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/122106025
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 carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

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

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

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

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

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

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

Text Books	
1.	Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 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 EditionTata 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 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-IV					
PRINCIPLES OF ARTIFICIAL INTELLIGENCE **Category: IPCC**					
Course Code	:	B24AI403	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.	Gain a historical perspective of AI and its foundations.
2.	Become familiar with basic principles of AI toward problem solving
3.	Understand and apply heuristic-based search algorithms and propositional logic for reasoning in knowledge-based intelligent agents.
4.	Get to know fundamentals of First Order Logic and enable them to perform logical inference using unification, forward and backward chaining, and resolution.
5.	To provide knowledge of reasoning under uncertainty using probabilistic methods and to introduce expert systems for representing and acquiring domain-specific knowledge

Module – 1: Introduction	**No. of Hours**
What is AI? Foundations and History of AI, **Intelligent Agents:** Agents and environment, Concept of Rationality, The nature of environment, The structure of agents**.** Text book 1: Chapter 1- 1.1, 1.2, 1.3 Chapter 2- 2.1, 2.2, 2.3, 2.4	9
Module – 2: Problem-solving	**No. of Hours**
problem-solving agents, Example problems, Searching for Solutions Uninformed Search Strategies: Breadth First search, Depth First Search, Iterative deepening depth first search; Text book 1: Chapter 3- 3.1, 3.2, 3.3, 3.4	9
Module – 3: Informed Search Strategies	**No. of Hours**
Heuristic functions, Greedy best first search, A*search. Heuristic Functions **Logical Agents**: Knowledge–based agents, The Wumpus world, Logic, Propositional logic, Reasoning patterns in Propositional Logic Text book 1: Chapter 3-3.5,3.6 Chapter 4 – 4.1, 4.2 Chapter 7- 7.1, 7.2, 7.3, 7.4, 7.5	9
Module – 4: First Order Logic	**No. of Hours**
Representation Revisited, Syntax and Semantics of First Order logic, Using First Order logic. **Inference in First Order Logic** : Propositional Versus First Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution Text book 1: Chapter 8- 8.1, 8.2, 8.3 Chapter 9- 9.1, 9.2, 9.3, 9.4, 9.5	9
Module – 5: Uncertain Knowledge and Reasoning: Quantifying Uncertainty	**No. of Hours**
Acting under Uncertainty, Basic Probability Notation, Inference using Full Joint Distributions, Independence, Baye's Rule and its use. Wumpus World Revisited **Expert Systems:** Representing and using domain knowledge, ES shells. Explanation, knowledge acquisition. Text Book 1: Chapter 13-13.1, 13.2, 13.3, 13.4, 13.5, 13.6 Text Book 2: Chapter 20	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply knowledge of agent architecture, searching and reasoning techniques for different applications.
CO2	Compare various Searching and Inferencing Techniques.
CO3	Develop knowledge base sentences using propositional logic and first order logic
CO4	Describe the concepts of quantifying uncertainty.
CO5	Use the concepts of Expert Systems to build applications

Text Books	
1.	Stuart J. Russell and Peter Norvig , Artificial Intelligence, 3rd Edition, Pearson,2015
2.	Elaine Rich, Kevin Knight, Artificial Intelligence, 3rd edition,Tata McGraw Hill,2013

Reference Text Books	
1.	George F Lugar, Artificial Intelligence Structure and strategies for complex, Pearson Education, 5th Edition, 2011
2.	Nils J. Nilsson, Principles of Artificial Intelligence, Elsevier, 1980
3.	Saroj Kaushik, Artificial Intelligence, Cengage learning, 2014

Web links and Video lectures (e-Resources)
1. https://www.kdnuggets.com/2019/11/10-free-must-read-books-ai.html
2 https://www.udacity.com/course/knowledge-based-ai-cognitive-systems--ud409
3. https://nptel.ac.in/courses/106/105/106105077/

LABORATORY

Practical Component of IPCC (12 Experiments)

Sl. No	Name of the experiment
1.	Implement and Demonstrate Depth First Search Algorithm on Water Jug Problem
2.	Implement and Demonstrate Best First Search Algorithm on Missionaries-Cannibals Problems using Python
3.	Implement A* Search algorithm
4.	Implement AO* Search algorithm
5.	Solve 8-Queens Problem with suitable assumptions
6.	Implementation of TSP using heuristic approach
7.	Implementation of the problem- solving strategies: either using Forward Chaining or Backward Chaining
8.	Implement resolution principle on FOPL related problems
9.	Implement Tic-Tac-Toe game using Python
10.	Build a bot which provides all the information related to text in search box
11.	Implement any Game and demonstrate the Game playing strategies

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	2	3	1	-	-	-	-	-	2	-	1
CO2	2	3	1	-	-	-	-	-	-	-	1
CO3	2	2	3	-	-	-	-	-	2	-	1
CO4	2	2	3	-	-	-	-	-	-	-	1
CO5	2	2	3	-	-	-	-	-	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: 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
6.	Study and Implementation of

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

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

SEMESTER-IV					
UNIX SYSTEM PROGRAMMING **Category: PCC**					
Course Code	:	B24AI461	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.	To help the students to understand 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.	To understand concepts of signals and handling logging and debug of errors in daemon process.

Module – 1: Introduction, Unix files	**No. of Hours**
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 doubledots (..) notations to represent present and parent directories and their usage in relative pathnames. 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, SharedLibraries, 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**
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 VIPC, Message Queues, Semaphores. **Shared Memory**, Client-Server Properties, Passing File Descriptors, An Open Server-Version1. Text Book2: Chapter 8, 15,17	9
Module – 5: Signals and Daemon Processes	**No. of Hours**
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 commands 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

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

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

SEMESTER-IV					
OPTIMIZATION TECHNIQUES **Category: ESC/ETC/PLC-IV** **(Common to CSE(IC), AIML)**					
Course Code	:	B24IC462	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.	The objective of this course is to make students to learn principles of optimization
2.	To implement the optimization Concepts for the structural engineering problems.
3.	To evaluate different methods of optimization.

Module – 1: Introduction to optimization	**No. of Hours**
Introduction to Classical Methods & Linear Programming Problems Terminology, Design Variables, Constraints, Objective Function, Problem Formulation. Calculus method, Kuhn Tucker conditions.	9
Module – 2: Linear Programming Problem	**No. of Hours**
Linear Programming Problem, Simplex method, Two-phase method, Big-M method, duality, Integer linear Programming, Dynamic Programming, Sensitivity analysis.	9
Module – 3: Single Variable Optimization Problems	**No. of Hours**
Optimality Criterion, Bracketing Methods, Region Elimination Methods, Interval Halving Method, Fibonacci Search Method, Golden Section Method. Gradient Based Methods: Newton-Raphson Method, Bisection Method.	9
Module – 4: Multivariable and Constrained Optimization Techniques	**No. of Hours**
Multi Variable and Constrained Optimization Technique, Optimality criteria , Direct search Method, Simplex search methods, Hooke-Jeeve‘s pattern search method, Powell‘s conjugate direction method, Gradient based method.	9
Module – 5: Intelligent Optimization Techniques	**No. of Hours**
Introduction to Intelligent Optimization, Genetic Algorithm: Types of reproduction operators, crossover & mutation, Simulated Annealing Algorithm, Particle Swarm Optimization (PSO), Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Comprehend the techniques and applications of Engineering optimization.
CO2	Analyze characteristics of a general linear programming problem
CO3	Apply basic concepts of mathematics to formulate an optimization problem
CO4	Analyse various methods of solving the unconstrained minimization problem
CO5	Analyze and appreciate variety of performance measures for various optimization problems

Text Books	
1	S. S. Rao, Engineering Optimisation: Theory and Practice , Wiley, 2008.
2	K. Deb, Optimization for Engineering design algorithms and Examples , Prentice Hall, 2nd edition 2012.

Reference Text Books	
1	C.J. Ray, Optimum Design of Mechanical Elements , Wiley, 2007.
2	R. Saravanan, Manufacturing Optimization through Intelligent Techniques , Taylor & Francis Publications, 2006.
3	D. E. Goldberg, Genetic algorithms in Search, Optimization, and Machine Learning , Addison-Wesley Longman Publishing, 1989.

Web links and Video lectures (e-Resources)
https://www.youtube.com/watch?v=wEdZLKMMZ8o&list=PLwdnzlV3ogoXKKb9nABDWYltTDgi37lYD
https://www.youtube.com/watch?v=GMTvoKRfxQw&list=PLGbjwqYC00hsy6XGalOBAphm2tdeLbgK0
https://www.youtube.com/watch?v=fszNBvdfKrY

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

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

SEMESTER-IV					
JAVA FOR MOBILE APPLICATIONS **Category: ESC/ETC/PLC-IV**					
Course Code	:	B24AI463	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 have an insight into enumerations and collection frameworks for storing and processing data.
2.	To understand the architecture and components of android application.
3.	To design interactive user interface.
4.	To work with SQLite database.
5.	To Understand Android user interface components and layouts, and to enable them to design interactive mobile applications.

Module – 1: Introduction	**No. of Hours**
Enumerations, Autoboxing and Annotations(metadata): Enumerations, Enumeration fundamentals, the values () and valueOf() Methods, java enumerations are class types, enumerations Inherits Enum, example, type wrappers, Autoboxing, Autoboxing and Methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of Warning. Annotations, Annotation basics, specifying retention policy, Obtaining Annotations at runtime by use of reflection, Annotated element Interface, Using Default values, Marker Annotations, Single Member annotations, Built-In annotations.	9
Module – 2: Problem-solving	**No. of Hours**
The collections and Framework: Collections Overview, Recent Changes to Collections, The Collection Interfaces, The Collection Classes, accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working with Maps, Comparators, The Collection Algorithms, Why Generic Collections? The legacy Classes and Interfaces, Parting Thoughts on Collections	9
Module – 3: Informed Search Strategies	**No. of Hours**
String Handling: The String Constructors, String Length, Special String Operations, String Literals, String Concatenation, String Concatenation with Other Data Types, String Conversion and toString( ) Character Extraction, charAt( ), getChars( ), getBytes( ) toCharArray(), String Comparison, equals( ) and equalsIgnoreCase( ), regionMatches( ) startsWith( ) and endsWith( ), equals( ) Versus ==, compareTo( ) Searching Strings, Modifying a String, substring( ), concat( ), replace( ), trim( ), Data Conversion Using valueOf( ), Changing the Case of Characters Within a String, Additional String Methods, StringBuffer, StringBuffer Constructors, length( ) and capacity( ), ensureCapacity( ), setLength( ), charAt( ) and setCharAt( ), getChars( ),append( ), insert( ), reverse( ), delete() and deleteCharAt( ), replace( ), substring( ), Additional StringBuffer Methods, StringBuilder **Text Book 1: Ch 15**	9
Module – 4	**No. of Hours**
Getting Started with Android Programming: What is Android? Features of Android, Android Architecture, obtaining the required tools, launching your first android application **Activities, Fragments and Intents:** Understanding activities, linking activities using intents, fragments. **Text Book 3: Ch 1, 3**	9
Module – 5	**No. of Hours**
Getting to know the Android User Interface: Views and ViewGroups, FrameLayout, LinearLayout, TableLayout, RelativeLayout, ScrollView **Designing User Interface with Views:** TextView view – Button, ImageButton, EditText, Checkbox, ToggleButton, RadioButton and RadioGroupViews. **Creating and using Databases:** Creating the DBAdapter Helper class, using the database programmatically. **Text Book 3: Ch 4.1, 5.1, 7.3**	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Interpret the need for advanced Java concepts like enumerations and collections in developing modular and efficient programs
CO2	Understand various application components in android.
CO3	Design efficient user interface using different layouts.
CO4	Develop application with persistent data storage using SQLite
CO5	Design responsive user interfaces using various Android views and layouts, and implement database operations using SQLite through DBAdapter.

Text Books	
1.	Herbert Schildt: JAVA the Complete Reference, 7th /9th Edition, Tata McGraw Hill, 2007.
2.	Jim Keogh: J2EE-TheCompleteReference, McGraw Hill, 2007
3.	J. F. DiMarzio, Beginning Android Programming with Android Studio, 4th Edition, 2017

Reference Text Books	
1.	John Horton,Android Programming for Beginners, 1st Edition, 2015
2.	Dawn Griffiths & David Griffiths, Head First Android Development, O'Reilly, 1st Edition, 2015

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 carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

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

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

SEMESTER-IV					
ALGORITHMIC GAME THEORY **Category: ESC/ETC/PLC-IV**					
Course Code	:	B24AI464	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.	Comprehend the basics of strategic gaming and mixed strategic equilibrium.
2.	Enable students to develop skills on extensive gaming strategies.
3.	Analyze and discuss various gaming models.
4.	Illustrate some real-time situations
5.	To provide a conceptual and analytical understanding of strictly competitive games.

Module – 1: Introduction	**No. of Hours**
Introduction to Strategic Games: What is game theory? The theory of rational choice, Strategic games; Examples: The prisoner's dilemma, Bach or Stravinsky, Matching pennies; Nash equilibrium; Examples of Nash equilibrium; Best response functions; Dominated actions. **(RBT Levels: L1, L2 and L3)**	9
Module – 2: Problem-solving	**No. of Hours**
Introduction; Strategic games in which players may randomize; Mixed strategy Nash equilibrium; Dominated actions; Pure equilibrium when randomization is allowed. Illustration: Expert Diagnosis; Equilibrium in a single population. **(RBT Levels: L1, L2 and L3)**	9
Module – 3: Informed Search Strategies	**No. of Hours**
Extensive games with perfect information; Strategies and outcomes; Nash equilibrium; Subgame perfect equilibrium; Finding sub-game perfect equilibria of finite horizon games: Backward induction; Illustrations: The ultimatum game, Stackelberg's model of duopoly. **(RBT Levels: L1, L2 and L3)**	9
Module – 4	**No. of Hours**
Bayesian Games**,** Motivational examples; General definitions; Two examples concerning Information; Illustrations: Cournot's duopoly game with imperfect information, Providing a public good; Auctions: Auctions with an arbitrary distribution of valuations. **(RBT Levels: L1, L2 and L3)**	9
Module – 5	**No. of Hours**
Competative Games: Strictly competitive games and maximization. **Repeated games:** The main idea; Preferences; Repeated games; Finitely and infinitely repeated Prisoner's dilemma; Strategies in an infinitely repeated Prisoner's dilemma; Nash equilibrium of an infinitely repeated Prisoner's dilemma, Nash equilibrium payoffs of an infinitely repeated Prisoner's dilemma. **(RBT Levels: L1, L2 and L3)**	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Interpret the basics of strategic gaming and extensive games.
CO2	Analyze gaming strategies on real-time incidence.
CO3	Develop the models of gaming on real-time incidence
CO4	Apply game theory in the real world problems
CO5	Analyze strategies and outcomes in competitive and repeated games

Text Books	
1.	Martin Osborne: "An Introduction to Game Theory", Oxford University Press, First Indian Edition, 2009, 7th Edition, ISBN – 0195128958.

Reference Text Books	
1.	**Roger B. Myerson: "Analysis of Conflict Game Theory",** Re-print Edition, Harvard University Press, 2008, ISBN – 978-0674341166.
2.	**Frederick S. Hillier and Gerald J. Lieberman: "Introduction to Operations Research, Concepts and Cases",** 9th Edition; Tata McGraw Hill, 2010, ISBN – 0073376299.
3.	**Joel Watson: "An Introduction to Game Theory"** Strategy, 2nd Edition, W.W. Norton & Company, 2007, ISBN – 9780393929348.John Horton, Android Programming for Beginners, 1st Edition, 2015

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 carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	3	1	-	-	-	-	-	2	-	1
CO2	2	3	1	-	-	-	-	-	-	-	1
CO3	2	2	3	-	-	-	-	-	2	-	1
CO4	2	2	3	-	-	-	-	-	-	-	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 by building and automating test cases using Maven & Gradle.
CO3	Experiment with configuration management using Ansible.
CO4	Demonstrate Cloud-based DevOps tools using Azure DevOps.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) 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					
MONGODB					
Category: AEC/SEC-IV					
Course Code	:	B24AI483	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.	Understand basic MongoDB functions, operators and types of operations in MongoDB
2.	Demonstrate the use of Indexing, Advanced Indexing in MongoDB.
3.	Apply the aggregation and Map Reduction in MongoDB.
4.	Demonstrate text searching on collections in MongoDB
5.	The students will be able to understand the working, Mongodb, its features.

Sl. No	**Experiments**
1.	a. Illustration of Where Clause, AND, OR operations in MongoDB. b. Execute the Commands of MongoDB and operations in MongoDB: Insert, Query, Update, Delete and Projection. (Note: use any collection) [Refer: Book 1 chapter 4].
2.	a. Develop a MongoDB query to select certain fields and ignore some fields of the documents from any collection. b. Develop a MongoDB query to display the first 5 documents from the results obtained in a. [use of limit and find] [Refe: Book1 Chapter 4, book 2: chapter 5]
3.	a. Execute query selectors (comparison selectors, logical selectors) and list out the results on any collection b. Execute query selectors (Geospatial selectors, Bitwise selectors) and list out the results on any collection [Refer: Book 3 Chapter 13]
4.	Create and demonstrate how projection operators ($, $elematch and $slice) would be used in the MondoDB. [Refer: Book 3 Chapter 14]
5.	Execute Aggregation operations ($avg, $min,$max, $push, $addToSet etc.). students encourage to execute several queries to demonstrate various aggregation operators) [Refer: Book 3 Chapter 15]
6.	Execute Aggregation Pipeline and its operations (pipeline must contain $match, $group, $sort, $project, $skip etc. students encourage to execute several queries to demonstrate various aggregation operators)
7.	a. Find all listings with listing_url, name, address, host_picture_url in the listings And Reviews collection that have a host with a picture url b. Using E-commerce collection write a query to display reviews summary.
8.	a. Demonstrate creation of different types of indexes on collection (unique, sparse, compound and multikey indexes) b. Demonstrate optimization of queries using indexes.
9.	a. Develop a query to demonstrate Text search using catalog data collection for a given word b. Develop queries to illustrate excluding documents with certain words and phrases

10.	Develop an aggregation pipeline to illustrate Text search on Catalog data collection.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Make use of MongoDB commands and queries.
CO2	Illustrate the role of aggregate pipelines to extract data.
CO3	Demonstrate optimization of queries by creating indexes.
CO4	Develop aggregate pipelines for text search in collections
CO5	Knowledge of students will get hands- on experience in working with Mongodb

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-IV MERN Category: AEC/SEC-IV					
Course Code	:	B24AI484	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.	Understand and apply critical web development languages and tools to create dynamic and responsive web applications.
2.	To build server-side applications using Node.js and Express
3.	Develop user interfaces with React.js,
4.	Manage data using MongoDB, and integrate these technologies to create full stack apps
5.	Understanding APIs and routing.

Sl. No	Suggested Experiments
1.	Using MongoDB, create a collection called transactions in database usermanaged (drop if it already exists) and bulk load the data from a json file, transactions.json b.Upsert the record from the new file called transactions_upsert.json in Mongodb
2.	Query MongoDB with Conditions: [Create appropriate collection with necessary documents to answer the query] a. Find any record where Name is Somu b. Find any record where total payment amount (Payment.Total) is 600. c. Find any record where price (Transaction.price) is between 300 to 500. d. Calculate the total transaction amount by adding up Payment.Total in all records.
3.	a. Write a program to check request header for cookies. b. write node.js program to print the a car object properties, delete the second property and get length of the object.
4.	a. Read the data of a student containing usn, name, sem, year_of_admission from node js and store it in the mongodb b. For a partial name given in node js, search all the names from mongodb student documents created in Question(a)
5.	Implement all CRUD operations on a File System using Node JS
6.	Develop the application that sends fruit name and price data from client side to Node.js server using Ajax
7.	Develop an authentication mechanism with email_id and password using HTML and Express JS (POST method)
8.	Develop two routes: find_prime_100 and find_cube_100 which prints prime numbers less than 100 and cubes less than 100 using Express JS routing mechanism
9.	Develop a React code to build a simple search filter functionality to display a filtered list based on the search query entered by the user.
10.	Develop a React code to collect data from rest API.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply the fundamentals of MongoDB, such as data modelling, CRUD operations, and basic queries to solve given problem.
CO2	Use constructs of Express.js, including routing, software and constructing RESTful APIs to solve real world problems.
CO3	Develop scalable and efficient RESTful APIs using NodeJS.
CO4	Develop applications using React, including components, state, props, and JSX syntax.
CO5	Knowledge of MERN stack is designed for building scalable and high-performance applications.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

Component	Scale down to	Total Marks
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Internal Lab Test 2 (After 6 experiments) Exam conduction for 50 marks	15	15
	CIE	**50**

SEMESTER END EXAMINATION (SEE)

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