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

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

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

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

Text Books	
1.	Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd 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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CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

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

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

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

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

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

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

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

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

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

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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

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

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY COMPONENT OF IC:

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

CIE FOR THE PRACTICAL COMPONENT OF IC:

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

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

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

SEMESTER END EXAMINATION (SEE)

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

LABORATORY

Practical Component of IPCC (10 Experiments)

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

CO-PO Mapping

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

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

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

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

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

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

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

Reference Text Books	
1.	Andrew S. Tanenbaum – " Modern Operating Systems, 4th Edition, Pearson, 2015".
2.	Dhananjay M.Dhamdhere –**"**Operating Systems: A Concept-Based Approach, 3rd Edition, McGraw-Hill, 2017".
3.	Gary Nutt – "Operating Systems, 3rdEdition, 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.

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

SEMESTER END EXAMINATION (SEE)

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7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

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

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

SEMESTER-III					
DATA 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	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 ISE,AIML)**					
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.	**Name of the Experiment**
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, , 4th 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 1-High, Level 2-Moderate, Level 3-Low

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

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

Module – 1: Introduction to Data Science	**No. of Hours**
What is Data Science?, Evolution and Applications of Data Science, Data Science vs. Business Intelligence vs. Machine Learning, Role of a Data Scientist, Data Science Lifecycle, Ethical Issues and Challenges in Data Science.	9
Module – 2: Data Handling & Preprocessing	**No. of Hours**
Types of Data: Structured, Unstructured, and Semi-structured, Data Collection Techniques (APIs, Web Scraping, Databases), Data Cleaning: Handling Missing Values, Outliers, and Data Imputation, Data Transformation: Normalization, Standardization, and Feature Engineering, Exploratory Data Analysis (EDA) and Data Visualization	9
Module – 3: Probability & Statistics for Data Science	**No. of Hours**
Descriptive Statistics: Mean, Median, Mode, Variance, Standard Deviation, Probability Theory: Probability Distributions (Normal, Binomial, Poisson), Inferential Statistics: Hypothesis Testing, Confidence Intervals, Correlation and Regression Analysis, Central Limit Theorem and Law of Large Numbers.	9
Module – 4: Introduction to Machine Learning	**No. of Hours**
Basics of Machine Learning (ML), Supervised Learning vs. Unsupervised Learning, Regression Techniques (Linear Regression, Logistic Regression), Classification Methods (Decision Trees, Naïve Bayes, k-NN), Clustering Techniques (K-Means, Hierarchical Clustering), Model Evaluation Metrics: Accuracy, Precision, Recall, F1-score.	9
Module – 5: Tools for Data Science & Case Studies	**No. of Hours**
Python for Data Science: Numpy, Pandas, Matplotlib, Scikit-learn, R for Data Science Basics, SQL for Data Querying, Introduction to Big Data and Cloud Platforms (Hadoop, Spark, AWS, Google Cloud), Case Studies: Applications in Healthcare, Finance, Marketing, and Social Media Analytics	9

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

CO1	Understand the fundamental principles and lifecycle of Data Science.
CO2	Analyze datasets using various preprocessing, transformation, and visualization techniques.
CO3	Apply probability and statistical concepts to perform data-driven decision-making.
CO4	Implement basic machine learning algorithms for classification, regression, and clustering.
CO5	Utilize programming tools such as Python, R, and SQL to perform data analysis.

Textbooks	
1.	Joel Grus – **"** *Data Science from Scratch*, 2nd Edition, O'Reilly, 2019".
2.	Jake VanderPlas - **"***Python Data Science Handbook*, O'Reilly, 2016".

Reference Textbooks	
1.	Hadley Wickham – "*R for Data Science*, O'Reilly, 2016"

2.	Trevor Hastie – **"***The Elements of Statistical Learning*, Springer, 2017".
3.	Aurélien Géron – **"***Hands-On Machine Learning with Scikit-Learn, Keras, and Tensor Flow*, 2nd Edition, O'Reilly, 2019".

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

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

SEMESTER END EXAMINATION (SEE)

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

CO-PO Mapping

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

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

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

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

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

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

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

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

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

SEMESTER END EXAMINATION (SEE)

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

CO-PO Mapping

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

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

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

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

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

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

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

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

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

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

SEMESTER END EXAMINATION (SEE)

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

CO-PO Mapping

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

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

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/SEC-III**					
Course Code	:	B24IS382	CIE	:	50 Marks
Teaching Hours L : T : P	:	1:0:0	SEE	:	50 Marks
Total Hours	:	15(T)	Total	:	100 Marks
Credits	:	1	SEE Duration	:	1 Hr

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

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

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

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

ASSESSMENT DETAILS (BOTH CIE AND SEE)

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

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

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

SEMESTER END EXAMINATION (SEE)

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

CO-PO Mapping

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

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

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

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

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

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

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) 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
CO5	2	2	2	2	3	-	-	-	2	2	2

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

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

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

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

	b) Plot the data using the plot command. Plot the logarithm (log) of each variable and see if that makes a difference
7.	Develop R program to create a Data Frame with following details and do the following operations. **Item Code** — **Item Category** — **Item Price** 1001 — Electronics — 700 1002 — Desktop Supplies — 300 1003 — Office Supplies — 350 1004 — USB — 400 1005 — CD Drive — 800 a) Subset the Data frame and display the details of only those items whose price are greater than or equal to 350. b) Subset the Data frame and display only the items where the category is either "Office Supplies" or "Desktop Supplies" c) Create another Data Frame called "item-details" with three different fields item Code, Item Qty on Hand and Item Reorder Lvl and merge the two frames
8.	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
9.	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"
10.	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 Develop R program, to solve the following: a) What is the total number of observations and variables in the dataset? b) Find the car with the largest hp and the least hp using suitable functions c) Plot histogram / density for each variable and determine whether continuous variables are normally distributed or not. If not, what is their skewness? d) What is the average difference of gross horse power(hp) between automobiles with 3 and 4 number of cylinders(cyl)? Also determine the difference in their standard deviations. e) Which pair of variables has the highest Pearson correlation?
11.	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.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain the fundamental syntax of R data types, expressions and the usage of the R-Studio IDE
CO2	Develop a program in R with programming constructs: conditionals, looping and functions.
CO3	Apply the list and data frame structure of the R programming language.
CO4	Use visualization packages and file handlers for data analysis.
CO5	Analyze real-time datasets using statistical models and correlation techniques, and visualize results using plots.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) 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.

IV - Semester Syllabus

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

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

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

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

Text Books	
1.	Ralph P. Grimaldi: "Discrete and Combinatorial Mathematics", 5th Edition, Pearson Education. 2004.
2.	West, Introduction to Graph Theory, 2nd 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/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	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 constratints as assertions and action Triggers.	9
Module – 4: Relational & Normalization	**No. of Hours**
Database Design: Pitfalls in Relational-Database designs, Concept of normalization, Function Dependencies, Normal Forms- 1NF, 2NF, 3NF, multivalued dependency and 4NF, Join dependencies and 5NF, BCNF	9
Module – 5: Transaction Management and Recovery	**No. of Hours**
Transaction Concept, ACID properties, Transaction States, Implementation of atomicity and durability, Concurrent Executions, Serializability, Concurrency Control Protocols: Lock-based, Timestamp based, Validation Based, Deadlock Handling, Recovery System: Failure classification, Log based recovery, Shadow Paging, ARIES recovery algorithm.	9

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

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

Reference Text Books	
1.	Abraham Silberschatz, Henry F. Korth and S. Sudarshan's Database System Concepts 6th 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 it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

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

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

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

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

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

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

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

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

LABORATORY

Practical Component of IPCC (12 Experiments

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

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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

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

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY COMPONENT OF IC:

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

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

CIE FOR THE PRACTICAL COMPONENT OF IC:

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

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

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

SEMESTER END EXAMINATION (SEE)

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

CO-PO Mapping

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

Level 3 - High, Level 2 - Moderate, Level 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 probem 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, CSD, CSE(IC), AIML, ISE)**					
Course Code	:	B24CS405L	CIE	:	50 Marks
Teaching Hours L : T : P	:	0 : 0 : 2	SEE	:	50 Marks
Total hours	:	15(P)	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

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

Sl. No	**List of Experiments**
	PART-A
1.	Implementation of DDL commands of SQL with suitable examples • 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	1
CO2	3	3	3	3	2	-	-	-	-	1	1
CO3	3	3	3	3	2	-	-	-	-	1	1
CO4	3	3	3	3	2	-	-	-	-	1	1
CO5	3	3	3	3	2	-	-	-	-	1	1

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

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

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

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

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

Textbooks	
1.	**William Stallings** – *Cryptography and Network Security: Principles and Practice*
2.	**Chuck Easttom** – *Computer Security Fundamentals*

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

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

SEMESTER END EXAMINATION (SEE)

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

CO-PO Mapping

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

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

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

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

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

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

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

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

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

SEMESTER END EXAMINATION (SEE)

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

CO-PO Mapping

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

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

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

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

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

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

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

Web links and Video lectures (e-Resources)
1.https://www.youtube.com/watch?v=w0cD26CLBA0
2. https://www.youtube.com/watch?v=5-hhfBXykec
3. https://www.youtube.com/watch?v=9e4IohiFmZ8&t=63s
4. https://www.youtube.com/watch?v=qj4ziswxupE
5. https://www.youtube.com/watch?v=jTW79ofC6Go
6. https://www.youtube.com/watch?v=_pPlanX5wQY

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

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

SEMESTER END EXAMINATION (SEE)

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

CO-PO Mapping

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

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

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

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

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

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

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

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

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

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

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4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

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

CO-PO Mapping

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

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

SEMESTER-IV					
MICROSOFT POWER BI **Category: AEC/SEC-IV** **(Common to CSE, ISE, CSD, AIML, CSE(IC))**					
Course Code	:	B24 IS481	CIE	:	50 Marks
Teaching Hours L : T : P	:	1:0:0	SEE	:	50 Marks
Total Hours	:	15(T)	Total	:	100 Marks
Credits	:	1	SEE Duration	:	1 Hrs

Course Objectives	
1.	Understand the Core Concepts and Architecture of Power BI
2.	Import, Transform, and Model Data Effectively
3.	Design and Develop Interactive Reports and Dashboards
4.	Implement Advanced Data Analysis Using DAX
5.	Publish, Share, and Collaborate on Power BI Reports

Module – 1: Introduction to Business Intelligence and Power BI	**No. of Hours**
Overview of Business Intelligence (BI) , Introduction to Microsoft Power BI , Power BI Desktop vs. Power BI Service vs. Power BI Mobile , Installing and navigating Power BI Desktop, Power BI Ecosystem Overview, Use Cases of Power BI in Different Industries, Power BI File Types and Formats, Navigating the Power BI Desktop Interface, Power BI Community and Support Resources	3
Module – 2 : Data Loading and Transformation (Power Query)	**No. of Hours**
Connecting to various data sources (Excel, SQL Server, Web, CSV, etc.) Using Power Query Editor for data transformation Cleaning, shaping, and filtering data Merging and appending queries Creating custom columns Data types and handling missing values, Connecting to Diverse Data Sources, Data Transformation Techniques, Parameterization and Function Creation, Data Type Handling and Locale Settings	3
Module – 3: Data Preparation with Power Query	**No. of Hours**
Introduction to Power Query Editor, Basic data cleaning and transformation Removing nulls and duplicates, Changing data types, Filtering rows and columns, Creating simple calculated columns Data Profiling and Diagnostics, Text Data Preparation, Numerical Data Preparation, Date and Time Handling, Conditional Column Creation	3
Module – 4: Data Visualization and Report Building	**No. of Hours**
Overview of visualization types (bar charts, line charts, maps, gauges, etc.), Formatting and customizing visualizations, Adding slicers, filters, and drill-throughs Creating and organizing multiple report pages Using themes and templates for consistency Understanding Visual Types and Use-Cases Interactivity and Navigation, Accessibility and UX Design Principles	3
Module – 5: Power BI Integration and Advanced Features	**No. of Hours**
Power BI with Excel (PivotTables, Power Pivot), Using Power BI with SharePoint and Teams, Power BI with Power Automate and Power Apps (basic overview), Embedding Power BI reports in websites and portals	3

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the architecture, components, and functionalities of the Power BI ecosystem including Desktop, Service, and Mobile platforms.
CO2	Demonstrate the ability to connect to various data sources and perform data transformation using Power Query for clean and structured datasets.
CO3	Develop data models with relationships, calculated columns, and DAX measures to support accurate and efficient data analysis.
CO4	Create interactive and visually appealing reports and dashboards using a variety of visualization tools and techniques in Power BI.
CO5	Publish and share reports through the Power BI Service, enabling collaboration, scheduled data refresh, and secure data distribution.

Text Books	
1.	**Data Visualization with Microsoft Power BI Authors:** Alex Kolokolov& Maxim Zelensky, **Publisher:** O'Reilly Media, **Release:** September 2024
2.	Microsoft Power BI Cookbook – Third Edition, **Authors:** Greg Deckler& Brett Powell, **Publisher:** Packt Publishing, **Release:** July 2024

Reference Text Books	
1.	Expert Data Modeling with Power BI – Second Edition , **Authors:** SoheilBakhshi& Christian Wade **Publisher:** Packt Publishing, **Release:** April 2023
2.	Microsoft Power BI Performance Best Practices – 2nd Edition, **Authors:** Thomas LeBlanc &Bhavik Merchant **Publisher:** Packt Publishing **Release:** August 2024
3.	Microsoft Power BI: The Complete Masterclass – 2025 Edition by Nikolai Schuler

Web links and Video lectures (e-Resources)
1. https://learn.microsoft.com/en-us/training/powerplatform/power-bi
2. https://www.youtube.com/watch?v=e6QD8lP-m6E
3. https://www.youtube.com/watch?v=e6QD8lP-m6E

ASSESSMENT DETAILS (BOTH CIE AND SEE)

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

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

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

SEMESTER END EXAMINATION (SEE)

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

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

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

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

Course Outcomes: At the end of the course, the students will be able to	
CO1	Get the bigger picture of the context of Multimedia and its applications
CO2	Use the different types of media elements of different formats on content pages
CO3	Author 2D and 3D creative and interactive presentations for different target multimedia applications.
CO4	Use different standard animation techniques for 2D, 21/2 D, 3D applications
CO5	Understand the complexity of multimedia applications in the context of cloud, security,bigdata streaming, social networking, CBIR etc.,
Text Books	
1.	Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, Fundamentals of Multimedia", Third Edition,Springer Texts in Computer Science, 2021. (UNIT-I, II, III)
Reference Text Books	
1.	John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation,CRC press, 3rd Edition, 2016.
2.	Gerald Friedland, Ramesh Jain, "Multimedia Computing", Cambridge University Press,2018.
3.	Prabhat K.Andleigh, Kiran Thakrar, "Multimedia System Design", PearsonEducation, 1st Edition, 2015.

ASSESSMENT DETAILS (BOTH CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

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

SEMESTER END EXAMINATION (SEE)

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

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

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

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

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

ASSESSMENT DETAILS (BOTH CIE AND SEE)

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

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks (Multiple Choice Questions), after the completion of the syllabus 40%, 70% and 80% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

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