

Dr. Ambedkar Institute of Technology, Bengaluru-560056
SCHOOL OF COMPUTER SCIENCE & ENGINEERING
B.E. Name of the Programmes: CSE/ISE/CSBS/AIIML/CSE(DS)
Scheme of Teaching and Examination effective from the Academic Year 2025 - 26

III SEMESTER

Outcome-Based Education (OBE) and Choice-Based Credit System (CBCS) (Effective from the academic year 2026-27)

Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching & Learning Scheme					Examination				Credits	
					CI		LI	TW & SL	# TH/mon /s	Durat TH in hours	CIE Marks	SE Marks	Total Marks		
					L	T	P	SL							
1	ASC	1BMAT301B	Probability and Statistical Inference	TD: Mathematics PSB: Mathematics	42	28	0	50	120	3	50	50	50	100	4
2	IPCC	1BSCSU302	Digital Design and Computer Organization	TD: SCS PSB: CSE	42	0	28	50	120	3	50	50	50	100	4
3	PCC	1BSCST303	Data Structures and Applications	TD: SCS PSB: CSE	42	28	0	50	120	3	50	50	50	100	4
4	PCC	1BSCST304	Operating Systems	TD: SCS PSB: CSE	42	0	0	48	90	3	50	50	50	100	3
5	PCC	1BSCST305	Java Programming	TD: SCS PSB: CSE	42	0	0	48	90	3	50	50	50	100	3
6	PCCL	1BSCSL306	Data Structures Laboratory	TD: SCS PSB: CSE	0	0	28	02	30	2	50	50	50	100	3
7	AEC	1BSCSL307A	Ability Enhancement Course/Skill Enhancement Course-III Project Management (with Git)	TD: SCS/CS Allied branches PSB: SCS/CS Allied branches	0	0	28	02	30	2	50	50	50	100	1
8	SDC	1BSCSP308	Community Project (Project-Based Learning) / Societal Project	Respective Engineering Dept.	0	0	0	30	30	2	50	50	50	100	1
9	MC	1BCDN309	Apptitude and Verbal Ability Skills	Placement Cell	2	0	0	0	--	--	50	--	--	50	PP/NP
10	NCMC	1BNSN310	National Service Scheme (NSS)	Campus NSS coordinator Physical Education Director Yoga Teacher Music Teacher											
		1BPEN310	Physical Education (PE) (Sports and Athletics)		0	0	0	28	28	--	100	---	100	PP	
		1BYON310	Yoga												
		1BMUN310	Music												
Total									658		550	400	950	21	

2025

11	NCMC	1BMATDIP311	Mathematics course for Lateral Entry Students	TD - Maths Dept.	14	0	0	14	28	3	100	---	100	PP
Total									686		650	400	1050	21

TH/S- Total Hours per Semester, TW & SL- Term Work & Self Learning

Ability Enhancement Course (Laboratory) 1BxxL307x														
CSE/ISE/CSE(DS) Programmes														
1BSCSL307A					CSBS Programme									
Project Management (with Git) (SCS/CS Allied branches)														
1BSCSL307A					AIML Programme									
Project Management (with Git) (SCS/CS Allied branches)														
1BSCSL307A					Exploratory Data Analysis									
Project Management (with Git) (SCS/CS Allied branches)														

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HEAD of School (HOS)
School of Computer Science and Engineering
Dr. Ambedkar Institute of Technology
 Bangalore-560 056

Dr. Ambedkar Institute of Technology, Bengaluru-560056 SCHOOL OF COMPUTER SCIENCE & ENGINEERING B.E. Name of the Programmes: CSE/ISE/CSBS/AIIML/CSE(DS) Scheme of Teaching and Examination effective from the Academic Year 2025 – 26 Outcome-Based Education (OBE) and Choice-Based Credit System (CBCS) (Effective from the academic year 2026-27)	IV SEMESTER
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					Total						658	550	400	950	21
10	NCMC	1BMATDIP411	Mathematics course for Lateral Entry Students	TD -Maths Dept	14	0	0	14	28	--	100	--	100	PP	
					Total						686	650	400	1050	21
Ability Enhancement Course (Laboratory) 1BxxL406x															
CSE/ISE/CSBS/CSE(DS) Programmes															
1BSCSL406A	Web Application Development and User Experience Design				1BSCSL406B	Human Computer Interaction									
AIML Programme															
1BAIL406A	R Programming				1BAIL406B	MERN									
# TH/S- Total Hours per Semester, TW & SL- Term Work & Self Learning, ** The course 1BXXL406x – Ability Enhancement Course Laboratory can be offered either as a single compulsory course. Alternatively, the Ability Enhancement Course Laboratory course can be offered with multiple elective options under the course codes 1BXXL406x (where x = A, B, C, D).															

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Dr. Ambedkar Institute of Technology
School of Computer Science and Engineering
CSE/ISE/CSBS/AIML/CSE(DS) Programmes

Semester: III

Scheme: 2025

Course Title	Course Code	Course Category	Teaching - Learning				Scheme & Credit		CIE Marks: 50
Probability and Statistical Inference	IBMAT301B	ASC (Applied Science Course)	L	T	P	Total	Credits	Lecture: 42 + Tutorials: 28 + Practical: 0 + Self Study: 50 = 120	Duration of SEE: 03 Hours
			3	2	0	4			
			SEE Marks: 50	Total Max. Marks: 100					

Course Learning Objectives:

This course is proposed to impart to the students the skills to identify and solve real life problems in their field of study involving the application of the concepts of probability, statistical inferences and ANOVA testing.

SYLLABUS		No. of Hours	BTLs
UNIT 1		15	L1-L4
Probability Distributions: Random Variables, moment generating function, expectations. Discrete probability distributions - Binomial, Poisson and Geometric distributions, Continuous probability distributions-Exponential and Normal distributions.			
SELF-STUDY COMPONENT		10 Hours	
Gamma and Weibull distributions. Transmission errors in noise media.			
UNIT 2		15	L1-L4
Two-dimensional Random variables: Joint probability mass function, marginal probability function, covariance and correlation coefficient.			
Random Process: Classification of random process, description of random process, stationary random process - first order and wide sense stationary processes, Autocorrelation function.			
SELF-STUDY COMPONENT		10 Hours	
Joint density function, marginal and conditional probability density function. Cross-correlation function.			
UNIT 3		15	L1-L4
Statistical Inference: Sampling distribution, standard errors, level of significance, confidence limits, testing of hypothesis- test of significance for large samples, testing of mean and proportion of single population and difference of means and proportions, students t-distribution.			
SELF-STUDY COMPONENT		10 Hours	
F-distribution, Chi-square distribution - goodness of fit.			
UNIT 4		15	L1-L4
Markov Chain: Introduction to stochastic process, probability vectors, stochastic matrices, Markov chains, higher transition probabilities, stationary distribution of regular Markov chains and absorbing states.			
SELF-STUDY COMPONENT		10 Hours	



Scheme: 2025

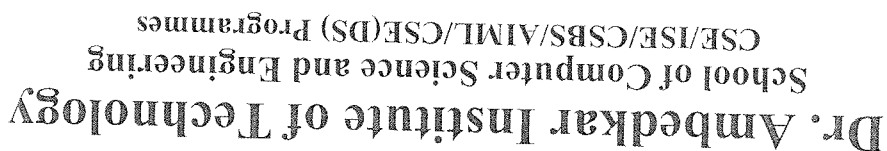
Semester: IV

Regular stochastic matrices. Model the behavior of stock prices.		
UNIT 5		
10	11-14	
Design of Experiments and ANOVA: 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.		
SELF-STUDY COMPONENT		10 Hours
Latin-square design. To test effectiveness of different marketing strategies.		

TEXT BOOKS:	
1	B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers
2	Kishore S. Trivedi, Probability and Statistics with Reliability, Queuing and Computer Science Applications, Wiley India publication.
3	V. Sundarapandian, Probability, Statistics and Queuing theory, PHI Learning.
4	G. Hari Baskaran, Probability Queuing Theory and Reliability Engineering, Lakshmi publications.
5	Peter Bruce, Andrew Bruce and Peter Gedeck, Practical Statistics for Data Scientists, O'REILLY.

REFERENCE BOOKS:	
1	B. V. Ramana, Higher Engineering Mathematics, McGraw-Hill Education.
2	Srimanta Pal & Subodh C. Bhunia, Engineering Mathematics, Oxford University Press.
3	C. Ray Wylie, Louis C. Barrett, Advanced Engineering Mathematics, McGraw Hill Book Co., New York.
4	H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand Publication
e-LEARNING RESOURCES:	
1	https://nptel.ac.in/courses/111106051
2	https://nptel.ac.in/courses/106106179
3	VTU e-Shiksha Program
4	https://nptel.ac.in/courses/1111106102

Assessment Details for both CIE and SEE	
The weightage assigned to the Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) is 50% each.	
To pass the course, students must secure a minimum of 40% marks separately in both CIE and SEE.	
Continuous Internal Evaluation (CIE)	
The CIE consists of three components:	
1. CIE – Theory Component	
2. Assignment	
3. Group Activity	
Students must secure a minimum of 40% marks in the combined total of the CIE Theory, Assignment, and Group Activity components to qualify for appearing in the SEE.	
Semester End Examination (SEE)	



Scheme: 2025

The Theory SEE is conducted for 100 marks with a duration of 3 hours. The marks obtained are subsequently scaled down to 50 marks for calculating the final course grade. The student must secure a minimum of 40% marks in the SEE to pass the course. **Self-Study Component should be included for CIE.		CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks Required in SEE (40% individually)
Theory	Weightage of CIE-1 and CIE-2 or CIE-3	40	05	05	20
	Assignment		05		
	Group Activity		05		
	TOTAL	50			

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Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Identify and solve problems involving random variables, probability distributions and its applications.
CO2	Analyze random processes and understand two dimensional random variables.
CO3	Understand the concept of statistical inferences and the basics of hypothesis testing with emphasis on some commonly encountered problems.
CO4	Apply the knowledge of stochastic processes and Markov chain in Mathematical modeling.
CO5	Examine the principles of experimentation in design and understand the different ANOVA techniques.

Mapping of CO's, PO's with PSO's						
Strength of correlation:						
	Strongly related-3,	Moderately related-2,	Weakly related-1,	Not related-0		
CO	PO1	PO2	PO3	PO4	PO5	PO6
PO1	-	-	-	-	-	-
PO2	1	-	-	-	-	-
PO3	2	-	-	-	-	-
PO4						
PO5						
PO6						
PSO1						
PSO2						
PSO3						



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Semester: IV

Scheme: 2025

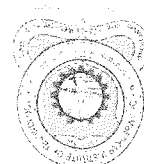
CO2	3	2	-	-	-	-	-	-	-	-	-	-	2	2
CO3	2	3	-	-	-	-	-	-	-	-	-	-	2	2
CO4	3	2	-	-	-	-	-	-	-	-	-	-	2	2
CO5	2	3	-	-	-	-	-	-	-	-	-	-	2	2

Mapping of COs with Knowledge and Attitude Profile (WK)														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	CO1	CO2	CO3	CO4	CO5
	3	3	2	-	-	-	-	-	-	3	3	3	3	3
	3	3	2	-	-	-	-	-	-	2	2	2	2	2
	3	3	2	-	-	-	-	-	-	2	2	2	2	2
	3	3	2	-	-	-	-	-	-	2	2	2	2	2
	3	3	2	-	-	-	-	-	-	2	2	2	2	2

Course Coordinators:

	Dr. Divya Darshini S, Assistant Professor Mathematics
	Dr. Latha D N, Assistant Professor Mathematics

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Course Title	Digital Design and Computer Organization				
Course Code	IBSCSU302				
Course Category	IPCC (Integrated Professional Core Course)				
Teaching - Learning Scheme	L	T	P	Total Credits	Total Teaching Hours
	3	0	1	4	
CIE Marks: 50	SEE		Total Max. Marks: 100		Duration of SEE: 03 Hours

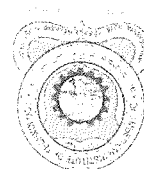
Course Learning Objectives:	
CLO1	To understand the fundamental concepts of digital systems, binary codes, Boolean algebra, logic operations, logic gates, and integrated circuits.
CLO2	To apply Boolean algebra and Karnaugh map techniques for simplification and design of combinational logic circuits.
CLO3	To understand and analyze sequential logic circuits, storage elements, flip-flops, and synchronous counters.
CLO4	To understand the basic organization of a computer, instruction set architecture, addressing modes, memory operations, and processor performance.
CLO5	To analyze the basic processing unit, instruction execution, bus organization, cache memory, and pipelining concepts including data hazards.

SYLLABUS		
UNIT 1	8	L1-L4
INTRODUCTION TO DIGITAL SYSTEMS: Binary Codes, Binary Storage, Binary Logic, Boolean Functions, Canonical and Standard Forms, Other Logic Operations, Digital Logic Gates, Integrated Circuits.		
SELF-STUDY COMPONENT		
Digital System, Binary Numbers, Number-Base Conversions, Octal and Hexadecimal Numbers, Complements of Numbers, Signed Binary Numbers.		
UNIT 2		
9		L1-L4
COMBINATIONAL LOGIC: The Map Method, Two, Three and Four-Variable K-Map, Sum-of-Products, Don't-Care Conditions, NAND and NOR Implementation, Introduction to Combinational Circuits, Design Procedure, Binary Adder-Subtractor, Decoders, Multiplexers.		



SELF-STUDY COMPONENT		10 Hours		Product-of-Sums Simplification, Don't-Care Conditions, NAND and NOR Implementation, Analysis of Combinational Circuits, Magnitude Comparator, Encoders.
UNIT 3		9	L1-L4	Introduction, Sequential Circuits, Storage Elements: Latches, Storage Elements: Flip-Flops, Synchronous Counter.
SELF-STUDY COMPONENT		10 Hours		Registers, Shift Registers, BCD Counters, Binary counter with parallel Load.
UNIT 4		8	L1-L4	BASIC STRUCTURE OF COMPUTERS: Functional Units, Basic Operational Concepts, Bus structure, Instruction Set: CISC an RISC, Performance Measurement.
MACHINE INSTRUCTIONS AND PROGRAMS:		Memory Operations, Instruction and Instruction sequencing, Addressing Modes.		
SELF-STUDY COMPONENT		10 Hours		Performance –Processor Clock, Basic Performance Equation, Clock Rate, Addition and Subtraction of signed numbers, Overflow in integer Arithmetic, Memory Location and Addresses
UNIT 5		8	L1-L4	BASIC PROCESSING UNIT: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization.
SELF-STUDY COMPONENT		10 Hours		PIPELINING: Role of Cache Memory, Pipeline Performance, Data Hazards.
Hardwired Control, Instruction Hazards.				

Practical Component		Instruction: Experiments can be implemented using digital trainer kits or simulators like Logisim/Multisim or virtual labs as applicable to the experiments. 1. Design and Implement the following using basic/universal gates. a. Automatic room-light controller Circuit. b. Machine safety circuit. 2. Implement the following using basic/universal gates a) simplification of given Boolean expression using K-Map b) Digital Vending Machine Control System Using 4-Variable K-Map.		
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3. A digital calculator performs the addition of two binary numbers. During multi-bit addition, the addition of each bit position may receive a carry from the previous bit position. Design and implement the circuit that accepts two binary inputs (A) and (B), along with the carry input (C_{in}), and produce the SUM (S) and CARRY (C_{out}) outputs.
4. A digital balance monitoring system calculates the remaining balance after deducting a transaction amount. In multi-bit binary subtraction, each bit position may receive a borrow from the previous lower-order bit. Design and implement the circuit that accepts two binary inputs (A) and (B), along with a borrow input (B_{in}), and generate the Difference (D) and Borrow output (B_{out}).
5. Implement the following
 - a) Given Boolean expressions using suitable Multiplexer IC.
 - b) Smart Industrial Monitoring System with 4 sensors Using 8:1 Multiplexer..
 6. a) Simplification of given Boolean expressions using suitable Decoder IC.
 - b) Implement the Smart Parking Lane Control Using 3-to-8 Decoder.
 7. Design and implement digital control and memory units using universal gates.
 8. Design and implement MOD-n Synchronous Counter for digital Sequence controlling.
 9. Design and implement 4-bit Arithmetic Logic Unit for data processing unit.
 10. Design and implement a simple digital data processing system for transferring and processing binary data

TEXT BOOKS:

1	M. Morris Mano & Michael D. Ciletti, Digital Design, 6th edition, Pearson Education.
2	Carl Hamacher, Zvonko Vranesic, Safwat Zakay, Computer Organization, 5th Edition, Tata McGraw Hill.

REFERENCE BOOKS:

1	NPTEL Video Course: Digital Computer Organization by Prof. P. K. Biswas, IIT Khharagpur - https://nptel.ac.in/courses/117105078
2	MIT Open Course Ware: Computation Structures (6.004) by Prof. Chris Terman, MIT - https://ocw.mit.edu/courses/6-004-computation-structures-spring-2017/
3.	Computer Organization Virtual Lab , IIT Hyderabad (Virtual Labs) – https://cse11-iitih.vlabs.ac.in
4	Infosys Springboard Courses: https://infosyspringboard.onwingspan.com



Dr. Ambedkar Institute of Technology
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Scheme: 2025

Semester: III

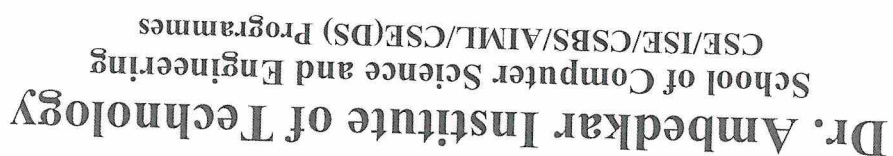
Assessment Details both (CIE and SEE)	
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has two COMPONENT – CIE - theory component and CIE – laboratory component. Students have to score a minimum of 40% Marks in the total of CIE - theory and CIE – laboratory COMPONENT put together, provided students have to score a minimum of 40% marks in CIE laboratory component alone to qualify to take SEE. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be included for CIE.	

CONTINUOUS INTERNAL EVALUATION (CIE)					Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3			30		
Laboratory COMPONENT	The record will be evaluated weekly according to the rubrics, and the average marks will be considered.			10	20	08
NT	Lab CIE					
TOTAL				50	20	

QUESTION PAPER PATTERN (SEE)									
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
UNIT	1		2		3		4		5
1. Two full questions (each of 20 Marks) are to be set from each unit.									
2. Student shall answer five full questions selecting one full question from each unit.									

COURSE SUSTAINABLE DEVELOPMENT GOALS (SDGs)									
Goal No.	Goal Title					Description			
CO1	Explain the fundamental concepts and principles of digital systems and computer organization.								
CO2	Apply fundamental principles and appropriate techniques to solve problems related to digital and computer systems.								
CO3	Analyze digital systems to develop efficient solutions for given functional requirements.								
CO4	Analyze the organization and operation of computer systems to understand their functional behavior.								
CO5	Analyze the operational principles and performance aspects of computer systems.								

COURSE SUSTAINABLE DEVELOPMENT GOALS (SDGs)									
Goal No.	Goal Title					Description			
CO1	Explain the fundamental concepts and principles of digital systems and computer organization.								
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CO5	Analyze the operational principles and performance aspects of computer systems.								

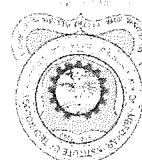


Scheme: 2025

Mapping of COs with POS with PSOs												
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0												
CO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
CO1	3	3	2	1	1	1	1	1	1	3	2	3
CO2	3	3	3	2	2	1	1	1	1	3	2	1
CO3	3	3	3	2	2	1	1	1	1	3	3	1
CO4	3	3	2	2	2	1	1	1	1	3	2	2
CO5	3	3	3	2	2	1	1	1	1	3	2	2

for Arathi P Assistant Professor CSE Programme, SCSE	Vinutha M S Assistant Professor CSE Programme, SCSE	Dr Kavitha Devi C S Assistant Professor CSBS Programme, SCSE
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Course Title	Course Code	Course Category	Teaching - Learning Scheme	CIE Marks: 50	SEE Marks: 50	Total Max. Marks: 100	Duration of SEE: 03 Hours
Data Structures and Applications	IBSCST303	PCC (Professional Core Course)	L T P Total Credits	3 1 0 4	3 1 0 4	Lecture: 42 + Tutorials: 28 + Practical: 0 + Self Study: 50 = 120	

Course Learning Objectives:	
CLO 1	Explain fundamentals of data structures and their application essentials for implementing solutions to problems.
CLO 2	Illustrate representation of data structures: Stacks, Queues, Linked List and Trees.
CLO 3	Design and Develop Solution to problems using Arrays, Structures, Stack, Queues, Linked Lists, and Trees.
CLO 4	Find suitable data structure for application development.

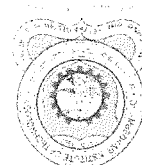
SYLLABUS		
	UNIT 1	
	14	L2-L3
	No. of Hours	BTLs
Algorithm Specification: Algorithms for sorting (Bubble, Selection, Insertion) and searching (Linear, Binary).		
Introduction: Data Structures, Classifications (Primitive & Non-Primitive), Data structure operations. (Traversing, inserting, deleting, searching, and sorting).		
Arrays and Structures: Arrays, Dynamically Allocated Arrays, Structures and Unions, Demonstration of representation of Polynomials and Sparse Matrices. Dynamic Memory Allocation along with its Functions.		
SELF-STUDY COMPONENT		
	10 Hours	
Applications of arrays, sparse matrices operations, Multidimensional Arrays		
UNIT 2		
	14	L2-L3
	No. of Hours	
Recursion: Recursive Definition and Processes, Recursion in C, The Towers of Hanoi Problem.		
Stacks: Definition, System stack, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays. Different expressions. Stack Applications with Infix to postfix conversion and evaluation of postfix expression		
SELF-STUDY COMPONENT		
	10 Hours	
Example Problems using Recursion, Multiple Stacks		
UNIT 3		
	14	L2-L4



Queues: Definition, Kinds of Queues, Array Representation of Queues, Queue Operations, Circular Queues, Queues and Circular queues using Dynamic arrays.	
Linked Lists: Definition, classification of linked lists. Representation of different types of linked lists in Memory, Traversing, Insertion, Deletion, Searching, Sorting, and Concatenation Operations on Singly linked list, Linked Stacks and Queues.	
SELF-STUDY COMPONENT	10 Hours
Double Ended Queue, Circular Singly Linked List	
UNIT 4	
14	L2-L4
Header linked lists and Circular linked lists with Header basic operations.	
Applications of Linked lists – Polynomials, Programming Examples. Doubly Linked lists and Circular Doubly linked lists, Programming Miscellaneous problems on Linked List.	
SELF-STUDY COMPONENT	10 Hours
Polynomial Representation using Linked Lists, Header Nodes, Identify applications to solve using Linked lists.	
UNIT 5	
14	L2-L4
Trees 1: Terminologies, Representation of Trees, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - In-order, Post-order, Preorder; Level-order. Binary Search Trees – Definition, Insertion, Traversal, and Searching operation on the Binary search tree.	
Trees 2: Construction of Binary tree from Traversal, Application of Trees-Evaluation of Expression, Threaded binary trees, Heaps: Definition, Insertion into Max heap.	
SELF-STUDY COMPONENT	10 Hours
Binary Search Tree-Deletion, AVL Trees (Introduction), Heap Construction	

TEXT BOOKS	
1. Horowitz, Sahni, Anderson-Freed, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, ISBN-13 : 978-8173716058	
2. Y Langsam, M J Augenstein, A M Tenenbaum, Data Structures using C and C++, 2nd Ed, PHI, ISBN-13 : 978-9332549319	

REFERENCE BOOKS	
1. Gilbert and Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, Cengage Learning, 2014.	
2. Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, 2nd Ed, McGraw Hill, 2013	



3.	Robert Kruse, Data Structures and Program Design in C, 2nd Ed, PHI, 1996.
4.	Reema Thareja, Data Structures using C, 3rd Ed, Oxford press, 2012.

e-LEARNING RESOURCES	
http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS35.html	
https://nptel.ac.in/courses/106/105/106105171/	
http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html	

Assessment Details for both CIE and SEE			
The weightage assigned to the Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) is 50% each. To pass the course, students must secure a minimum of 40% marks separately in both CIE and SEE. Continuous Internal Evaluation (CIE) The CIE consists of three components: 1. CIE – Theory Component 2. Assignment 3. Group Activity Students must secure a minimum of 40% marks in the combined total of the CIE Theory, Assignment, and Group Activity components to qualify for appearing in the SEE. Semester End Examination (SEE) The Theory SEE is conducted for 100 marks with a duration of 3 hours. The marks obtained are subsequently scaled down to 50 marks for calculating the final course grade. The student must secure a minimum of 40% marks in the SEE to pass the course. **Self-Study Component should be included for CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks in CIE to Qualify for SEE (40% individually)	Theory
Weightage of CIE-1 and CIE-2 or CIE-3		40	
Assignment		05	
Group Activity		05	
TOTAL		50	
		20	

SEE QUESTION PAPER PATTERN									
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
UNIT	1	2	3	4	5	6	7	8	9
1. Two full questions (each of 20 Marks) are to be set from each unit.									



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2. Students shall answer five full questions selecting one full question from each unit.

Course Outcomes: After the completion of the course, the student will be able to	
CO1	Analyze the characteristics of different data structures and implement arrays, structures, unions, and dynamic memory allocation for efficient data organization.
CO2	Apply recursion and stack data structures to solve computational problems such as expression conversion and evaluation.
CO3	Apply queue and linked list data structures to perform various operations and solve problems involving dynamic data management.
CO4	Analyze and implement different types of linked lists for solving application-oriented problems.
CO5	Design and implement binary trees, binary search trees, and heaps for searching, traversal, and expression evaluation applications.

COURSE SUSTAINABLE DEVELOPMENT GOALS (SDGs)		
Goal No.	Goal Title	Description
4	Quality Education	Develops computational thinking and programming fundamentals.
9	Industry, Innovation and Infrastructure	Builds efficient software design skills, optimal data organization; mastering them equips students to design resilient computing infrastructure and contribute to innovation in application development.

Mapping of COs with POs with PSOs													
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0													
CO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO1	PSO2
1	2	3	4	5	6	7	8	9	10	11	PO	PSO1	PSO2
CO1	3	3	2	1	2	-	-	-	-	-	2	2	2
CO2	3	3	2	1	2	-	-	-	-	-	2	2	2
CO3	3	3	3	2	3	-	-	-	-	-	3	3	3
CO4	3	3	3	2	3	-	-	-	-	-	3	3	3
CO5	3	3	3	2	3	-	-	-	-	-	3	3	3

Mapping of COs with Knowledge and Attitude Profile (WK)



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Semester: III

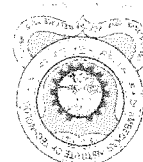
Scheme: 2025

Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	2	3	3	2	2	1	-	-	-
CO2	2	3	3	3	3	1	-	-	-
CO3	2	3	3	3	3	1	-	-	-
CO4	2	3	3	3	3	1	-	-	-
CO5	2	3	3	3	3	1	-	-	-

Course Coordinators:

Dr. Harish G, Professor, CSE, SCSE	Mrs. Rajeshwari, Assistant Professor, AI&ML, SCSE
<i>HHG</i>	<i>Rajeshwari</i>

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Course Title	Course Code	Course Category	Teaching - Learning Scheme	CIE Marks: 50	SEE Marks: 50	Total Max. Marks: 100	Duration of SEE: 03 Hours
Operating Systems	IBSCST304	PCC (Professional Core Course)	L T P Total Credits	3 0 0 3	SEE	Lecture: 42 + Tutorials: 0 + Practical: 0 + Self Study: 48 = 90	
Total Teaching Hours							

Course Learning Objectives:	
CL01	To introduce the basics of computer system organization and different structures of operating system design.
CL02	To explain process management and CPU scheduling, along with the concept of multithreading.
CL03	To illustrate process Synchronization and concept of Deadlock by solving problems
CL04	To explain Main Memory and Virtual memory management
CL05	To illustrate File system and Mass storage structures with problem solving

SYLLABUS		
UNIT 1	8	L1-L4
Introduction: What Operating Systems Do, Computer-System Organization, Computer-System Architecture, Operating-System Structure, Resource Management, Virtualization, Distributed Systems Operating-System Structures: Operating-System Services, System Calls, Types of system calls, Operating-System Design and Implementation, Operating-System Structure.		
SELF-STUDY COMPONENT		
Different real time OS such as Android, IOS and Mac OS structure and design, Role of AI to improve OS performance, contribution of AI and Machine Learning tools in modern Operating System.	10	Hours
UNIT 2		
8	L1-L4	
Process Management: Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication, IPC in Shared-Memory Systems, IPC in Message-Passing Systems. Multi-threaded Programming: Overview; Multithreading models CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling		
SELF-STUDY COMPONENT		
Steps involved in Process Creation Mechanism and demonstration using Linux/ UNIX platform, Identification of IPC using a real-world scenario, such as:	10	Hours

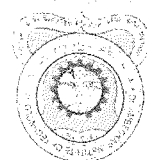


- A web browser communicating with a rendering process
- A print application communicating with a printer service
- A client application communicating with a database server

UNIT 3		
L1-L4	9	
Process Synchronization: Background, The Critical-Section Problem, Peterson's Solution, Hardware Support for Synchronization, Mutex Locks, Semaphores, Monitors - Monitor usage.		
Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock		
SELF-STUDY COMPONENT		10 Hours
Real-World Industrial Case Study- Prevention and recovery from deadlock, Process Synchronization in Modern Operating System.		
UNIT 4		
L1-L4	9	
Main Memory: Main memory Techniques, Background, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation.		
Virtual Memory: Background, Demand Paging, Page Replacement, Allocation of Frames, Introduction to Thrashing		
SELF-STUDY COMPONENT		9 Hours
Modern Operating Systems Control Thrashing, Fragmentation, comparison between Contiguous and Non-Contiguous Memory Allocation.		
UNIT 5		
L1-L4	8	
File system: File concept, Access methods, Directory structure, File system mounting, File sharing, Memory Compression.		
Secondary Storage Management: Disk structure, Disk attachment, Disk scheduling, Disk management, Swap space management.		
SELF-STUDY COMPONENT		9 Hours
AI-Assisted File Organization and Directory Management, Traditional and AI-Based File-Management Systems.		

TEXT BOOKS		
1.	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, John Wiley & Sons, Operating System Principles, 10 th Edition, Inc. ISBN 978-1-118-06333-0	

REFERENCE BOOKS		
1.	D.M Dhamdhere: Operating systems - A concept-based Approach, 3 rd Edition, Tata McGraw- Hill, 2012. ISBN13: 9781259005589	



2.	P.C.P. Bhatt: Introduction to Operating Systems Concepts and Practice, 3rd Edition, PHI, 2010. ISBN-10: 9788120348363
3.	Harvey M Deitel: Operating systems, 3rd Edition, Pearson Education, 2011. ISBN: 9788131712894

e-LEARNING RESOURCES	
https://www.os-book.com/OS10/slide-dir/index.html	
https://www.booksfree.org/pages/book-downloading-page/?dlm-dp-dl=24807	
https://archive.mptel.ac.in/courses/106/105/106105214/	

Assessment Details for both CIE and SEE			
The weightage assigned to the Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) is 50% each. To pass the course, students must secure a minimum of 40% marks separately in both CIE and SEE. Continuous Internal Evaluation (CIE) The CIE consists of three components: 1. CIE – Theory Component 2. Assignment 3. Group Activity Students must secure a minimum of 40% marks in the combined total of the CIE Theory, Assignment, and Group Activity components to qualify for appearing in the SEE. Semester End Examination (SEE) The Theory SEE is conducted for 100 marks with a duration of 3 hours. The marks obtained are subsequently scaled down to 50 marks for calculating the final course grade. The student must secure a minimum of 40% marks in the SEE to pass the course. **Self-Study Component should be included for CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks Required in CIE to Qualify for SEE (40% individually)
Theory	Weightage of CIE-1 and CIE-2 or CIE-3	40	20
Assignment		05	05
Group Activity		05	05
TOTAL		50	20

SEE QUESTION PAPER PATTERN									
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Q10									



UNIT	1	2	3	4	5
1. Two full questions (each of 20 Marks) are to be set from each unit.					
2. Student shall answer five full questions selecting one full question from each unit.					

Course Outcomes: After the completion of the course, the student will be able to	
CO1	Illustrate the role of an operating system with respect to resource management, interfaces and system calls
CO2	Apply process scheduling algorithms to select the processes for execution and compare their performances.
CO3	Interpret the requirements for process synchronization and understand the state of deadlock.
CO4	Describe and analyze the memory management and its allocation methods.
CO5	Identify the storage management techniques with respect to memory management.

COURSE SUSTAINABLE DEVELOPMENT GOALS (SDGs)		
Goal No.	Goal Title	Description
4	Quality Education	Operating Systems develops problem-solving, programming, and system design skills through concepts such as process management, memory management, synchronization, and file systems. It equips students with essential computing knowledge for higher education and lifelong learning.
8	Decent Work and Economic Growth	The course prepares students with industry-relevant skills in multitasking, multithreading, virtualization, resource management, and cloud computing, enhancing employability and supporting innovation and productivity in the IT sector.

Mapping of COs with POs with PSOs Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO	P	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
CO1	3	2	0	0	2	0	0	0	0	0	0	0	2	3
CO2	3	3	2	2	2	0	0	0	0	1	0	0	0	3
CO3	3	3	3	2	2	0	0	1	0	1	0	0	1	3
CO4	3	3	2	2	2	0	0	0	0	0	0	0	1	3
CO5	3	2	2	1	3	0	0	0	0	0	0	0	2	3



Mapping of COs with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	3	2	2	-	1	-	-	-	1
CO2	3	3	3	2	2	1	-	-	1
CO3	3	3	3	2	2	2	1	1	2
CO4	3	3	2	2	2	1	-	-	1
CO5	3	2	2	1	2	1	-	-	1

Course Coordinators:

Sneha G Assistant Professor, Computer Science and Engineering	Komala N Assistant Professor, Computer Science and Engineering	Vybhavi P Assistant Professor, Computer Science and Engineering
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Course Title	Course Code	Course Category	Teaching - Learning Scheme				CIE Marks: 50		SEE Marks: 50		Total Max. Marks: 100		Duration of SEE: 03 Hours	
Java Programming	IBSCST305	PCC (Professional Core Course)	L	T	P	Total Credits	Lecture: 42 + Tutorials: 0 + Practical: 0 + Self Study: 48 = 90		3	0	0	3		

Course Learning Objectives:

CLO1	To introduce the core concepts of object-oriented programming using the Java language.
CLO2	To build foundational skills in designing classes, objects, and modular code structures.
CLO3	To demonstrate the use of inheritance, packages, and interfaces for creating reusable applications.
CLO4	To teach techniques for managing runtime errors via exception handling and building concurrent systems using multithreading.
CLO5	To enable the development of full-stack desktop applications by integrating GUI components (Swing), collections, and database connectivity (JDBC).

SYLLABUS			
UNIT 1		8	L1-L4
Introduction to Java: Evolution, features, Java buzzwords, JDK, JRE, JVM, bytecode, Java program execution, and simple Java programs. Java Fundamentals: Ops Principles, Program structure, blocks of code, identifiers, keywords, literals, comments, whitespace, and separators, Data Types, Variables, Arrays and Operators, Control Statements, Classes and Methods : Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, This Keyword, Garbage Collection, Overloading Methods, Objects as Parameters, Argument Passing, Returning, Objects, Recursion, Access Control, Understanding static, introducing final, Introducing Nested and Inner Classes.			
SELF-STUDY COMPONENT		10 Hours	
Environment path configuration and command-line compilation using JDK, JRE, and JVM; implementation of type-casting variations, jagged arrays, and logical control flow nesting, memory management using constructor chaining, the this keyword, and object reference passing, analysis of recursive functions on the execution stack, data encapsulation via access modifiers, and application of static initialization blocks, final variables, and inner classes.			
UNIT 2		8	L1-L4
Inheritance: Basics of inheritance, super keyword, multilevel inheritance, constructor execution in inheritance, local variable type inference with inheritance, and the Object class. Packages: Creating packages, package access, importing packages, and organizing Java programs using packages. Interfaces:			

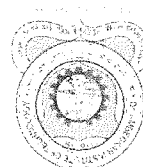


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Semester: III

Scheme: 2026

Defining and implementing interfaces, multiple inheritance using interfaces, default methods, static methods, and private methods in interfaces.				
SELF-STUDY COMPONENT		10 Hours		
Implementation of multi-level inheritance hierarchies using the super keyword, execution of runtime polymorphism via dynamic method dispatch, exploration of local variable type inference (var) within structural hierarchies, organization of source code across user-defined packages with custom visibility levels, and design of highly decoupled interfaces using default, static, and private interface methods.				
UNIT 3		8		
LI-L4				
Exception Handling: Exception-handling fundamentals, exception types, uncaught exceptions, try, catch, multiple catch blocks, nested try statements, throw, throws, finally, built-in exceptions, user-defined exceptions, and chained exceptions. Multithreaded Programming: Java thread model, main thread, creating threads, creating multiple threads, thread lifecycle, isAlive(), join(), thread priorities, and obtaining a thread's state.				
SELF-STUDY COMPONENT		10 Hours		
Construction of robust error-containment layers using multi-catch strategies, nested try blocks, and custom checked or unchecked exceptions, identification of exception chaining mechanisms, concurrent programming execution using both the Thread class and the Runnable interface, and thread synchronization management using thread priorities, isAlive(), and join() methods to control lifecycle sequencing.				
UNIT 4		9		
LI-L4				
Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model. Swings: Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application. Networking: Introduction to network program, TCP/IP, Client and Server Communication using TCP/IP.				
SELF-STUDY COMPONENT		10 Hours		
Implementation of the delegation event model using custom event sources and listener interfaces, composition of graphical desktop layouts utilizing core Swing containers, panels, and input components, configuration of low-level networking elements using TCP/IP protocols, and development of synchronous client-server communication channels using network sockets and input/output streams.				
UNIT 5		9		
LI-L4				
String Handling: The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison. RMI: RMI Architecture, Creating Stub and Skeleton, Client and Server communication. JDBC: Introduction to JDBC, JDBC architecture, JDBC driver types, JDBC packages, database connectivity, statement objects, and processing query results using ResultSet.				
SELF-STUDY COMPONENT		10 Hours		
Performance benchmarking of immutable string operations against mutable alternatives, construction of distributed objects using Remote Method Invocation (RMI) architecture with custom stub and skeleton communication layers, installation and registration of relational database drivers, and execution of SQL queries using Statement abstractions and cursor manipulation via the JDBC ResultSet API.				



TEXT BOOKS	1. Herbert Schildt and Danny Coward, Java: The Complete Reference, 13th Edition, McGraw-Hill, 2024.
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REFERENCE BOOKS	1. Cay S. Horstmann, Core Java Volume I – Fundamentals, 14th Edition, Oracle Press, 2026.
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e-LEARNING RESOURCES	Programming examples and practice (GeeksforGeeks): https://www.geeksforgeeks.org/java/java/ Official Java documentation (Oracle): https://docs.oracle.com/javase/tutorial/ HackerRank platform: https://www.hackerrank.com/domains/java Infosys Springboard Course on Java Programming Fundamentals: https://infosyspringboard.onwingspan.com/web/en/login Videos and Lecture Notes: http://www.nptel.ac.in
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Assessment Details for both CIE and SEE	
The weightage assigned to the Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) is 50% each. To pass the course, students must secure a minimum of 40% marks separately in both CIE and SEE. Continuous Internal Evaluation (CIE) The CIE consists of three components: 1. CIE – Theory Component 2. Assignment 3. Group Activity Students must secure a minimum of 40% marks in the combined total of the CIE Theory, Assignment, and Group Activity components to qualify for appearing in the SEE. Semester End Examination (SEE) The Theory SEE is conducted for 100 marks with a duration of 3 hours. The marks obtained are subsequently scaled down to 50 marks for calculating the final course grade. The student must secure a minimum of 40% marks in the SEE to pass the course. **Self-Study Component should be included for CIE.	
CONTINUOUS INTERNAL EVALUATION (CIE)	
Max. Marks	40
Minimum Marks Required in CIE to Qualify for SEE (40% individually)	40
Theory	
Weightage of CIE-1 and CIE-2 or CIE-3	40
Assignment	05
Group Activity	05
TOTAL	50
20	



SEE QUESTION PAPER PATTERN									
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9 Q10
UNIT	1		2		3		4		5
1. Two full questions (each of 20 Marks) are to be set from each unit.									
2. Student shall answer five full questions selecting one full question from each unit.									

Course Outcomes: After the completion of the course, the student will be able to	
CO1	Learn fundamental features of object-oriented Programming language with JAVA.
CO2	Develop Java programs using classes, objects, constructors, methods, access modifiers, recursion, and nested classes by applying object-oriented programming principles.
CO3	Implement inheritance, packages, and interfaces to create modular, reusable, and extensible Java applications.
CO4	Apply exception handling and multithreading concepts to develop robust and concurrent Java programs.
CO5	Design and implement database-driven, GUI-based Java applications using object-oriented principles, Swing, JDBC, and the Collections Framework to solve real-world problems.

COURSE SUSTAINABLE DEVELOPMENT GOALS (SDGs)		
Goal No.	Goal Title	Description
4	Quality Education	Develops computational thinking and programming fundamentals.
9	Industry, Innovation and Infrastructure	Builds efficient software design skills, optimal data organization; mastering them equips students to design resilient computing infrastructure and contribute to innovation in application development.

Mapping of COs with POs with PSOs														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1	2	-	-	1	1	2	1	2	2	3
CO2	3	3	2	2	2	-	-	2	2	2	2	2	2	3
CO3	3	3	3	3	3	-	-	3	3	3	3	3	3	3
CO4	3	3	3	3	3	-	-	3	3	3	3	3	3	3
CO5	3	3	3	3	3	-	-	3	3	3	3	3	3	3



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Semester: III

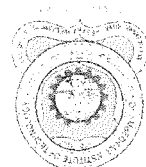
Scheme: 2026

Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	2	3	3	2	2	1	-	-	-
CO2	2	3	3	3	3	1	-	-	-
CO3	2	3	3	3	3	1	-	-	-
CO4	2	3	3	3	3	1	-	-	-
CO5	2	3	3	3	3	1	-	-	-

Course Coordinators:

Dr. Praveena M V Assistant Professor, CSE Programme	
Prof. Pushpaveni H P Assistant Professor, CSE Programme	
Prof. Yashaswini H M Assistant Professor, CSE Programme	
Prof. Veena N Iyer Assistant Professor, CSE-DS Programme	

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Course Title	Course Code	Course Category	Teaching - Learning Scheme				CIE Marks: 50		SEE Marks: 50		Total Max. Marks: 100		Duration of SEE: 03 Hours							
			L	T	P	Total Credits	Lecture: 0 + Tutorials: 0 + Practical: 28 + Self Study: 02 = 30	0	0	1	1	Total Teaching Hours								
			PCCL (Professional Core Course Laboratory)																	
			IBSCSL306																	
			Data Structures Laboratory																	

Course Learning Objectives:

CLO1	Develop C programs to implement fundamental data structures and perform basic operations using arrays, structures, recursion, and dynamic memory allocation.
CLO2	Implement linear data structures such as stacks, queues, and linked lists to solve computational problems involving searching, sorting, and expression evaluation
CLO3	Design and implement non-linear data structures such as binary search trees and heaps for efficient storage, retrieval, and manipulation of data.
CLO4	Apply appropriate data structures to solve practical computing problems and evaluate the correctness and efficiency of the implemented solutions.

Syllabus

PART: A - FIXED SET OF EXPERIMENTS

1	- Sort the list using Selection Sort. - Search for a given score using Linear Search. A warehouse stores products in a large grid of storage locations where only a few locations actually contain items. To save memory, only the occupied locations are recorded. Develop a C program to later search for a particular student's score. Develop a C program to
2	- Read the sparse matrix. - Represent it using the triple (row, column, value) format. - Search whether a product with a specified value exists and display its location. Write recursive C Programs for
3	- Searching an element on a given list of integers using the Binary Search method. - Solving the Towers of Hanoi problem. Write a C Program to construct a stack of integers and to perform the following operations on it:
4	a. Push b. Pop c. Display The program should print appropriate messages for stack overflow, stack underflow, and stack empty.



5	A compiler receives arithmetic expressions written in infix notation but internally evaluates postfix expressions. Develop a C program to: • Convert a valid parenthesized infix expression into postfix notation. • Display both expressions.	6	A scientific calculator internally evaluates postfix expressions generated by its parser. Develop a C program using a stack to evaluate a valid postfix expression consisting of single-digit operands and arithmetic operators. The arithmetic operators are + (add), - (subtract), * (multiply) and / (divide).	7	Design, develop, and execute a program in C to simulate the working of a queue of integers using an array. Provide the following operations: a. Insert b. Delete c. Display	8	Write a C Program to simulate the working of a circular queue of integers using an array. Provide the following operations: a. Insert b. Delete c. Display	PART: B - OPEN-ENDED EXPERIMENTS	
1	Undo Feature in a Text Editor (Stack using Linked List) A text editor stores recently performed operations so that users can undo them. Develop a C program using a singly linked list to implement a stack supporting: • Perform Operation (Push) • Undo Operation (Pop) • Display Stored Operations Display suitable messages for stack overflow and empty stack.	2	Hospital Registration System (Queue using Linked List) Patients arriving at a hospital are registered dynamically throughout the day, making the number of patients unpredictable. Develop a C program using a singly linked list to implement a queue supporting: • Register Patient • Call Next Patient • Display Waiting List Display suitable messages for queue full and queue empty.	3	Polynomial Addition Using Linked List Using circular representation for a polynomial, design, develop, and execute a program in C to accept two polynomials, add them, and then print the resulting polynomial.	4	Doubly Linked List Design, develop, and execute a program in C to implement a doubly linked list where each node consists of integers. The program should support the following operations: i. Create a doubly linked list by adding each node at the front. ii. Insert a new node to the left of the node whose key value is read as an input. iii. Delete the node of a given data if it is found, otherwise display appropriate messages. iv. Display the contents of the list.		

(Note: Only either (a,b and d) or (a, c and d) may be asked in the examination)	
Student Database using Binary Search Tree A university stores student roll numbers in a Binary Search Tree for efficient searching and retrieval. Develop a C program to: Construct a Binary Search Tree. Perform the following traversals ◆ Inorder ◆ Preorder ◆ Postorder	5
Hospital Emergency Priority System (Max Heap) In a hospital emergency department, patients with higher priority must always be attended before others. A max heap can efficiently organize patient priorities. Develop a C program to: • Create a Max Heap by inserting one priority value at a time. • Represent the heap using an array.	6

SELF-STUDY COMPONENT	
02 Hours	Practice the implementation of additional operations on data structures, test programs using different input cases, and explore data structure visualization tools to strengthen programming and debugging skills.

Teaching and Learning Process (Innovative Delivery Methods)	
1. Active Learning Techniques	1.
2. Problem-Based Learning (PBL)	2.
3. Demonstration-Based Learning	3.
4. Hands-On Programming Sessions	4.

TEXT BOOKS	
1. Horowitz, Sahni, Anderson-Freed, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, ISBN-13 : 978-8173716058	1.
2. Y Langsam, M J Augenstein, A M Tenenbaum, Data Structures using C and C++, 2nd Ed, PHI, ISBN-13 : 978-9332549319	2.

REFERENCE BOOKS	
1. Gillberg and Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, Cengage Learning, 2014.	1.
2. Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, 2nd Ed, McGraw Hill, 2013	2.
3. Robert Kruse, Data Structures and Program Design in C, 2nd Ed, PHI, 1996.	3.

e-LEARNING RESOURCES	
http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS35.html	
https://ds1-jith.vlabs.ac.in/exp/stacks-queues/index.html	
https://ds1-jith.vlabs.ac.in/exp/infix-postfix/index.html	



Assessment Details for CIE				
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks Required in CIE to Qualify for SEE	
Laboratory Component	The record will be evaluated weekly according to the rubrics, and the average marks will be considered.	10	20	SEMESTER END EXAMINATION (SEE)
	LAB CIE	40		
	TOTAL	50		
The student must secure a minimum of 40% marks in the SEE to pass the course.				

Practical Examination Guidelines

- All laboratory experiments shall be included for the practical examination.
- The instructions and marks breakup printed on the cover page of the answer script shall be strictly adhered to by the examiners.
- Students shall be allowed to randomly select any one experiment from the given lot.
- Change of the selected experiment shall be permitted only once.
- Any change of experiment shall attract mark deduction as per the Dr. AIT Autonomous Examination Rules and Regulations.

Course Outcomes: After the completion of the course, the student will be able to	
CO1	Develop C programs to implement searching, sorting, recursion, arrays, sparse matrices, and dynamic memory allocation for solving computational problems.
CO2	Develop C programs to implement stack and queue data structures using arrays and linked lists for expression conversion, evaluation, and other data processing operations.
CO3	Develop C programs using singly, doubly, and circular linked lists to perform data manipulation and polynomial representation operations.
CO4	Develop C programs to implement binary search trees and max heaps for performing insertion, traversal, searching, and heap construction operations.

COURSE SUSTAINABLE DEVELOPMENT GOALS (SDGs)		
Goal No.	Goal Title	Description
4	Quality Education	Develops practical programming, analytical thinking, and problem-solving skills through hands-on implementation of data structures.
9	Industry, Innovation and Infrastructure	Builds competencies in designing efficient data structures that support the development of scalable and innovative software systems.



Dr. Ambedkar Institute of Technology
School of Computer Science and Engineering
CSE/ISE/CSBS/AIML/CSE(DS) Programmes

Semester: III

Scheme: 2025

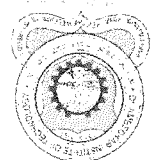
Mapping of COs with POs with PSOs												
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0												
CO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
CO1	3	3	3	2	1	3	-	-	-	-	-	-
CO2	3	3	3	3	2	3	-	-	-	-	-	-
CO3	3	3	3	2	3	3	-	-	-	-	-	-
CO4	3	3	3	3	3	3	-	-	-	-	-	-

Mapping of COs with Knowledge and Attitude Profile (WK)												
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0												
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	WK12
CO1	3	3	3	3	3	1	-	-	-	-	-	-
CO2	1	3	3	3	3	1	-	-	-	-	-	-
CO3	1	3	3	3	3	1	-	-	-	-	-	-
CO4	1	3	3	3	3	1	-	-	-	-	-	-

Course Coordinators:

Dr. Harish G, Professor, CSE Programme, SCSE	Mrs. Rajeshwari, Assistant Professor, AIML Programme, SCSE
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Dr. Ambedkar Institute of Technology
 Bengaluru-560 056



Course Title	Course Code	Course Category	Teaching - Learning Scheme				CIE Marks: 50	
Project Management with GIT	IBSCSL307A	AEC (Ability Enhancement Course)	L	T	P	Total Credits	Lecture: 0 + Tutorials: 0 + Practical: 28 + Self Study: 02 = 30	Duration of SEE: 03 Hours
			0	0	1	1	SEE Marks: 50	
			Total Max. Marks: 100					

Course Learning Objectives:

CLO1	Understand the fundamentals of Git and distributed version control systems.
CLO2	Develop proficiency in repository management, branching, merging, and collaboration using Git.
CLO3	Apply remote repository management, tagging, and advanced Git operations in software development projects.
CLO4	Analyze and manage Git history to maintain repository integrity and support collaborative development.

SYLLABUS	
EXPERIMENTS	
1.	Setting Up and Basic Commands Initialize a new Git repository in a directory. Create a new file and add it to the staging area and commit the changes with an appropriate commit message.
2.	Creating and Managing Branches Create a new branch named "feature-branch". Switch to the "master" branch. Merge the "feature-branch" into "master".
3.	Creating and Managing Branches Write the commands to stash your changes, switch branches, and then apply the stashed changes.
4.	Collaboration and Remote Repositories Clone a remote Git repository to your local machine.
5.	Collaboration and Remote Repositories Fetch the latest changes from a remote repository and rebase your local branch onto the updated remote branch.
6.	Collaboration and Remote Repositories Write the command to merge "feature-branch" into "master" while providing a custom commit message for the merge.
7.	Git Tags and Releases Write the command to create a lightweight Git tag named "v1.0" for a commit in your local repository.

8.	Advanced Git Operations	Write the command to cherry-pick a range of commits from "source-branch" to the current branch.
9.	Analysing and Changing Git History	Given a commit ID, how would you use Git to view the details of that specific commit, including the author, date, and commit message?
10.	Analysing and Changing Git History	Write the command to list all commits made by the author "JohnDoe" between "2023-01-01" and "2023-12-31."
11.	Analysing and Changing Git History	Write the command to display the last five commits in the repository's history.
12.	Analysing and Changing Git History	Write the command to undo the changes introduced by the commit with the ID "abc123".

Note: The above experiments shall be implemented using **GitHub and GitHub Codespaces**. The GitHub web interface and integrated terminal may be used for repository management, branching, merging, collaboration and other Git operations.

SELF-STUDY COMPONENT		02 Hours
GitHub Repository and Collaborative Project Workflow: Create and configure a GitHub repository, add a README file, create and manage issues, clone the repository, create a feature branch, make changes, push the branch, and create a pull request. Understand the role of <i>.gitignore</i> , repository visibility, and basic collaborative workflow.		

Teaching and Learning Process (Innovative Delivery Methods)		
1.	Active Learning Techniques	
2.	Problem-Based Learning (PBL)	
3.	Team-Based Learning (TBL)	
4.	Hands-On Experiments and Simulations	

TEXT BOOKS		
1.	Version Control with Git, 3rd Edition, by Prem Kumar Ponuthurai, Jon Loeliger Released October 2022, Publisher(s): O'Reilly Media, Inc.	
2.	Pro Git book, written by Scott Chacon and Ben Straub and published by Apress.	https://git-scm.com/book/en/v2

REFERENCE BOOKS		
1.	Git Pocket Guide, by Richard E. Silverman, https://www.oreilly.com/library/view/git-pocketguide/9781449327507/	
2.	Mike McQuaid, <i>Git in Practice: Git for Software Developers</i> , Manning Publications, 2014.	

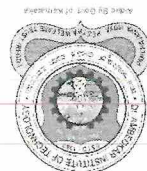
e-LEARNING RESOURCES	
Git and GitHub Fundamentals (Infosys Springboard):	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013094443347369984782_shared/overview
Version Control Using Git (Infosys Springboard):	https://infyspringboard.onwingspan.com/web/en/login?ref=%2Fapp%2Ftoc%2Flex_auth_01330134712177459211926_share%2Foverview
Pro Git (Official Git Documentation):	https://git-scm.com/book/en/v2
Introduction to Git and GitHub (Coursera Google):	https://www.coursera.org/learn/introduction-git-github

Assessment Details for CIE			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks Required in CIE to Qualify for SEE
Laboratory Component	The record will be evaluated weekly according to the rubrics, and the average marks will be considered.	10	20
	Lab CIE	40	
	TOTAL	50	

The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has two components – CIE - theory component and CIE – laboratory component. Students have to score a minimum of 40% Marks in the total of CIE - theory and CIE – laboratory components put together, provided students have to score a minimum of 40% marks in CIE laboratory component alone to qualify to take SEE. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.

Course Outcomes: After the completion of the course, the student will be able to	
CO1	Demonstrate the use of basic Git repository commands for version control operations.
CO2	Implement branch management strategies for collaborative software development
CO3	Apply collaboration techniques using remote repositories and distributed version control systems.
CO4	Configure Git tags, releases, and advanced Git operations for effective project management.
CO5	Modify Git history to maintain repository integrity and support project requirements.

COURSE SUSTAINABLE DEVELOPMENT GOALS (SDGs)		
Goal No.	Goal Title	Description



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4	Quality Education	Ensure Inclusive and equitable quality education and promote lifelong learning opportunities for all
8	Decent Work and Economic Growth	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Mapping of COs with POs with PSOs												
CO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
CO1	3	2	-	-	3	-	-	-	-	-	-	3
CO2	-	2	3	-	3	-	-	-	-	2	-	-
CO3	-	2	3	-	3	-	-	-	-	2	-	-
CO4	-	2	-	-	3	-	-	-	-	2	3	-
CO5	-	3	2	2	3	-	-	-	-	2	3	-
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0												

Mapping of COs with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	3	2	-	-	-	-	-	-	-
CO2	2	3	2	-	-	-	-	-	-
CO3	2	3	3	-	-	-	-	-	-
CO4	2	2	3	-	-	-	-	-	-
CO5	2	2	3	2	-	-	-	-	-

Course Coordinators:

 Mrs. Jayalakshmi K, Assistant Professor, CSE, SCSE	 Mr. Calabe P S, Assistant Professor, CSE, SCSE
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Dr. Ambedkar Institute of Technology
School of Computer Science and Engineering
Computer Science and Business System Programme

Scheme: 2025

Semester: III



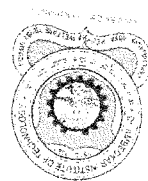
Course Title	Course Code	Course Category	Teaching - Learning Scheme & Credit	CIE Marks: 50										
Foundations of Business Analytics	IBCBL307B	AEC (Ability Enhancement Course)	<table border="1"> <tr> <th>Total Credits</th><th>L</th><th>T</th><th>P</th><th>Total</th></tr> <tr> <td>1</td><td>0</td><td>1</td><td>1</td><td>2</td></tr> </table>	Total Credits	L	T	P	Total	1	0	1	1	2	SEE Marks: 50
Total Credits	L	T	P	Total										
1	0	1	1	2										
Total Teaching Hours				Total Max. Marks: 100										
Lecture: 0 + Tutorials: 0 + Practical: 28 + Self Study: 02 = 30				Duration of SEE: 03 Hours										

Course Learning Objectives:		
CL01	Apply SWOT and PESTLE analysis tools to evaluate real-world business situations.	
CL02	Design basic business models and marketing plans using standard frameworks such as STP.	
CL03	Interpret financial statements and apply elementary financial ratio analysis to assess business performance.	
CL04	Demonstrate basic HR and project management practices through simulation exercises.	
CL05	Develop and present simple dashboards to communicate data-driven business insights from case studies.	

SYLLABUS

PART: A - CONVENTIONAL EXPERIMENTS.

1.	SWOT Analysis of a Real/Case Company	Identify and score the Strengths, Weaknesses, Opportunities, and Threats of the assigned company and visualize the results using Excel.	Use Case: Analyzing Titan Company's competitive position in the Indian watch & jewellery market.
2.	PESTLE Analysis	Identify the Political, Economic, Social, Technological, Legal, and Environmental factors affecting the assigned industry, score their impact, and visualize the results.	Use Case: Studying the impact of GST and EV policy changes on India's automobile industry.
3.	Business Model Canvas	Develop a 9-block Business Model Canvas for a hypothetical startup, covering customers, value proposition, activities, resources, partners, costs, and revenues.	Use Case: Designing the business model for a campus food-delivery startup.
4.	Reading Financial Statements	Calculate and interpret the Current Ratio and Net Profit Margin from the given financial statements using Excel.	Use Case: Evaluating the liquidity and profitability of Infosys Ltd. from its published annual report.
5.	Marketing Plan Exercise		



	Analyse customer data to identify market segments, target customers, and suitable positioning using Power BI visualizations. Use Case: Segmenting customers for a new fitness-tracker product launch in urban India.
6.	HR Simulation — Recruitment Analyse the given recruitment and candidate data to identify factors influencing selection and present insights using Power BI. Use Case: Identifying which skills/experience factors most influence hiring decisions for a software trainee role. Project Management Basics Create a WBS and Gantt Chart for the assigned project, showing activities, durations, dependencies, and milestones. Use Case: Planning the timeline for organizing a college technical fest.
7.	Case Study Analysis & Presentation Analyse the given business case and KPIs, identify the key problem, visualize findings, and recommend data-driven solutions. Use Case: Diagnosing declining customer retention for an e-commerce case study using KPI dashboards.
8.	Decision-Making Exercise Evaluate alternative business options using a Decision Matrix or Cost-Benefit Analysis and justify the best option using Excel. Use Case: Choosing between three vendor proposals for office supply procurement.
9.	Basic Dashboard for Management Data Develop an interactive management dashboard with KPIs, charts, filters, and business insights using the given dataset. Use Case: Building a sales performance dashboard for a retail chain's regional stores.
10.	*NOTE: MS Excel, Canva, Power BI, Tableau Public and other applicable tools can be used to execute the above programs

SELF-STUDY COMPONENT

Basics of business analytics, Introduction to SWOT, PESTLE, business data, KPIs, Excel, and data visualization.
decisions.

Teaching and Learning Process (Innovative Delivery Methods)

1. Active Learning Techniques
2. Problem-Based Learning (PBL)
3. Team-Based Learning (TBL)
4. Hands-On Experiments and Simulations

TEXT BOOKS

1. Stephen P. Robbins, Mary A. Coulter and Lori Long, <i>Management</i> , 16th Edition, Pearson Education, 2024/2025.



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2.	Harold Koontz, Heinz Wehrich and Mark V. Cannice, <i>Essentials of Management: An International, Innovation and Leadership Perspective</i> , 11th Edition, McGraw Hill Education, 2021.
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REFERENCE BOOKS	
1.	James R. Evans, <i>Business Analytics</i> , 3rd Edition, Pearson Education.
2.	Ramresh Sharda, Dursun Delen and Efraim Turban, <i>Business Intelligence, Analytics, Data Science, and AI: A Managerial Perspective</i> , 5th Edition, Pearson Education.

e-LEARNING RESOURCES	
	NPTEL – <i>Business Intelligence & Analytics</i> , IIT Madras.
	Microsoft Learn – <i>Power BI Learning Resources</i> .

Assessment Details for CIE			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks Required in CIE to Qualify for SEE
Laboratory Component	The record will be evaluated weekly according to the rubrics, and the average marks will be considered.	LAB CIE	TOTAL
	10	40	50
20			
SEMESTER END EXAMINATION (SEE)			
The student must secure a minimum of 40% marks in the SEE to pass the course.			
Practical Examination Guidelines			
• All laboratory experiments shall be included for the practical examination. • The instructions and marks breakup printed on the cover page of the answer script shall be strictly adhered to by the examiners. • Students shall be allowed to randomly select any one experiment from the given lot. • Change of the selected experiment shall be permitted only once. • Any change of experiment shall attract mark deduction as per the Dr. AIT Autonomous Examination Rules and Regulations.			

Course Outcomes: After the completion of the course, the student will be able to	
CO1	Apply foundational management analysis tools (SWOT, PESTLE) to real-world business situations.
CO2	Design basic business models and marketing plans using standard frameworks



CO3	Interpret financial statements and apply elementary financial ratio analysis.
CO4	Demonstrate basic HR and project management practices through simulation exercises.
CO5	Present data-driven business insights using simple dashboards and case study evaluations.

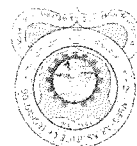
COURSE SUSTAINABLE DEVELOPMENT GOALS (SDGs)		
Goal No.	Goal Title	Description
4	Quality Education	Ensure Inclusive and equitable quality education and promote lifelong learning opportunities for all
8	Decent Work and Economic Growth	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Mapping of COs with POs with PSOs													
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0													
CO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO1	PSO2
1	2	3	4	5	6	7	8	9	10	11	PO	PO	PSO3
CO1	2	3	3	3	2	2	2	2	2	2	3	3	2
CO2	2	3	3	2	2	1	2	2	3	2	3	3	3
CO3	3	3	2	3	2	1	2	1	2	2	3	3	2
CO4	2	3	3	2	3	1	3	3	3	2	3	3	3
CO5	3	3	3	3	2	1	2	2	3	3	3	3	3

Mapping of COs with Knowledge and Attitude Profile (WK)													
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0													
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	WK12	WK13
CO1	1	1	2	3	2	3	3	3	2	3	3	3	3
CO2	1	1	2	3	3	3	3	2	2	2	2	2	3
CO3	1	3	2	3	2	3	3	2	2	1	2	2	2
CO4	1	1	2	3	3	3	3	3	2	3	3	3	3
CO5	1	3	2	3	3	3	3	3	2	3	3	3	3

Course Coordinators:

	Dr. Vidyanth H J, Associate Professor CSBS Programme, SCSE
	Mrs. Divya S, Assistant Professor CSBS Programme, SCSE



Semester: III

Scheme: 2025

Course Title	Course Code	Course Category	Teaching - Learning Scheme & Credit				SEE Marks: 50	CIE Marks: 50
EXPLORATORY DATA ANALYSIS	IBAIL307B	AEC (Ability Enhancement Course)	L	T	P	Total Credits	Lecture: 0 + Tutorials: 0 + Practical: 28 + Self Study: 02 = 30	Duration of SEE: 03 Hours
			0	0	1	1		
			Total Max. Marks: 100				SEE Marks: 50	

Course Learning Objectives:	
CLO1	Introduce the philosophy, process and significance of exploratory data analysis within the data-science life cycle.
CLO2	Develop competence in acquiring, cleaning and wrangling structured data using Python libraries.
CLO3	Impart skills in computing and interpreting descriptive statistics, distributions and correlation measures.
CLO4	Enable effective univariate, bivariate and multivariate visualisation using Matplotlib, Seaborn and Plotly.
CLO5	Equip learners to derive, validate and communicate actionable insights from real-world datasets.

Syllabus	
PART: A - EXPERIMENTS	
1	Exploratory data analysis environment and data acquisition: Set-up of Python with Jupyter Notebook / Google Colab, NumPy, Pandas, Matplotlib and Seaborn; loading of data from CSV, Excel, JSON and web sources; initial inspection using head(), tail(), shape, info(), dtypes, describe() and memory profiling.
2	Data-quality assessment and treatment of missing values: Detection using isnull(), notnull() and missingness heat maps; listwise deletion, mean / median / mode imputation, forward and backward fill, interpolation and k-nearest-neighbour imputation; comparison of the effect of each strategy on the distribution.



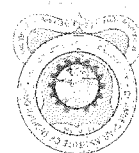
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3	Handling duplicate, inconsistent and noisy data: Duplicate detection and removal, correction of data-type mismatches, standardization of categorical labels, whitespace and case normalization, and regular-expression-based cleaning of textual fields.
4	Outlier detection and treatment: Box plot and inter-quartile-range rule, Z-score and modified Z-score, percentile capping; assessment of the impact of outlier treatment on the summary statistics of the dataset.

5	Descriptive statistics: Measures of central tendency and dispersion, quantiles, skewness and kurtosis; frequency distributions, contingency tables and grouped summaries using groupby() and agg().
6	Univariate analysis and visualization: Histogram, kernel-density plot, box plot, violin plot, count plot, bar chart and pie chart; interpretation of distribution shape, spread, modality and symmetry.
7	Bivariate analysis: Scatter plot, line plot, joint plot, grouped bar chart and cross-tabulation; Pearson, Spearman and Kendall correlation coefficients with a correlation heat map; distinction between correlation and causation.
8	Multivariate analysis: Pair plot, facet grids, bubble chart, stacked and grouped charts, parallel-coordinates plot and three-dimensional scatter plot; cluster-map based exploration of feature relationships.
9	Data wrangling and reshaping: Indexing and slicing with loc and iloc, filtering, sorting, apply / map / lambda operations, pivot tables and crosstab, merge, join and concat, and reshaping using melt, stack and unstack.
10	Feature transformation and encoding: Label, ordinal and one-hot encoding; min-max, standard and robust scaling; logarithmic and Box-Cox transformation; binning and discretization; and the effect of each on the shape of the distribution.
11	Time-series exploratory analysis: Datetime parsing and indexing, resampling and aggregation, rolling and expanding statistics, trend and seasonality decomposition, lag plots and autocorrelation plots.
12	Exploratory analysis of text data: Tokenization, stop-word removal, case and punctuation normalization, frequency distribution, n-gram analysis and word-cloud visualization of a text corpus.

PART: B – CONVENTIONAL EXPERIMENTS



Semester: III

Scheme: 2025

Conventional experiments are a type of laboratory activity where the outcome is not predetermined, and students are given the freedom to explore, design, and conduct the experiment based on the problem statements as per the concepts defined by the course coordinator. It encourages creativity, critical thinking, and inquiry-based learning.	
1	End-to-end exploratory analysis of an agricultural or crop-yield dataset obtained from an open data portal, culminating in insight-driven recommendations for stakeholders.
2	Comparative exploratory analysis of a public healthcare dataset across regions or time periods, including formulation and statistical validation of hypotheses.

3	Anomaly-oriented exploration of a financial transaction dataset to characterise unusual spending or transaction behaviour and to justify the anomalies identified.
4	Design of an interactive exploratory dashboard for a socially relevant open dataset, accompanied by a narrative report of the findings.

Teaching & Learning Process (Innovative Delivery Methods):	
1	Chalk-and-talk supported by live notebook demonstrations in the laboratory.
2	Hands-on practice with open datasets drawn from public repositories and government open-data portals.
3	Problem-Based Learning (PBL) through dataset-driven analytical assignments.
4	Team-Based Learning (TBL) for the open-ended exploratory activities of Part B.
5	Data-storytelling presentations, peer review and viva-voce to strengthen interpretation and communication.

SELF-STUDY COMPONENT (02 Hours)

The self-study component comprises topics that extend and deepen the laboratory work of Part A and Part B. These topics are to be learnt by the student independently under the guidance of the course coordinator, through prescribed readings, documentation, online resources and small self-directed exercises, and are consolidated through a self-study report or a short presentation. The self-study component is not included for CIE and SEE.



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1	Foundations and philosophy of exploratory data analysis: Tukey's formulation of exploratory analysis, the distinction between exploratory and confirmatory analysis, the role of exploratory analysis in the data-science life cycle and the risks of data dredging.	2	Mechanisms of missingness: Missing completely at random, missing at random and missing not at random; implications of each mechanism for the choice of imputation strategy and for the validity of conclusions drawn from the data.	3	Exploratory analysis of large datasets: Chunked and out-of-core processing, memory profiling and dtype optimisation, columnar libraries such as Polars and parallel frameworks such as Dask, and principled sampling for exploration of datasets that exceed main memory.
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Teaching and Learning Process (Innovative Delivery Methods)					
1.	Active Learning Techniques	2.	Problem-Based Learning (PBL)	3.	Team-Based Learning (TBL)
4.	Hands-On Experiments and Simulations				

TEXT BOOKS:	
1	Suresh Kumar Mukhiya and Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing, 2020.
2	Wes McKinney, "Python for Data Analysis: Data Wrangling with pandas, NumPy and Jupyter", 3rd Edition, O'Reilly Media, 2022.

REFERENCE BOOKS:	
1	John W. Tukey, "Exploratory Data Analysis", Addison-Wesley, 1977.
2	Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", 2nd Edition, O'Reilly Media, 2023.
3	Peter Bruce, Andrew Bruce and Peter Gedeck, "Practical Statistics for Data Scientists", 2nd Edition, O'Reilly Media, 2020.



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4	Claus O. Wilke, "Fundamentals of Data Visualization", O'Reilly Media, 2019.
e-LEARNING RESOURCES:	
1	pandas Documentation – User Guide – https://pandas.pydata.org/docs/user_guide/index.html
2	Videos and Lecture Notes: http://www.nptel.ac.in
3	seaborn: Statistical Data Visualization – Official Tutorial – https://seaborn.pydata.org/tutorial.html
4	Kaggle Learn – Pandas, Data Cleaning and Data Visualization micro-courses – https://www.kaggle.com/learn
5	Hands-on Exploratory Data Analysis with Python https://github.com/packtpublishing/hands-onexploratory-data-analysis-with-python

Assessment Details for CIE						
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)	20		
					The record will be evaluated weekly according to the rubrics, and the average marks will be considered.	Lab CIE
		TOTAL	50		20	
SEMESTER END EXAMINATION (SEE)						
The student must secure a minimum of 40% marks in the SEE to pass the course.						

Practical Examination Guidelines

- All laboratory experiments shall be included for the practical examination.
- The instructions and marks breakup printed on the cover page of the answer script shall be strictly adhered to by the examiners.
- Students shall be allowed to randomly select any one experiment from the given lot.
- Change of the selected experiment shall be permitted only once.



Semester: III

Scheme: 2025

- Any change of experiment shall attract mark deduction as per the Dr. AIT Autonomous Examination Rules and Regulations.

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Apply Python data-handling libraries to acquire, inspect and assess the quality of structured datasets.
CO2	Make use of appropriate cleaning, imputation, outlier-treatment and transformation techniques to prepare data for analysis.
CO3	Compute and interpret descriptive statistics, distributions and correlation measures to characterise a dataset.
CO4	Construct univariate, bivariate and multivariate visualisations using Matplotlib, Seaborn and Plotly to reveal patterns and relationships.
CO5	Design and demonstrate an end-to-end exploratory analysis on a real-world dataset and communicate the resulting insights effectively.

COURSE SUSTAINABLE DEVELOPMENT GOALS (SDGs)	
Goal No.	Goal Title
4	Ensure Inclusive and equitable quality education and promote lifelong learning opportunities for all
8	Decent Work and Economic Growth
Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.	

Mapping of COs with POs with PSOs															
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	
CO1	3	2	-	2	3	-	-	-	-	-	2	3	1	-	
CO2	3	3	2	2	3	-	-	-	-	-	2	3	2	1	
CO3	3	3	-	3	2	-	-	-	-	2	2	3	2	1	
CO4	3	3	2	3	3	-	-	-	-	2	2	3	3	1	
CO5	2	3	3	3	3	2	1	2	3	1	3	3	3	2	

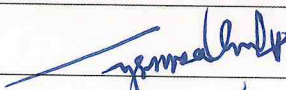


Semester: III

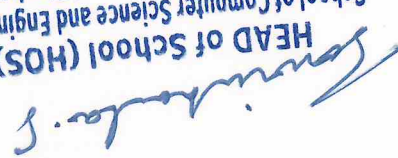
Scheme: 2025

Mapping of COs with Knowledge and Attitude Profile (WK) Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	-	3	2	-	-	3	-	-	-
CO2	-	3	3	2	-	3	-	-	-
CO3	2	3	2	2	-	3	-	-	-
CO4	-	3	3	3	2	3	-	-	-
CO5	-	3	3	3	3	3	2	2	1

Course Coordinators:

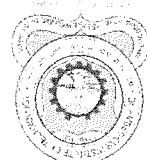
	Dr. Ajay Prakash B. V., Research Professor & Head, AI & ML, SCSE
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Head of the Department
Artificial Intelligence and Machine Learning
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Course Title	Course Code	Course Category	Teaching - Learning Scheme & Credits	CIE Marks: 50		
APTITUDE AND VERBAL ABILITY SKILLS	IBCDN309	MC (Mandatory Course)	L T P	2 0 0	Total Credits 0	Lecture: 26 + Tutorials: 0 + Practical: 0 + Self Study: 0 = 26
			Total Teaching Hours			

Course Learning Objectives:	
CLO1	This unit aims at teaching the Verbal Ability. It gives them the insight about grammar rules & concepts.
CLO2	This lesson will help students make inferences and predictions about spoken, writing & listening discourse.
CLO3	This unit comprises with the concepts of Profit Loss, Ratio Proportion and Percentage Problems.
CLO4	This unit deals with the analytical reasoning concepts which signifies on Blood relation, Seating Arrangements and Syllogism.
CLO5	This unit deals with the concepts on reasoning ability.

SYLLABUS		
UNIT 1		
Verbal Ability I – Reading Comprehension: Types and Tackling Strategies, Understanding meaning of a text, Drawing Connections, Summarizing and Synthesizing, Building Vocabulary, Speed Reading Strategies--(GA) - Story Chain, Playing the Bus Game	6	LI-L4
Verbal Ability II – Verbal Reasoning and Verbal Analogy: Verbal Reasoning, Verbal Classification, Logical sequence of word.		
Verbal Ability III – Vocabulary based exercise: Antonyms, Synonyms, One-word Substitution, Reading techniques, Managing time.		
UNIT 2		
Verbal Ability V – Letter and E-mail writing exercises: Types (Formal, Informal, Semi-Formal), Formats, Samples, Practice using the right salutations, greetings, subject line, addresses, conciseness and preciseness.	6	LI-L4
Verbal Ability VI – Letter and E-mail writing exercises: Types (Formal, Informal, Semi-Formal), Formats, Samples, Practice using the right salutations, greetings, subject line, addresses, conciseness and preciseness.		
Managing one's social media presence, tips to build social media presence, Optimizing social media presence, importance to have social media presence, making a strong social media presence,		
Technical writing skills and Technical speaking skills--		
1) Technical Skills --- Knowledge of the industry , products and Services as well as specialized tools used in the industry.		
2) Communication Skills--- The ability to communicate effectively complex ideas to end users.		
Students should learn about project presentation		



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Semester: III

3) Audience Analysis -- The ability to identify the right audience 4) Critical Thinking --- The ability to think in critical Situations. 5) Team work --- To work in collaboration with Content designers, Software engineers, Product Managers. 6) Design Skills --- The ability to visually present ideas. 7) Research Skills --- The ability to do research work. 8) Experience with Technical writing software tools. ---(GA) - Each group selects a common device or software. (e.g., a smartphone, a microwave oven, a social media app).		
UNIT 3		
6	L1-L4	
Profit and Loss: Concept and Problem-solving technic in Profit and Loss Ratio, Proportion and Partnership, Allegation and Mixture: Basic Concept of Allegation and Mixture, concept of mixture containing more than two Ingredients, Concept and Problem-solving technic in Ratio and Proportion, Partnership Percentage: Percentages as Fractions and Decimals, Percentage Increase / Decrease-(PH)		
UNIT 4		
4	L1-L4	
Blood Relation: Option elimination method in Blood Relation Seating Arrangements: Different types of seating arrangement and shortcut method to solve. Syllogism-Types of questions with options, Some, All, and No questions. (PH)		
UNIT 5		
4	L1-L4	
Logical Reasoning: Different types of Problems on reasoning Direction Sense: Basic concept and Problem-solving technique for various types of problem in Direction sense. -(PH)		

REFERENCE BOOKS:		
1	Quantitative aptitude for competitive exams by S.Chand, Dr. R.S. Aggarwal	
2	Quantitative aptitude for CAT by Arun Sharma, Tata McGraw Hill	
3	Rapid Quantitative Aptitude by Er. Deepak Agarwal and Mr. D.P Gupta	
4	Numerical Ability and Quantitative aptitude for Competitive examinations by P.K.Mittal.	
5	Verbal Ability and Reading comprehension by Arun Sharma and Meenakshi Upadhyay, Tata McGraw Hill Education	
e-LEARNING RESOURCES:		
1	Note: Required reference links to each unit will be provided in PH	
2	Videos and Lecture Notes: http://www.mptel.ac.in	

Assessment Details for CIE		
To pass the course, students must secure a minimum of 40% marks in CIE. Continuous Internal Evaluation (CIE) The CIE consists of three components: 1. CIE – Theory Component		



CONTINUOUS INTERNAL EVALUATION (CIE)			
Max. Marks to Qualify for SEE (40% Minimum Marks Required in CIE individually)	Theory	Weightage of CIE-1 and CIE-2 or CIE-3	40
	Assignment	05	05
	Group Activity	05	50
	TOTAL	50	20

2. Assignment
 3. Group Activity
 Students must secure a minimum of 40% marks in the combined total of the CIE Theory, Assignment, and Group Activity components to pass the subject. No SEE for the subject

Course Outcomes After the successful completion of the course, the students are expected to:	
CO1	After the completion of this unit students will know about the basic concepts of general quantitative aptitude.
CO2	At the end of this unit student will learn about the Arithmetic Aptitude. This unit helps the students to gain the knowledge on Business Mathematics.
CO3	This unit aims to teach students understand their interpretation skills in relation to patterns, diagrammatic tests, abstract reasoning tests, deductive reasoning tests, and inductive reasoning tests.
CO4	This unit will make the students understand the problems on Blood relations, Seating Arrangements and Syllogism.
CO5	After this unit, students will learn the usage of Grammar by exercising with basic concepts.

COURSE SUSTAINABLE DEVELOPMENT GOALS (SDGs)		
Goal No.	Goal Title	Description
4	Quality Education	Ensure Inclusive and equitable quality education and promote lifelong learning opportunities for all
8	Decent Work and Economic Growth	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Mapping of COs with POs with PSOs																
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																
CO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
	1	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO1	3	3	3	2	2	2	3	2	2	2	2	2	2	2	2	2
CO2	3	3	3	2	2	2	3	2	2	2	2	2	2	2	2	2
CO3	3	3	3	3	2	2	3	2	2	2	2	2	2	2	2	2
CO4	3	3	3	3	2	2	3	2	2	2	2	2	2	2	2	2
CO5	3	3	3	3	2	2	3	2	2	2	2	2	2	2	2	2



Mapping of COs with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3

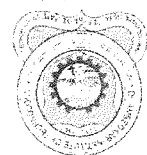
Course Coordinators:

CAREER GUIDANCE AND PLACEMENT CELL (CGPC)	

[Signature]

TRAINING AND PLACEMENT OFFICER
Dr. Ambedkar Institute of Technology
Bengaluru-560 056

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HEAD of School (HOS)
School of Computer Science and Engineering
Dr. Ambedkar Institute of Technology
Bengaluru-560 056
[Signature]



Course Title	DISCRETE MATHEMATICAL STRUCTURES	
	IBMAT401B	
Course Code	IBMAT401B	
Course Category	ASC (Applied Science Course)	
Teaching - Learning Scheme & Credit	L	T
	P	Total
CIE Marks: 50	3	2
	0	4
SEE Marks: 50	Total Max. Marks: 100	
	Duration of SEE: 03 Hours	
Lecture: 42 + Tutorials: 28 + Practical: 0 + Self Study: 50 = 120	Total Teaching Hours	
	Duration of SEE: 03 Hours	

Course Learning Objectives:

This course is proposed to enhance the student's ability to think logically, mathematically and algorithmically and use the concepts of discrete mathematical structures to solve problems connected to computer and information science and engineering.

SYLLABUS		
UNIT 1	14	L1-L4
Fundamentals of Logic		
Propositions, logical connectives, tautologies, contradictions, logical equivalence, laws of logic, inverse, converse and contrapositive. Logical implication – Rules of inference. Quantifiers and types of quantifiers.		
SELF-STUDY COMPONENT		
Applications: Applications to switching networks.		
10 Hours		
UNIT 2		
Set Theory and Mathematical Induction		
Sets, subsets, set operations, laws of set theory. The well ordering principle, principle of mathematical induction.		
Applications: Applications to recursive relations - Fibonacci, Lucas numbers.		
SELF-STUDY COMPONENTS		
Axioms of probability.		
10 Hours		
UNIT 3		
14		
L1-L4		

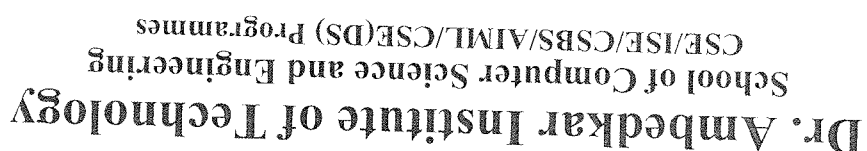


Relations and Functions		
Cartesian product, relations, equivalence relation and partition. Partial order, Poset, Hasse diagram. Functions, one-one and onto functions, composition of functions. Applications: Computer recognition - zero-one matrices and directed graphs.		
SELF-STUDY COMPONENT		
10 Hours		
UNIT 4		
14	L1-L4	
Introduction to Graph Theory		
Definition of a graph and examples. Degree of a vertex and degree sequence - Hakimi's theorem (without proof). Standard graphs - complete graph, regular graph, bipartite graph. Graph isomorphism, complement of a graph. Sub graph, spanning sub graph. Walk, trail, path, cycle, connectedness, Euler and Hamiltonian graph. Applications: Königsberg bridge problem, seating arrangement problem.		
SELF-STUDY COMPONENT		
10 Hours		
UNIT 5		
14	L1-L4	
Planar Graphs, Matrix Representation and Graph Coloring		
Planar Graphs, Matrix Representation of a Graph - Adjacency matrix, Incidence matrix, Circuit Matrix, Fundamental circuit matrix - properties and rank. Vertex and Edge Coloring, Chromatic Polynomial. Applications: Scheduling Problem.		
SELF-STUDY COMPONENT		
10 Hours		
Laplacian-matrix, Four color theorem, Chromatic-Partitioning.		

TEXT BOOKS:		
1	Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education, 2004.	
2	J. P. Tremblay and R. Manohar: Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw-Hill.	
3	Gary Chartrand and Ping Zhang: Introduction to Graph Theory, Tata McGraw-Hill Edition, 2006.	

REFERENCE BOOKS:		
1	Narsingh Deo: Graph Theory with Applications to Engineering and Computer Science, PHI, 1979.	
2	C. L. Liu & D. P. Mohapatra: Elements of Discrete Mathematics, A Computer Oriented Approach, The McGraw-Hill Companies.	
3	Kenneth H. Rosen: Discrete Mathematics and its Applications, 6th Edition, McGraw Hill, 2007.	

e-LEARNING RESOURCES:



Scheme: 2025

The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. ****Self-Study components should be included for CIE.**

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

3



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Goal No.	Goal Title	Description
4	Quality Education	Develops computational thinking and programming fundamentals.
9	Innovation and Infrastructure	Builds efficient software design skills, optimal data organization, mastering them equips students to design resilient computing infrastructure and contribute to innovation in application development.

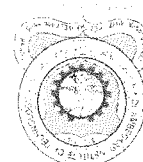
Mapping of COs, POs with PSOs												
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1
CO1	2	1	-	-	-	-	-	-	-	-	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	2
CO3	2	3	-	-	-	-	-	-	-	-	-	2
CO4	3	2	-	-	-	-	-	-	-	-	-	2
CO5	2	3	-	-	-	-	-	-	-	-	-	2

Mapping of COs with Knowledge and Attitude Profile (WK)												
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0												
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9			
CO1	3	3	2	-	-	-	-	-	-			
CO2	3	3	2	-	-	-	-	-	-			
CO3	3	3	2	-	-	-	-	-	-			
CO4	3	3	2	-	-	-	-	-	-			
CO5	3	3	2	-	-	-	-	-	-			

Course Coordinators:

 Dr. Divya Darshini S, Assistant Professor Mathematics	 Dr. Latha D N, Assistant Professor Mathematics
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Dr. Ambedkar Institute of Technology
School of Computer Science and Engineering
Computer Science and Engineering Programme

Semester: IV

Scheme: 2025

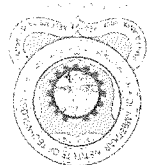
Course Title	Course Code	Course Category	Teaching - Learning Scheme	CIE Marks: 50	SSE	Marks: 50	Total Max. Marks: 100	Duration of SSE: 03 Hours
Microcontroller and Embedded Systems	IBCSU402	IPCC (Integrated Professional Core Course)	L T P Total Credits	3 0 1 4	0	1	4	Lecture: 42 + Tutorials: 0 + Practical: 28 + Self Study: 50 = 120

Course Learning Objectives:	
CL01	Understand the fundamentals of ARM-based systems, including programming modules with registers and the CPSR.
CL02	Use the various instructions to program the ARM microcontroller.
CL03	Identify various components, their purpose and application to the embedded systems' Applicability.
CL04	Understand the pin description of Raspberry Pi.
CL05	Program various embedded components using python program and Proteus Simulator

SYLLABUS			No. of Hours	BTLs
UNIT 1			9	L1-L4
The History of ARM and Microcontrollers: Introduction to Microcontrollers, the ARM Family History, ARM Architecture and Assembly Language Programming: The General Purpose Registers in the ARM, ARM CPSR (Current Program Status Register), The ARM Memory Map, Program ROM Space in the ARM, The Program Counter, RISC Architecture in ARM, Assembling an ARM Program, viewing Registers and Memory with ARM Keil IDE.			10 Hours	
SELF-STUDY COMPONENT				
Introduction to Microprocessor and microcontroller, differences between microprocessor and microcontroller in the industries,				
UNIT 2			9	L1-L4
Introduction to ARM Assembly Programming: ARM Data Format and Directives, Arithmetic and Logic Instructions and Programs: Arithmetic Instructions, Logic Instructions, Rotate and Barrel Shifter, Shift and Rotate Instructions in ARM Cortex, Load and Store Instructions in ARM, Some ARM Addressing Modes, Advanced Indexed Addressing Mode.			10 Hours	
SELF-STUDY COMPONENT				
Instruction set architecture, Structure of assembly language program, assembly instruction format, program development tools.				
UNIT 3			9	L1-L4



Branch, Call, and Looping in ARM: Looping and Branch Instructions, Calling Subroutine with BL, ARM Time Delay and Instruction Pipeline, Conditional Execution, Stack and stack usage in ARM.	
Signed Numbers and IEEE 754 Floating Point: Signed Numbers Concept, Signed Number Instructions and Operations,	
IEEE 754 Floating-Point Standards: Single precision and double precision floating point formats	
SELF-STUDY COMPONENT	
10 Hours	
Industry standard for number representation, floating point number representation, signed number representation and operations.	
UNIT 4	
L1-L4	7
Embedded System Components: Embedded Vs General computing system, History of embedded systems, Classification of Embedded systems, Major applications areas of embedded systems, purpose of embedded systems. Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, stepper motor, Keyboard, Push button switch, Embedded firmware..	
SELF-STUDY COMPONENT	
10 Hours	
Identifying the components and analyzing the working of following embedded systems • Washing machine • Air conditioner • Automatic Chocolate Vending machine	
UNIT 5	
L1-L4	8
ARM based Raspberry Pi Interfacing: What is Raspberry Pi, What can you do with Raspberry Pi, A tour of the Raspberry Pi, Setting up your Raspberry Pi, and Booting up.	
Interfacing Hardware: GPIO pin connections, Bread boarding with jumper wires, Digital outputs, Analog outputs, Digital Inputs, Analog Inputs,	
Interfacing examples (using Python and Proteus Simulator): Interfacing Raspberry Pi to LED, Seven segment Display, Stepper Motor, Keypad.	
SELF-STUDY COMPONENT	
10 Hours	
Structure of Python program for Raspberry Pi interfacing, installation and working of Proteus simulator, Development of simple embedded system using Proteus simulator, applications of Raspberry Pi in industries.	
Practical Component	
ARM Assembly language Programs	
Note: Develop the programs using Keil or any other suitable simulator	
Programs using only Registers 1. Write a program to store 8 bit, 16 bit and 32 bit data to register R1, R2, and R3 respectively. 2. Write a program to add two 8 bit data stored in register R1 and R2 and store the result in R3. 3. Rotate the content of R3 right 4 bit and store the result in R4. 3. Write a program to store 32 bit data to register R1 and exchange the content of lower half word with higher half word	



4. Write a program to find 1's complement and 2's complement of 32 bit data stored in register R1. Store the 1's complement in R2 and 2's complement in R3.

Programs using Variables

1. Write a program to evaluate the following expressions

Result=(val1+val2)*(val1-val2) and sum=(val1*val2)+(val1/2)

Assume variable of size 32 bits

$F1=A^*CD^*+AC^*D+A^*C^*D+ACD$ and $F2=(A+C+D)(A^*+C+D^*)(A^*+C^*+D)$

2. Write a program to define 5 bytes of data in location X. copy the middle element of x to the fifth position of Y and last element of X to first position of Y. (+ means OR operation, . means AND operation, ' means NOT operation. Assume variables of size 32 bits

Programs using Branch Instructions

1. An embedded processor receives a sequence of 16-bit sensor readings stored in memory location X. Design an ARM assembly program to dynamically determine the number of readings and compute their total sum. Store the count and total sum in the location **XCOUNT** and **SUM** respectively

2. An embedded monitoring system stores 10 sensor readings as 32-bit values in memory location P. Design an ARM assembly program to analyse the readings and identify the maximum and minimum sensor values.

3. A microcontroller-based voting system stores voting patterns as a 32-bit binary number in location A. Create an assembly language program to calculate the number of enabled bits (1s) and disabled bits (0s), and store the outputs in **ONECOUNT** and **ZEROCOUNT**.

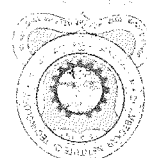
4. A temperature monitoring system stores the temperature status as a signed byte in the memory location **VALUE**. The controller must identify whether the temperature reading is zero, above zero, or below zero. Based on the result, it should store:
 - 0x1 in TYPE if the value is zero
 - 0x22 in TYPE if the value is positive
 - 0x33 in TYPE if the value is negative

5. Write an assembly language program to perform this operation.
 - A weather monitoring system installed in a remote agricultural field continuously records temperature variations every hour. These temperature readings are stored as signed byte values in memory because the readings may include both positive and negative temperatures.
 - The total number of temperature readings collected is stored in the variable **LENGTH**, and the readings begin from the memory location labelled **NUM**.

6. Write an assembly language program to identify the lowest temperature recorded among the series of signed byte values and store the minimum value in the variable **NUMIN**.
 - A financial analysis system stores daily profit and loss values of a company as 32-bit signed numbers in an array of size N. The array contains a combination of positive values (profit), negative values (loss), and zero values (no profit or loss).
 - Write an assembly language program to analyse the array and count how many entries are positive, negative, and zero. Store the respective counts in the memory locations **PCOUNT**, **NCOUNT**, and **ZCOUNT**.



7. A digital monitoring system compares readings from three different high-precision sensors. Each sensor outputs a 32-bit unsigned value representing measured intensity levels under different conditions. The readings are stored in memory locations **VALUE1**, **VALUE2**, and **VALUE3**. Write an assembly language program to compare these three sensor readings and determine the smallest value among them. Store the smallest value in the 32-bit memory location **RESULT**.
8. A simple inventory management system stores a list of item IDs in memory as signed word data in an array labelled **ELEMENTS**, with the total number of items given by **N**. Each item ID represents a product in a warehouse database. A user enters a product ID to search, which is stored in the memory location **KEY**. Write an assembly language program to perform a linear search on the **ELEMENTS** array. If the **KEY** is found in the list, store **0xFF** in the variable **STATUS**; otherwise, store **0x11** to indicate that the item is not available in the inventory.
9. A small embedded system is responsible for processing sensor calibration data. The system receives 5 bytes of raw calibration values stored sequentially in memory starting at location **X**. These values must first be transferred to a working memory buffer starting at location **Y** for further processing. After copying, the system must arrange the calibration values in ascending order to ensure proper sensor tuning and accuracy using bubble sort method. Write an assembly language program for the above scenario.
10. Define two strings in locations **STR1** and **STR2**. Write a program to compare two strings, move **0xFF** to **RESULT** if strings are equal else move **0x11** to **RESULT**. Compare length of two strings before comparison and store **0x22** to **RESULT** if length of two strings equal **0x33** to **RESULT** if length of first string is greater than second string **0x44** to **RESULT** if length of second string is greater than first string
- Embedded Applications (Using Python and Proteus simulator)**
1. Interface Raspberry to LED and write python program to simulate the 2 bit up/down counter.
 2. Interface three LEDs to Raspberry PI and Write python program to simulate the traffic signal repeatedly by assuming the following
 - Initially signal should be **Stop** and duration is 5 seconds
 - Next signal is **Go** duration is 5 seconds
 - In between **Watch** signal of duration 1 seconds
 3. Interface single Seven Segment Display (SSD) to Raspberry PI and write python program to display the values from 0 to 9.
 4. Interface Stepper motor to Raspberry PI and write python program to rotate motor in clockwise and anticlockwise direction.
 5. Development of any simple embedded application.



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Semester: IV

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2.	Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education, Private Limited, 2nd Edition.
3.	Simon Monk, "Programming the Raspberry Pi", Tata McGraw Hill Education, Private Limited, 2nd Edition, ISBN 978-1-25-958740-2.

REFERENCE BOOKS	
1.	Andrew N Sloss, Dominic Symes and Chris Wright, ARM system developers guide, Elsevier, Morgan Kaufman publishers, 2008.
2.	Raghuveer, G.H, Microcontroller (ARM) and Embedded System, Cengage learning Publication, 2019
3.	The Insider's Guide to the ARM7 Based Microcontrollers, Hitec Ltd., 1st edition, 2005.
4.	Steve Furber, ARM System-on-Chip Architecture, Second Edition, Pearson, 2015.

e-LEARNING RESOURCES	
elearning.vtu.ac.in/content/courses/video/BS/15PCD23.html	
https://nptel.ac.in/courses/106/105/106105171/	

Assessment Details for both CIE and SEE

The weightage assigned to the Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) is 50% each.

To pass the course, students must secure a minimum of 40% marks separately in both CIE and SEE.

Continuous Internal Evaluation (CIE)

The CIE consists of two components:

1. CIE – Theory Component
2. CIE – Laboratory Component

Students must secure a minimum of 40% marks in the combined CIE theory and laboratory components. In addition, students must secure a minimum of 40% marks in the CIE laboratory component separately to qualify for appearing in the SEE.

Semester End Examination (SEE)

The Theory SEE is conducted for 100 marks with a duration of 3 hours. The marks obtained are subsequently scaled down to 50 marks for calculating the final course grade.

The student must secure a minimum of 40% marks in the SEE to pass the course.

****Self-Study Component should be included for CIE.**

CONTINUOUS INTERNAL EVALUATION (CIE)				
Theory	Laboratory component	TOTAL		
Weightage of CIE-1 and CIE-2 Tests or CIE-3	The record will be evaluated weekly according to the rubrics, and the average marks will be considered.	Lab CIE	10	10
30	20	50	20	20
Max. Marks	Minimum Marks Required in CIE to Qualify for SEE (40% in Each Component)	12	08	20

SEE QUESTION PAPER PATTERN



Dr. Ambedkar Institute of Technology
School of Computer Science and Engineering
Computer Science and Engineering Programme

Scheme: 2025

Semester: IV

Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1	2	3	4	5	6	7	8	9	10
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to	
CO1	Describe the architecture of ARM microcontroller.
CO2	Write the assembly language program using ARM microcontroller instructions.
CO3	Identify the embedded components and their applications
CO4	Understand the working of Raspberry Pi and Interface peripherals to Raspberry Pi
CO5	Develop simple embedded applications using python and Proteus simulator.

COURSE SUSTAINABLE DEVELOPMENT GOALS (SDGs)		
Goal No.	Goal Title	Description
4	Quality Education	Ensure Inclusive and equitable quality education and promote lifelong learning opportunities for all
8	Decent Work and Economic Growth	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Mapping of COs with POS with PSOs										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO
CO1	3	3	2	2	2	-	-	-	-	3
CO2	3	3	3	2	3	2	-	-	-	3
CO3	3	2	2	2	3	2	-	-	-	3
CO4	3	3	2	3	3	3	-	-	-	3
CO5	3	3	2	3	3	3	-	-	-	3

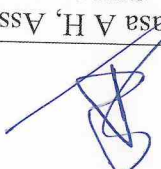
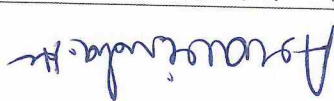
Mapping of COs with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	3	3	3	3	1	2	2	2	3	
CO2	3	3	3	3	3	3	2	2	3	
CO3	2	1	2	2	1	2	3	2	3	
CO4	3	3	3	3	3	3	2	2	3	
CO5	3	3	3	3	3	3	3	3	3	

Course Coordinators:



Semester: IV

Scheme: 2025

Dr. Srinivasa A H, Associate Professor CSE Programme	Dr. Aravinda H L, Associate Professor CSE Programme
	

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Dr. Ambedkar Institute of Technology
School of Computer Science and Engineering
Computer Science and Engineering Programme

Semester: IV

Scheme: 2025

Course Title	Digital Marketing				
Course Code	IBCBU402				
Course Category	IPCC (Integrated Professional Core Course)				
Teaching-Learning Scheme & Credit	L	T	P	Total Credits	Total Teaching Hours
	3	0	1	4	Lecture: 42 + Tutorials: 0 + Practical: 28 + Self Study: 50 = 120
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100		Duration of SEE: 03 Hours

Course Learning Objectives: Students are able to					
CLO	1	CLO	2	CLO	3
	Understand Digital Marketing concepts, evolution, and AI-driven trends.		Analyze Mobile Marketing strategies and emerging mobile-commerce practices.		Describe Online Marketing concepts, practices, and AEO.
					Analyze AI-powered tools and practices in Email Marketing automation.
					Apply AI-based tools to Social Media Analytics.

SYLLABUS		
UNIT 1		
BTLs	No. of Hours	L1-L4
	10	L1-L4
Introduction to Digital Marketing		
The Concept, Need & Evolution of Digital Marketing, Reason for growing importance of Digital Marketing in India, Digital Marketing: Types & Examples, Role of Artificial Intelligence and Automation in Modern Digital Marketing, Personalization and Hyper-targeting, Emerging Trend – Answer Engine Optimization (AEO): brief introduction to AI-related search/answer engines (ChatGPT, Google AI Overviews, Perplexity) as a new channel in the digital marketing landscape. Case Study on Digital Marketing.		
SELF-STUDY COMPONENT		
	10 Hours	
Case studies: (i) Digital marketing strategy of an Indian e-commerce brand (Flipkart/Myntra); (ii) Amazon's digital brand-building journey; (iii) Nike's digital marketing transformation.		
UNIT 2		
	8	L1-L4
Mobile Marketing		
Meaning, types & Evolution, Mobile – market size and rate of growth, Mobile applications, Types of Mobile Marketing, Advantages and Disadvantages of Mobile marketing, Performance marketing: definition, benefits, 5G-enabled Mobile Commerce and App-based Marketing trends. Case Study on Mobile Marketing.		



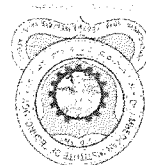
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SELF-STUDY COMPONENT		10 Hours
Case studies: (i) Mobile marketing strategy of a food-delivery app (Swiggy/Zomato); (ii) Ola/Uber's mobile app-based marketing; (iii) Paytm's mobile marketing evolution.		
UNIT 3		
8	L1-L4	
Online Marketing The concept of Digital Marketing Mix, 7 P's of Online Marketing: Product, Price, Promotion, Place, People, Process, Physical evidence, Methods of Online Marketing promotion (SEO, SEM, Content Marketing), Answer Engine Optimization (AEO): optimizing content for AI-related search engines and answer engines (ChatGPT, Google AI Overviews/Gemini, Perplexity, Bing Copilot) that generate direct answers instead of a list of links, how AEO differs from traditional SEO, and techniques to make content discoverable and citable by AI search engines. Case Study on Online Marketing / AEO.		
SELF-STUDY COMPONENT		10 Hours
Case studies: (i) Online marketing mix (7Ps) of a D2C brand (Mamaearth/boAt); (ii) Amazon's online marketing strategy; (iii) Lenskart's online marketing approach.		
UNIT 4		
8	L1-L4	
Email Marketing Email Marketing: Need for Emails, Types of Emails, options in Email advertising, Do's and Don'ts of an email marketing campaign, Introduction to AI-powered Email Marketing tools (Mailchimp, HubSpot), Automation and Personalization in Email Campaigns. Case Study on Email Marketing.		
SELF-STUDY COMPONENT		10 Hours
Case studies: (i) Email marketing campaign of a SaaS or EdTech company (Byju's/Unacademy); (ii) Cred's email marketing style; (iii) Airbnb's email marketing strategy.		
UNIT 5		
8	L1-L4	
Social Media Analytics Types of Analytics in Social Media: Analytics, Listening, Advertising Analytics, Analytics from CMS and CRM, The Analytics Process, Metrics, Dashboards, and Reports, AI-driven Social Media Analytics tools and Social Commerce trends. Case Study on Social Media Analytics.		
SELF-STUDY COMPONENT		10 Hours
Case studies: (i) Social media analytics strategy of a global brand (Nike/Starbucks); (ii) Netflix's social media analytics practices; (iii) Spotify Wrapped as a social media analytics campaign.		

Practical Component	
1. Create a business/personal brand profile and prepare a Digital Marketing plan identifying suitable digital marketing channels for a chosen business. 2. Design a Mobile Marketing campaign strategy for an app-based business, including push-notification and SMS marketing drafts.	



3. Perform on-page and off-page SEO analysis of a website using free tools (Google Search Console, Ubersuggest) and prepare an SEO report.
4. Practical exercise on Answer Engine Optimization (AEO): restructure a web page/content piece in Q&A/FAQ format and test its extractability using AI search tools (ChatGPT, Perplexity, Google AI Overview); compare results with traditional SEO ranking.
5. Design and execute a sample Email Marketing campaign using Mailchimp – create a template, segment the audience, and analyze open and click-through rates.
6. Plan a mock Google Ads/Meta Ads campaign applying the 7 P's of the Online Marketing mix, including budget and target-audience settings.
7. Perform Social Media Analytics on a business page (Facebook/Instagram/LinkedIn) using native or free analytics tools; extract engagement, reach, and impression metrics and prepare a dashboard/report.
8. Mini-project: Develop an integrated digital marketing strategy (mobile + online + email + social media, including at least one AEO tactic) for a mock startup and present it as a case study report.

***Note- Use Microsoft Excel, Power BI, Tableau and other applicable tools for execution of above programs**

TEXT BOOKS

1	Chaffey, D., Ellis-Chadwick, F., & Abed-Rabbo, M. (2026). Digital Marketing (9th ed.). Pearson. [Fully updated with Generative AI case studies and coverage of AI-driven personalization.]
2	Allison, K. (2026). Strategic Digital Marketing: Modernizing 21st Century Business (2nd ed.). Sentia Publishing. [Covers SEO/SEM, social media, digital analytics, AI, and emerging technologies.]

REFERENCE BOOKS

1.	Handa, Z., & Simn, G. (2025). Answer Engine Optimization: The 2026 Answer Engine Journal Guide to AI Visibility, SEO, GEO, and AEO. Demeter Academy Press
2.	Lipschultz, J. H. (2025). Social Media Measurement and Management: Entrepreneurial Digital Analytics (2nd ed.). Routledge.:

e-LEARNING RESOURCES

https://www.coursera.org/learn/foundations-of-digital-marketing-and-e-commerce
https://open.wm.edu/opentextbooks/textbooks/1602

Assessment Details for both CIE and SEE

The weightage assigned to the Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) is 50% each.

To pass the course, students must secure a minimum of 40% marks separately in both CIE and SEE.

CONTINUOUS INTERNAL EVALUATION (CIE)					Max. Marks	(40% in Each Component)
Theory	Weightage of CIE-1 and CIE-2 or CIE-3			30		
Laboratory component	The record will be evaluated weekly, and the average score will be considered.			20	08	20
	Lab CIE					
TOTAL					50	20

Course Outcomes: After the completion of the course, the student will be able to	
CO1	Analyze fundamentals and emerging practices of Digital Marketing.
CO2	Evaluate Mobile Marketing strategies and emerging 5G-enabled commerce trends.
CO3	Apply online marketing mix and AEO techniques for promotional strategies.
CO4	Design AI-powered automated Email Marketing campaigns.
CO5	Evaluate social media data using AI-driven analytics tools.

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Semester: IV
Scheme: 2025

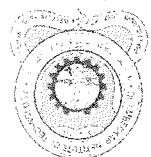
Mapping of COs with POs with PSOs												
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0												
CO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
CO1	2	2	1	-	3	2	1	-	2	2	3	2
CO2	3	3	2	3	2	1	1	-	2	2	3	3
CO3	3	3	3	2	3	1	1	-	2	2	3	3
CO4	3	3	3	2	3	1	1	1	2	2	3	3
CO5	3	3	2	3	3	1	1	1	2	2	3	3

Mapping of COs with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	2	2	3	1	1	2	2	2	3
CO2	3	3	3	3	3	3	2	2	3
CO3	2	1	2	2	1	2	3	2	3
CO4	3	3	3	3	3	3	2	2	3
CO5	3	3	3	3	3	3	3	3	3

Course Coordinators:

Dr. Vidyanand H J, Associate Professor HOP, CSBS Programme, SCSE	Mrs. Veena B, Assistant Professor CSBS Programme, SCSE
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Bengaluru-560 056

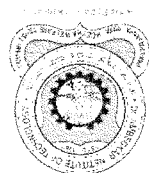


Course Title	Course Code	Course Category	Teaching - Learning Scheme				CIE Marks: 50		SEE Marks: 50		Total Max. Marks: 100	Duration of SEE: 03 Hours
Fundamentals of Data Science	IBSCSU402	IPCC (Integrated Professional Core Course)	L	T	P	Total Credits	Lecture: 42 + Tutorials: 0 + Practical: 28 + Self Study: 50 = 120	3	0	1	4	
						Total Teaching Hours						

Course Learning Objectives:

CL01	Apply Python programming and data science libraries to acquire, clean, and preprocess real-world datasets.
CL02	Perform exploratory data analysis and visualize data using appropriate statistical and graphical techniques.
CL03	Implement machine learning algorithms for solving classification and prediction problems and evaluate their performance.
CL04	Interpret analytical results and communicate data-driven insights for informed decision-making using suitable visualization and reporting tools.

SYLLABUS			No. of Hours	BTLs
UNIT 1			8	L1-L4
What is Data Science? The Data Science Cycle, Data Science in Practice, Data and Datasets, types of data, using technology for Data Science, Overview of Data Collection methods, Survey design and Implementation, Web scraping and Social Media Data Collection, Data Cleaning and preprocessing, Data Preprocessing using python, handling large datasets.			10 Hours	
SELF-STUDY COMPONENT			10 Hours	
Data Science with Python, search data using python pandas, visualize data using matplotlib, using python to scrap data from the web, extracting table data from the web, Regular Expressions in Python, Parsing and extracting data.				
UNIT 2			8	L1-L4
Measures of center, variation and position, Probability Theory, Basic concepts of probability, Discrete and Continuous Probability distributions, Statistical Inference and Confidence Intervals, Sampling distribution for the mean, Sample size determination, bootstrapping methods, using python to calculate confidence intervals, Correlation and Linear Regression Analysis, Linear Regression, using python for correlation and linear regression.				
SELF-STUDY COMPONENT			10 Hours	
Hypothesis Testing, testing samples based on one sample, Testing Claims for the Mean When the Population Standard Deviation Is Known, Testing Claims for the Mean When the Population Standard Deviation Is unknown, using python to conduct hypothesis tests, hypothesis testing of two samples.				

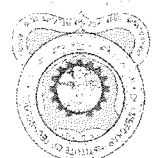


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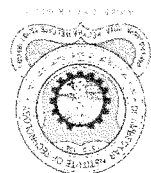
Semester: IV

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comparing two means, matched pairs data, testing claims for two proportions, Analysis of Variance (ANOVA), using python for one-way ANOVA.		
UNIT 3	9	L1-L4
Introduction to time series analysis, what is a time series, time series forecasting, Components of time series analysis, The Trend Curve and Trend-Cycle Component, time series forecasting methods, detrending the data and smoothing techniques, Simple Moving Average (SMA), SMA and differencing in python, analyzing seasonality, decomposing a time series into components using Python, what is machine learning, overfitting and underfitting, machine learning in regression analysis, linear regression and bootstrapping, multiple regression techniques, Decision trees, building a decision tree, other machine learning techniques, random forests, multinomial naïve bayes classifier, gaussian naïve bayes for continuous probabilities, working with big data.	10 Hours	SELF-STUDY COMPONENT
Forecast evaluation methods, forecasting error, prediction intervals, classification using machine learning, logistic regression, log-odds and discrete logistic regression, maximum likelihood and continuous logistic regression, logistic regression in python, k-means, k-means clustering in python, DBSCAN, DBSCAN in python, Confusion matrix, generating confusion matrix in python.	9	L1-L4
UNIT 4	9	L1-L4
Introduction to neural networks, what is a neural network, Neurons, Weights, Biases, and Activation Functions, types of activation functions, perceptrons, building a simple neural network, Back propagation, static backpropagation, error and loss, Introduction to deep learning, convolutional neural network, Image analysis using CNNs, natural language processing, ethics in data collection, ethics in data analysis, modeling and visualization.	10 Hours	SELF-STUDY COMPONENT
Training a Neural Network Using Backpropagation in Python using TensorFlow, recurrent neural network, unrolling an RNN, Vanishing/Exploding Gradient Problem, LSTM, RNNs in python, ethics in visualization and reporting, accurate representation, data Source attribution, accessibility and inclusivity.	8	L1-L4
UNIT 5	8	L1-L4
Encoding univariate data, boxplots, using python to create boxplots, histograms, using python to create histograms, pareto charts, encoding data that change over time, line charts and trend curves, using python for time series data visualization, graphing probability distributions, graphing the binomial distribution, the poisson distribution, and the normal distribution, geospatial and heatmap data visualization using python	10 Hours	SELF-STUDY COMPONENT
Multivariate and network data visualization using Python, scatter plots, correlation heatmaps, visualizing three-dimensional data.	10 Hours	SELF-STUDY COMPONENT
REPORTING RESULTS: writing an informative report, validating your model, effective executive summaries, executive summary example.	10 Hours	SELF-STUDY COMPONENT
Practical Component		



1. Write Python code using regular expressions to search for a selected word "Python" in a given string and print the number of times it appears.
2. A biotechnology research laboratory aims to develop an intelligent system for classifying mushrooms as edible or poisonous based on their physical characteristics.
Write a Python program to import the Mushroom dataset by
(<https://archive.ics.uci.edu/dataset/73/mushroom>), perform exploratory data analysis by displaying the dataset information and summary statistics.
Identify and handle missing values, encode the categorical features using appropriate encoding techniques, separate the dataset into input features (X) and target variable (Y), and display the final preprocessed dataset.
3. A company maintains its monthly sales reports in PDF format, where important business information is stored in tabular form. As a data analyst, you are required to extract the table from the given PDF document for further analysis.
Write a Python program to read the table from the PDF file using an appropriate Python library, convert the extracted table into a Pandas DataFrame, display the extracted data, and save it as a CSV file for future analysis.
4. Load the Iris dataset as a list of lists (each of the 150 lists should have 5 elements).
Compute and print the mean and the standard deviation for each of the 4 measurement columns (i.e. sepal length and width, petal length and width).
Compute and print the mean and the standard deviation for each of the 4 measurement columns, separately for each of the three Iris species (Versicolor, Virginica and Setosa).
Which measurement would you consider "best", if you were to guess the Iris species based only on those four values?
5. Write a python code to calculate a 90% confidence interval, and use Python functions to calculate the confidence interval. (Consider a data set of college administrator)
6. Write a python code to read the time series dataset, convert the date column into a datetime format, visualize the sales trend using a line graph, Analyze the seasonal and trend components of the data, and forecast the sales for the next twelve months using an appropriate time series forecasting technique. (<https://raw.githubusercontent.com/jbrownlee/Datasets/master/airline-passengers.csv>)
7. A botanical research institute wants to classify Iris flowers based on their characteristics.
Write a Python program to load the Iris dataset, split it into training and testing sets (75:25), standardize the features, train a Perceptron classifier, and evaluate its performance using classification accuracy.
8. A transportation department has collected GPS coordinates of traffic congestion points across a city.



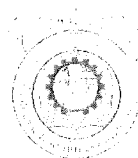
9. A wildlife research organization has collected data on different penguin species, including their physical characteristics and habitat information. Write a Python program to read the dataset, display the locations on a geospatial map, and create a heatmap to identify traffic hotspots using suitable Python libraries. (https://www.kaggle.com/datasets/sobhanmoosavi/us-accidents) 9. A wildlife research organization has collected data on different penguin species, including their physical characteristics and habitat information. Write a Python program to load the Palmer Penguins dataset, perform multivariate visualization using suitable plots such as pair plots or scatter matrices, and construct a network graph representing the similarity among penguins based on their species or physical characteristics using appropriate Python libraries. (https://github.com/allisonhorst/palmerpenguins)

TEXT BOOKS
1. Aul, S. V., Liao, S. N., and Musolino, L., <i>Principles of Data Science</i>, OpenStax, Rice University, Houston, Texas, 2025.

REFERENCE BOOKS
1. Jake VanderPlas, <i>Python Data Science Handbook</i>, 2nd Edition, O'Reilly Media, 2023.
2. Joel Grus, <i>Data Science from Scratch: First Principles with Python</i>, 2nd Edition, O'Reilly Media, 2019.
3. John D. Kelleher and Brendan Tierney, <i>Data Science</i>, MIT Press Essential Knowledge Series, MIT Press, Cambridge, MA, 2018.
4. Wes McKinney, <i>Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Jupyter</i>, 3rd Edition, O'Reilly Media, 2022

e-LEARNING RESOURCES
https://nptel.ac.in/courses/106107220 https://onlinecourses.nptel.ac.in/noc26_cs86/preview https://nptel.ac.in/courses/106106212

Assessment Details for both CIE and SEE
The weightage assigned to the Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) is 50% each. To pass the course, students must secure a minimum of 40% marks separately in both CIE and SEE. Continuous Internal Evaluation (CIE) The CIE consists of two components: 1. CIE – Theory Component 2. CIE – Laboratory Component Students must secure a minimum of 40% marks in the combined CIE theory and laboratory components. In addition, students must secure a minimum of 40% marks in the CIE laboratory component separately to qualify for appearing in the SEE.



Semester End Examination (SEE) The Theory SEE is conducted for 100 marks with a duration of 3 hours. The marks obtained are subsequently scaled down to 50 marks for calculating the final course grade. The student must secure a minimum of 40% marks in the SEE to pass the course. **Self-Study Component should be included for CIE.					
CONTINUOUS INTERNAL EVALUATION (CIE)					
Max. Marks Minimum Marks Required (40% in Each Component)	Weightage of CIE-1 and CIE-2 Tests or CIE-3		30		
	Theory	Laboratory component		s	
	The record will be evaluated weekly, and the average score will be considered.		Lab CIE		TOTAL
	10	10	20	50	20
12	08		20		

SEE QUESTION PAPER PATTERN									
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
UNIT	1	2	3	4	5	6	7	8	9
1. Two full questions (each of 20 Marks) are to be set from each unit.	1	2	3	4	5	6	7	8	9
2. Student shall answer five full questions selecting one full question from each unit.	1	2	3	4	5	6	7	8	9

Course Outcomes: After the completion of the course, the student will be able to	
CO1	Implement Python-based techniques to acquire, preprocess, and transform structured and unstructured datasets for analysis.
CO2	Perform exploratory data analysis and visualize multidimensional, geospatial, and temporal data using appropriate Python libraries.
CO3	Build and evaluate machine learning models for classification and prediction using Scikit-learn and standard evaluation metrics.
CO4	Apply data science techniques to solve real-world problems and effectively communicate analytical results through visualizations and reports.

COURSE SUSTAINABLE DEVELOPMENT GOALS (SDGs)		
Goal No.	Goal Title	Description
4	Quality Education	Ensure Inclusive and equitable quality education and promote lifelong learning opportunities for all
8	Decent Work and Economic Growth	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Mapping of COs with POs with PSOs													
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0													
CO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO1	PSO2
PSO3	PSO2	PSO1	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO1	PSO2



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	1	2	3	4	5	6	7	8	9	10	11	
CO1	3	3	3	2	3	-	-	-	-	-	3	2
CO2	3	3	3	2	3	-	-	-	-	-	2	2
CO3	3	3	3	2	3	-	-	-	-	-	3	1
CO4	3	3	3	2	3	-	-	-	-	-	2	1

Mapping of COs with Knowledge and Attitude Profile (WK)												
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0												
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9			
CO1	1	3	2	3	2	3	-	-	1			
CO2	1	3	2	3	3	3	1	1	2			
CO3	1	3	3	3	3	3	1	1	2			
CO4	-	2	2	3	3	3	2	2	3			

Course Coordinators:

	Nayana D V, Assistant Professor, CSE (DS)
	Veena N Iyer, Assistant Professor, CSE (DS)

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Semester: IV

Scheme: 2025

Dr. Ambedkar Institute of Technology
School of Computer Science and Engineering
CSE/ISE/CSBS/AIML/CSE(DS) Programmes

Course Title	Course Code	Course Category	Teaching-Learning Scheme				SEE	CIE Marks: 50	
Database Management System	IBSCSU403	IPCC (Integrated Professional Core Course)	Total	Credits	Total Teaching Hours		Total Max.	Marks: 100	Duration of SEE: 03 Hours
			L	T	P	Total	4	0	1
			3	0	1	Lecture: 42 + Tutorials: 0 + Practical: 28 + Self Study: 50 = 120			
							Marks: 50		

Course Learning Objectives:

CLO1	Understand the fundamental concepts, architecture, data models, schemas, and characteristics of Database Management Systems.
CLO2	Apply SQL commands and relational algebra operations to create, manipulate, query, and retrieve data from relational databases.
CLO3	Apply Entity-Relationship modeling and relational database design principles to develop appropriate database schemas for real-world applications.
CLO4	Analyze functional dependencies, normalization techniques, transaction schedules, and concurrency control mechanisms to design efficient and reliable databases.
CLO5	Evaluate advanced database concepts, including NoSQL databases, query processing, distributed databases, transaction management, and database recovery techniques for different application requirements

SYLLABUS		No. of Hours	ETLs
UNIT 1		10	10
Introduction to DBMS: Introduction to DBMS, an example database application, Characteristics of the Database Approach, Advantages of using the DBMS approach, Data Models, Schemas and Instances, Three-Schema Architecture, Data Independence, Database Languages and Interfaces, Classification of Database Management Systems.			
SQL: Introduction to SQL, SQL Data Types, Creating and Modifying Database Schemas, CREATE, ALTER and DROP statements, Specifying Basic Constraints in SQL, Basic Queries in SQL, SELECT, Sorting and filtering data, SQL Operators and Expressions, INSERT, UPDATE and DELETE statements, SQL Aggregate Functions, GROUP BY and HAVING, SQL JOIN Operations, Nested and Correlated Queries, Set Operations, Views (Virtual Tables), Assertions, Triggers.		10 Hours	
SELF-STUDY COMPONENT		10 Hours	
NoSQL Database, Types of NoSQL, NoSQL Features, Comparison between NoSQL and SQL, NoSQL use cases, Introduction to MongoDB, working of MongoDB and CRUD operations.			
UNIT 2		7	7
Relational Model: Relational Model Concepts, Schemas, Model Constraints, Domain Constraints, Key Constraints, Entity Integrity, Referential Integrity, Update Operations, Dealing with Constraint Violations.			
Relational Algebra: Unary Relational Operations, SELECT Operation, PROJECT Operation, Relational Algebra Operations from Set Theory, Binary Relational Operations, JOIN Operations, DIVISION Operation, Additional Relational Algebra Operations, Examples of Queries in Relational Algebra.			



SELF-STUDY COMPONENT		10 Hours	
Database Recovery Techniques: Recovery Concepts, NO-UNDO/REDO Recovery Based on Deferred Update, Recovery Techniques Based on Immediate Update, Database Backup and Recovery from Catastrophic Failures.			
SELF-STUDY COMPONENT			
Transaction Management: Transaction and System Concepts, Transaction States, Desirable Properties of Transactions, ACID Properties, Concurrent Transactions, Schedules, Characterizing Schedules Based on Recoverability, Recoverable Schedules, Cascadeless Schedules, Strict Schedules, Serializability: Characterizing Schedules Based on Serializability, Serial Schedules, Conflict Serializability, View Serializability, Precedence Graph, Concurrency Control: Two-Phase Locking Techniques, Basic 2PL, Strict 2PL, Rigorous 2PL, Lock-Based Concurrency Control, Shared and Exclusive Locks, Deadlocks, Deadlock Prevention and Detection, Concurrency Control Based on Timestamp Ordering, Timestamp Ordering Protocol, Basic Recovery Concepts			
UNIT 5		8	L1-L4
Transaction Management: Transaction and System Concepts, Transaction States, Desirable Properties of Transactions, ACID Properties, Concurrent Transactions, Schedules, Characterizing Schedules Based on Recoverability, Recoverable Schedules, Cascadeless Schedules, Strict Schedules, Serializability: Characterizing Schedules Based on Serializability, Serial Schedules, Conflict Serializability, View Serializability, Precedence Graph, Concurrency Control: Two-Phase Locking Techniques, Basic 2PL, Strict 2PL, Rigorous 2PL, Lock-Based Concurrency Control, Shared and Exclusive Locks, Deadlocks, Deadlock Prevention and Detection, Concurrency Control Based on Timestamp Ordering, Timestamp Ordering Protocol, Basic Recovery Concepts			
UNIT 5		8	L1-L4
Distributed Database Concepts: Data Fragmentation, Replication, and Allocation Techniques for Distributed Database Design, Overview of Concurrency Control and Recovery in Distributed Databases, Overview of Transaction Management in Distributed Databases.			
SELF-STUDY COMPONENT		10 Hours	
Relational Database Design: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Functional Dependency Inference, Attribute Closure, Armstrong's Axioms, Minimal Cover of Functional Dependencies, Normal Forms Based on Primary Keys, First Normal Form, Second Normal Form, Third Normal Form, Boyce-Codd Normal Form, General Definitions of 2NF and 3NF, Properties of Relational Decompositions, Lossless-Join Decomposition, Dependency-Preserving Decomposition, Algorithms for Relational Database Schema Design, Multi-Valued Dependencies, Fourth Normal Form, Join Dependencies, Fifth Normal Form			
UNIT 4		8	L1-L4
Relational Database Design: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Functional Dependency Inference, Attribute Closure, Armstrong's Axioms, Minimal Cover of Functional Dependencies, Normal Forms Based on Primary Keys, First Normal Form, Second Normal Form, Third Normal Form, Boyce-Codd Normal Form, General Definitions of 2NF and 3NF, Properties of Relational Decompositions, Lossless-Join Decomposition, Dependency-Preserving Decomposition, Algorithms for Relational Database Schema Design, Multi-Valued Dependencies, Fourth Normal Form, Join Dependencies, Fifth Normal Form			
SELF-STUDY COMPONENT		10 Hours	
The Enhanced Entity-Relationship (EER) Model: Subclasses, Super classes, and Inheritance, Specialization and Generalization, Constraints and Characteristics of Specialization and Generalization Hierarchies.			
UNIT 3		9	L1-L4
Entity-Relationship Model Entity-Relationship Model, High-Level Conceptual Data Models for Database Design, An Example Database Application, Entity Types, Attributes, Types of Attributes, Keys, Relationship Types, Relationship Sets, Roles, Structural Constraints, Cardinality Constraints, Participation Constraints, Weak Entity Types, ER Design: Refining the ER Design, Generalization and Specialization, Aggregation, Enhanced ER Model, ER Diagram for Real-World Applications, ER-to-Relational Schema Mapping.			
SELF-STUDY COMPONENT		10 Hours	
Strategies for Query Processing: Translating SQL Queries into Relational Algebra and Other Operators, Methods for External Sorting, Methods for SELECT Operation, Implementing the JOIN Operation.			



Semester: IV

Scheme: 2023

Dr. Ambedkar Institute of Technology
School of Computer Science and Engineering
CSE/ISE/CSEBS/AIML/CSE(DS) Programmes

Practical Component

Laboratory Component:

1. Part A - Execution of the three exercises specified below.
2. Part B - Implementation of mini project.

Part A

Consider the customer-sale scenario given below. The primary keys are underlined and the data types are specified: Create the tables with the appropriate integrity constraints& insert around 10 records in each of the tables.

CUSTOMER (Cust_id: integer, cust_name: string)
ITEM (item_id: integer, item_name: string, price: integer)
SALE (bill_no: integer, bill_date: date, cust_id: integer, item_id: integer, qty_sold: integer)
For the above schema, perform the following:

- a) List all the bills for the current date with the customer names and item numbers
- b) List the total Bill details with the quantity sold, price of the item and the final amount
- c) List the details of the customer who have bought a product which has a price>200
- d) Give a count of how many products have been bought by each customer
- e) Give a list of products bought by a customer having cust_id as 5
- f) List the item details which are sold as of today
- g) Create a view which lists out the bill_no, bill_date, cust_id, item_id, price, qty_sold, amount

2. 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

- a) Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each Programme, etc.
- b) Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2019 to Jun 2019
- c) Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.
- d) Partition the BOOK table based on year of publication. Demonstrate its working with a simple query.
- e) Create a view of all books and its number of copies that are currently available in the library.

3. Consider the following relational schema for the Office of the Controller of Examinations

STUDENT (Rollno, Name, Dob, Gender, Doa, Bcode); Implement a check constraint for Gender Application.
BRANCH (Bcode, Bname, Dno);
DEPARTMENT (Dno, Dname);
COURSE (Ccode, Cname, Credits, Dno);
BRANCH COURSE (Bcode, Ccode, Semester);



ENROLLS (Rollno, Code, Sess, Grade);
For Example, SESS can take values 'MAY2019', 'DEC2019'. Implement a check constraint for grade Value Set ('S', 'A', 'B', 'C', 'D', 'E', 'U'); Students are admitted to Branches and they are offered by Departments. A branch is offered by only one department. Each branch has a set of Courses (Subjects). Each student must enroll during a semester. Courses are offered by Departments. A course is offered only by one department. If a student is unsuccessful in a course, he/she must enroll for the course during next session. A student has successfully completed a course if the grade obtained by is from the list ('S', 'A', 'B', 'C', 'D', and 'E'). A student is unsuccessful if he/she has grade 'U' in a course. Write SQL queries to
a) List details of Departments that offer more than 3 branches.
b) List the details of Departments that offer more than 6 courses.
c) List the details of courses that are common for more than 3 branches.
d) List students who got 'S' in more than 2 courses during single enrollment.
e) Create a view that will keep track of the roll number, name and number of courses, a student has completed successfully.

Part B

A mini project should be implemented by the students in teams. The maximum size of a team can be 2-3 from the same batch. The students must finalize a project topic by discussing with the faculty. The mini project must be carried out in the college only.

The tasks when implementing mini project would be:

1. Understand the complete domain knowledge of the application and derive the complete data requirement specification for the mini project.
 2. Design the ER diagram for the application.
 3. Design Relational Schema diagram for the application.
 4. Normalization of the relational design.
 5. Implement minimum 5 queries for the application.
 6. Documentation & submission of report.
- General guidelines:**
7. Database for the project - Oracle / MySQL / DB2 / SQL Server / MongoDB etc.
 8. Design a Database application for a particular case study using Visual Basic/Java Script in visual studio / Eclipse Tool etc.

TEXT BOOKS

1. Fundamental of Database Systems by Elmasri and Navathe, 7th Edition, Addison-Wesley, 2015, ISBN-10: 0133970779, ISBN-13: 978-0133970777

REFERENCE BOOKS

1. Database Management Systems by Raghuram Ramakrishnan and Johannes Gehrke, 4th Edition, McGraw-Hill Education, ISBN-13: 978-0072968255, ISBN-10: 0072968257.
2. Database Design for Mere Mortals by Michael J. Hernandez, 4th Edition, Addison-Wesley, 2020 ISBN-13: 978-0136788041, ISBN-10: 0136788041.
3. Database System Concepts by Abraham Silberschatz, Henry F. Korth and S. Sudarshan, 5th Edition, McGraw-Hill Higher Education, 2006, ISBN-10: 0072958863, ISBN-13: 978-0072958867
4. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence. By Sadalage, Pramod J., and Martin Fowler. 1st Edition, Addison-Wesley Professional, 2012, ISBN-10: 0321826620, ISBN-13: 978-0321826626



Semester: IV

Scheme: 2025

Dr. Ambedkar Institute of Technology
School of Computer Science and Engineering
CSE/ISE/CSBS/AIML/CSE(DS) Programmes

e-LEARNING RESOURCES

Database Management System: https://onlinecourses.nptel.ac.in/noc19_cs46/course

Introduction to Database Management Systems:

<https://www.youtube.com/watch?v=OMwGGL3IHII&list=PLBlnK6fEvgRivvTYbKHX1Sh9hY10phX>

SQL Tutorial - Full Database Course for Beginners:

<https://www.youtube.com/watch?v=HXV3zeQKqGY>

MongoDB University – <https://learn.mongodb.com/>

Assessment Details for both CIE and SEE

The weightage assigned to the Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) is 50% each.
To pass the course, students must secure a minimum of 40% marks separately in both CIE and SEE.
Continuous Internal Evaluation (CIE)
The CIE consists of two components:
1. CIE – Theory Component
2. CIE – Laboratory Component
Students must secure a minimum of 40% marks in the combined CIE theory and laboratory components. In addition, students must secure a minimum of 40% marks in the CIE laboratory component separately to qualify for appearing in the SEE.
Semester End Examination (SEE)
The Theory SEE is conducted for 100 marks with a duration of 3 hours. The marks obtained are subsequently scaled down to 50 marks for calculating the final course grade.
The student must secure a minimum of 40% marks in the SEE to pass the course.
****Self-Study Component should be included for CIE only.**

CONTINUOUS INTERNAL EVALUATION (CIE)

Theory	Weightage of CIE-1 and CIE-2 or CIE-3	Max. Marks	Minimum Marks Required in CIE to qualify for SEE (40% in Each Component)
08	20	50	20
TOTAL			

SEE QUESTION PAPER PATTERN

Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1	2	3	4	5	6	7	8	9	10

1. Two full questions (each of 20 Marks) are to be set from each unit.

2. Student shall answer five full questions selecting one full question from each unit.



Course Outcomes: After the completion of the course, the student will be able to	
CO1	Explain the fundamental concepts of Database Management Systems, including database architecture, data models, schemas, data independence, and DBMS characteristics.
CO2	Apply SQL commands and relational algebra operations to create, manipulate, query, and retrieve data from relational databases.
CO3	Design conceptual and logical database schemas using Entity-Relationship modeling, Enhanced ER modeling, and relational schema mapping techniques.
CO4	Analyze functional dependencies, normalization techniques, and relational decomposition methods to develop efficient and well-structured relational database designs.
CO5	Analyze transaction processing, concurrency control, database recovery, NoSQL databases, query processing, and distributed database concepts for reliable database system design and management.

COURSE SUSTAINABLE DEVELOPMENT GOALS (SDGs)		
Goal No.	Goal Title	Description
4	Quality Education	Ensure Inclusive and equitable quality education and promote lifelong learning opportunities for all
8	Decent Work and Economic Growth	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Mapping of COs with POs with PSOs																
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																
CO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO
CO1	3	-	-	-	-	-	-	-	-	-	-	2	1	1	2	3
CO2	3	3	3	-	-	-	-	-	-	-	-	3	2	2	3	-
CO3	3	2	2	-	-	-	-	-	-	-	-	3	3	3	1	-
CO4	-	-	2	-	-	-	-	-	-	-	-	3	3	3	-	-
CO5	2	3	3	3	3	3	3	-	3	3	2	3	3	3	3	3

Mapping of COs with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	2	3	3	3	1	2	2	2	1
CO2	2	3	3	2	3	3	2	3	3
CO3	2	3	2	2	1	2	3	2	3
CO4	2	3	2	2	3	3	2	2	2
CO5	2	3	2	2	3	3	3	3	3

Course Coordinators:

Prof. Veena Potdar	Dr. Suresha D	Dr. Ajay Prakash	Dr. Gowrishankar S
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Course Title	Design and Analysis of Algorithms				
Course Code	IBSCST404				
Course Category	PCC (Professional Core Course)				
Teaching - Learning Scheme	L	T	P	Total Credits	
	3	1	0	4	
CIE Marks: 50	SFE			Total Max. Marks: 100	
	Marks: 50			Duration of SFE: 03 Hours	
& Credit				Lecture: 42 + Tutorials: 28 + Practical: 0 + Self Study: 50 = 120	
				Total Teaching Hours	

Course Learning Objectives:	
CLO1	Understand fundamental principles of algorithm design and complexity analysis.
CLO2	Analyze the efficiency of algorithms using asymptotic notations and mathematical techniques.
CLO3	Apply suitable algorithm design paradigms such as brute force, divide-and-conquer, greedy, dynamic programming, decrease-and-conquer, backtracking, and branch-and-bound to solve computational problems.
CLO4	Compare alternative algorithmic approaches and select appropriate techniques for efficient problem solving.

SYLLABUS		
UNIT 1	No. of Hours	RTLs
Introduction: What is an Algorithm? It's Properties, Fundamentals of Algorithmic Problem solving, Analysis Framework-Time efficiency and space efficiency, Worst-case, Best-case and Average case efficiency. Performance Analysis: Estimating Space complexity and Time complexity of algorithms. Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ) with examples. Basic efficiency classes, Mathematical analysis of Non-Recursive and Recursive Algorithms with Examples.	15	L1-H3
UNIT 2	15	L1-H4
Brute Force Technique: Introduction, Linear Search, Bubble Sort, Selection Sort Divide and Conquer: General method, Recurrence equation for divide and conquer, Divide and Conquer algorithms and complexity Analysis of Binary search, Merge sort, Quick sort, MaxMin problem	10 Hours	
SELF-STUDY COMPONENT		
Sets and Dictionaries, Order of Growth, Solving examples of Recurrence relations		



SELF-STUDY COMPONENT		10 Hours
Other problems to solve by Brute force approach, Strassen's Matrix Multiplication, Masters Theorem		
UNIT 3		
14	L1-L4	
Greedy Method: General method, Knapsack Problem, solving Job sequencing with deadlines Problems. Minimum cost spanning trees: Prim's Algorithm, Kruskal's Algorithm with performance analysis. Single source shortest paths: Dijkstra's Algorithm. Decrease and Conquer Approach: Introduction, Topological Sorting using source removal method, Breadth First Search, Depth First Search.		
SELF-STUDY COMPONENT		10 Hours
Huffman Trees, Additional applications of Greedy algorithms, Topological sort using DFS.		
UNIT 4		
14	L1-L4	
Dynamic Programming: General method with Examples, Transitive Closure: Warshall's Algorithm. All Pairs Shortest Paths: Floyd's Algorithm, Knapsack problem. Space-Time Tradeoffs: Introduction, Sorting by Counting, Input Enhancement in String Matching Horspool's algorithm.		
SELF-STUDY COMPONENT		10 Hours
Hashing: Separate Chaining, Open Addressing.		
UNIT 5		
12	L1-L4	
Backtracking: General method, solution using back tracking to N-Queens problem, Sum of subsets problem, Branch and Bound: Assignment Problem, Travelling Sales Person problem.		
SELF-STUDY COMPONENT		10 Hours

1. Books	
1.	Anany Levitin: Introduction to Design & Analysis of Algorithms, 3 rd Edition, Pearson Education, 2012, ISBN 10: 0-13-231681-1, ISBN 13: 978-0-13-231681-1
2.	Ellis Horowitz, Sartaj Sahni, Sanguithevar Rajasekaran: Fundamentals of Computer Algorithms, 2 nd Edition, University press, 2008, ISBN 10: 8173716129, ISBN 13: 9788173716126
REFERENCE BOOKS	
1.	Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, 3 rd Edition, PHI
2.	Design and Analysis of Algorithms, 2014, S. Sridhar, Oxford (Higher Education), ISBN: 0198093691.

4. LEARNING RESOURCES	
http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS43.html	
https://nptel.ac.in/courses/106/101/106101060	
http://elearning.vtu.ac.in/econtent/courses/video/FEP/ADA.html	



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School of Computer Science and Engineering
CSE/ISE/CSBS/AIML/CSE(DS) Programmes

Semester: IV

Scheme: 2025

Assessment Details for both CIE and SEE			
The weightage assigned to the Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) is 50% each. To pass the course, students must secure a minimum of 40% marks separately in both CIE and SEE. Continuous Internal Evaluation (CIE) The CIE consists of three components: 1. CIE – Theory Component 2. Assignment 3. Group Activity Students must secure a minimum of 40% marks in the combined total of the CIE Theory, Assignment, and Group Activity components to qualify for appearing in the SEE. Semester End Examination (SEE) The Theory SEE is conducted for 100 marks with a duration of 3 hours. The marks obtained are subsequently scaled down to 50 marks for calculating the final course grade. The student must secure a minimum of 40% marks in the SEE to pass the course. **Self-Study Component should be included for CIE.			
Max. Marks	Minimum Marks Required in CIE to Qualify for SEE (40% individually)	Weightage of CIE-1 and CIE-2 or CIE-3	Assignment
50	40	40	05
Group Activity			05
TOTAL			50

SEE QUESTION PAPER PATTERN									
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
UNIT	1	2	3	4	5	6	7	8	9
1. Two full questions (each of 20 Marks) are to be set from each unit. 2. Student shall answer five full questions selecting one full question from each unit.									

Course Outcomes: After the completion of the course, the student will be able to	
CO1	Analyze the time and space complexity of algorithms using asymptotic notations and apply the brute-force technique to solve computational problems.
CO2	Apply divide-and-conquer techniques to solve computational problems and analyze their performance using recurrence relations.
CO3	Apply greedy and decrease-and-conquer techniques to solve computational problems and compare their efficiency.
CO4	Apply dynamic programming and space-time trade-off techniques to design efficient algorithmic solutions.
CO5	Apply backtracking and branch-and-bound techniques to solve combinatorial optimization problems.



Goal No.	Goal Title	Description
4	Quality Education	Primary focus of the course is developing algorithmic thinking and computational problem-solving skills.
9	Industry, Innovation and Infrastructure	Enables students to design scalable and efficient computational solutions that support technological innovation.

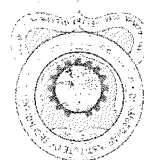
Mapping of COs with POs												
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0												
CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	1	2	2	-	-	-	-	-	3
CO2	3	3	3	2	2	2	-	-	-	-	-	2
CO3	3	3	3	3	2	2	-	-	-	-	-	3
CO4	3	3	3	3	3	2	-	-	-	-	-	3
CO5	3	3	3	3	3	2	-	-	-	-	-	-

Mapping of COs with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	2	3	3	3	3	1	-	-	-
CO2	2	3	3	3	3	1	-	-	-
CO3	2	3	3	3	3	1	-	-	-
CO4	2	3	3	3	3	1	-	-	-
CO5	2	3	3	3	3	1	-	-	-

Course Coordinators:

Dr. Harish G, Professor CSE Programme, SCSE	HG
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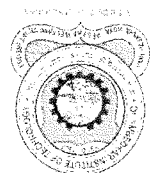
HEAD of School (HOS)
School of Computer Science and Engineering
Dr. Ambedkar Institute of Technology
Bengaluru-560 056



Course Title	Algorithms Laboratory				
Course Code	IBSCSL405				
Course Category	PCCL (Professional Core Course Laboratory)				
Teaching - Learning Scheme	L	T	P	Total Credits	Total Teaching Hours
	0	0	1	1	
& Credit	CIE Marks: 50		SEE Marks: 50		Total Max. Marks: 100
				Duration of SEE: 03 Hours	
				Lecture: 0 + Tutorials: 0 + Practical: 28 + Self Study: 02 = 30	

Course Learning Objectives:				
CLO 1	Develop C programs to implement fundamental algorithm design techniques for solving computational problems.	1		
CLO 2	Analyze and compare the performance of algorithms using experimental evaluation and time complexity measurements.	2		
CLO 3	Implement graph, greedy, dynamic programming, and backtracking algorithms to solve optimization and graph-related problems.	3		
CLO 4	Select appropriate algorithmic techniques for solving real-world computational problems efficiently.	4		

Syllabus	
PART: A - FIXED SET OF EXPERIMENTS	
1	Sort a given set of elements using Bubble Sort/Selection Sort and determine the time required to sort the elements. Specify the time efficiency class of this algorithm. The elements can be read from a file or can be generated using the random number generator.
2	Implement Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n and the elements can be read from a file or can be generated using the random number generator.
3	Sort a given set of elements using the Quicksort method and determine the time required to sort the elements. Repeat the experiment for different values of n and the elements can be read from a file or can be generated using the random number generator.
4	Using Sieve of Eratosthenes, generate list of primes till a given value of n.
5	Implement a C program to print all nodes reachable from a given starting node in a directed or undirected graph using Breadth-First Search (BFS)
PART: B - OPEN-ENDED EXPERIMENTS	
1	From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm .
2	Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm .
3	Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm .
4	a. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm . b. Compute the transitive closure of a given directed graph using Warshall's algorithm .



5	Implement 0/1 Knapsack problem using Dynamic Programming.
6	Implement N Queen's problem using Back Tracking.
7	Find a subset of a given set $S = \{s_1, s_2, \dots, s_n\}$ of n positive integers whose sum is equal to a given positive integer d . For example, if $S = \{1, 2, 5, 6, 8\}$ and $d = 9$ there are two solutions $\{1, 2, 6\}$ and $\{1, 8\}$. A suitable message is to be displayed if the given problem instance doesn't have a solution.

SELF-STUDY COMPONENT	02 Hours
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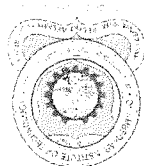
Experimental comparison of sorting algorithms for different input characteristics (random, sorted, and reverse-sorted data) and analysis of their execution time and observed performance.
Students shall:
1. Generate or create three types of input:
• Random • Sorted • Reverse sorted
2. Execute Bubble/Selection Sort, Merge Sort, and Quick Sort.
3. Record execution time for different values of n .
4. Compare the observed performance with the theoretical time-efficiency classes.
5. Prepare a brief observation/conclusion.

Teaching and Learning Process (Innovative Delivery Methods)	
1.	Active Learning Techniques
2.	Problem-Based Learning (PBL)
3.	Demonstration-Based Learning
4.	Hands-On Programming Sessions

TEXT BOOKS	
1.	Anany Levitin: Introduction to Design & Analysis of Algorithms, 3 rd Edition, Pearson Education, 2012, ISBN 10: 0-13-231681-1, ISBN 13: 978-0-13-231681-1
2.	Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran: Fundamentals of Computer Algorithms, 2 nd Edition, University press, 2008, ISBN 10: 8173716129, ISBN 13: 9788173716126

REFERENCE BOOKS	
1.	Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, 3 rd Edition, PHI
2.	Design and Analysis of Algorithms, 2014, S. Sridhar, Oxford (Higher Education), ISBN: 0198093691

e-LEARNING RESOURCES	
http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS43.html	
https://onlinecourses-archive.mptel.ac.in/noc18_cs20/	
https://visualgo.org/	



Assessment Details for CIE				
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks Required in CIE to Qualify for SEE	20
Laboratory Component				
LAB CIE				
TOTAL				
The record will be evaluated weekly according to the rubrics, and the average marks will be considered.		10	40	50

SEMESTER END EXAMINATION (SEE)

The student must secure a minimum of 40% marks in the SEE to pass the course.

Practical Examination Guidelines

- All laboratory experiments shall be included for the practical examination.
- The instructions and marks breakup printed on the cover page of the answer script shall be strictly adhered to by the examiners.
- Students shall be allowed to randomly select any one experiment from the given lot.
- Change of the selected experiment shall be permitted only once.
- Any change of experiment shall attract mark deduction as per the Dr. AIT Autonomous Examination Rules and Regulations.

Course Outcomes: After the completion of the course, the student will be able to

- | | |
|------------|---|
| CO1 | Implement brute-force and divide-and-conquer algorithms for sorting and prime generation, and experimentally analyze their time efficiency. |
| CO2 | Develop programs using greedy and graph algorithms for solving traversal, shortest path, and minimum spanning tree problems. |
| CO3 | Implement dynamic programming algorithms to solve optimization problems efficiently. |
| CO4 | Implement backtracking algorithms to solve combinatorial optimization problems. |

COURSE SUSTAINABLE DEVELOPMENT GOALS (SDGs)

Goal No.	Goal Title	Description
4	Quality Education	Develops practical programming, computational thinking, algorithmic reasoning, and problem-solving skills through hands-on laboratory implementation.
9	Industry, Innovation and Infrastructure	Develops competencies in designing efficient algorithms that support innovative software solutions and digital infrastructure.



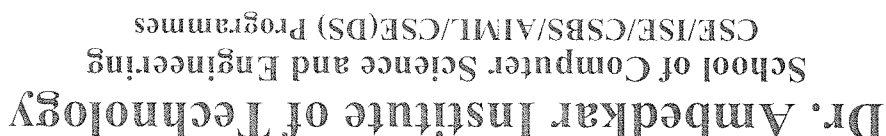
Mapping of COs with POs with PSOs												
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0												
CO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
CO1	3	3	2	3	2	-	-	-	-	-	3	2
CO2	3	3	3	3	2	-	-	-	-	-	3	-
CO3	3	3	3	2	2	-	-	-	-	-	3	-
CO4	3	3	3	2	2	-	-	-	-	-	3	-

Mapping of COs with Knowledge and Attitude Profile (WK)												
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0												
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	WK12
CO1	1	3	3	3	3	1	-	-	-	-	-	-
CO2	1	3	3	3	3	1	-	-	-	-	-	-
CO3	1	3	3	3	3	1	-	-	-	-	-	-
CO4	1	3	3	3	3	1	-	-	-	-	-	-

Course Coordinators:

H6	Dr. Harish G, Professor, CSE Programme, SCSE
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HEAD of School (HOS)
 School of Computer Science and Engineering
 Dr. Ambedkar Institute of Technology
 Bengaluru-560 056



Course Learning Objectives:	
CLO1	Understand the fundamental concepts of web technologies and develop responsive web pages using HTML5 and CSS3.
CLO2	Apply JavaScript programming concepts, including functions, events, DOM manipulation and form validation, to develop interactive web applications.
CLO3	Apply XML and PHP concepts to represent structured data and implement basic server-side web applications.
CLO4	Understand and apply fundamental User Interface and User Experience design principles to develop interfaces for different application domains.
CLO5	Design and prototype user interfaces for real-world applications by applying appropriate layout, navigation, interaction and usability principles.

PART A – WEB DEVELOPMENT FUNDAMENTALS

PART B – USER INTERFACE AND USER EXPERIENCE DESIGN

Page | 1



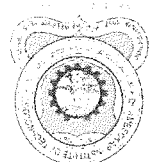
Semester: IV

Scheme: 2025

6.	Design an User Interface for Online Banking System which includes the following modules: • Registration • Balance Enquiry • Transfer • Account Summary
7.	Design an User Interface for Booking of Movie Tickets which includes the following modules: • Select a movie • Select timings • Select a quantity • Select a seat number • Notification to user and admin
8.	Design an User Interface for Online Job Search which includes the following modules: • Employee Registration • Job Details • Search • Job Alerts
9.	Design an User Interface for Social Network Sites which includes the following modules: • Login • Facebook home page • Display friends • Look at a friend's image and post comment
10.	Design an User Interface for ATM Machine which includes the following modules: • Login • Withdrawal • Mini Statement • Fixed Deposit

SELF-STUDY COMPONENT	
UI/UX Case Study and Heuristic Evaluation: Select an existing mobile or web application, study its user interface and user experience, identify at least five usability issues using suitable heuristics, and propose appropriate design improvements.	02 Hours

Teaching and Learning Process (Innovative Delivery Methods)	
1.	Active Learning Techniques
2.	Problem-Based Learning (PBL)
3.	Team-Based Learning (TBL)
4.	Hands-On Experiments and Simulations
5.	Design Thinking and User-Centred Design Activities



Dr. Ambedkar Institute of Technology
School of Computer Science and Engineering
CSE/ISE/CSBS/AI/ML/CSE/DS Programmes

Semester: IV

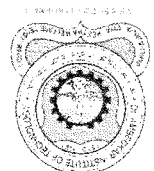
Scheme: 2025

TEXT BOOKS	
1.	Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1st Edition, Pearson Education India, ISBN: 978-9332575271.
2.	Robin Nixon, "Learning PHP, MySQL & JavaScript with jQuery, CSS and HTML5", 4th Edition, O'Reilly Publications, 2015, ISBN: 978-9352130153.
3.	Wilbert O. Galitz, "The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques", 3rd Edition, Wiley, 2007, ISBN 978-0-470-05342-3.
4.	Don Norman, "The Design of Everyday Things: Revised and Expanded Edition", Basic Books, 2013.

REFERENCE BOOKS	
1.	Nicholas C. Zakas, "Professional JavaScript for Web Developers", 3rd Edition, Wrox/Wiley India, 2012, ISBN: 978-8126535088.
2.	Zak Ruvalcaba and Anne Boehm, "Murach's HTML5 and CSS3", 3rd Edition, Murach's/Shroff Publishers & Distributors Pvt Ltd, 2016, ISBN: 978-9352133246.
3.	Steve Krug, "Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability", 3rd Edition, New Riders, 2014.
4.	Alan Cooper, Robert Reimann, David Cronin and Christopher Noessel, "About Face: The Essentials of Interaction Design", 4th Edition, Wiley, 2014.

e-LEARNING RESOURCES	
	W3Schools – Web development learning resources.
	Figma Learn – Official learning resources for UI design and prototyping
	Nielsen Norman Group – UX research, usability and interaction design resources.
	Google UX Design resources.
	Interaction Design Foundation – UX and interaction design resources.

Assessment Details for CIE		
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has two components – CIE - theory component and CIE – laboratory component. Students have to score a minimum of 40% Marks in the total of CIE - theory and CIE – laboratory components put together, provided students have to score a minimum of 40% marks in CIE laboratory component alone to qualify to take SEE. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.		
CONTINUOUS INTERNAL EVALUATION (CIE)	Max. Marks	Minimum Marks Required in CIE to Qualify for SEE
The record will be evaluated weekly according to the rubrics, and the average marks will be considered.	10	20
	Laboratory	



Dr. Ambedkar Institute of Technology
School of Computer Science and Engineering
CSE/ISE/CSBS/AIML/CSE(DS) Programmes

Semester: IV

Scheme: 2025

SEMESTER END EXAMINATION (SEE)			The student must secure a minimum of 40% marks in the SEE to pass the course.
Component s	Lab CIE	TOTAL	50
		40	

Course Outcomes: After the completion of the course, the student will be able to	
CO1	Design and develop responsive web pages using HTML5 and CSS3 for specified application requirements.
CO2	Develop interactive web applications using JavaScript by applying functions, events, DOM manipulation and form validation.
CO3	Create structured data using XML and develop basic server-side web applications using PHP.
CO4	Design user interfaces for real-world applications by applying fundamental UI/UX principles and interaction design concepts.
CO5	Develop and prototype application interfaces for domains such as online banking, movie booking, job search, social networking and ATM systems by applying appropriate usability and user interaction principles.

COURSE SUSTAINABLE DEVELOPMENT GOALS (SDGs)	
Goal No.	Goal Title
4	Ensure Inclusive and equitable quality education and promote lifelong learning opportunities for all
8	Decent Work and Economic Growth Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Mapping of COs with POs with PSOs														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	3	-	-	-	-	-	3	3	2
CO2	2	3	3	3	3	2	-	-	2	2	-	3	3	2
CO3	3	3	3	2	3	3	-	-	-	-	-	3	3	2
CO4	3	2	3	2	3	2	-	-	-	-	-	3	3	2
CO5	3	3	3	3	3	3	-	-	2	2	-	3	3	3



Semester: IV

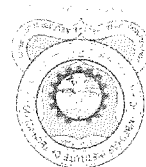
Scheme: 2025

Mapping of COs with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	3	2	-	-	-	-	-	-	-
CO2	2	3	2	-	-	-	-	-	-
CO3	2	3	3	-	-	-	-	-	-
CO4	2	2	3	-	-	-	-	-	-
CO5	2	2	3	2	-	-	-	-	-

Course Coordinators:

Dr. Asha K N Assistant Professor CSE, SCSE	Mrs. Yashaswini H M Assistant Professor CSE, SCSE
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HEAD of School (HOS)
School of Computer Science and Engineering
Dr. Ambedkar Institute of Technology
Bengaluru-560 056



Course Title	Human Computer Interaction				
Course Code	1BSCSL406B				
Course Category	AEC(Ability Enhancement Course)				
Teaching - Learning Scheme	L	T	P	Total Credits	Total Teaching Hours
	0	0	1	1	
& Credit					Lecture: 0 + Tutorials: 0 + Practical: 28 + Self Study: 02 = 30
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100		Duration of SEE: 03 Hours

Course Learning Objectives:	
CLO	1
Introduce the fundamental concepts of Human-Computer Interaction, user interface design principles, usability guidelines, and user-centered design approaches for developing effective interactive systems.	
CLO	2
Enable students to design and implement graphical user interfaces (GUIs) using Python-based frameworks by applying appropriate controls, layouts, and event-driven programming concepts.	
CLO	3
Develop skills to create user-centered interactive applications such as login systems, registration forms, calculators, and other real-world interfaces by considering user requirements and consistency principles.	
CLO	4
Provide knowledge of interaction design techniques, including navigation design, feedback mechanisms, error handling, and responsive interface development to enhance user experience.	
CLO	5
Train students to evaluate the usability and effectiveness of interactive systems using HCI evaluation methods and improve interface quality through iterative design processes.	

SYLLABUS	
PART: A - CONVENTIONAL EXPERIMENTS	
1.	Design and develop an interactive and user-friendly Login Form using Python Tkinter. The application should provide a graphical interface that allows users to enter their login credentials, including Username and Password, using appropriate Tkinter widgets such as Labels, Entry fields, Frames, and Buttons. Implement suitable buttons such as Login, Clear, and Exit to perform the corresponding operations.
2.	Design and develop a user-friendly Student Registration Graphical User Interface (GUI) using Python Tkinter. The application should provide suitable input fields for entering student details such as Student Name, Register Number, Date of Birth, Gender, Course, Email ID, Phone Number, and Address. Incorporate appropriate Tkinter widgets such as Labels, Entry fields, Radio Buttons, Check Buttons, List boxes or Combo boxes, and Buttons.
3.	Design and implement a functional calculator interface using Python Tkinter. The application should provide a user-friendly graphical interface with a display area and appropriate buttons for numerical inputs (0-9) and arithmetic operations such as addition, subtraction, multiplication, division, percentage, decimal point, and equal-to operations.
4.	Design and develop a menu-driven text editor application using Python Tkinter. The application should provide a user-friendly graphical interface with a text area for creating and editing text.

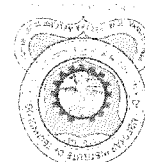


documents and a menu bar containing appropriate menus such as File, Edit, and Help.	
5.	Design and develop an interactive Quiz Application using Python Tkinter. The application should provide a user-friendly graphical interface for displaying multiple-choice questions along with four answer options. Implement suitable Tkinter widgets such as Labels, Radio Buttons, Buttons, and Frames to organize the quiz interface.
6.	Design and develop an interactive Online Shopping Interface using Python Tkinter. The application should provide a user-friendly graphical interface for displaying and managing products available for purchase.
7.	Design and develop an interactive Feedback Collection System using Python Tkinter. The application should provide a user-friendly graphical interface for collecting feedback from users. Include suitable input fields for details such as Name, Email ID, Feedback Category, Rating, and Comments.
8.	Design and develop a user-friendly Healthcare Application Interface using Python Tkinter. The application should provide an interactive graphical interface for managing basic healthcare-related information such as patient name, age, gender, contact details, symptoms, health parameters, appointment information, and medical observations. Implement appropriate Tkinter widgets such as Labels, Entry fields, Text areas, Comboboxes, Radiobuttons, Checkbuttons, Frames, and Buttons to organize and collect the required information effectively.
PART: B - TYPICAL OPEN-ENDED EXPERIMENTS	
Open-ended experiments are laboratory activities in which the outcome is not predetermined. Students are given the freedom to explore, design, and conduct experiments based on problem statements related to the concepts defined by the Course Coordinator. Such experiments encourage creativity, critical thinking, problem-solving, and inquiry-based learning	
1.	Design and develop an E-Learning Portal UI
2.	Design an Interface for Healthcare Monitoring Dashboard
3.	Develop an interface for Weather Application UI
4.	Design and Development of a Food Delivery App Prototype
5.	Design and Development of an Online Examination System Prototype

SELF-STUDY COMPONENT	
02 Hours	Theoretical Framework, User-Centered Design (UCD), GUI Development, Practical Implementation, UX & Error Handling, Heuristic Evaluation, Ergonomics.

Teaching and Learning Process (Innovative Delivery Methods)	
1.	Active Learning Techniques
2.	Problem-Based Learning (PBL)
3.	Team-Based Learning (TBL)
4.	Hands-On Experiments and Simulations

TEXT BOOKS	
1.	The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques, Wilbert O. Galitz, Publisher: Wiley India / John Wiley & Sons, Latest Edition: 3rd Edition



2.	Human-Computer Interaction, Alan Dix, Janet Finlay, Gregory Abowd and Russell Beale, Publisher: Pearson Education, Edition: 3rd Edition.
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REFERENCE BOOKS	
1.	Designing the User Interface: Strategies for Effective Human-Computer Interaction, Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, Publisher Pearson Education Edition, 6th Edition
2.	Interaction Design: Beyond Human-Computer Interaction, Helen Sharp, Jennifer Preece, Yvonne Rogers, Publisher, Wiley Edition 5th Edition.
3.	User Interface Design: A Software Engineering Perspective, Soren Lauesen, Publisher Pearson Education
e-LEARNING RESOURCES	
NPTEL – Human Computer Interaction, Video lectures on HCI fundamentals, usability, interaction design, and cognitive models.	
W3C Web Accessibility Initiative (WAI), Standards and guidelines for accessible web interface design.	

Assessment Details for CIE				
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks Required in CIE to Qualify for SEE	20
Laboratory Components	The record will be evaluated weekly according to the rubrics, and the average marks will be considered.	10	40	
	LAB CIE		40	
	TOTAL		50	
SEMESTER END EXAMINATION (SEE)				
The student must secure a minimum of 40% marks in the SEE to pass the course.				
Practical Examination Guidelines				

- All laboratory experiments shall be included for the practical examination.
- The instructions and marks breakup printed on the cover page of the answer script shall be strictly adhered to by the examiners.
- Students shall be allowed to randomly select any one experiment from the given lot.
- Change of the selected experiment shall be permitted only once.
- Any change of experiment shall attract mark deduction as per the Dr. AIT Autonomous Examination Rules and Regulations.

Course Outcomes: After the completion of the course, the student will be able to	
CO1	Understand and apply fundamental principles of Human-Computer Interaction, user interface design, and usability guidelines in developing interactive applications.
CO2	Design and implement graphical user interfaces (GUIs) using Python-based frameworks with appropriate controls, layouts, and event-handling mechanisms.



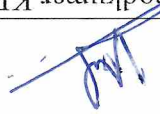
CO3	Develop user-centered applications such as login systems, registration forms, calculators, and interactive tools by considering user requirements and interface consistency.
CO4	Apply interaction design techniques to create effective navigation, feedback mechanisms, error handling, and responsive user interfaces.
CO5	Evaluate the usability and effectiveness of interactive systems using HCI principles and improve the user experience through iterative interface design.

COURSE SUSTAINABLE DEVELOPMENT GOALS (SDGs)		
Goal No.	Goal Title	Description
4	Quality Education	Ensure Inclusive and equitable quality education and promote lifelong learning opportunities for all
8	Decent Work and Economic Growth	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

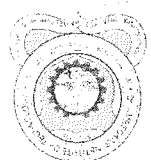
Mapping of COs with POs with PSOs													
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0													
CO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO3
CO1	3	3	2	-	2	2	-	-	-	-	-	3	-
CO2	3	3	3	-	3	2	-	-	-	-	-	3	-
CO3	3	-	2	2	3	2	-	-	-	-	-	3	-
CO4	3	3	-	3	3	3	-	-	-	-	-	3	-
CO5	3	3	2	3	3	3	-	-	-	-	-	3	-

Mapping of COs with Knowledge and Attitude Profile (WK)													
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0													
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9				
CO1	2	2	3	1	1	2	2	2	3				
CO2	3	3	3	3	3	3	2	2	3				
CO3	2	1	2	2	1	2	3	2	3				
CO4	3	3	3	3	3	3	2	2	3				
CO5	3	3	3	3	3	3	3	3	3				

Course Coordinators:

 Dr. Madhu B, Associate Professor CSE Programme, SCSE	 Dr. Vinod Kumar KP, Assistant Professor CSE Programme, SCSE
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HEAD of School (HOS)
School of Computer Science and Engineering
Dr. Ambedkar Institute of Technology
Bengaluru-560 056



Course Title	R Programming				IBAIL406A				AEC (Ability Enhancement Course)				
Course Code	IBAIL406A												
Course Category	AEC (Ability Enhancement Course)												
Teaching - Learning Scheme & Credit	L	T	P	Total Credits	Lecture: 0 + Tutorials: 0 + Practical: 28 + Self Study: 02 = 30								
CIE Marks: 50	SEE		0	0	1	Total Max. Marks: 100		Duration of SEE: 03 Hours					

Course Learning Objectives: Students can able to	
CLO1	Explore the R and RStudio interactive programming environment.
CLO2	Understand fundamental data structures and data types used in R programming.
CLO3	Develop R programs by applying operators, control structures, functions and string-manipulation techniques.
CLO4	Import data into R from various sources and generate appropriate data visualizations.
CLO5	Analyze datasets and draw insights using statistical and predictive analytics techniques.

SYLLABUS

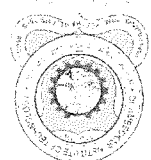
EXPERIMENTS

1.	2.
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	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:



10.	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,
9.	Let us use the built-in dataset air quality which has Daily air quality measurements in New York, May to September 1973. Develop R program to generate histogram by using appropriate arguments for the following statements. a) Assigning names, using the air quality data set. b) Change colors of the Histogram c) Remove Axis and Add labels to Histogram d) Change Axis limits of a Histogram e) Add Density curve to the histogram
8.	ItemCode ItemCategory ItemPrice 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 is 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 itemCode, ItemQtyonHand and ItemReorderLvl and merge the two frames
7.	The built-in data set mammals contain data on body weight versus brain weight. Develop R commands to: a) Find the Pearson and Spearman correlation coefficients. Are they similar? b) Plot the data using the plot command. c) Plot the logarithm (log) of each variable and see if that makes a difference
6.	Implement different String Manipulation functions in R.
5.	Implement R script to check the given year is leap year or not.
4.	Develop an R Program using functions to find all the prime numbers up to a specified number by the method of Sieve of Eratosthenes.
3.	Develop a program to create two 3 X 3 matrices A and B and perform the following operations Transpose of the matrix b) addition c) subtraction d) multiplication e) division
	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



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. Retrieve the employees in the IT Department whose salary is greater than 20000 and write these details into another file "output.csv"	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. 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.
SELF-STUDY COMPONENT 02 Hours Students shall independently explore application-oriented R programming problems related to financial analytics, environmental monitoring, sustainable inventory management, air-quality analysis, vehicle fuel-efficiency, workforce analytics and predictive modelling	Teaching and Learning Process (Innovative Delivery Methods) 1. Active Learning Techniques 2. Problem-Based Learning (PBL) 3. Team-Based Learning (TBL)	



Dr. Ambedkar Institute of Technology
School of Computer Science and Engineering
Artificial Intelligence and Machine Learning Programme

Semester: IV

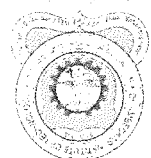
Scheme: 2025

4.	Hands-On Experiments
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TEXT BOOKS	
1.	Cotton, R. (2013). Learning R: A Step by Step Function Guide to Data Analysis. 1 st ed. O'Reilly Media Inc.
2.	Jones, O., Maillardet, R. and Robinson, A. (2014). Introduction to Scientific Programming and Simulation Using R. Chapman & Hall/CRC, The R Series.
3.	Davies, T.M. (2016) The Book of R: A First Course in Programming and Statistics. No Starch Press.

Assessment Details for CIE				
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks Required in CIE to Qualify for SEE	
Laboratory Component s	The record will be evaluated weekly according to the rubrics, and the average marks will be considered.	10	40	20
	LAB CIE	40	50	
	TOTAL	50		
	SEMESTER END EXAMINATION (SEE)			
The student must secure a minimum of 40% marks in the SEE to pass the course.				
Practical Examination Guidelines				
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Course Outcomes: After the completion of the course, students can able to	
CO1	Understand the fundamental structure and syntax of R programming — data types, operators, vectors and matrices.
CO2	Illustrate data preparation techniques in R using vectors, data frames and CSV files on real-world data.
CO3	Apply R's graphical packages to visualize data and interpret the resulting plots.
CO4	Apply statistical analysis methods — correlation and descriptive statistics — for data analytics.
CO5	Develop and interpret predictive (regression) models in R for data-driven analytics.



Dr. Ambedkar Institute of Technology
School of Computer Science and Engineering
Artificial Intelligence and Machine Learning Programme

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COURSE SUSTAINABLE DEVELOPMENT GOALS (SDGs)		Goal Title	Description
Goal No.	4	Quality Education	Analytics Skills: The course develops students' programming, data preparation, visualization, statistical analysis and predictive analytics skills using R. Students independently apply R programming to real-world datasets, strengthening computational thinking, problem-solving and data-driven learning. Data Analytics for Economic and Workforce Decision-Making: R programming is applied to financial statements, revenue, expenses, profit analysis, employee salary, department and experience data. These activities develop analytical skills useful for productivity, financial decision-making, workforce planning and employment-oriented data analysis
8	Decent Work and Economic Growth		Innovation through Data Analytics and Computational Tools: The course uses R for matrix computation, data processing, visualization, statistical analysis and predictive modelling. These skills support technology-driven innovation, computational problem solving and data-based solutions applicable to industry and infrastructure-related problems.
9	Industry, Innovation and Infrastructure		Data-Driven Analysis for Sustainable Communities: R is used to analyze environmental and community-related datasets, particularly air-quality data and transportation/vehicle-performance data. Visualization and statistical analysis help students understand patterns that can support data-driven approaches to cleaner, more efficient and sustainable communities.
11	Sustainable Cities and Communities		

Mapping of COs with POs with PSOs															
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0															
CO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
PSO3	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
PSO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
PSO1	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-
PSO	11	10	10	-	-	-	-	-	-	-	-	-	-	-	-



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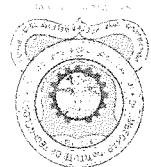
Mapping of COs with Knowledge and Attitude Profile (WK) Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	2	2	-	-	-	-	-	-	-
CO2	-	2	2	-	-	-	-	-	-
CO3	-	-	2	2	-	-	-	-	-
CO4	-	-	-	-	2	2	-	-	-
CO5	-	-	-	-	-	-	2	2	2

Course Coordinators:

	Dr. AjayPrakash B V, Professor HoP, AI&ML
	Mrs. Rajeswari, Assistant Professor AI&ML

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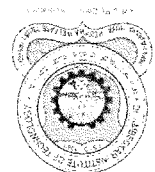
Course Title	MERN						
Course Code	1BAIL406B						
Course Category	AEC (Ability Enhancement Course)						
Teaching - Learning Scheme & Credit	L	T	P	Total Credits	Total Teaching Hours	Lecture: 0 + Tutorials: 0 + Practical: 28 + Self Study: 02 = 30	Duration of SEE: 03 Hours
	0	0	1	1			
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100				

Course Learning Objectives:	
CLO1	Understand and apply critical web development languages and tools to create dynamic applications.
CLO2	To build server-side application using Node.js and Express
CLO3	Develop user interfaces with React.js
CLO4	Manage date using MongoDB, and integrate these technologies to create full stack apps
CLO5	Understanding APIs and routing

SYLLABUS

EXPERIMENTS

1	Using MongoDB
	- Create a collection called transactions in the user managed database (drop it if it already exists) - Bulk load the data from a JSON file named transactions.json. - Upsert the record from the new file called transactions_upsert.json into MongoDB.
2	Query MongoDB with Conditions (Create appropriate collections with necessary documents answer the queries) a. Find any record where Name = "Somu". b. Find any record where the total payment amount (Payment, Total) is 600. c. Find any record where Transaction, price is between 300 and 500. d. Calculate the total transaction amount by summing Payment, Total in all records.
3	a. Write a Node.js program to check the request header for cookies. b. Write a Node.js program to print the properties of a car object, delete the second property, display the updated object length.
4	a. Read the data of a student containing USN, Name, Semester, and Year of Admission from Node.js and store it in MongoDB. b. For a partial name given in Node.js, search all matching student names from the MongoDB collection created in Question 4(a).
5	Implement all CRUD operations on a File System using Node.js.
6	Develop an application that sends fruit name and price data from the client side to a Node.js server using AJAX.



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7	Develop an authentication mechanism using Email ID and Password with HTML and Express (POST method).
8	Develop two Express.js routes: • find_prime_100 – prints prime numbers less than 100. • find_cube_100 – prints cube numbers less than 100.
9	Develop a React application to build a simple search filter that displays a filtered list based on search query entered by the user.
10	Develop a React application to collect data from a REST API.

SELF-STUDY COMPONENT	
Students shall independently explore application-oriented MERN stack problems related to full-stack CRUD application development, JWT/session-based authentication and authorization, RESTful API integration with third-party services, state management in React (Context API/Redux), form validation and error handling, and deployment of MERN applications (e.g., MongoDB Atlas, Render/Vercel/Heroku).	
02 Hours	

TEXT BOOKS:

1	MongoDB in Action: Covers MongoDB version 3.0 2nd Edition, by Kyle Banker (Author), Peter Bakum (Author), Shaun Verch (Author), Doug Garrett (Author), Tim Hawkins (Author), MANNING SHELTER ISLAND
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Teaching and Learning Process (Innovative Delivery Methods)	
1.	Active Learning Techniques
2.	Problem-Based Learning (PBL)
3.	Team-Based Learning (TBL)
4.	Hands-On Experiments

Assessment Details for CIE			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks Required in CIE to Qualify for SEE
Laboratory Component	The record will be evaluated weekly according to the rubrics, and the average marks will be considered.	10	20
	LAB CIE	40	
	TOTAL	50	
SEMESTER END EXAMINATION (SEE)			
The student must secure a minimum of 40% marks in the SEE to pass the course.			



Practical Examination Guidelines	
• All laboratory experiments shall be included for the practical examination. • The instructions and marks breakup printed on the cover page of the answer script shall be strictly adhered to by the examiners. • Students shall be allowed to randomly select any one experiment from the given lot. • Change of the selected experiment shall be permitted only once. • Any change of experiment shall attract mark deduction as per the Dr. AIT Autonomous Examination Rules and Regulations.	

Course Outcomes: After the completion of the course, the student will be able to	
CO1	Able to apply the fundamentals of MongoDB , such as data modelling, CRUD operations, and basic queries to solve given problems.
CO2	Use the concepts of Express.js , including routing software and constructing RESTful APIs to solve real-world problems.
CO3	Develop scalable and efficient RESTful APIs using Node.js .
CO4	Develop applications using React , including components, state, props, and JSX syntax.

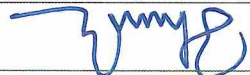
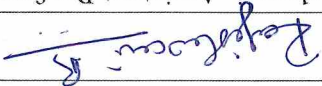
COURSE SUSTAINABLE DEVELOPMENT GOALS (SDGs)			
Goal No.	Goal Title	Description	
4	Quality Education	Ensure Inclusive and equitable quality education and promote lifelong learning opportunities for all	
8	Decent Work and Economic Growth	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.	

Mapping of COs with POs with PSOs													
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0													
CO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO1	PSO2
CO1	3	3	3	2	2	2	2	2	2	2	2	3	3
CO2	3	3	3	3	3	2	2	2	2	2	2	3	3
CO3	3	3	3	2	2	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3

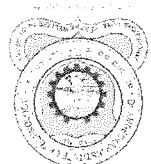


Mapping of COs with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	2	2	3	1	1	2	2	2	3
CO2	3	3	3	3	3	3	2	2	3
CO3	2	1	2	2	1	2	3	2	3
CO4	3	3	3	3	3	3	2	2	3
CO5	3	3	3	3	3	3	3	3	3

Course Coordinators:

 Dr. Bharath V S, Associate Professor AI&ML, SCSE	 Mrs. Rajeshwari, Assistant Professor AI&ML, SCSE
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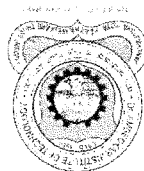
Semester: IV

Scheme: 2025

Course Title	Course Code	Course Category	Teaching - Learning Scheme & Credit					CIE Marks: 50	
APTITUDE AND TECHNICAL SKILLS – I	IBCDN409	MC(Mandatory Course)	L	T	P	Credits Total	Lecture: 26 + Tutorials: 0 + Practical: 0 + Self Study: 0 = 26		
			2	0	0	0			

Course Learning Objectives:	
CLO1	The lessons under this unit make students to understand the extended Arithmetic concepts.
CLO2	This unit aims to teach students understand their interpretation skills in relation to patterns, diagrammatic tests, abstract reasoning tests, deductive reasoning tests, and inductive reasoning tests. Logical reasoning refers to the act of analyzing a situation and deducing correct conclusions from it. The problem at hand should be studied objectively, as should all clauses, their inter-relationships and the conclusion reached should be rational.
CLO3	This unit aims students to crack competitive exam or a job interview. Quantitative aptitude assesses mental acuity.
CLO4	The objective of this unit is to prepare students to crack technical interviews which includes C language. It involves the concepts of Functions, Arrays & Structure Unions.

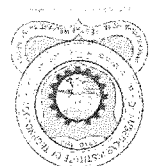
SYLLABUS			No. of Hours	BTLs
UNIT 1			4	L1-L4
Time, Speed & Distance: Basics of time, speed and distance, Relative speed, Problems based on trains, Problems based on boats and streams, Problems based on races.				
Time and Work: Work with different efficiencies, Alternate day work, Pipes and cisterns, Work equivalence, Division of wage, Leaving the work concept with example. ---(PH)				
UNIT 2			4	L1-L4
Problems on Averages: Concept of Average, Weighted Average.				
Problems on Ages: Problems on Ages (based on average), Problems on ages (based on Ratio)---				
UNIT 3			6	L1-L4
Probability: Probability, Total Probability, Finding Probability without using Combination, Finding Probability using Pascal Triangle				
Permutation and Combination: Fundamental Counting Principle, Permutation and Combination, Computation of Permutation, Circular Permutations, Computation of Combination				
(GA)				
- Split into groups of 3–5 students. - Work through the 3 tasks. - Students should write down their answers and reasoning. - Discuss with the class: each group can present one of their solutions				



Clocks and Calendars: Concepts on Clocks, angles between the hand of a clock, concept of Calendar, Concept of Leap year, days and date.		
C Language: Introduction, Structure, Compilation and execution, Identifiers, Constant, Features, Keywords, Pre-processors		
Variables and Data types- Common Variable Types, Declaration in C		
Operators- Types of Operators in C and usage		
UNIT 5		
6	L1-L4	
Control system and Function- Common Control Structures, Switch Statement, Syntax, Return type, Parameters, Function call		
Array: Declaring an Array, Initializing an Array, Accessing Array Elements		
Structure Union- Syntax and example		

REFERENCE BOOKS:	
1	"A First Course in Probability" by Sheldon Ross
2	"Quantitative Aptitude for Competitive Examinations" by R.S. Aggarwal.
3	"C Programming: A Modern Approach" by K.N. King
4	"Let Us C" by Yashavant Kanetkar
5	"Expert C Programming: Deep C Secrets" by Peter van der Linden
e-LEARNING RESOURCES:	
1	Note: Required reference links to each unit will be provided in PH
2	Videos and Lecture Notes: http://www.nptel.ac.in

Assessment Details for CIE			
To pass the course, students must secure a minimum of 40% marks in CIE.			
The CIE consists of three components:			
1. CIE – Theory Component			
2. Assignment			
3. Group Activity			
Students must secure a minimum of 40% marks in the combined total of the CIE Theory, Assignment, and Group Activity components to pass the subject. No SBE for the subject.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks Required in CIE to Qualify for SBE (40% individually)
Weightage of CIE-1 and CIE-2 or CIE-3		40	20
Theory		05	05
Assignment		05	05
Group Activity		05	05



	TOTAL	50
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Course Outcomes: After the successful completion of the course, the students are expected to:	
CO1	This unit will deliver the students with the concept of Time, Work, and Speed & Distance which is the extended Arithmetic concepts.
CO2	After the completion of this unit, students will have ability to analyze information and solve problems using analytical reasoning techniques.
CO3	Students will be learning shortcut methods like pascal triangle for coins, Dice and cards problems from permutation and combination, Probability topics. Also, shortcut methods to solve clocks and calendar topics questions in analytical reasoning
CO4	Introduction to C program and it's features applications
CO5	This unit teaches the students about the C language introductory with the fundamentals. This is the extension topic of C Language and practical coding techniques will be learnt by students with additional featuring concepts.

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CO3	3	3	3	2	2	2	3	2	2	2	1	3	3	3	2
CO4	3	3	3	2	2	2	3	2	2	2	1	3	3	3	2
CO5	3	3	3	2	2	2	3	2	2	2	1	3	3	3	2

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Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	CO1	CO2	CO3	CO4	CO5
	3	3	3	3	3	3	3	3		3	3	3	3	3
	3	3	3	3	3	3	3	3		3	3	3	3	3
	3	3	3	3	3	3	3	3		3	3	3	3	3
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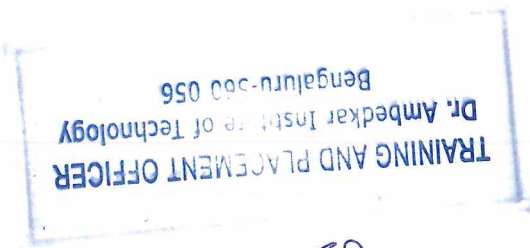
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Semester: IV

Scheme: 2025

CAREER GUIDANCE AND PLACEMENT CELL (CGPC)

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