



Mahatma Gandhi Mission's
COLLEGE OF ENGINEERING

Near Airport, Off Hingoli Road, Nanded-431605.
(An Autonomous Institute, Accredited by NAAC & NBA)

**Department of Computer Science and
Engineering**

**Curriculum for
Second Year B.Tech Program**

w.e.f.

Academic year 2026-27

(NEP- 2020 Compliant)

Dr. Archana M. Rajurkar

Head, Department of CSE

Dr. Archana M. Rajurkar

Dean Academics

Dr. Geeta S.Lathkar

Director



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Program Outcomes [PO]

1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.



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Vision of Department

To be one of the leading Departments for Computer Science & Engineering education developing proficient Computer Engineers with global acceptance in the service of mankind.

Mission of Department

1. Providing technical skills with strong fundamentals of Computer Science discipline with an emphasis on software development.
2. Inculcating analytical, programming and multidisciplinary skills to enhance employability.
3. Fostering problem-solving, team-building, and lifelong learning skills with societal, environmental and ethical sense.
4. Developing researchers and entrepreneurs to solve real-life problems through industry interactions and collaborations.

Program Specific Outcomes (PSOs)

- PSO1:** Apply knowledge of core courses and emerging areas including Data Science, AI/ML, Cloud Computing, Information Security, Image Processing for solving real life problems.
- PSO2:** Design and develop software and hardware systems using latest technologies, programming languages, and open-source platforms.
- PSO3:** Apply standard software engineering principles and professional skills to create solutions that meet Industry needs.

Program Educational Objectives (PEOs)

Graduates of Computer Science and Engineering employed should be able to:

- PEO1:** Analyze Computer Science & Engineering techniques, relate them with real life problems and provide solutions that are technically sound, economically viable and socially acceptable
- PEO2:** Utilize acquired programming, analytical, design and implementation skills to formulate and solve computational problems.
- PEO3:** Evolve as competent professionals, researchers and entrepreneurs having collaborative and leadership skills with effective communication abilities to pursue appropriate career options and become capable of working in multi-disciplinary environment.
- PEO4:** Excel as socially committed Computer Engineers having good human and ethical values.



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Department of Computer Science and Engineering Curriculum Structure
(Effective from AY 2026-27)

Semester Wise Credit Distribution Structure for Four Year UG
Engineering Program - One Major, One Minor

Course Category	Sub Category	I	II	III	IV	V	VI	VII	VIII	Total Credits
Basic Science Course	BSC/ESC	7	7	3						17
Engineering Science Course		8	11							19
Program Core Course (PCC)	Program Courses			11	12	15	10	8		56
Program Elective Course (PEC)						3	6	6	6	21
Multidisciplinary Minor (MDM)	Multidisciplinary Courses			As per the respective MDM courses taken by the students						16
Open Elective (OE) Other than a particular program	Open Elective (OE)			3	2	3				8
Vocational & Skill Enhancement Course (VSEC)	Skill Courses	2		3	1		1	1		8
Ability Enhancement Course (AEC-01, AEC-02)	Humanities, Social Science & Management (HSSM)	3				2	2			7
Entrepreneurship / Economics / Management Courses					2					2
Indian Knowledge System (IKS)			2							2
Value Education Course (VEC)				2	2					4
Research Methodology	Experiential Learning Courses						1			1
Community Engagement Project (CEP) / Field Project (FP)			2 (OA)							0
Project							1	2		3
Internship / OJT					2 (OA)		2 (OA)		6	6
Co-curricular Courses (CC)	Liberal Learning Courses	2	2	2						6
Total Credits (Major)		22	22	24	19	23	21	17	12	160+16

OA: Over & Above



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**B. Tech in Computer Science and Engineering Curriculum Aligned with NEP-2020
(Effective from Academic Year 2026 - 2027)**

Third Semester

Sr. No.	Course Category	Course Code	Course Name	Teaching Scheme		Evaluation Scheme				Credit
				L	P	CA	MSE	ESE	Total	
1	BSC	BSC-CSE-201	Engineering Mathematics-III	3		20	30	50	100	3
2	PCC	PCC-CSE-202	Data Structures	3		20	30	50	100	3
3	PCC	PCC-CSE-203	Discrete Mathematics	3		20	30	50	100	3
4	PCC	PCC-CSE-204	Digital Electronics & Microprocessor	3		20	30	50	100	3
5	VEC	MGM-VEC-UHV-231	Universal Human Values	2		20	30	50	100	2
6	MDM	MDM-CSE-205	Multidisciplinary Minor							
7	PCC Lab	PCCL-CSE-206	Data Structures Lab		2	50		50	100	1
8	PCC Lab	PCCL-CSE-207	Digital Electronics & Microprocessor Lab		2	50		50	100	1
9	VSEC	VSEC-CSE-208	Python Programming Lab	1	2	50		50	100	2
10	VSEC	VSEC-CSE-209	Web Application Development Lab (Project Based Learning)		2	50		50	100	1
11	CC	MGM-CC-AEL-232	Asian -European Languages A. German B. Spanish C. French D. Japanese E. Sanskrit	2		20	30	50	100	2
12	OE	MGM-OE-233	Open Elective - I	3		20	30	50	100	3
13	Internship	INT-FY-162	Internship-I			50	-	50	100	2(OA)*
Total				20	8	390	210	600	1200	24

OA: Over & Above



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Fourth Semester

Sr. No.	Course Category	Course Code	Course Name	Teaching Scheme		Evaluation Scheme				Credit
				L	P	CA	MSE	ESE	Total	
1	PCC	PCC-CSE-251	Design and Analysis of Algorithms	3		20	30	50	100	3
2	PCC	PCC-CSE-252	Database Management Systems	3		20	30	50	100	3
3	PCC	PCC-CSE-253	Computer Architecture and Organization	2		20	30	50	100	2
4	MDM	MDM-CSE-254	Multidisciplinary Minor							
5	VEC	MGM-VEC-CI-281	Constitution of India	2		20	30	50	100	2
6	PCC Lab	PCCL-CSE-255	Design and Analysis of Algorithms Lab		2	50		50	100	1
7	PCC Lab	PCCL-CSE-256	Database Management Systems Lab		2	50		50	100	1
8	PCC Lab	PCCL-CSE-257	Object-Oriented Programming using JAVA Lab	1	2	50		50	100	2
9	VSEC	VSEC-CSE-258	Forward Deployed Engineering Lab (Project Based Learning)		2	50		50	100	1
10	HSSM	MGM-HSSM-ED-282	Entrepreneurship Development	2		20	30	50	100	2
11	OE	MGM-OE-283	Open Elective - II	2		20	30	50	100	2
12	Internship	INT-CSE-259	Internship-II			-	-	-	-	Credit to be evaluated in V Semester
Total				15	8	320	180	500	1000	19

MDM: Multidisciplinary Minor, **OE :** Open Elective, **OA:** Over & Above

***Note:** Student is expected to work for (two to four weeks, minimum four to five hours per day) in Industries / NGO / Govt. organizations on understanding/solving their problems/awareness programs (understanding the HR processes, Products, Services and other issues related to program of study).



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Fifth Semester

Sr. No.	Course Category	Course Code	Course Name	Teaching Scheme		Evaluation Scheme				Credit
				L	P	CA	MSE	ESE	Total	
1	PCC	PCC-CSE-301	Machine Learning	3		20	30	50	100	3
2	PCC	PCC-CSE-302	Operating System	3		20	30	50	100	3
3	PCC	PCC-CSE-303	Theory of Computation	3		20	30	50	100	3
4	PCC	PCC-CSE-304	Computer Networks	3		20	30	50	100	3
5	PEC	PEC-CSE-305	Program Elective - I: A. Advanced Web Technology B. Pattern Recognition C. Mobile Application Development D. Computer Graphics	2		20	30	50	100	2
6	MDM	MDM-CSE-306	Multidisciplinary Minor							
7	PCC Lab	PCCL-CSE-307	Machine Learning Lab (Project Based Learning)		2	50		50	100	1
8	PCC Lab	PCCL-CSE-308	Operating System & Shell Programming Lab		2	50		50	100	1
9	PCC Lab	PCCL-CSE-309	Computer Networks Lab		2	50		50	100	1
10	PEC Lab	PECL-CSE-310	Program Elective - I Lab		2	50		50	100	1
11	AEC	MGM-AEC-QACT-331	Quantitative Analysis and Critical Thinking	2		20	30	50	100	2
12	OE	MGM-OE-332	Open Elective-III	3		20	30	50	100	3
13	Internship	INT-CSE-259	Internship-II			50	-	50	100	² (OA)*
Total				19	8	390	210	600	1200	23

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Sixth Semester

Sr. No.	Course Category	Course Code	Course Name	Teaching Scheme		Evaluation Scheme				Credit
				L	P	CA	MSE	ESE	Total	
1	PCC	PCC-CSE-351	Artificial Intelligence and Prompt Engineering	3		20	30	50	100	3
2	PCC	PCC-CSE-352	Compiler Design	3		20	30	50	100	3
4	PCC	PCC-CSE-353	Software Engineering	2		20	30	50	100	2
3	PEC	PEC-CSE-354	Program Elective - II: A. Cloud Computing B. Data Science C. Software Defined Network D. Data Mining and Warehousing	3		20	30	50	100	3
5	PEC	PEC-CSE-355	Program Elective - III: A. Digital Image Processing B. Business Intelligence C. Natural Language Processing D. Information Retrieval	2		20	30	50	100	2
6	MDM	MDM-CSE-356	Multidisciplinary Minor							
7	PCC Lab	PCCL-CSE-357	Artificial Intelligence and Prompt Engineering Lab		2	50		50	100	1
8	PEC Lab	PECL-CSE-358	Program Elective -II Lab		2	50		50	100	1
9	PCC Lab	PCCL-CSE-359	Software Engineering and Compiler Design Lab		2	50		50	100	1
10	VSEC	VSEC-CSE-360	Competitive Programming Lab		2	50		50	100	1
11	RM	SEM-CSE-361	Seminar		2	50		50	100	1
12	Project	PRO-CSE-362	Minor Project		2	50		50	100	1
13	AEC	MGM-AEC-VARD-381	Verbal Ability and Reading Comprehension	2		20	30	50	100	2
14	Internship	INT-CSE-363	Internship -III			-	-	-	-	Credit to be evaluated in VIII Semester
Total				15	12	420	180	600	1200	21

MDM: Multidisciplinary Minor, **OE:** Open Elective, **OA:** Over & Above

***Note:** Student is expected to work for (two to four weeks, minimum four to five hours per day) in Industries / NGO / Govt. organizations on understanding/solving their problems/awareness programs (understanding the HR Processes, Products, Services and other issues related to program of study).



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Seventh Semester

Sr. No.	Course Category	Course Code	Course Name	Teaching Scheme		Evaluation Scheme				Credit
				L	P	CA	MSE	ESE	Total	
1	PCC	PCC-CSE-401	Cyber Security	3		20	30	50	100	3
2	PCC	PCC-CSE-402	System Design	3		20	30	50	100	3
3	PEC	PEC-CSE-403	Program Elective - IV: A. Deep Learning B. Cryptography and Network Security C. Big Data Analytics D. Internet of Things	2		20	30	50	100	2
4	PEC	PEC-CSE-404	Program Elective - V: A. Software Testing and Quality Assurance B. Virtual and Augmented Reality C. Database Security and Access Control D. Parallel Computing	3		20	30	50	100	3
5	PCC Lab	PCCL-CSE-405	Cyber Security Lab		2	50		50	100	1
6	PCC Lab	PCCL-CSE-406	System Design Lab		2	50		50	100	1
7	PEC Lab	PEC-CSE-407	Program Elective - IV Lab		2	50		50	100	1
8	VSEC	VSEC-CSE-408	Advanced Skill Lab: DevOps		2	50		50	100	1
9	Project	PRO-CSE-409	Major Project - I		4	50		50	100	2
10	Internship	INT-CSE-363	Internship -III			50		50	100	2 (OA)*
Total				11	12	380	120	500	1000	17

OA: Over & Above



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Eighth Semester

Sr. No.	Course Category	Course Code	Course Name	Teaching Scheme		Evaluation Scheme				Credit
				L	P	CA	MSE	ESE	Total	
1	PEC	PEC-CSE-451	Program Elective - VI: A. Blockchain Technology B. Quantum Computing C. Agentic AI D. Network Forensics and Cyber Threat Analysis	3		20	30	50	100	3
2	PEC	PEC-CSE-452	Program Elective - VII: A. AI Ethics B. GEN AI & Large Language Model C. Ethical Hacking D. Agile Software Development	3		20	30	50	100	3
3	Internship/Project	INT-CSE-453	Internship –IV / Major Project II		12	50		50	100	6
Total				6	12	90	60	150	300	12

Note: Students undertaking Industry Internship in Semester-VIII shall complete the Program Elective Courses through SWAYAM/NPTEL or any other recognized MOOC platform approved by the Institute.



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Open Electives		
Course Code	Course Name	Semester
MGM-OE-233	Open Elective-I A. Product Design & Engineering B. Energy Conservation & Management C. Disaster Risk Detection and Management D. Agriculture Entrepreneurship Development E. Medical Informatics	III
MGM-OE-283	Open Elective-II A. Economics B. Biology for Engineers C. Sustainable Development Goals D. Industrial Safety E. Organizational Behaviour	IV
MGM-OE-332	Open Elective-III A. Project Management B. Electric Vehicle Technology C. Drone Technologies D. Financial Accounting E. Introduction to Operation Research	V



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**Department of Computer Science and
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SEMESTER-III

w.e.f.

Academic year 2026-27

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Second Year Computer Science & Engineering			
Semester III			
Course Title	Engineering Mathematics-III		
Course Code	BSC-CSE-201		
Category	Basic Sciences		
Scheme and Credits	L	P	No. of credits
	3	0	3
Prerequisite Courses, if any: Engineering Mathematics-I, Engineering Mathematics-II			
Companion Course, if any: - Nil			
Course Objectives: 1. To explore different methods for determining the roots of polynomial equations. 2. To develop the ability to organize, summarize, and visualize engineering data. 3. To examine the concepts of measures of central tendency and dispersion. 4. To understand the fundamentals of vector spaces. 5. To analyze uncertainty using the principles of probability. 6. To apply the concepts of probability, conditional probability, independence, and probability distributions to solve relevant problems			
Course Outcomes: After successful completion of the course, learner will be able to: CO1: Implement bracketing methods: Bisection, False position and Open methods: Newton-Raphson method to find roots. CO2: Compute definite integrals using Newton Formulas: Trapezoidal and Simpson's Rule. CO3: Compute descriptive statistics and use least-squares linear and multiple regression to relate input variable to output response. CO4: Apply the concepts of linear independence, basis, dimension, and rank to assess the uniqueness of solutions of a system of linear equations. CO5: Compute permutation and combination and use Bayes' theorem to update beliefs given new evidence. CO6: Apply the Binomial, Poisson and Normal Distributions.			



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Unit No.	Unit Title & Contents	Hours
1	Numerical Methods -I Solutions of polynomials and transcendental equations – Bisection method , Newton Raphson Method and Regula Falsi Method ,Finite differences , Relation between Operators ,Interpolations using Newton's forward and backward difference formulae , Interpolations with unequal intervals ; Lagrange's formula . Numerical Differentiation.	8
2	Numerical Methods-II Numerical Integration ; Trapezoidal rule and Simpsons $1/3^{\text{rd}}$ rule and $3/8^{\text{th}}$ rule . Ordinary differential equations ; Taylor's series , Euler and Modified Eulers methods .Runge –Kutta methods of fourth order for solving first and second order equations .	8
3	Statistics Measures of Central tendency – Mean Median, Mode, Measures of dispersion – Standard Deviation, Variance, Linear Regression, Curve fitting, Method of least square, Multivariate data analysis, Hypothesis Test: z-test, t-test, Chi-Square test.	7
4	Linear Algebra Introduction to Vector Spaces, Subspaces, Linear Dependence and Linear Independence of vectors, Basis and dimensions of Vector spaces, Introduction to linear Transformation, Matrix representation relative to standard basis, kernel and range of Linear Transformation, Rank-Nullity Theorem, Diagonalization, LU Decomposition.	7
5	Probability Introduction to Permutation and Combination, Basic concepts of probability and its properties, Conditional Probability, Independent Events, Bayes' Theorem.	8
6	Probability Distributions Random Variables - Discrete and Continuous, Probability Mass Functions, Mathematical Expectation, Variance and PDF, Probability Distribution: Binomial, Poisson and Normal Distributions.	7



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Learning Resources:

Textbooks:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Numerical methods in Engineering & Science	B.S. Grewal	Khanna Publications	9 th	2014
2	Introductory Methods of Numerical Analysis	S.S. Sastry	PHI learning Pvt. Ltd	4 th	2006
3	Linear Algebra	David Poole	Cengage Learning	4 th	2002

Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Fundamentals of Mathematical Statistics	S. C. Gupta	Sultan Chand & Sons	10 th	2000
2	Engineering Mathematics	Mukul Bhatt	McGraw Hill	2 nd	2020

MOOC/NPTEL Courses:

1.NPTEL: Numerical Methods

Course Link: <https://nptel.ac.in/courses/111107105>

2. NPTEL: Linear Algebra

Course Link: <https://nptel.ac.in/courses/111106135>



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Second Year Computer Science and Engineering			
Semester III			
Course Title	Data Structures		
Course Code	PCC-CSE-202		
Category	Program Core Course		
Scheme and Credits	L	P	No. of Credits
	3	-	3
Prerequisite Courses, if any: Programming for Problem Solving using C			
Companion Course, if any: Data Structures Lab (PCCL-CSE-206)			
Course Objectives: 1. To explain the fundamental concepts of data structures, Abstract Data Types (ADT), and algorithm analysis with respect to time and space complexity. 2. To apply linear data structures such as arrays, stacks, queues, hash tables, and linked lists to solve computational problems efficiently. 3. To implement and analyze non-linear data structures including trees, binary search trees, heaps, and graphs along with their traversal techniques. 4. To demonstrate proficiency in searching and sorting techniques such as sequential search, binary search, insertion sort, selection sort, radix sort, and skip lists. 5. To select and implement suitable data structures and algorithms for developing efficient, scalable, and maintainable software applications.			
Course Outcomes: After successful completion of the course, students will be able to: CO1: Understand the fundamental concepts of algorithms, linear and non-linear data structures. CO2: Demonstrate various operations on linear and non-linear data structures. CO3: Identify appropriate data structures to solve given problems. CO4: Examine algorithms and data structures in terms of time and space complexity of basic operations. CO5: Analyze different searching, sorting and hashing techniques.			



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Unit No.	Unit Title & Contents	Hours
1	Introduction to Data Structures & Arrays Data, Data types, Data structure, Classification of data structures, Abstract Data Type (ADT), representation of Information, characteristics of an algorithm, Time and space complexity, Asymptotic notations, Arrays-storage representation, Array addressing, array operations, sparse matrices, transpose of sparse matrices.	08
2	Stacks and Queues Introduction, stack and queue as ADT, representation and implementation of stack and queue using sequential and linked allocation, Circular queue and its implementation, Application of stack for expression evaluation and expression conversion, recursion, Double ended queue, priority queue.	08
3	Linked Lists Concept of linked organization, dynamic memory management , singly and doubly and circular linked list, operations on linked list such as insertion, deletion, search , concatenation, traversal , garbage collection , Applications of linked lists.	08
4	Trees Basic terminology, binary trees and their representation, insertion and deletion of nodes in binary trees, binary search tree and its traversal, threaded binary tree, Heap, Balanced Trees Applications of trees.	06
5	Graphs Graph terminology and types, Graph representations - adjacency matrix & Adjacency list, Graph traversal techniques - Breadth First Search (BFS) & Depth First Search (DFS), Applications of graphs.	06
6	Searching Sorting & Hashing Searching and Sorting: Sequential, binary searching, skip lists – dictionaries, linear list representation, skip list representation, operations – insertion, deletion, and searching. Insertion sort, selection sort, radix sort, Hash Tables, Direct address tables, Hash tables, Hash functions, Open addressing, Perfect hashing.	08



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Learning Resources

Text Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Fundamentals of Data Structures in C	Horowitz and Sahani	Universities Press	Second	2008
2	Data Structure using C and C++	Y. Langsm, M. Augenstin, A. Tanenbaum	Prentice Hall India	Second	2015

Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Data structures and algorithms analysis in C++	Mark Allen Weiss	Pearson Education	Fourth	2013
2	An Introduction to Data Structures with Applications	Trembley and Sorenson	Prentice Hall India	Second	2017
3	Introduction to Algorithms	Thomas Cormen	Prentice Hall India	Fourth	2022

MOOC/NPTEL Courses:

- 1) <https://nptel.ac.in/courses/106102064>
- 2) https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_cs81



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Second Year Computer Science & Engineering (2026 Course)			
Semester III			
Course Title	Discrete Mathematics		
Course Code	PCC-CSE-203		
Category	Program Core Course		
Scheme and Credits	L	P	No. of Credits
	3	-	3
Course Objectives: 1. To understand the fundamental mathematical concepts for Computer Science and Engineering. 2. To develop analytical thinking and logical reasoning skills for solving engineering and computational problems. 3. To apply mathematical structures such as sets, relations, functions, graphs and trees in computer science application. 4. To analyze the role of discrete mathematical concepts in algorithms, automata theory, cryptography and data structures. 5. To solve computational problems using combinatorics, recurrence relations and Boolean algebra techniques.			
Course Outcomes: After successful completion of the course, students will be able to: - CO1: Describe propositions, predicates, quantifiers and proof techniques used in discrete mathematical reasoning. - CO2: Apply sets, relations, functions and algebraic structures to solve discrete and computational problems. - CO3: Analyze graphs and trees for representing connectivity, traversal, and network-related problems in computer science. - CO4: Solve combinatorial problems using counting techniques, recurrence relations, and generating functions in algorithmic applications. - CO5: Interpret Boolean algebra and discrete mathematical structures for applications in digital logic, automata theory, cryptography, and data structures.			



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Unit No.	Unit Title & Contents	Hours
1	The Foundations: Logic and Proofs Propositional Logic, Compound Propositions, Logical Connectives, Propositional Equivalences, Converse, Contra-positive and Inverse, Tautology, Contradiction and Contingency, Predicates and Quantifiers, Rules of Inference, Introduction to proofs, Mathematical Induction, Normal Forms.	08
2	Basic Structures: Sets, Functions and Relations Sets: Introduction, Set Operations, Venn Diagrams. Cardinality of set, Power Set, Subsets. Functions: Introduction, Types of functions, Inverse Function, Composition of functions. Relations: Relations and Their Properties, n-ary Relations and Their Applications, Representing Relations, Closures of Relations, Equivalence Relations, Partial Ordering, Hasse Diagram, Lattice.	08
3	Graph Theory Introduction to Graphs, Representation of Graphs, Types of Graphs, Graph Isomorphism, Connectivity, Euler's and Hamilton Path and Circuits, Shortest Path Problems, The Travelling and Salesman Problem, Planner Graph, Graph Coloring, Applications of Graphs.	07
4	Trees Introduction to Trees, Applications of Trees, Binary Tree, Tree Traversal, Spanning Trees: Breadth First Search and Depth First Search, Minimum Spanning Tree: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Forest.	07
5	Counting Techniques Basics of Counting, The Pigeonhole Principle, Inclusion-Exclusion Principle, Recurrence Relations, Permutation and Combinations, Binomial Coefficient, Generating Functions.	07
6	Boolean Algebra and Algebraic Structures Boolean Algebra: Boolean Functions, Representing Boolean Functions, Boolean Rings. Algebraic Structures: Introduction, The structure of Algebras, Algebraic Systems, Semi Groups, Monoids, Groups, Homomorphism, Rings and Fields.	08



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Learning Resources

Text Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Discrete Mathematics and its Applications	Kenneth H. Rosen	Tata McGraw-Hill	Seventh	2012
2	Elements of Discrete Mathematics: A Computer Oriented Approach	C. L. Liu and D. P. Mohapatra	McGraw Hill	Fourth	2017

Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Schaum's Outline of Discrete Mathematics	S. Lipschutz and M. Lipson	McGraw-Hill Education	Third	2007
2	Discrete Mathematical Structures with Applications to Computer Science	J. P. Tremblay and R. Manohar	McGraw-Hill Education	Second	2004
3	Discrete Mathematics for Computer Scientists and Mathematicians	J. L. Mott, A. Kandel, and T. P. Baker	Prentice Hall	Second	2005

MOOC/NPTEL Courses:

Discrete Mathematics by Prof. Sudarshan Iyengar, IIT Ropar.

- Link : https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs137



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Second Year Computer Science & Engineering			
Semester III			
Course Title	Digital Electronics & Microprocessor		
Course Code	PCC-CSE-204		
Category	Program Core Course		
Scheme and Credits	L	P	No. of Credits
	3	-	3
Prerequisite Courses, if any: Foundational understanding of basic electrical and electronic circuits.			
Companion Course, if any: Digital Electronics & Microprocessor Lab(PCCL-CSE-207)			
Course Objectives: 1. To acquaint the students with the fundamental principles of two-valued logic and various devices to implement logical operations on variables. 2. To Understand the principles of asynchronous counters and design them to meet specific counting requirements 3. To solve real-world problems related to arithmetic operations, code conversion, counter applications, and other digital logic scenarios. 4. To understand how to interface microprocessors with memory and peripheral devices. 5. To design microprocessor-based systems for measurement and control applications			
Course Outcomes: After successful completion of the course, students will be able to: CO1: Comprehend and simplify Boolean expressions using logic gates, and analyze number Systems and codes. CO2: Design and implement arithmetic circuits, multiplexers, flip-flops, Registers, and counters. CO3: Outline the internal architecture, pin configurations, and bus operations of standard Processors. CO4: Write assembly language programs, understand addressing modes, and utilize the instruction Set to execute mathematical and logical operations. CO5: Design systems by interfacing microprocessors with external peripheral chips and memory modules.			



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Unit No.	Unit Title & Contents	Hours
1	Introduction Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, Number Systems: binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes.	08
2	Combinational Digital Circuits Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions, Don't care conditions, Multiplexer, De-Multiplexer / Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, parity checker / generator.	07
3	Sequential circuits and systems 1-bit memory, the clocked SR flip flop, J-K, T and D-types of flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, applications of counters.	08
4	Fundamentals of Microprocessors Fundamentals of Microprocessor, Comparison of 8-bit, (8085) 16-bit (8086), and 32-bit microprocessors (80386), The 8086 Architecture: Internal Block Diagram, CPU, ALU, address, data and control bus, Working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, 8086 Pin configuration, 8086 Modes: Minimum & Maximum mode.	08
5	Microprocessor Interfacing Even & Odd Memory Banks, Memory Segmentation, Memory Interfacing, I/O Interfacing, Interrupts in 8086.	07
6	Microprocessor Instruction Set & Programming 8086 Instruction Set and Programming: Addressing modes, Instruction timings, Instruction types: Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instruction, Assembly language programs, Assemblers and compilers, Programming and debugging tools.	07



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Text Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Modern Digital Electronics	R.P. Jain	McGraw-Hill	Fifth	2022
2	Microprocessor Architecture, Programming and Applications	Ramesh S Gaonkar	Prentice Hall India	Sixth	2013

Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Digital logic and Computer design	M. M. Mano	Pearson Education India	Third	2016
2	Fundamentals of Digital Circuits	A. Anandkumar	Prentice Hall of India	Third	2016
3	Microprocessors and Interfacing	Douglas Hall	McGraw-Hill Publication	Revised 2nd Edition	2006

MOOC/NPTEL Courses:

1. https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_ee75
2. https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_ee09



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Second Year Computer Science and Engineering			
Semester III			
Course Title	Universal Human Values		
Course Code	MGM-VEC-UHV-231		
Category	Value Education Course		
Scheme and Credits	L	P	No. of Credits
	2	-	2
Prerequisite Courses, if any: Nil			
Companion Course, if any: Nil			
Course Objectives: 1. To understand the importance of value education, self-exploration, happiness, prosperity, and basic human aspirations. 2. To distinguish the needs of the self and body and achieve harmony between them. 3. To promote harmony in family and society through trust and respect in human relationships. 4. To understand the interrelationship among the four orders of nature for sustainable and peaceful coexistence. 5. To apply human values in professional ethics, decision-making, and value-based living.			
Course Outcomes: After successful completion of the course, students will be able to: CO1: Understand the overview of Value Education. CO2: Explore the concept of Harmony in human being as Self and Body. CO3: Acquire the depth knowledge of Harmony in the Family and Society. CO4: Identify Harmony in the Nature/Existence. CO5: Analyze professional ethics to present the sustainable solutions CO6: Apply universal human values and ethics for responsible and sustainable living.			



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Unit No.	Unit Title & Contents	Hours
1	Introduction to Value Education Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity, the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity, Current Scenario, Method to Fulfill the Basic Human Aspirations.	04
2	Harmony in the Human Being Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to Ensure self-regulation and Health.	04
3	Harmony in the Family and Society Harmony in the Family, the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Understanding Harmony in the Society, Vision for the Universal Human Order.	04
4	Harmony in the Nature (Existence) Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.	04
5	Foundations of Holistic Understanding and Human Values Implications of Holistic Understanding – A Look at Professional Ethics, Natural Acceptance of Human Values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Universal Human Order.	04
6	Professional Ethics and Value-Based Practices Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models, Typical Case Studies on Professional Ethics and Human Values, Strategies for Transition towards a Value-Based Life and Profession.	04



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Learning Resources

Text Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	A Foundation Course in Human Values and Professional Ethics	R R Gaur, R Asthana, G P Bagaria	Excel Books	Second	2019
2	Microelectronics: Circuit Analysis and Design	Donald A Neamen	Excel Books	Fourth	2021

Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	JeevanVidya: EkParichaya	A Nagaraj	JeevanVidya Prakashan, Amarkantak	Fourth	1999
2	Human Values	A. N. Tripathi	New Age Intl. Publishers, New Delhi	Third	2004

MOOC/NPTEL Courses:

- Universal Human Values for Higher Education (Monograph & Course Content)
<https://uhv.org.in/highereducation>
- AICTE UHV-II: Understanding Harmony and Ethical Human Conduct
https://uhv.org.in/UHV-II_Course_Material



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Second Year Computer Science and Engineering			
Semester-III			
Course Title	Data Structures Lab		
Course Code	PCCL-CSE-206		
Category	Program Core Course Lab		
Scheme and Credits	L	P	No. of Credits
	-	02	01
Prerequisite Courses, if any: Programming for Problem Solving using C			
Companion Course, if any: Data Structures (PCC-CSE-202)			
Course Objectives: 1. To understand static and dynamic memory allocation techniques for efficient data organization and management. 2. To implement linear and non-linear data structures such as stacks, queues, linked lists, trees, graphs, and hashing techniques. 3. To apply searching, sorting, and graph traversal algorithms for solving computational problems. 4. To analyze the performance of data structures and algorithms in terms of time and space complexity.			
Course Outcomes: CO1: Demonstrate static and dynamic memory allocation techniques CO2: Implement various operations on linear and non-linear data structures. CO3: Develop program for searching and sorting techniques. CO4: Analyze different data structures in terms of time and space complexities			



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Laboratory Requirements:

Students shall perform 10 to 12 laboratory assignments using C programming language to implement and analyze fundamental data structures and algorithms

List of experiments to be performed

1. Write a program to implement a stack using arrays
2. Write a program to evaluate a given postfix expression using stacks.
3. Write a program to convert a given infix expression to postfix form using stacks.
4. Write a program to implement a circular queue using arrays.
5. Write a program to implement double ended queue (dequeue) using arrays.
6. Write a program to implement a stack using two queues such that the push operation runs in constant time and the pop operation runs in linear time.
7. Write a program to implement a stack using two queues such that the push operation runs in linear time and the pop operation runs in constant time
8. Write a program to implement a queue using two stacks such that dequeue operation runs in constant time and dequeue operation runs in linear time
9. Write programs to implement the following data structures: (a) Single linked list, (b) Double linked list, (c) Circular linked list
10. Write a program to implement a stack using a linked list such that the push and pop operations of the stack still take $O(1)$ time.
11. Write a program to create a binary search tree (BST) by considering the keys in given order and perform the following operations on it. (a) Minimum key (b), Maximum key, (c) Search for a given key, (d) Find predecessor of a node, (e) Find successor of a node, (f) Delete a node with given key.
12. Write a program to implement hashing with (a) Separate Chaining and (b) Open addressing methods.
13. Implement the following sorting algorithms:
(a) Insertion sort, (b) Merge sort, (c) Quick sort, (d) Heap sort
14. Write programs for the implementation of graph traversals by applying: (a) BFS, (b) DFS.

Virtual LAB Links:

1. <https://ds1-iiith.vlabs.ac.in/>
2. <https://ds2-iiith.vlabs.ac.in/>
3. <https://cse01-iiith.vlabs.ac.in/>



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Second Year Computer Science and Engineering			
Semester-III			
Course Title	Digital Electronics & Microprocessor Lab		
Course Code	PCCL-CSE-207		
Category	Program Core Course Lab		
Scheme and Credits	L	P	No. of Credits
	-	02	01
Prerequisite Courses, if any: A foundational understanding of electronic circuits, Computer Fundamentals and Low Level Programming.			
Companion Course, if any: Digital Electronics & Microprocessor(PCC-CSE-204)			
Course Objectives: 1. Understand basic electronic components, logic gates, and Boolean simplification. 2. Learn to analyze and design combinational and sequential circuits on breadboard. 3. Explore the internal organization, pin configurations, and registers of standard microprocessors. 4. Develop assembly language programs and interface microprocessors with memory.			
Course Outcomes: After successful completion of the course, students will be able to: CO1: Identify digital Integrated Circuits (ICs), test their parameters, and verify truth tables. CO2: Construct, build, and troubleshoot combinational blocks such as adders, multiplexers, and decoders. CO3: Analyze and verify the behavior of sequential circuits including flip-flops and counters. CO4: Write, debug, and execute basic assembly language programs.			
Laboratory Requirements: Students should perform eight to ten experiments from the list using Digital ICs, Breadboards, Connecting Wires, LEDs, Power Supply and computers equipped with assembler/emulator software for assembly language programming.			



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List of experiments to be performed
1. Study of gates – AND; OR; NOT; NAND; NOR; EX-OR; EX-NOR
2. Verification of Boolean Theorems using basic gates- De-Morgan's Theorem for 2 variables.
3. Design and implement the Half Adder and Full Adder using basic logic gates.
4. Logic Function Generator using Multiplexer & Decoder
5. To verify the truth tables of S-R; J-K; T and D type flip flops.
6. Design, and Verify the 4- Bit Synchronous Counter.
7. Design, and Verify the 4-Bit Asynchronous Counter.
8. Study of 8086 Instruction Set
9. Write a assembly language program to implement Addition of series of numbers
10. Write a assembly language program to implement Finding out no of even and odd nos. / positive and negative nos. from a series of 16 bit nos.
11. Write a assembly language program to implement Moving a block of 50 words from data segment to extra segment
12. Write a assembly language program to implement arrange a series of 16-bit nos. in ascending/ descending order.
13. Write a assembly language program to implement Convert 0-9 BCD to equivalent 7-segment code using look up table.
Virtual LAB Links: https://de-iitr.vlabs.ac.in/



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Second Year Computer Science and Engineering			
Semester III			
Course Title	Python Programming Lab		
Course Code	VSEC-CSE-208		
Category	Vocational & Skill Enhancement Course		
Scheme and Credits	L	P	No. of Credits
	1	2	2
Course Objectives: 1. To introduce the fundamentals of Python programming and problem-solving techniques. 2. To develop programming skills using control structures, functions, and modules. 3. To familiarize students with Python data structures and their applications. 4. To impart object-oriented programming concepts using Python. 5. To enable students to perform file processing and exception handling. 6. To use SQL queries to store, retrieve, and manage data for practical projects			
Course Outcomes: After successful completion of the course, students will be able to: CO1: Understand the fundamentals of Python programming CO2: Develop Python programs using conditional statements, loops, and control statements to solve computational problems. CO3: Apply Python data structures such as lists, tuples, sets, and dictionaries to solve programming problems. CO4: Develop modular programs using functions, modules, and packages in Python. CO5: Implement object-oriented programming concepts such as classes, objects, inheritance, polymorphism, and abstraction in Python. CO6: Perform file handling, exception handling, and database connectivity operations using Python.			



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Unit No.	Unit Title & Contents	Hours
1	Introduction to Python Features and applications of Python, Installation and execution of Python programs, Tokens, keywords, identifiers, and comments, Variables and data types, Input and output statements, Operators and expressions, Type conversion.	06
2	Decision Making and Looping Conditional statements (if, if-else, nested if), Iterative statements (for and while loops), break, continue, and pass statements, Nested loops, Range function, Simple programming applications using control structures.	04
3	Strings and Data Collections String creation and operations, String slicing and built-in functions, Lists and list operations, Tuples and tuple operations, Sets and dictionaries, List comprehensions.	04
4	Functions, Modules and Packages in Python Defining and calling functions, Function arguments and return values, Recursive functions, Scope and lifetime of variables, Lambda functions, Built-in modules, Creating and importing user-defined modules, Introduction to packages and package organization.	05
5	Object Oriented Programming in Python Classes and objects, Constructors, Instance and class variables, Data Abstraction and Encapsulation, Inheritance and polymorphism, Method overriding.	05
6	File, Exception, and Database Handling in Python File Handling: Introduction, File Operations, File Modes, Reading and Writing Files, Exception Handling: Introduction, Types of Errors, try and except Blocks, Common Built-in Exceptions, Database Handling using MySQL: Installing mysql-connector, cursor() Object, execute() Method, fetchall() Method, Creating a Simple Program to Connect to a Database	06



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Laboratory Requirements

Students shall perform 10 to 12 laboratory assignments using Python and tools such as Visual Studio Code, PyCharm, IDLE, or Jupyter Notebook. The laboratory exercises cover programming fundamentals, data structures, file handling, exception handling, object-oriented programming, and database connectivity.

List of Practical Assignments to be Performed**Experiment 1: Introduction to Python**

- Installation of Python and IDE
- Write simple Python programs using print() and input()

Experiment 2: Programs on Operators in Python

- Perform arithmetic operations
- Demonstrate relational and logical operators
- Demonstrate bitwise, membership, and identity operators

Experiment 3: Programs on Conditional and Control Flow Statements

- Implement decision-making using if, if-else, and nested if statements
- Implement looping using for and while statements
- Demonstrate the use of break, continue, and pass statements

Experiment 4: Programs on Lists

- Create lists and perform basic operations
- Implement list manipulation using built-in methods
- Perform searching and sorting operations on lists

Experiment 5: Programs on Tuples

- Create and access tuple elements
- Perform tuple operations and slicing
- Use built-in tuple functions and methods

Experiment 6: Programs on Sets

- Create sets and perform set operations
- Implement union, intersection, and difference operations
- Use built-in set methods

Experiment 7: Programs on Dictionaries

- Create dictionaries and access elements
- Perform insertion, deletion, and update operations
- Use built-in dictionary methods



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Experiment 8: Programs on Functions in Python

- Implement user-defined functions
- Demonstrate function arguments and return values
- Implement lambda functions and recursion

Experiment 9: Programs on Modules and Packages

- Create and import user-defined modules
- Use built-in modules such as math and random
- Install and use packages using PIP

Experiment 10: Programs on Classes and Objects

- Create classes and objects
- Access class attributes and methods
- Implement real-world applications using classes

Experiment 11: Programs on Constructors and Inheritance

- Implement constructors using `__init__()`
- Demonstrate single inheritance
- Demonstrate multiple and multilevel inheritance

Experiment 12: Programs on Polymorphism and Data Abstraction

- Implement method overriding for polymorphism
- Demonstrate data hiding using private members
- Implement abstraction using abstract classes

Experiment 13: Programs on File Handling

- Read data from files
- Write data to files
- Perform file operations using different file modes

Experiment 14: Programs on Exception Handling

- Handle exceptions using try and except
- Demonstrate multiple exception handling
- Use finally block for cleanup operations

Experiment 15: Programs on Database Connectivity using MySQL

- Install and configure MySQL Connector
- Connect Python applications with MySQL database
- Execute SQL queries and retrieve records using `fetchone()` and `fetchall()` methods



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Learning Resources

Text Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Core Python Programming	R. Nageswara Rao	Dreamtech Press	Third	2021
2	Python Basics: A Practical Introduction to Python 3	David Amos, Dan Bader, Joanna Jablonski, Fletcher Heisler	Real Python	Fourth	2021

Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Learning Python	Mark Lutz	O'Reilly Media	Fifth	2013
2	Python Programming	Michael Urban and Joel Murach	Murach's Publication	Fourth	2019

MOOC/NPTEL Courses:

The Joy of Computing using Python, By Prof. Sudarshan Iyengar |IIT Ropar
https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs84



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Second Year Computer Science & Engineering			
Semester III			
Course Title	Web Application Development Lab (Project Based Learning)		
Course Code	VSEC-CSE-209		
Category	Vocational and Skill Enhancement Course		
Scheme and Credits	L	P	No. of Credits
	-	2	1
Prerequisite Courses, if any: Programming Fundamentals, HTML Basics			
Companion Course, if any: Nil			
Course Vision (Project-Based Learning Approach) This laboratory course is designed using a Project-Based Learning (PBL) methodology where students progressively design, develop, and deploy modern web applications through hands-on practical assignments, mini-projects, and collaborative development activities. The course emphasizes responsive web design, client-side and server-side programming, database integration, RESTful API development, and full-stack application development using contemporary web technologies. Students will work individually and in teams to identify real-world problems, gather requirements, design user interfaces, develop dynamic web applications, integrate databases and APIs, and deploy complete web solutions. The course promotes industry-oriented development practices, version control using Git and GitHub, collaborative teamwork, problem-solving skills, and professional project documentation, preparing learners for modern web development and software engineering roles.			
Course Objectives: 1. To understand modern web technologies and full stack development concepts. 2. To design and develop responsive and interactive web applications. 3. To apply frontend and backend technologies in real-time projects. 4. To integrate databases and APIs into dynamic web applications. 5. To develop industry-oriented project-based web solutions collaboratively			



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Course Outcomes:

After successful completion of the course, students will be able to:

CO1: Design static and responsive web pages using HTML5, CSS3, Bootstrap, and JavaScript.

CO2: Develop interactive and dynamic user interfaces using client-side scripting and frontend development techniques.

CO3: Implement server-side web applications using Node.js/PHP and manage projects using Git and GitHub.

CO4: Integrate databases and perform CRUD operations with proper validation, session handling, and REST API integration.

CO5: Develop, test and deploy a complete full stack web application collaboratively using modern web development practices.

Unit No.	Unit Title & Contents	Hours
1	Problem Identification and Frontend Planning Introduction to Project Based Learning, Identification of Real-World Problems, Requirement Gathering, Web Technologies Overview, Client-Server Architecture, IDE Setup, HTML5 Structure and Semantic Tags, Forms, Tables, Multimedia Elements, CSS3 Basics, Responsive Layout Planning, Wireframing and UI Design. Project Activity Identify a real-world problem and design static responsive web pages for the proposed project.	05
2	Interactive Frontend Development JavaScript Basics, Variables, Operators, Control Structures, Functions, Arrays, Events, DOM Manipulation, Form Validation, Dynamic Content Handling, Responsive Design Concepts, Bootstrap Grid System, Navigation Bars, Cards, Forms, and Interactive User Interfaces. Project Activity Develop interactive frontend modules with validation and responsive design features.	05
3	Version Control and Server-Side Development Introduction to Git and GitHub, Repository Management, Branching and Merging, Introduction to Server-side Scripting, Node.js/PHP Basics, Web Servers, Request-Response Cycle, Modules, Routing, File Handling, Dynamic Web Page Generation.	05



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	Project Activity Develop backend functionalities and maintain collaborative project repositories using GitHub.	
4	Database Integration and CRUD Operations Introduction to Databases, MySQL/MongoDB Basics, Database Design Concepts, Database Connectivity with Web Applications, SQL Queries, CRUD Operations, Form Data Handling, Session and Cookie Management, Error Handling and Validation Techniques. Project Activity Integrate database connectivity and implement CRUD operations for project modules.	05
5	REST API and Full Stack Web Application Development Introduction to REST API Concepts, API Methods, API Testing Tools, Frontend-Backend Integration, Authentication Basics, JSON Handling, REST API Integration, Dynamic Data Exchange, Security Basics, Testing and Debugging Techniques. Project Activity Develop REST API-based modules and integrate frontend with backend services.	05
6	Full Stack Project Implementation and Deployment Complete Full Stack Application Development, Project Documentation, Collaborative Development Practices, Deployment Concepts, Hosting Platforms, Performance Optimization, Security Best Practices, Testing, Demonstration and Presentation Techniques. Major Project Activity Develop, test, deploy, and demonstrate a complete real-world full stack web application.	05

Laboratory Requirements

Students shall perform the laboratory assignments and project work using modern web development tools and platforms. The recommended development environment includes Visual Studio Code (VS Code), Git and GitHub, Node.js/PHP, MySQL/MongoDB, Postman, and modern web browsers. The practicals will utilize HTML5, CSS3, JavaScript, Bootstrap, REST APIs, and database technologies for developing full-stack web applications. Students are expected to maintain project repositories on GitHub and submit practical assignments, documentation, and the final mini-project as part of the course requirements.



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List of Practical Assignments to be Performed
1. Introduction to Web Technologies and IDE Setup
2. Static Web Page Design using HTML5
3. Web Page Styling using CSS3
4. JavaScript Basics and DOM Manipulation
5. Form Validation using JavaScript
6. Responsive Design using Bootstrap
7. Version Control using Git and GitHub
8. Server-side Programming using Node.js/PHP
9. Database Connectivity using MySQL/MongoDB
10. CRUD Operations in Web Applications
11. REST API Integration
12. Mini Project: Full Stack Web Application
Suggested Project Domains
1. Online Student Management System
2. Event Management Portal
3. E-Commerce Website
4. Hospital Appointment System
5. Library Management System
6. Restaurant Ordering System
7. Online Quiz System
8. Portfolio and Blogging Website



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Learning Resources

Text Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Web Design with HTML, CSS, JavaScript and jQuery	J. Duckett	Wiley	First	2014
2	Internet and World Wide Web: How to Program	M. L. Deitel and P. J. Deitel	Pearson	Fifth	2011

Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Head First HTML and CSS	E. Freeman and E. Robson	O'Reilly Media	Second	2012
2	JavaScript: The Definitive Guide	D. Flanagan	O'Reilly Media	Seventh	2020



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Second Year Computer Science and Engineering			
Semester III			
Course Title	Asian-European Language: German		
Course Code	MGM-CC-AEL-232A		
Category	Co-curricular Courses		
Scheme and Credits	L	P	No. of Credits
	2	-	2
Prerequisite Courses, if any: Nil			
Companion Course, if any: Nil			
Course Objectives: 1. To introduce the students to Germany as an education hub and career destination. 2. To introduce the basic structure of German Language. 3. To make the students understand the character set of German 4. To understand the German Culture 5. To understand basic vocabulary 6. To understand basic Grammar			
Course Outcomes: After successful completion of the course, students will be able to: CO1: Understand the basic info about Germany for job/ higher education CO2: Understand basic German Alphabets. CO3: Know additional symbols and alphabet combinations. CO4: Learn German phonetic rules and exceptions CO5: Learn basic vocabulary , grammar , and self-introduction in German			



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Unit No.	Unit Title & Contents	Hours
1	Introduction to German Language Definition and importance of language, Structure of German Language, Basic Info about Germany, German Alphabet – 1	06
2	Alphabets and Greetings German Alphabet – 2, Vocabulary- 1 basic Greetings, Self introduction, Vocabulary 2, Weekdays , months etc, Grammar 1 The articles	06
3	Basic Vocabulary and Numbers Vocab – Family, Professions, Numbers -1, Numbers- 2, Ordinal numbers	06
4	Basic Grammar and Reading Time reading, Grammar – Personal Pronouns, Vocab – Job, modes of Transport, Vocab – Colours	06
5	Sentence Formation Sentence structure, Declarative sentences, Interrogative -A – WH Questions, Interrogative -B – yes/no questions	06

Learning Resources

Text Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Studio D A1	Bettermann, Christel; Demme, Silke; Funk, Hermann; Kuhn, Christina; Werner, Regina	Goyal Publishers & Distributers, ISBN-13 : 9783464207321	NA	2005
2	Netzwerk1 A1	Stefanie Dengler	Goyal Publishers & Distributers, ISBN-10: 8183076963	NA	2012



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Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Tech Yourself	Paul Coggle, Heiner Schenke	Teach Yourself, ISBN-10 : 1444177362	NA	2012
2	Towards Germany	Deutscher Sachverständiger	Lingo Mastery, ISBN-10: 1951949552	NA	2022





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Second Year Computer Science and Engineering			
Semester III			
Course Title	Asian-European Language: Spanish		
Course Code	MGM-CC-AEL-232B		
Category	Co-curricular Courses		
Scheme and Credits	L	P	No. of Credits
	2	-	2
Prerequisite Courses, if any: Nil			
Companion Course, if any: Nil			
Course Objectives: 1. To introduce the students to Spain as an education hub and career destination. 2. To introduce the basic structure of Spanish Language. 3. To make the students understand the character set of Spanish 4. To understand the Spanish Culture 5. To understand basic vocabulary 6. To understand basic Grammar			
Course Outcomes: After successful completion of the course, students will be able to: CO1: Understand the basic info about Spain for job/ higher education CO2: Understand basic Spanish Alphabets. CO3: Know additional symbols and alphabet combinations. CO4: Learn Spanish phonetic rules and exceptions CO5: Learn basic vocabulary, grammar , and self-introduction in Spanish			



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Unit No.	Unit Title & Contents	Hours
1	Introduction to Spanish Language Use and importance of language, Basic information about Spain, Sentence structure of Spanish Language, Informal introduction	06
2	Alphabet and Basic Grammar Spanish alphabet – 1:Salutation and expression, Subject pronouns, Verb Ser	06
3	Basic Vocabulary and Asking Questions Negation,Vocabulary, Professions, Asking question using ‘¿Qué?, Asking and telling first-name and last-name	06
4	Genders and Articles Use of the question ¿Quién es? / ¿Qué hace? etc., Cardinal numbers 1-20, Noun: Gender and number, Articles: Definite	06
5	Adjectives and Numbers Adjective: Gender and number, Nationality and Country name, Numbers 21-100, Adjective: Demonstrative	06

Learning Resources

Text Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Aula-1	Jaime Corpas, Eva Garcia, Agustín Garmendia	Goyal Publishers & Distributors Pvt Ltd , ISBN13: 9788415640097	Level: A1	2021
2	Chicoschicas 1	Maria Angeles Palomino	Edelsa, ISBN-10 : 8477117728	NA	2002



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Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Spanish made easy	Alex Martinez	Goyal Publishers & Distributors Pvt Ltd , ISBN-13: 9788183070942	NA	2002

MOOC/NPTEL Courses:

Sr. No.	NPTEL Courses Name	Instructor	Host Institute & Link
1	Basics of Spanish Language and Culture-I	Mr. Vikash Kumar Singh	Indira Gandhi National Open University https://onlinecourses.swayam2.ac.in/e-learning/preview/nou22_lg12



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Second Year Computer Science and Engineering			
Semester III			
Course Title	Asian-European Language: French		
Course Code	MGM-CC-AEL-232C		
Category	Co-curricular Courses		
Scheme and Credits	L	P	No. of Credits
	2	-	2
Prerequisite Courses, if any: Nil			
Companion Course, if any: Nil			
Course Objectives: 1. To introduce the students to French as an education hub and career destination. 2. To introduce the basic structure of French Language. 3. To make the students understand the character set of French 4. To understand the French Culture 5. To understand basic vocabulary 6. To understand basic Grammar			
Course Outcomes: After successful completion of the course, students will be able to: CO1: Understand the basic info about French for job/ higher education CO2: Understand basic French Alphabets. CO3: Know additional symbols and alphabet combinations. CO4: Learn French phonetic rules and exceptions CO5: Learn basic vocabulary , grammar , and self-introduction in French			



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Unit No.	Unit Title & Contents	Hours
1	Introduction to French Language Definition and importance of language, Structure of French Language, Basic Info about French, French Alphabets	06
2	Greeting and Self Introduction Basic Greetings, Self introduction, Weekdays , months etc, Grammer 1 The articles	06
3	Basic Vocabulary and Numbers Vocab – Family, Professions, Numbers , Ordinal numbers	06
4	Basic Grammar and Reading Time reading, Grammar – Personal Pronouns, Vocab – Job, modes of Transport, Vocab – Colours	06
5	Sentence Formation Sentence structure, Declarative sentences, Interrogative -A – WH Questions, Interrogative -B – yes/no questions	06

Learning Resources

Text Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Alter Ego A1 & Alter Ego D'Activites	Hachette	Goyal Publishers & Distributors Pvt Ltd, ISBN-10: 8183075452	Level:A1	2013
2	Saison Method de Francais 1 A1	Marie-Noëlle Cocton Anneline Dintilhac Anouchka Oliveira Delphine Ripaud Dorothee Dupleix	Didier Publisher, ISBN : 9782278112708	Level:A1	2024



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Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Echo Method de Francais A1	Jacques Pecheur & Jacky Girardet	Goyal Publishers & Distributors Pvt Ltd, ISBN-13: 9782090385885	Level:A1	2013
2	A Propos Livre de l'eleve	Christine Andant	French and European Publications Inc, ISBN 13: 9782706122866	Level:A1	2015

MOOC/NPTEL Courses:

Sr. No.	NPTEL Courses Name	Instructor	Host Institute & Link
1	Foundations of French	Ramya Jagannathan	IIM Bangalore https://onlinecourses.swayam2.ac.in/e-learning/preview/imb25_mg88



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Second Year Computer Science and Engineering			
Semester III			
Course Title	Asian-European Language: Japanese		
Course Code	MGM-CC-AEL-232D		
Category	Co-curricular Courses		
Scheme and Credits	L	P	No. of Credits
	2	-	2
Prerequisite Courses, if any: Nil			
Companion Course, if any: Nil			
Course Objectives: 1. To introduce learners to basic Japanese language structure, vocabulary, and sentence formation. 2. To develop beginner-level listening, speaking, reading, and writing skills in Japanese. 3. To enable students to understand and use common daily expressions and greetings in Japanese. 4. To familiarize learners with Hiragana, Katakana, and essential Kanji characters required for JLPT N5. 5. To prepare students for elementary-level Japanese communication and the JLPT N5 examination.			
Course Outcomes: After successful completion of the course, students will be able to: CO1: Understand and use basic Japanese greetings, expressions, and sentence patterns in daily Communication. CO2: Read and write Hiragana, Katakana, and simple Kanji characters accurately. CO3: Apply elementary Japanese grammar rules to form correct sentences. CO4: Comprehend short Japanese conversations and simple written passages. CO5: Demonstrate beginner-level proficiency required for the JLPT N5 examination.			



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Unit No.	Unit Title & Contents	Hours
1	Introduction to Japanese Language and Scripts Hiragana & Katakana - Reading Writing, and Basic Pronunciation, Greetings, Self-Introduction, Numbers, Days of the Week, Months	06
2	Basic Grammar and Sentence Formation Particles {wa, ga, no ,ni}, Basic usage and sentence structure, Introduction to basic verbs, Present tense and negative form	06
3	Numbers and Basic Vocabulary Describing things: Nouns + 1/0, Using negative/positive, Basic shopping vocabulary	06
4	Types of Grammar Describing people and objects using adjectives, Types Grammar: Question words {nan, itsu, doko, donna} and asking questions	06
5	Asking Questions and Practice Grammar: Question words {nan, itsu, doko, donna} and asking questions, Verb conjugation: Dictionary form and (te) form, Mock tests, Speaking practice, revision, mini quiz and vocabulary drills	06

Learning Resources

Text Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Minna no Nihongo 1-1	3A Corporation	Goyal Publishers, ISBN-10: 8183071708	First	2007



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Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Genki I: An Integrated Course in Elementary Japanese	Eri Banno, Yoko Ikeda, Yutaka Ohno, Chikako Shinagawa, Kyoko Tokashiki	Japan Times Publishing, Ltd., ISBN-13 : 978-4789017305	Third	2020

MOOC/NPTEL Courses:

Sr. No.	NPTEL Courses Name	Instructor	Link
1	Introduction to Japanese Language and Culture	Prof. Vatsala Misra, IIT Kharagpur	https://nptel.ac.in/courses/121104005



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Second Year Computer Science and Engineering			
Semester III			
Course Title	Asian-European Language: Sanskrit		
Course Code	MGM-CC-AEL-232E		
Category	Co-curricular Courses		
Scheme and Credits	L	P	No. of Credits
	2	-	2
Prerequisite Courses, if any: Nil			
Companion Course, if any: Nil			
Course Objectives: 1. Understand the historical, cultural, and literary heritage preserved in ancient Sanskrit texts such as the Vedas, Upanishads, Ramayana, Mahabharata, and Puranas. 2. Develop fundamental knowledge of Sanskrit language, grammar, vocabulary, and sentence construction. 3. Acquire proficiency in reading, reciting, comprehending, and interpreting Sanskrit texts, verses, and stories. 4. Apply Sanskrit grammatical principles, number systems, and verb conjugations in written and spoken communication. 5. Enhance Sanskrit writing skills using traditional and modern scripts while appreciating the relevance of Sanskrit literature in contemporary knowledge systems			



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Course Outcomes:

After successful completion of the course, students will be able to:

- CO1: Explain the cultural, literary, and philosophical contributions of major Sanskrit texts including Ramayana, Mahabharata, Vedas, Upanishads, and Puranas.
- CO2: Read, recite, comprehend, and summarize simple Sanskrit texts, verses, stories, and literary passages with proper pronunciation and accent.
- CO3: Apply Sanskrit grammar, numbers, time expressions, noun forms, and verb conjugations to construct grammatically correct sentences.
- CO4: Analyze and interpret selected Sanskrit literary works such as Panchatantra, Hitopadesha, and various forms of Kāvya to derive moral and cultural insights.
- CO5: Demonstrate Sanskrit writing skills by composing simple texts, messages, and letters using appropriate grammatical structures and writing conventions.

Unit No.	Unit Title & Contents	Hours
1	Cultural Aspect Overview of आर्षमहाकाव्यम् – रामायणम् and महाभारतम्, Overview of वेद, ब्राह्मण, उपनिषद् and वेदाङ्ग, Overview of पुराण – अष्टादशपुराणानि, Read and comprehend from simple texts/paragraphs, Summarizing the main points of the given texts.	06
2	Sanskrit numbers and sentence structure संस्कृतवर्णानां परिचयः– माहेश्वरसूत्राणि, उच्चारणस्थानानि।, Apply सङ्ख्या (Numbers) and समयम् (Time) in sentence, Introduction to नामरूपाणि –Words related to Engineering – स्वरान्तशब्द, Introduction to verb conjugation (लट्, लङ्, लृट्, लोट्, विधिलिङ्) -1,4,6,10 गण – धातुरूपाणि।	06
3	Sanskrit grammar Introduction to Sanskrit Alphabets, word and sentence, Writing simple text,	06



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	short messages, letters on given topics, Correct errors in given texts, Solving grammar exercises to get elementary level sentence structure in Sanskrit.	
4	Enhancing proficiency in Sanskrit reading through उपजीव्यसाहित्य Overview of various kinds of काव्यम् – नीतिकाव्यम्, गीतिकाव्यम्, स्तोत्रसाहित्यम्, चम्पूकाव्यम्, Overview of कथासानहत्यम् – बृहत्कथा, कथासररत्नागर, पञ्चतन्त्रम्, हितोपदेशः etc., पञ्चतन्त्रम् सूक्तिसुधा Selected verses from पञ्चतन्त्रम्, Discover story behind the selected verse of पञ्चतन्त्रम् and नहतोपदेशः, Read Sanskrit verses and paragraphs in appropriate accent.	06
5	Sanskrit writing skills Introduction to नामधातुरूपाणि – Related to Engineering – व्यञ्जनान्तशब्दाः, Application of verb conjugation (लट्, लङ्, लृट्, लोट्, विधिलिङ्)-(2,3,5,7,8,10 गण- धातुरूपाणि), Basic rules for Sanskrit writing, Sanskrit Writing Traditions: Devanagari, Roman (IAST)	06

Learning Resources

Text Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Saṃskṛta Vyākaraṇakaumudī,	Dora Ghanashyam	PCCOE Publication, Pune 2025	NA	2025
2	सुगम संस्कृत	ओक अंजली	पीसीसीओ, पुणे	NA	2025
3	संस्कृत-व्याकरणशास्त्र-प्रवेश	मुळे रवीन्द्र	ज्ञानेंद्र अंबादास मुळे प्रकाशित	NA	2004



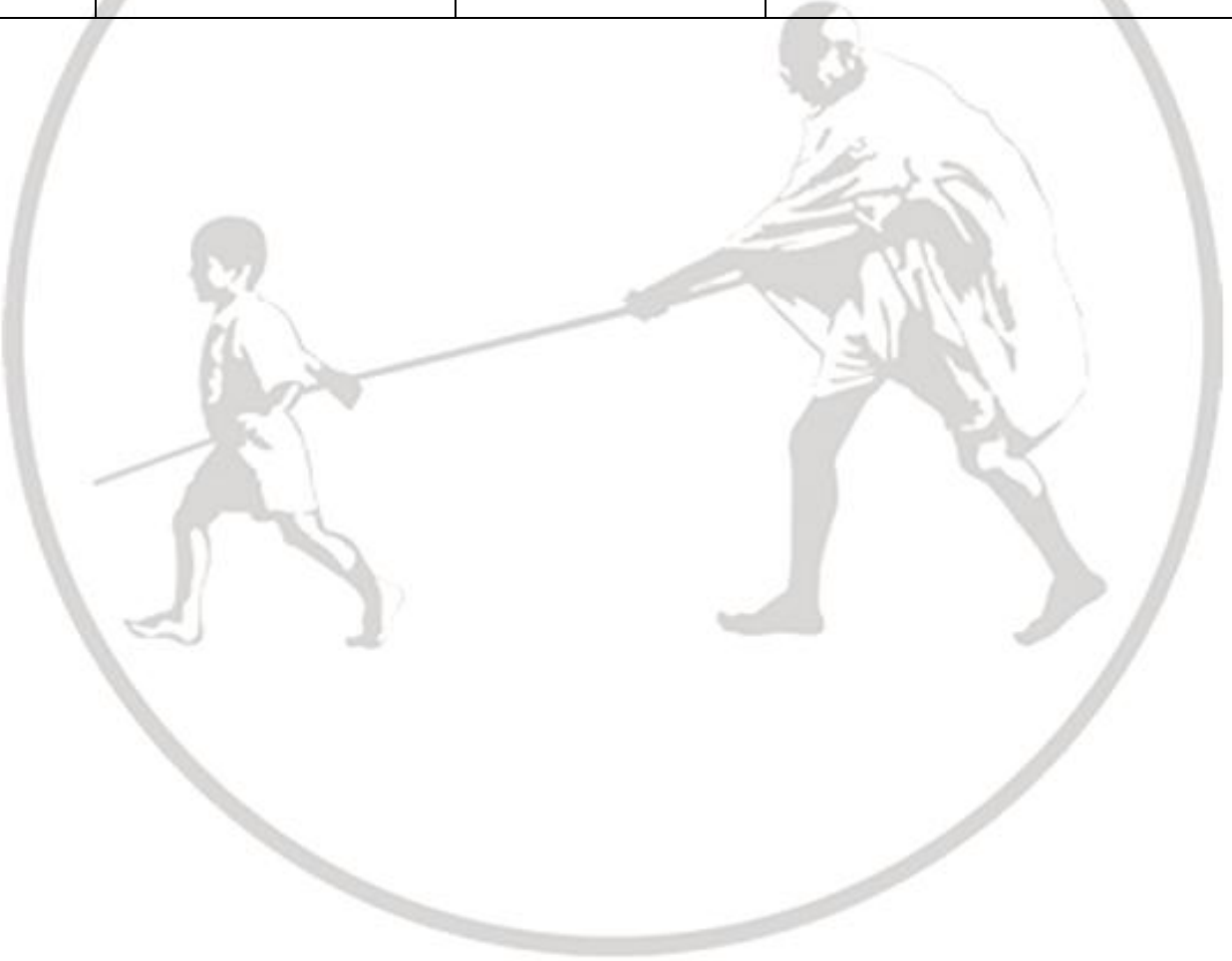
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MOOC/NPTEL Courses:

Sr. No.	NPTEL Courses Name	Instructor	Host Institute & Link
1	Introduction to Basic Spoken Sanskrit and Intermediate Level of Spoken Sanskrit	Prof. Anuradha Choudry	IIT Kharagpur, https://nptel.ac.in/courses/109105135
2	Advanced Level of Spoken Sanskrit	Prof. Anuradha Choudry	IIT Kharagpur, https://nptel.ac.in/courses/109105189





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**Department of Computer Science and
Engineering**

SEMESTER-IV

w.e.f.

Academic year 2026-27

(NEP- 2020 Compliant)



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Second Year Computer Science and Engineering			
Semester IV			
Course Title	Design and Analysis of Algorithms		
Course Code	PCC-CSE-251		
Category	Program Core Course		
Scheme and Credits	L	P	No. of Credits
	3	-	3
Prerequisite Courses, if any: Programming for Problem Solving using C			
Companion Course, if any: Design and Analysis of Algorithms Lab (PCCL-CSE-255)			
Course Objectives: 1. To understand fundamentals of algorithm design and analysis. 2. To provide insights into complexity theory. 3. To analyze performance of algorithmic strategies using time and space complexity measures. 4. To explore advanced techniques in algorithm design. 5. To apply algorithmic techniques for real-world problem solving.			
Course Outcomes: After successful completion of the course, students will be able to: CO1: Analyze asymptotic notations, recurrence relations, and performance measures of algorithms CO2: Compare Divide and Conquer techniques for computational problems. CO3: Apply Greedy and Dynamic Programming techniques for optimization problems CO4: Solve combinatorial problems using Backtracking and Branch and Bound techniques. CO5: Evaluate NP-Completeness, polynomial-time reductions, and complexity classes.			



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Unit No.	Unit Title & Contents	Hours
1	Introduction to Algorithms Definition, Properties of Algorithms, Expressing Algorithm, Flowchart, Algorithm Design Techniques, Performance Analysis of Algorithms, Types of Algorithms Analysis, Order of Growth, Asymptotic Notations, Recursion, Recurrences Relation, Substitution Method, Iterative Method, Recursion Tree, Master Theorem, Changing Variable.	08
2	Divide and Conquer Introduction, Binary Search, Merge Sort, Quick Sort, Strassen's Matrix Multiplication.	06
3	Backtracking and Branch and Bound Backtracking: Backtracking Concept, N-Queens Problem, Four-Queens Problem, Eight-Queen Problem, Hamiltonian Cycle, Sum of Subsets Problem, Graph Coloring Problem, Branch and Bound: Introduction, Traveling Salesperson Problem, 15-Puzzle Problem, Comparisons between Backtracking and Branch and Bound.	08
4	Greedy Algorithms Introduction to Greedy Technique, Greedy Method, Optimal Merge Patterns, Huffman Coding, Fractional Knapsack Problem, Activity Selection Problem, Job Sequencing with Deadline, Minimum Cost Spanning Tree, Single-Source Shortest Path Algorithm.	07
5	Dynamic Programming Introduction, Characteristics of Dynamic Programming, Component of Dynamic Programming, Comparison of Divide-and-Conquer and Dynamic Programming Techniques, Longest Common Subsequence, matrix multiplication, 0/1 knapsack problem, shortest paths: Bellman-Ford, Floyd Warshall, Application of Dynamic Programming.	08
6	NP Completeness NP Completeness: Introduction, the Complexity Class P, the Complexity Class NP, Polynomial-Time Reduction, the Complexity Class NP-Complete.	05



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Learning Resources

Text Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Introduction to Algorithms	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein	MIT Press	Fourth	2021
2	Fundamentals of Computer Algorithms	E. Horowitz and S. Sahni, S. Rajasekaran	Computer Science Press	Second	2018

Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	The Design and Analysis of Computer Algorithms	A. V. Aho, J. E. Hopcroft, J. D. Ullman	Addison Wesley	-	2006
2	Fundamentals of Algorithms	G. Brassard, P. Bratley	PHI India	-	1996

MOOC/NPTEL Courses:

Design and analysis of algorithms, by Prof. Madhavan Mukund , Chennai Mathematical Institute .
Link :https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs67 Learning Resources



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Second Year Computer Science and Engineering			
Semester IV			
Course Title	Database Management Systems		
Course Code	PCC-CSE-252		
Category	Program Core Course		
Scheme and Credits	L	P	No. of Credits
	3	-	3
Prerequisite Courses, if any: Computer Fundamentals, Discrete Mathematics & Data Structures and Algorithms.			
Companion Course, if any: Database Management Systems Lab (PCCL-CSE-256)			
Course Objectives: The course aims to enable students to: 1. Understand the fundamentals, architecture, and applications of database management systems. 2. Apply relational data models, relational algebra, and relational calculus for database query formulation. 3. Develop SQL skills including query writing, database definition, transactions, and advanced SQL programming concepts. 4. Explore NoSQL databases, JSON-based data models, and modern database connectivity techniques. 5. Design efficient relational databases using ER modeling, normalization, functional dependencies, and indexing techniques. 6. Comprehend transaction processing, concurrency control, recovery mechanisms, and ACID properties in database systems.			



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Course Outcomes:

After successful completion of the course, students will be able to:

- CO1:** Demonstrate the understanding of concepts of database management system.
- CO2:** Apply relational algebra and relational calculus to formulate and analyze database queries.
- CO3:** Apply basic and advanced SQL queries for the given context in relational database.
- CO4:** Analyze advanced SQL and NoSQL concepts including database connectivity, triggers, procedures, JSON, and MongoDB for modern applications.
- CO5:** Examine data modeling, database design, normalization, functional dependencies, and indexing techniques to develop efficient and well-structured relational databases.
- CO6:** Analyze the techniques of indexing, transaction management, concurrency control and recovery on database.

Unit No.	Unit Title & Contents	Hours
1	Introduction Database Systems Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture.	07
2	Relational Data Model, Relational Algebra and Calculus Structure of Relational Databases, Database Schema, Keys Relational algebra. Fundamental Operations, Additional Relational Algebra Operations, Extended Relational Algebra Operations. Calculus: Tuple relational calculus, Domain relational calculus, calculus vs algebra, computational capabilities.	08
3	Introduction to SQL Overview of SQL, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operators, Set Operations, Null Values, Aggregate Functions, Nested Sub queries, Modification of the Database Intermediate SQL: Join Expressions, Views, Transactions, Integrity Constraints, SQL Data Types and Schema, Authorization.	08



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4	Advanced SQL and Introduction to NoSQL Advanced SQL: Assessing SQL from Programming Languages, JDBC, ODBC, Embedded SQL, Functions and Procedures, Triggers. Introduction to NoSQL: Difference between SQL and NoSQL, Key-Value Stores and Semi-structured Data using JSON and MongoDB.	07
5	Relational Database Design and File Organization, Indexing Data Modeling using the Entity Relationship Model. ER model concepts, notation for ER diagram, Constraints, keys, E-R Diagrams, Mapping Cardinality, Concepts of Super Key, candidate key, primary key, weak entity sets, Codd's rules, Reduction of an ER diagrams to tables. Normalization: Features of good relational designs, Functional dependencies, Normal forms, First, Second, Third normal forms, BCNF, Functional Dependency Theory, Multivalued Dependencies, and Database Design Process. File Organization, Ordered Indices, B+ tree Index files, B Tree Index File.	08
6	Transaction Processing Transaction Concept, A simple Transaction Model, Transaction Atomicity and Durability, Transaction Isolation, ACID Properties, Serializability Concurrency Control Techniques: Lock based Protocols, Deadlock handling, Multiple Granularity, Time stamp-Based Protocols, Recovery System.	07

Learning Resources

Text Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Database System Concepts	Silberschatz, Korth and Sudarshan	McGraw-Hill	Seventh	2021



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Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Database Management Systems	Raghu Ramakrishnan, Johannes Gehrke	McGraw-Hill	Third	2003
2	Database Management Systems	RP Mahapatra	Khanna Publishing House	First Reprint	2026

MOOC/NPTEL Courses:

1. Introduction to Database Systems –IIT Madras (Prof. Sreenivasa Kumar)
<https://nptel.ac.in/courses/106106220>
2. Database Management System by By Prof. Partha Pratim Das, Prof. Samiran Chattopadhyay
IIT Kharagpur
https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_cs91
3. Indexing and Searching Techniques in Databases, IIT Kanpur (Dr. Arnab Bhattacharya)
<https://nptel.ac.in/courses/106104021>



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Second Year Computer Science & Engineering			
Semester IV			
Course Title	Computer Architecture and Organization		
Course Code	PCC-CSE-253		
Category	Program Core Course		
Scheme and Credits	L	P	No. of Credits
	2	-	2
Prerequisite Courses, if any: Foundational understanding of Digital Electronics and fundamental data representation.			
Companion Course, if any: Nil			
Course Objectives: 1. To discuss the basic concepts and structure of computers. 2. To analysis of the design of arithmetic & logic unit and understanding of the fixed point and floating point arithmetic operations. 3. To understanding the hierarchical memory system, cache memories and virtual memory. 4. To instruction Set Architectures and the concept of Pipelining. 5. To analyze processor performance improvement using instruction level parallelism.			
Course Outcomes: After successful completion of the course, students will be able to: CO1: Understand the basic structure and functional units of computer architecture. CO2: Illustrate the Instruction Set Architectures and concept of instruction pipelining. CO3: Analyze the design arithmetic and logical operations with integer and floating-point operands. CO4: Interpreting different types of memory hierarchy, and data transfer techniques in computer. CO5: Describe the ways of communication with I/O devices and concept of multiprocessor organizations.			



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Unit No.	Unit Title & Contents	Hours
1	Introduction Concept of computer organization and architecture, Fundamental unit, Computer function and interconnection, CPU structure and function.	05
2	Instruction Sets Characteristics, Types of operands, Types of operations, Assembly language, Addressing modes, Instruction format, Types of instruction, Instruction execution, Introduction to RISC and CISC architecture, Instruction pipelining.	05
3	Computer Arithmetic The arithmetic and logic Unit, Integer representation, Integer arithmetic, Floating point representation, Floating point arithmetic.	05
4	Memory Organization Memory hierarchy, Internal Memory: Semiconductor main memory, Error correction, Advanced DRAM organization. External Memory: Organization and characteristics of magnetic disk, Magnetic tape, Optical memory, RAID.	05
5	Input/ Output Organization External devices, I/O module, Programmed I/O, Interrupt driven I/O, Direct memory access, I/O channels and processors, External interface.	05
6	Parallel processing Parallel processing: Multiple processor organization, Symmetric multiprocessor, Cache coherence and the MESI protocol.	05

Learning Resources

Text Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Computer Organization and Architecture: Designing for Performance	William Stalling	Pearson Education	11 th Edition	2019



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Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Computer Architecture and Organization	John P. Hayes	McGraw-Hill Publication	3rd Edition	2017
2	Computer Organization	Carl Hamacher, Safwat Zaky, Zvonko Vranesic	McGraw-Hill Publication	5th Edition	2002
3	Computer Architecture: A Quantitative Approach	Hennesy and Patterson	Morgan and Kaufmann Publication	6th Edition	2019

MOOC/NPTEL Courses:

- https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_cs154



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Second Year Computer Science and Engineering			
Semester IV			
Course Title	Constitution of India		
Course Code	MGM-VEC-CI-281		
Category	Value Education Course		
Scheme and Credits	L	P	No. of Credits
	2	-	2
Prerequisite Courses, if any: Nil			
Companion Course, if any: Nil			
Course Objectives: - To understand the basic features and philosophy of the Indian Constitution. - To develop awareness about Fundamental Rights, Duties, and Directive Principles of State Policy. - To understand the structure and functioning of Parliament and Judiciary in India. - To understand the role of the Election Commission, electoral process, and welfare commissions for SC/ST/OBC and women. - To understand Union–State relations and key constitutional bodies in India. - To examine Dr. B. R. Ambedkar’s role in promoting social justice, women empowerment, and labour welfare.			
Course Outcomes: After successful completion of the course, students will be able to: CO1: Explain the historical background, philosophy, and salient features of the Indian Constitution. CO2: Describe Fundamental Rights, Directive Principles of State Policy, and Fundamental Duties. CO3: Understand the structure and functions of Parliament and Judiciary in India. CO4: Describe the functions of the Election Commission, electoral process, and welfare commissions for SC/ST/OBC and women. CO5: Describe Union–State relations and the functions of key constitutional bodies in India. CO6: Discuss Dr. B. R. Ambedkar’s contribution to social justice, women empowerment, and labour welfare.			



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Unit No.	Unit Title & Contents	Hours
1	Introduction to the Constitution of India Historical Background of the Constitution, Constituent Assembly, Making of the Constitution, Preamble and Philosophy of the Constitution, Salient Features of the Constitution, Federal Structure and Parliamentary Democracy.	05
2	Fundamental Rights, DPSP and Fundamental Duties Fundamental Rights: Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Constitutional Remedies. Directive Principles of State Policy and role of Government, Fundamental Duties of Citizens of India.	06
3	Parliament and Judiciary of India Union Government and its Administration Structure: President and Vice President: Election, qualification, powers, and the process of impeachment. Prime Minister: Election, qualification, powers. Lok Sabha, Rajya Sabha, Legislative Process and Passing of Bills. Supreme Court and High Courts: Composition, appointment of judges, jurisdiction, powers, functions, Judicial Review and impeachment Process.	06
4	Election Commission of India Election Commission: Role and responsibilities of Chief Election Commissioner, Electoral Process and Democratic Governance, State Election Commission: Functions of Commissions for the welfare of SC/ST/OBC and women.	05
5	Relations between the Union and the States Legislative relation, administrative relation, financial Relations, Emergency provision, freedom of trade commerce, controller and auditor general of India, public service commission, special provisions relating to certain classes, amendment of the Constitution.	05
6	Dr. B. R. Ambedkar and Social Transformation Women Empowerment: Advocacy for Gender Equality, Hindu Code Bill, Women's Rights in Education and Employment, Constitutional Safeguards for Women. Labour Empowerment: Labour Welfare Policies, Reduction of Working Hours, Maternity Benefits, Minimum Wages and Social Security, Reservation Policy and Inclusive Development	05



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Learning Resources

Text Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Introduction to the Constitution of India	D. D. Basu	LexisNexis Butterworths Wadhwa	26 th	2021
2	Our Constitution	Subhash C. Kashyap	National Book Trust, India	—	2019

Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Constitution of India	P. M. Bakshi	Universal Law Publishing Co.	—	2023
2	Indian Constitutional Law	M. P. Jain	LexisNexis Butterworths Wadhwa, Nagpur	8th	2018

MOOC/NPTEL Courses:

Constitution Law and Public Administration in India By Prof. Sairam Bhat|National Law School of India University
https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_lw02



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Second Year Computer Science and Engineering			
Semester IV			
Course Title	Design and Analysis of Algorithms Lab		
Course Code	PCCL-CSE-255		
Category	Program Core Course Lab		
Scheme and Credits	L	P	No. of Credits
	-	2	1
Prerequisite Courses, if any: Programming for Problem Solving using C			
Companion Course, if any: Design and Analysis of Algorithms (PCC-CSE-251)			
Course Objectives: 1. To understand fundamental concepts of algorithm design, analysis, and performance evaluation using asymptotic notations and recurrence relations. 2. To apply various algorithmic paradigms such as divide-and-conquer, greedy, dynamic programming, backtracking, and branch-and-bound for solving computational problems. 3. To develop and analyze algorithms for searching, sorting, graph problems, matrix operations, and combinatorial optimization, and evaluate their time and space complexities. 4. To compare and select appropriate algorithmic techniques based on problem characteristics, efficiency requirements, and resource constraints. 5. To understand computational complexity theory by classifying problems into P, NP, and NP-complete classes and applying polynomial-time reductions for complexity analysis.			
Course Outcomes: CO1. Implement and evaluate Divide and Conquer algorithms for sorting, matrix multiplication, and related computational problems. CO2. Apply Greedy algorithmic strategies to solve optimization problems such as Fractional Knapsack and Job Sequencing with Deadlines. CO3. Develop solutions for combinatorial problems using Backtracking and Branch and Bound techniques. CO4. Implement Dynamic Programming algorithms to solve optimization and shortest-path problems efficiently. CO5. Analyze, compare, and validate the performance and suitability of various algorithm design techniques for solving real-world computational problems.			



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Laboratory Requirements

Students shall implement any 10 experiments, comprising at least 2 experiments from each unit using the C programming language.

List of Experiments

- | |
|--|
| 1. To implement Binary Search using the Divide and Conquer technique |
| 2. To implement Merge Sort using the Divide and Conquer technique. |
| 3. To implement Quick Sort using the Divide and Conquer technique. |
| 4. To implement Strassen's algorithm for matrix multiplication using Divide and Conquer strategy. |
| 5. To solve the Sum of Subsets problem using Backtracking technique |
| 6. To implement the 4-Queen or 8-Queen problem using Backtracking approach. |
| 7. To implement the Fractional Knapsack problem using Greedy method |
| 8. To solve the Travelling Salesperson Problem using Branch and Bound technique |
| 9. To implement the Longest Common Subsequence using Dynamic Programming technique. |
| 10. To implement Job Sequencing with Deadline using Greedy strategy. |
| 11. To implement the Longest Common Subsequence problem using Dynamic Programming technique |
| 12. To implement Bellman-Ford or Floyd-Warshall algorithm using Dynamic Programming approach to find shortest paths in a graph |

Virtual LAB Links: https://ds1-iiith.vlabs.ac.in/
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Second Year Computer Science and Engineering			
Semester IV			
Course Title	Database Management Systems Lab		
Course Code	PCCL-CSE-256		
Category	Program Core Course Lab		
Scheme and Credits	L	P	No. of Credits
	-	2	1
Prerequisite Courses, if any: Computer Fundamentals, Discrete Mathematics & Data Structures and Algorithms.			
Companion Course, if any: Database Management Systems (PCC-CSE-252)			
Course Objectives: The course aims to enable students: 1. To design database schemas and entity relationships for real-world applications. 2. To apply SQL and PL/SQL commands to create, manipulate, and retrieve data from relational databases. 3. To analyze database operations using joins, subqueries, set operations, functions, and normalization techniques. 4. To examine transaction management, concurrency control concepts, and database recovery mechanisms. 5. To develop database-driven applications using relational database management systems to solve real-world problems			



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Course Outcomes (CO)

Upon successful completion of the course, students will be able to:

- CO1:** Design and implement relational database schemas with appropriate entities, relationships, and integrity constraints for real-world applications.
- CO2:** Create, modify, and manage database objects and perform data manipulation using SQL and PL/SQL constructs.
- CO3:** Apply advanced SQL techniques including joins, subqueries, aggregate functions, set operations, triggers, and cursors to solve database problems.
- CO4:** Analyze database normalization, transaction schedules, serializability, recoverability, and concurrency control mechanisms to ensure data consistency.
- CO5:** Develop and deploy a mini-project using a relational database system that performs CRUD operations and demonstrates practical database application development.

Laboratory Requirements

Students shall perform all laboratory assignments using Oracle Database Express Edition, MySQL, draw.io, Lucidchart. The laboratory exercises involve schema design, SQL queries, PL/SQL programming, triggers, cursors, normalization, transaction management, and development of database applications.

During the first laboratory session, students shall form project groups and select a real-world problem domain for their mini-project. Students will be able to commence the design and development of the mini-project after completing the third practical. The project will subsequently be refined and extended through the practical assignments conducted throughout the semester.

List of Practical Assignments to be Performed

1	Designing and defining database schemas for real-world applications (e.g., University database, Student Management, Hospital Management, Library Management, Inventory Management, Online Course Management, and Placement Management Systems).
2	Creating tables, Renaming tables, Data constraints (Primary key, Foreign key, Not Null), and Data insertion into a table.



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3	Grouping data, aggregate functions, and Oracle functional, character functions.
4	Sub-queries, Set operations, Joins.
5	Creation of databases, writing SQL and PL/SQL queries to retrieve information from the databases.
6	Assignment on Triggers & Cursors.
7	Normal Forms: First, Second, Third and Boyce Codd's Normal Forms.
8	Large objects – CLOB, NCLOB, BLOB and BFILE.
9	Pen-and-paper exercises on transaction schedules, conflict serializability, recoverability, and related concurrency control concepts.
10	Develop a mini project using a relational database that performs CRUD operations for applications such as student management, hospital management, or inventory management.

Virtual Lab Links
1. Relax Relational algebra calculator: https://dbis-uibk.github.io/relax/landing
2. B+-tree visualization: https://www.cs.usfca.edu/~galles/visualization/BPlusTree.html
3. Database Security Virtual Lab https://ds-amrt.vlabs.ac.in/



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Second Year Computer Science & Engineering			
Semester IV			
Course Title	Object-Oriented Programming using JAVA Lab		
Course Code	PCCL-CSE-257		
Category	Program Core Course Lab		
Scheme and Credits	L	P	No. of Credits
	-	2	1
Prerequisite Courses, if any: Basic Programming Knowledge (C/C++ or equivalent)			
Companion Course, if any: Object-Oriented Programming using JAVA Theory			
Course Objectives: 1. Understand and apply object-oriented programming concepts using Java. 2. Design and implement Java programs using classes, objects, inheritance, polymorphism, interfaces, packages, and collections. 3. Develop GUI-based applications and apply exception handling, multithreading, and event-driven programming concepts. 4. Implement file handling techniques and develop robust Java applications following good programming practices. 5. Develop mini-projects using Java technologies to enhance problem-solving, debugging, teamwork and software development skills through project-based learning.			
Course Outcomes: After successful completion of the course, students will be able to: CO1: Develop Java programs using basic object-oriented programming concepts such as classes, objects, constructors, and methods. CO2: Implement inheritance, polymorphism, interfaces, and packages in Java applications. CO3: Apply exception handling, multithreading, and file handling techniques in Java programs. CO4: Design GUI-based applications using Java Swing and event handling concepts. CO5: Develop real-world Java mini-projects using object-oriented software development practices.			



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Unit No.	Unit Title & Contents	Hours
1	Introduction to Java and Development Environment Introduction to Java, features of Java, JVM, JDK, JRE, installation and configuration of Java environment, IDE setup, structure of Java program, data types, variables, operators, input/output operations, control structures, introduction to classes and objects. Practical Activities 1. Installation and configuration of JDK and IDE. 2. Programs on operators and control statements.	04
2	Constructors, Methods, and Encapsulation Constructors, constructor overloading, methods, method overloading, static keyword, this keyword, access modifiers, encapsulation, packages, arrays and strings in Java. Practical Activities 1. Programs on constructors and method overloading. 2. Programs using arrays and strings. 3. Package creation and usage.	04
3	Inheritance, Interfaces, and Polymorphism Inheritance types, method overriding, runtime polymorphism, abstract classes, interfaces, dynamic method dispatch, packages and reusability concepts. Practical Activities 1. Programs on inheritance. 2. Interface and abstract class implementation. 3. Runtime polymorphism applications.	05
4	Database Integration and CRUD Operations Introduction to Databases, MySQL/MongoDB Basics, Database Design Concepts, Database Connectivity with Web Applications, SQL Queries, CRUD Operations, Form Data Handling, Session and Cookie Management, Error Handling and Validation Techniques. Project Activity • Integrate database connectivity and implement CRUD operations for project modules.	05
5	Exception Handling and File Handling Types of exceptions, try-catch-finally block, throw and throws keywords, user-defined exceptions, file handling using File classes, byte streams and character streams.	06



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	Practical Activities 1. Exception handling programs. 2. User-defined exception programs. 3. File handling applications.	
6	Multithreading and GUI Programming Introduction to threads, thread lifecycle, thread creation methods, synchronization, Java Swing components, layouts, event handling, listeners, GUI application development. Practical Activities 1. Multithreading programs. 2. Synchronization examples. 3. GUI applications using Swing. 4. Event handling programs.	06

Laboratory Requirements

Students shall perform all laboratory assignments using Java Development Kit (JDK) and an Integrated Development Environment (IDE) such as Eclipse, NetBeans, or IntelliJ IDEA. The laboratory work involves object-oriented programming, packages, inheritance, interfaces, exception handling, file handling, multithreading, and GUI development using Java Swing.

During the first laboratory session, students shall form project groups, identify a suitable application domain, and initiate the design and development of a mini-project. The mini-project shall be progressively enhanced by incorporating the concepts learned through the practical assignments performed during the semester. Students are expected to maintain proper documentation, source code, and project reports for evaluation.

List of Practical Assignments to be Performed

1. Install and configure the Java Development Kit (JDK) and Integrated Development Environment (IDE) for Java application development.
2. Develop Java programs demonstrating the concepts of classes and objects.
3. Implement Java programs using constructors and method overloading techniques.
4. Develop Java applications to demonstrate different types of inheritance and method overriding.
5. Implement programs using abstract classes and interfaces to achieve abstraction in Java.
6. Create and use packages in Java programs for modular and reusable application development.
7. Develop Java programs using exception handling mechanisms such as try, catch, finally, throw, and throws.
8. Implement file handling applications using byte streams and character streams in Java.
9. Develop multithreading applications demonstrating thread creation, synchronization, and thread



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lifecycle management.

10. Design and develop GUI-based applications using Java Swing components and layout managers.

11. Implement event-driven Java applications using event handling and listener interfaces.

12. Develop a mini project using object-oriented programming concepts, GUI design, exception handling, file handling, and multithreading in Java.

Learning Resources

Text Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Java: The Complete Reference	Herbert Schildt	McGraw-Hill Education	Twelfth	2021
2	Programming with Java	E. Balagurusamy	McGraw-Hill Education	Sixth	2019

Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Core Java	Cay S. Horstmann	Pearson Education	Twelfth	2021
2	Head First Java	Kathy Sierra and Bert Bates	O'Reilly Media	Third	2022

MOOC/NPTEL Courses:

1. Programming in Java — By Debasis Samanta, Indian Institute of Technology Kharagpur through NPTEL / SWAYAM.
Course Link: https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs36
2. Programming in Java — Archived NPTEL Course by Debasis Samanta.
Course Link: <https://nptel.ac.in/courses/106105191>
3. Oracle Java Tutorials and Documentation : <https://docs.oracle.com/javase/tutorial/>
4. NPTEL – Programming in Java — By Debasis Samanta, IIT Kharagpur
Course Link: <https://nptel.ac.in/courses/106105191>

Virtual Lab Link:

1. <https://java-iitd.vlabs.ac.in/List%20of%20experiments.html>
2. <https://oop-amrt.vlabs.ac.in/List%20of%20experiments.html>



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Second Year Computer Science & Engineering			
Semester IV			
Course Title	Forward Deployed Engineering Lab (Project Based Learning)		
Course Code	VSEC-CSE-258		
Category	Vocational & Skills Enhancement Course		
Scheme and Credits	L	P	No. of Credits
	-	2	1
Prerequisite Courses, if any: Programming Fundamentals, Problem Solving Techniques			
Companion Course, if any: Nil			
Course Vision (Project-Based Learning Approach) This laboratory course is designed using a Project-Based Learning (PBL) approach to enable students to solve real-world engineering problems through collaborative software development and deployment activities. The course emphasizes requirement analysis, solution design, application development, database integration, cloud-based deployment, and modern engineering practices. Students will work individually and in teams to design, develop, test, and deploy innovative solutions while applying problem-solving, teamwork, project management, and industry-standard development tools. The course prepares learners to address practical challenges and develop industry-ready engineering solutions through hands-on project experiences.			
Course Objectives: 1. To understand industry-oriented software engineering and deployment practices. 2. To apply problem-solving and analytical skills to real-world engineering challenges. 3. To develop scalable applications using modern development tools and technologies. 4. To integrate cloud, database, API, and deployment concepts into projects. 5. To build collaborative engineering solutions following professional development workflows.			



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Course Outcomes:

After successful completion of the course, students will be able to:

- CO1:** Identify real-world engineering problems and design appropriate software-based solutions.
- CO2:** Develop frontend and backend modules using modern programming frameworks and tools.
- CO3:** Implement collaborative software development practices using Git, GitHub, and agile methodologies.
- CO4:** Integrate databases, APIs, cloud services, and deployment techniques into engineering applications.
- CO5:** Develop, test, deploy, and present a complete industry-oriented engineering project collaboratively.

Unit No.	Unit Title & Contents	Hours
1	Engineering Problem Identification and Requirement Analysis Introduction to Forward Deployed Engineering, Industry-Oriented Problem Solving, Requirement Gathering Techniques, Client Interaction Basics, Software Development Lifecycle, Agile Methodology, Project Planning, Wireframing, Documentation Standards, Team Formation and Task Allocation. Project Activity Identify a real-world engineering problem and prepare requirement specifications and project planning documents.	05
2	Application Design and Frontend Development Frontend Development Concepts, User Interface Design Principles, Responsive Design, HTML5, CSS3, JavaScript, UI Frameworks, Interactive Components, Form Handling, Data Visualization Basics, User Experience Enhancement Techniques. Project Activity Design responsive and user-friendly frontend interfaces for the selected engineering project	05
3	Backend Development and Collaborative Engineering Practices Backend Development Concepts, Server-side Programming, RESTful Services, Authentication Basics, Git and GitHub Workflow, Branching and Merging, Agile Sprint Management, Team Collaboration, Debugging and Testing Techniques. Project Activity Develop backend services and collaboratively manage project repositories using GitHub workflows.	05



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4	Database, API, and Cloud Integration Database Design Concepts, SQL and NoSQL Databases, CRUD Operations, API Integration, JSON Handling, Cloud Service Basics, Hosting Concepts, Data Security Practices, Session Management, Error Handling and Logging Techniques. Project Activity Integrate databases, APIs, and cloud-based services into the engineering application.	05
5	Deployment, Monitoring, and Optimization Application Deployment Techniques, Hosting Platforms, CI/CD Concepts, Application Monitoring, Performance Optimization, Security Best Practices, Scalability Concepts, Testing Strategies, Version Management and Maintenance. Project Activity Deploy and optimize project applications on suitable hosting or cloud platforms.	05
6	Industry-Oriented Project Implementation and Demonstration Complete Project Development Lifecycle, Team Collaboration Practices, Technical Documentation, Presentation Techniques, Project Demonstration, Industry Use Cases, Innovation and Enhancement Strategies, Project Evaluation and Maintenance Planning. Major Project Activity Develop, deploy, document, and demonstrate a complete forward deployed engineering solution addressing a real-world problem.	05

Laboratory Requirements

Students shall perform all laboratory assignments using modern software development tools and platforms such as Visual Studio Code (VS Code), Git and GitHub, Node.js/Python/PHP, MySQL/MongoDB, Postman, and suitable cloud deployment platforms. The laboratory work involves requirement analysis, UI/UX design, frontend and backend development, database integration, API development, testing, deployment, and project documentation.

During the first laboratory session, students shall form project groups, identify a real-world engineering problem and initiate the development of an industry-oriented mini-project. The project shall be progressively enhanced through the practical assignments performed during the semester. Students are expected to maintain project repositories, documentation, and implementation reports as part of the continuous assessment process.



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List of Practical Assignments to be Performed	
1.	Study of Forward Deployed Engineering concepts and identification of real-world problem statements.
2.	Requirement gathering, project planning, and preparation of Software Requirement Specification (SRS) document.
3.	Design of wireframes and user interface prototypes for the selected project.
4.	Development of responsive frontend web pages using HTML5, CSS3, and JavaScript.
5.	Implementation of interactive user interfaces using frontend frameworks and form validation techniques.
6.	Version control and collaborative development using Git and GitHub.
7.	Development of backend modules using Node.js/Python/PHP.
8.	Implementation of RESTful APIs for client-server communication.
9.	Database design and integration using MySQL/MongoDB.
10.	Development of CRUD-based engineering applications with authentication and session management.
11.	Integration of cloud services, APIs, and deployment platforms into the application.
12.	Testing, debugging, deployment, documentation, and final demonstration of the complete industry-oriented engineering project.
Suggested Project Domains	
1.	Smart Campus Management System
2.	AI-Based Service Dashboard
3.	Cloud-Based Attendance System
4.	IoT Monitoring Dashboard
5.	Healthcare Management Portal
6.	Real-Time Data Analytics System
7.	Logistics and Tracking System
8.	DevOps Automation Tool



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Learning Resources

Text Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Software Engineering	Ian Sommerville	Pearson	Tenth	2015
2	Python Crash Course: A Hands-On, Project-Based Introduction to Programming	E. Matthes	No Starch Press	Second	2019

Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Clean Code: A Handbook of Agile Software Craftsmanship	R. C. Martin	Pearson	First	2008
2	Refactoring: Improving the Design of Existing Code	M. Fowler	Addison-Wesley	Second	2018

MOOC/NPTEL Courses:

1. **NPTEL – Software Engineering**
<https://nptel.ac.in/courses/106105182>
2. **Coursera – Full Stack Web Development Specialization**
<https://www.coursera.org/specializations/full-stack-web-development>
3. **Coursera – Cloud Computing Basics**
<https://www.coursera.org/learn/cloud-computing-basics>
4. **FreeCodeCamp – API and Microservices Certification**
<https://www.freecodecamp.org/learn/back-end-development-and-apis>



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Second Year Computer Science & Engineering			
Semester IV			
Course Title	Entrepreneurship Development		
Course Code	MGM-HSSM-ED-282		
Category	Humanities, Social Science and Management		
Scheme and Credits	L	P	No. of credits
	2	-	2
Prerequisite Courses, if any: Nil			
Companion Course, if any: - Nil			
Course Objectives: 1. To introduce the fundamental principles of entrepreneurship, forms of business organizations, and the startup ecosystem. 2. To identify, evaluate, and select viable business opportunities using structured techniques. 3. To explore business models, financial planning, and market validation strategies. 4. To study key marketing strategies, customer acquisition techniques, and branding essentials for startups. 5. To develop entrepreneurial mindset and ability to communicate and pitch business ideas effectively using structured storytelling techniques			
Course Outcomes: CO1: Describe the role of entrepreneurship in economic growth and the startup ecosystem. CO2: Apply creative techniques to viable business ideas based on customer needs. CO3: Develop a basic business model using tools like the Business Model Canvas through market research. CO4: Implement basic marketing strategies for startups. CO5: Identify Customer acquisition strategy. CO6: Deliver a concise business pitch using storytelling and effective communication techniques.			



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Unit No.	Unit Title & Contents	Hours
1	Introduction to Entrepreneurship Entrepreneurship: Definition and evolution, Role of entrepreneurship in economic development. Role of entrepreneurship in economic development – Role in job creation, GDP, and innovation. Characteristics of an Entrepreneur: Key traits: Risk-taking, innovation, pro-activeness, Leadership, perseverance, and resilience Types of Entrepreneurships: Startup entrepreneurship, Social entrepreneurship, Intrapreneurship (Corporate entrepreneurship), Lifestyle and small business entrepreneurship Forms of Business Organization – Sole proprietorship, partnership, private limited, public limited. Entrepreneurial Mindset: Growth mindset and adaptability, Creativity and problem-solving, Opportunity recognition and initiative-taking Overview of the Startup Ecosystem: Key stakeholders: Incubators, accelerators, angel investors, VCs, Government support schemes (Startup India, Atal Innovation Mission, etc.), Global vs. Indian startup ecosystems Case Study: 1. Ritesh Agarwal – Founder of OYO Rooms (India) 2. Falguni Nayar – Founder of Nykaa (India) 3. Nandan Nilekani – Co-founder of Infosys & Architect of Aadhaar (India) etc.	07
2	Idea Generation & Opportunity Recognition Creativity Techniques for Idea Generation: Definition and importance of creativity in entrepreneurship. Brainstorming, Mind Mapping: Visual idea structuring using central themes and branches. Tools (manual and digital) for mind mapping. Understanding Customer Needs and Pain Points, Problem-solution fit: Linking pain points to possible solutions. Observational techniques, user interviews, and empathy mapping, Evaluating Opportunities: Difference between an “idea” and an “opportunity.” Basic filters: Desirability, feasibility, and viability. Tools: SWOT Analysis, Opportunity Matrix, Industry trends, market gaps. Feasibility Analysis Basics, Scalability Check: Geographically or vertically growth of the idea, Barriers to scaling. Introduction to the “Lean Canvas”. Case Study : Analyzing how “Dunzo” or “BigBasket” identified urban pain points and How “Zerodha” scaled in India with a digital-first approach	07
3	Business Model Development Introduction to Business Model Canvas: Definition and purpose of a business model, Overview of the Business Model Canvas by Osterwalder, Benefits of using BMC for startups. Key Components of BMC: Value Proposition: Defining	06



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	what unique value the product/service offers. Customer Segments, Creating customer personas, Revenue Models: Direct sales, subscriptions, freemium, licensing, etc. Basic Market Research for Validation: Importance of market research in early-stage business development. Designing effective surveys and customer feedback forms. Conducting basic interviews and analyzing responses. Introduction to MVP (Minimum Viable Product) and feedback loops. Case study: Map the BMC for a well-known startup (e.g., Uber or Zomato).	
4	Marketing Strategies Brand – Elements of brand identity: name, logo, voice, tone, and values. Positioning – How to create a unique space in the customer's mind. Positioning maps, Value-based positioning vs. competitor-based positioning Startup Branding Challenges – Limited budget, building trust, clarity in messaging. Costing & Pricing Strategies – Fixed vs. variable costs, break-even analysis. Introduction to Digital Marketing: Distribution Channels: Traditional vs. digital distribution. Social Media Marketing: Platforms overview (Instagram, LinkedIn, Facebook, X/Twitter) Creating a content strategy and calendar Organic vs. paid reach Search Engine Optimization (SEO): Basics of how search engines work, Keyword research and content optimization, On-page vs. off-page SEO Importance of Digital Presence – Website essentials, blogs, and analytics tools.	03
5	Customer Acquisition Strategies Understanding the Customer Journey – Awareness, interest, decision, action. Early-Stage Customer Acquisition Tactics: Word-of-mouth & referrals, Influencer marketing (micro-influencers), Email marketing basics, building a landing page and collecting leads Retention vs. Acquisition – Importance of building long-term customer relationships. Case Studies : 1. Zomato – Branding & Positioning in a Competitive Market 2. Mamaearth – Digital-First Customer Acquisition 3. Nykaa – Customer Segmentation and Channel Strategy	03
6	Pitching & Business Communication Crafting an Elevator Pitch: Definition and purpose, Key elements: Problem, solution, value proposition, target audience, Delivery tips: Clarity, brevity, confidence Storytelling & Communication: Importance of Storytelling in Business, Structure of a Business Story: Setup, Conflict, Resolution. Communication Skills: Verbal and Non-verbal Overview of Funding Sources: Public & private capital sources, venture capital, debt financing. Bootstrapping: Meaning, benefits, and risks, Angel investors:	04



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	Role, expectations, approach, Brief on incubators, government schemes, crowd funding. Case study: 1. Shark Tank India – Pitch Analysis (Any Season) 2. Airbnb – The Original Pitch Deck 3. Dropbox – Storytelling Through Demonstration 4. Dunzo – Investor Pitch Evolution	
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Learning Resources

Textbooks:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Entrepreneurship	Andrew Zacharakis, Andrew C. Corbett, William D. Bygrave	Wiley	Sixth	2025
2	Innovation and Entrepreneurship: Practice and Principles	Drucker, Peter F	Harper Business	Reprint	2006
3	Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers	Osterwalder, Alexander & Pigneur, Yves	Wiley	First	2010

Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses	Eric Ries	Crown	Reprint	2011

Online Resources

Sr. No.	Topic	Link
1	Entrepreneurship Essentials By Prof. Manoj Kumar Mondal IIT Kharagpur	https://onlinecourses.nptel.ac.in/noc20_ge08/preview
2	“Entrepreneurship” by Prof. C Bhaktavatsala Rao, IIT Madras	https://onlinecourses.nptel.ac.in/noc21_mg70/preview
3	Creating jobs, changing lives	https://www.youtube.com/@wadhvani-foundation/videos



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Honors Degree
in
Blockchain



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Department of Computer Science & Engineering

Criteria for Honors Degree

- In addition to the prescribed 176 credits of the B.Tech. Program (Major discipline), a student may opt for an Honors program in the same discipline/branch or in an approved emerging area related to the parent discipline.
- To earn the Honors degree, a student shall complete an additional 18 credits, distributed across Semesters III to VIII.
- Thus, the total credit requirement for the award of B.Tech. Honors shall be 194 credits (176 + 18) for students admitted in the first year.
- Students shall compulsorily pursue the Honors program within the same discipline/branch of their parent B.Tech. program.
- The Honors degree shall be awarded only after successful completion of all prescribed credits of the regular B.Tech. program along with the additional 18 Honors credits.
- For lateral entry students (admitted directly to the second year after Diploma), the minimum credit requirement shall be 132 credits for the regular program, in addition to 18 Honors credits.
- Students with CGPA of More than 8.0 at the end of First year are eligible for B Tech Honours degree. They also are required to maintain the CGPA of 8.0 in all subsequent semesters.



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Course Structure - Honors Degree in “Blockchain”

Sr. No.	Course Code	Course Name	Teaching Scheme		Evaluation Scheme				Credit	Semester
			L	P	CA	MSE	ESE	Total		
1	HON-CSE-501	Fundamentals of Blockchain	3		20	30	50	100	3	III
2	HON-CSE-502	Smart Contracts and Solidity	3		20	30	50	100	3	IV
3	HON-CSE-502L	Smart Contracts and Solidity Lab		2	50		50	100	1	IV
4	HON-CSE-503	Blockchain Platforms and Use cases	3		20	30	50	100	3	V
5	HON-CSE-503L	Blockchain Platforms and Use cases Lab		2	50		50	100	1	V
6	HON-CSE-504	Blockchain Security and Performance	3		20	30	50	100	3	VI
7	HON-CSE-504L	Blockchain Security and Performance Lab		2	50		50	100	1	VI
8	HON-CSE-505	Blockchain and FinTech	3		20	30	50	100	3	VII
Total			15	6	250	150	400	800	18	

Reference: AICTE Model Curriculum

https://www.aicte.gov.in/sites/default/files/Minor%20Degree_Dec_2020.pdf



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Second Year Computer Science & Engineering			
Semester III			
Course Title	Fundamentals of Blockchain		
Course Code	HON-CSE-501		
Category	Honors Degree in “Blockchain”		
Scheme and Credits	L	P	No. of Credits
	3	-	3
Prerequisite Courses, if any: Nil			
Companion Course, if any: Nil			
Course Objectives: 1. To understand a broad overview of the essential concepts of blockchain technology. 2. To familiarize with Bitcoin protocol followed by the Ethereum protocol – to lay the foundation necessary for developing applications and programming. 3. To learn about different types of blockchain and consensus algorithms.			
Course Outcomes: After successful completion of the course, students will be able to: CO1: Explain the basic notion of distributed systems. CO2: Use the working of an immutable distributed ledger and trust model that defines blockchain. CO3: Illustrate the essential components of a blockchain platform.			



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Unit No.	Unit Title & Contents	Hours
1	Basics Concepts The Double-Spend Problem, Byzantine Generals' Computing Problems, Fundamentals of Public-Key Cryptography and hashing techniques for ensuring security, authentication, integrity, and non-repudiation. Concepts of distributed systems, distributed consensus, and their role in maintaining reliability, fault tolerance, and synchronization in blockchain networks.	06
2	Technology Stack Introduction to blockchain technology, protocols and cryptocurrencies, evolution and architecture of the Bitcoin blockchain. Structure of blocks, transactions, Merkle trees, block creation and validation, mining process, wallets and addresses. Features of Bitcoin including decentralization, transparency, security and immutability, Proof of Work (PoW) consensus mechanism, mining rewards, transaction fees and incentive model.	10
3	Ethereum Blockchain Introduction to smart contracts, their features, lifecycle and applications, Ethereum architecture and account structure, transactions, gas, wallets and the Ethereum Virtual Machine (EVM). Ethereum block creation and transaction processing, consensus mechanisms and network operations. Incentive model including gas fees, validator rewards, staking concepts and the economic framework supporting the Ethereum ecosystem.	10
4	Tiers of Blockchain Technology Introduction to Blockchain 1.0 - cryptocurrencies, Blockchain 2.0 - smart contracts and decentralized applications, and Blockchain 3.0 - applications beyond finance in sectors such as healthcare, governance, and education. Types of blockchain including Public Blockchain, Private Blockchain, Semi-Private Blockchain, and Sidechains, their architecture, characteristics, advantages, limitations, and use cases.	06
5	Blockchain Consensus Mechanisms and Validation Protocols Introduction to blockchain consensus and distributed trust models, Proof of Work (PoW), Proof of Stake (PoS), Delegated Proof of Stake (DPoS), Proof of Elapsed Time (PoET), working principles, advantages, limitations, and comparison of consensus mechanisms.	06



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6	Advanced Consensus Models and Blockchain Applications Deposit-Based Consensus, Proof of Importance (PoI), Federated Consensus/Federated Byzantine Consensus (FBC), Practical Byzantine Fault Tolerance (PBFT), advanced fault-tolerant consensus mechanisms and their applications. Blockchain use case: Supply Chain Management, traceability, transparency, smart contracts, benefits, challenges, and real-world implementations.	06
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Learning Resources

Text Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Essentials of Bitcoin and Blockchain	Kirankalyan Kulkarni	Packt Publishing	First	2018
2	Block Chain & Crypto Currencies	Anshul Kaushik	Khanna Publishing House	Second	2014

Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Blockchain for Dummies	Tiana Laurence	John Wiley & Sons.	Second	2019
2	Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks	Imran Bashir	Packt Publishing	First	2017

MOOC/NPTEL Courses:

1. https://www.coursera.org/specializations/blockchain .
2. https://nptel.ac.in/courses/106105184/
3. https://swayam.gov.in/nd1_noc20_cs01/preview



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Second Year Computer Science & Engineering			
Semester IV			
Course Title	Smart Contracts and Solidity		
Course Code	HON-CSE-502		
Category	Honors Degree in “Blockchain”		
Scheme and Credits	L	P	No. of Credits
	3	-	3
Prerequisite Courses, if any: Nil			
Companion Course, if any: Smart Contracts and Solidity Lab (HON-CSE-502L)			
Course Objectives: 1. To understand the concept of smart contracts related to blockchain. 2. To develop proficiency in the Solidity programming language for designing, developing, and deploying smart contracts. 3. To learn Truffle IDE for creating and deploying a DApp.			
Course Outcomes: After successful completion of the course, students will be able to: CO1: Understand the working and importance of smart contracts. CO2: Apply the Solidity programming language to design and implement Ethereum smart contracts. CO3: Create and deploy a DApp on a Ethereum test network.			

Unit No.	Unit Title & Contents	Hours
1	Smart Contracts and Ethereum Programming Languages Definition, need, features, and applications of smart contracts in blockchain systems. Life cycle of a smart contract including development, deployment, execution, and termination. Introduction to Ethereum higher-level programming languages, particularly Solidity, for developing decentralized	06



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	applications and smart contracts.	
2	Smart Contract Development Environment Development of simple smart contracts using Solidity, contract compilation and deployment process using the Solc compiler. Understanding the Ethereum Contract ABI (Application Binary Interface) and its role in contract interaction and integration. Introduction to Remix IDE for writing, testing, debugging, and deploying smart contracts on the Ethereum platform.	08
3	Fundamentals of Solidity Programming Introduction to Solidity, smart contract structure and syntax, contracts, constructors and functions, variables and data types, getters and setters, arrays in Solidity, memory and storage concepts, mappings and their applications in smart contract development.	06
4	Advanced Solidity Programming and Smart Contract Design Structs and user-defined data types, error handling and restrictions in Solidity, libraries and reusable code components, global variables in Solidity, abstract contracts, inheritance and interfaces, events and logging mechanisms, development of modular and secure smart contracts.	06
5	Truffle Framework & Ganache Introduction to the Truffle framework and Ganache for Ethereum smart contract development and testing. Environment setup, project creation, and configuration using Truffle and Ganache. Smart contract compilation, deployment, migration, and execution using Truffle compile, migrate, and create commands.	08
6	Decentralized App Creation Design and development of decentralized applications, including smart contract creation and front-end interface development. Integration of smart contracts with front-end applications for blockchain interaction and data exchange. Deployment, validation, testing, and debugging of DApps to ensure functionality, security, and reliability.	10



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Learning Resources

Text Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Blockchain for Dummies	Tiana Laurence	John Wiley & Sons	Second	2019
2	Block Chain & Crypto Currencies	Anshul Kaushik	Khanna Publishing House	Second	2023

Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Building Blockchain Projects	Narayan Prusty	Packt Publishing	First	2017
2	Mastering Ethereum: Building Smart Contracts and Dapps	Andreas Antonopoulos and Gavin Wood	O'Reilly Publisher	First	2018

MOOC/NPTEL Courses:

1. <https://www.coursera.org/learn/smarter-contracts>
2. <https://www.udemy.com/course/solidity-smart-contracts-build-dapps-inethereum-blockchain/>
3. https://swayam.gov.in/nd1_noc20_cs01/preview



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Second Year Computer Science and Engineering			
Semester-IV			
Course Title	Smart Contracts and Solidity Lab		
Course Code	HON-CSE-502L		
Category	Honors Degree in “Blockchain”		
Scheme and Credits	L	P	No. of Credits
	-	02	01
Prerequisite Courses, if any: Fundamentals of Blockchain (HON-CSE-501)			
Companion Course, if any: Smart Contracts and Solidity (HON-CSE-502)			
Course Objectives: 1. To understand Ethereum blockchain concepts, accounts, and smart contract development tools. 2. To develop, test, and deploy Solidity smart contracts using key programming features. 3. To build decentralized applications (DApps) by integrating smart contracts with web interfaces and blockchain networks.			
Course Outcomes: CO1: Explain Ethereum fundamentals and configure a blockchain development environment. CO2: Design, implement, and test Solidity smart contracts using appropriate constructs and error-handling mechanisms. CO3: Develop and deploy DApps by integrating smart contracts with blockchain frameworks and front-end applications.			

Laboratory Requirements:

The laboratory should be equipped with **Solidity Compiler (Solc)**, **Remix IDE**, **Node.js**, and blockchain development frameworks such as **Truffle** or **Hardhat** for smart contract development and testing. The lab should also provide **Ganache** for local blockchain simulation, **MetaMask** for wallet integration, **Git and GitHub** for version control, and reliable Internet connectivity for accessing blockchain networks and development resources.



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List of experiments to be performed
1. Study and compare Ethereum accounts (Externally Owned Accounts and Contract Accounts). Installation of Python and IDE
2. Analyze the life cycle of a smart contract using Ethereum blockchain explorers and documentation.
3. Install and configure Remix IDE and create a basic "Hello Blockchain" smart contract.
4. Compile and deploy a simple storage contract using Remix IDE.
5. Develop a smart contract demonstrating constructors and state variables.
6. Implement getter and setter functions for contract variables and interact with them using Remix.
7. Develop a smart contract using arrays and perform insertion, retrieval, and deletion operations.
8. Implement a Student Record Management smart contract using mappings.
9. Create a smart contract using structures (Structs) to store employee or student information.
10. Demonstrate error handling using require(), assert(), and revert().
11. Develop a smart contract illustrating inheritance and function overriding.
12. Create and use interfaces and libraries in Solidity.
13. Implement event logging and monitor emitted events using Remix.
14. Install Ganache and Truffle, create a Truffle project, compile, migrate, and deploy a smart contract on a local blockchain.
15. Design and deploy a complete DApp (e.g., Voting System, Student Record System, Certificate Verification System, or Crowdfunding Application) using: • Solidity Smart Contract • Truffle Framework • Ganache Local Blockchain • Web3.js/Ethers.js • HTML/CSS/JavaScript Front-End The experiment should include deployment, testing, validation, and user interaction through the web interface.



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Exit Program



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Department of Computer Science & Engineering

Multiple Exit Policy

- Students shall have the flexibility to enter the program in odd semesters and exit the program after the successful completion of the First Year, Second Year, or Third Year, based on their academic and career requirements.

A student opting for exit shall:

- Earn the minimum prescribed credits as specified for the respective exit level.
 - Have no active backlogs at the time of exit.
 - Submit a formal exit request to the Chairman, Academic Council through the Chairman, Board of Studies (BoS), within two weeks from the date of declaration of results.
- In addition to the minimum academic credits, students shall compulsorily earn an additional 8 credits through vocational training, internships, apprenticeship, skill-based courses, mini-projects, or similar activities during the summer vacation, within two months from the approval of the exit request.
 - Exit options with appropriate awards shall be provided at the end of:
 - Second Semester – UG Certificate
 - Fourth Semester – UG Diploma
 - Sixth Semester – B.Voc. / B.Sc. Degree
 - Students who continue and successfully complete the four-year program shall be awarded the Bachelor's Degree in Engineering/Technology as per the prescribed program structure and credit requirements.



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Exit option after 2nd or 4th Semester

(As per Ref: NEP GR, Government of Maharashtra)

Exit Level	Minimum Duration Completed	Minimum Credits Earned	Qualification Awarded
Level 1 Exit	After 1st Year (2 nd Semesters)	Approximately 44 Credits	Undergraduate Certificate
Level 2 Exit	After 2nd Year (4 th Semesters)	Approximately 88 Credits	Undergraduate Diploma
Level 3 Exit	After 3rd Year (6 th Semesters)	Approximately 124 Credits	B.Voc. / B.Sc. Degree

FY B.Tech. (Computer Engineering) Exit Program after Semester II

Sr. No.	Course Code	Course Name	Teaching Scheme		Evaluation Scheme				Credit
			L	P	CA	MSE	ESE	TOTAL	
1	EXP2-CSE-601A	Web Development Lab	--	8	50	-	50	100	4
2	EXP2-CSE-602A	Fundamentals of Programming using Python	--	4	50	-	50	100	2
3	EXP2-CSE-603A	Mini Project	--	4	50	-	50	100	2
Total				16	150		150	300	8

OR

Sr. No.	Course Code	Course Name	Teaching Scheme		Evaluation Scheme				Credit
			L	P	CA	MS E	ES E	Total	
1	EXP2-CSE-604B	Office Assistance	--	16	50		50	100	8
Total				16	50		50	100	8

Students shall complete the course through a certification program conducted by Skill India, MKCL, or any other Government-approved certification provider.



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SY B.Tech. (Computer Engineering) Exit Program after Semester IV

Sr. No.	Course Code	Course Name	Teaching Scheme		Evaluation Scheme				Credit
			L	P	CA	MSE	ESE	TOTAL	
1	EXP4-CSE-601	Full Stack Development Lab	--	8	50		50	100	4
2	EXP4-CSE-602	Android Development Lab	--	4	50		50	100	2
3	EXP4-CSE-603	Mini Project	--	4	50		50	100	2
Total				16	150		150	300	8



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First Year Computer Science and Engineering			
Exit Program after Semester-II			
Course Title	Web Development Lab		
Course Code	EXP2-CSE-601A		
Category	Exit Program		
Scheme and Credits	L	P	No. of Credits
	-	08	04
Prerequisite Courses, if any: Nil			
Companion Course, if any: Nil			
Course Objectives: 1. To introduce students to the fundamentals of web technologies and website development. 2. To develop skills in creating structured and responsive web pages using HTML and CSS. 3. To enable students to build interactive web applications using JavaScript. 4. To familiarize students with client-side web development tools and frameworks. 5. To develop skills for designing, testing, and deploying websites. 6. To encourage adoption of industry-standard web development practices and tools.			
Course Outcomes: After successful completion of the course, students will be able to: CO1: Explain fundamental concepts of web technologies, web architecture, and website design. CO2: Develop structured web pages using HTML and apply styling using CSS. CO3: Create interactive and dynamic web pages using JavaScript. CO4: Design responsive websites using modern front-end frameworks and design principles. CO5: Utilize development tools, version control systems, and debugging techniques in web development. CO6: Develop and deploy a complete web application following industry best practices.			



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Unit No.	Unit Title & Contents	Hours
1	Introduction to Web Technologies and HTML Internet and World Wide Web, web browsers and web servers, website planning and design principles, structure of web pages, HTML elements and attributes, text formatting, lists and tables, hyperlinks and navigation, images, audio and video embedding, HTML forms and input controls.	07
2	Cascading Style Sheets (CSS) Introduction to CSS, inline, internal and external CSS, CSS selectors and properties, colors, backgrounds and borders, CSS box model, layout design using Flexbox, CSS Grid fundamentals, responsive web design concepts, media queries and styling best practices.	07
3	JavaScript Fundamentals Introduction to JavaScript, variables and data types, operators and expressions, conditional statements, loops and iteration, functions and scope, arrays and objects, event handling, user interaction techniques, form validation and error handling.	08
4	Dynamic Web Pages and DOM Manipulation Document Object Model (DOM), selecting and modifying HTML elements, dynamic content creation, event-driven programming, JavaScript event handling, timers and animations, introduction to JSON, client-side data storage using local storage, development of interactive web components.	07
5	Front-End Development Tools and Frameworks Introduction to Bootstrap framework, responsive layout design, navigation bars, cards and forms, Bootstrap components and utilities, introduction to Git and GitHub, version control fundamentals, browser developer tools, debugging techniques, website testing and validation methods.	08
6	Website Deployment Website hosting concepts, deployment using GitHub Pages, web application testing, performance optimization techniques, accessibility and usability guidelines, portfolio website development, project planning and implementation, website deployment, project presentation and documentation.	08



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Laboratory Requirements:

Visual Studio Code (or any equivalent code editor), modern web browsers such as Google Chrome, Mozilla Firefox, or Microsoft Edge, and Git for version control with access to GitHub. The laboratory should also support Bootstrap, Live Server extension, browser developer tools, and W3C validation tools for web development, testing, and deployment activities.

List of experiments to be performed

HTML

1. Create a personal profile webpage using HTML.
2. Design a webpage containing tables, lists, and hyperlinks.
3. Create a student registration form using HTML forms.
4. Develop a multimedia webpage using images, audio, and video.

CSS

5. Apply CSS styles to an existing webpage.
6. Design a responsive webpage using Flexbox.
7. Create a webpage layout using CSS Grid.
8. Develop a responsive navigation menu.

JavaScript

9. Write JavaScript programs for arithmetic and logical operations.
10. Implement form validation using JavaScript.
11. Create an interactive image gallery.
12. Develop a simple calculator using JavaScript.
13. Create a dynamic to-do list application.

DOM and Interactive Web Pages

14. Modify webpage content dynamically using DOM.
15. Create interactive menus and buttons.
16. Store and retrieve data using Local Storage.
17. Develop a simple quiz application.

Bootstrap and Tools

18. Design a responsive website using Bootstrap.
19. Create Bootstrap-based forms and cards.
20. Use browser developer tools for debugging.
21. Create and manage a GitHub repository.



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Deployment and Project

22. Deploy a static website using GitHub Pages.
23. Optimize and test website responsiveness.
24. Develop a personal portfolio website.
25. Mini Project: Design and deploy a complete responsive website for a small business, educational institute, event management system, or personal portfolio.

Learning Resources

Text Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Web Design with HTML, CSS, JavaScript and jQuery	J. Duckett	Wiley Publication	First	2014
2	Internet and World Wide Web: How to Program	M. L. Deitel and P. J. Deitel	Pearson	Fifth	2011

Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Head First HTML and CSS	E. Freeman and E. Robson	O'Reilly Media	Second	2012
2	Fundamentals of Web Development	Randy Connolly and Ricardo Hoar	Pearson	Third	2022

MOOC/NPTEL Courses:

- 1) nptel.ac.in/courses/106105084
- 2) <https://www.freecodecamp.org/learn/2022/responsive-web-design/>



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First Year Computer Science and Engineering			
Exit Program after Semester-II			
Course Title	Fundamentals of Programming using Python		
Course Code	EXP2-CSE-602A		
Category	Exit Program		
Scheme and Credits	L	P	No. of Credits
	-	04	02
Prerequisite Courses, if any: Nil			
Companion Course, if any: Nil			
Course Objectives: 1. To introduce the fundamentals of Python programming and problem-solving techniques. 2. To develop programming skills using control structures, functions, and modules. 3. To familiarize students with Python data structures and their applications. 4. To impart object-oriented programming concepts using Python. 5. To enable students to perform file processing and exception handling. 6. To use SQL queries to store, retrieve, and manage data for practical projects			
Course Outcomes: After successful completion of the course, students will be able to: CO1: Understand the fundamentals of Python programming CO2: Develop Python programs using conditional statements, loops, and control statements to solve computational problems. CO3: Apply Python data structures such as lists, tuples, sets, and dictionaries to solve programming problems. CO4: Develop modular programs using functions, modules, and packages in Python. CO5: Implement object-oriented programming concepts such as classes, objects, inheritance, polymorphism, and abstraction in Python. CO6: Perform file handling, exception handling, and database connectivity operations using Python.			



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Unit No.	Unit Title & Contents	Hours
1	Introduction to Python Features and applications of Python, Installation and execution of Python programs, Tokens, keywords, identifiers, and comments, Variables and data types, Input and output statements, Operators and expressions, Type conversion.	06
2	Decision Making and Looping Conditional statements (if, if-else, nested if), Iterative statements (for and while loops), break, continue, and pass statements, Nested loops, Range function, Simple programming applications using control structures.	04
3	Strings and Data Collections String creation and operations, String slicing and built-in functions, Lists and list operations, Tuples and tuple operations, Sets and dictionaries, List comprehensions.	04
4	Functions, Modules and Packages in Python Defining and calling functions, Function arguments and return values, Recursive functions, Scope and lifetime of variables, Lambda functions, Built-in modules, Creating and importing user-defined modules, Introduction to packages and package organization.	05
5	Object Oriented Programming in Python Classes and objects, Constructors, Instance and class variables, Data Abstraction and Encapsulation, Inheritance and polymorphism, Method overriding.	05
6	File, Exception, and Database Handling in Python File Handling: Introduction, File Operations, File Modes, Reading and Writing Files, Exception Handling: Introduction, Types of Errors, try and except Blocks, Common Built-in Exceptions, Database Handling using MySQL: Installing mysql-connector, cursor() Object, execute() Method, fetchall() Method, Creating a Simple Program to Connect to a Database	06



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Laboratory Requirements

Students shall perform 10 to 12 laboratory assignments using Python and tools such as Visual Studio Code, PyCharm, IDLE, or Jupyter Notebook. The laboratory exercises cover programming fundamentals, data structures, file handling, exception handling, object-oriented programming, and database connectivity.

List of Practical Assignments to be Performed

Experiment 1: Introduction to Python

- Installation of Python and IDE
- Write simple Python programs using print() and input()

Experiment 2: Programs on Operators in Python

- Perform arithmetic operations
- Demonstrate relational and logical operators
- Demonstrate bitwise, membership, and identity operators

Experiment 3: Programs on Conditional and Control Flow Statements

- Implement decision-making using if, if-else, and nested if statements
- Implement looping using for and while statements
- Demonstrate the use of break, continue, and pass statements

Experiment 4: Programs on Lists

- Create lists and perform basic operations
- Implement list manipulation using built-in methods
- Perform searching and sorting operations on lists

Experiment 5: Programs on Tuples

- Create and access tuple elements
- Perform tuple operations and slicing
- Use built-in tuple functions and methods

Experiment 6: Programs on Sets

- Create sets and perform set operations
- Implement union, intersection, and difference operations
- Use built-in set methods

Experiment 7: Programs on Dictionaries

- Create dictionaries and access elements
- Perform insertion, deletion, and update operations
- Use built-in dictionary methods



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Experiment 8: Programs on Functions in Python

- Implement user-defined functions
- Demonstrate function arguments and return values
- Implement lambda functions and recursion

Experiment 9: Programs on Modules and Packages

- Create and import user-defined modules
- Use built-in modules such as math and random
- Install and use packages using PIP

Experiment 10: Programs on Classes and Objects

- Create classes and objects
- Access class attributes and methods
- Implement real-world applications using classes

Experiment 11: Programs on Constructors and Inheritance

- Implement constructors using `__init__()`
- Demonstrate single inheritance
- Demonstrate multiple and multilevel inheritance

Experiment 12: Programs on Polymorphism and Data Abstraction

- Implement method overriding for polymorphism
- Demonstrate data hiding using private members
- Implement abstraction using abstract classes

Experiment 13: Programs on File Handling

- Read data from files
- Write data to files
- Perform file operations using different file modes

Experiment 14: Programs on Exception Handling

- Handle exceptions using try and except
- Demonstrate multiple exception handling
- Use finally block for cleanup operations

Experiment 15: Programs on Database Connectivity using MySQL

- Install and configure MySQL Connector
- Connect Python applications with MySQL database
- Execute SQL queries and retrieve records using `fetchone()` and `fetchall()` methods



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Learning Resources

Text Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Core Python Programming	R. Nageswara Rao	Dreamtech Press	Third	2021
2	Python Basics: A Practical Introduction to Python 3	David Amos, Dan Bader, Joanna Jablonski, Fletcher Heisler	Real Python	Fourth	2021

Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Learning Python	Mark Lutz	O'Reilly Media	Fifth	2013
2	Python Programming	Michael Urban and Joel Murach	Murach's Publication	Fourth	2019

MOOC/NPTEL Courses:

The Joy of Computing using Python, By Prof. Sudarshan Iyengar |IIT Ropar
https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs84



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First Year Computer Science and Engineering			
Exit Program after Semester-II			
Course Title	Mini Project		
Course Code	EXP2-CSE-603A		
Category	Exit Program		
Scheme and Credits	L	P	No. of Credits
	-	04	02
Prerequisite Courses, if any: Nil			
Companion Course, if any: Nil			
Course Objectives: 1. To provide students with an opportunity to apply fundamental engineering and computing concepts to solve practical problems through project-based learning. 2. To develop skills in project planning, design, implementation, testing, and documentation using appropriate tools and technologies. 3. To enhance teamwork, communication, problem-solving, and self-learning abilities through the development and presentation of a mini project.			
Course Outcomes: After successful completion of the course, students will be able to: CO1: Identify, analyze, and develop a solution for a real-world problem using fundamental engineering and computing principles. CO2: Design, implement, test, and document a functional prototype, model, or software application using appropriate tools and techniques. CO3: Demonstrate teamwork, project management, technical communication, and presentation skills through successful project execution and evaluation.			



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Guidelines for Mini Project

- The mini project shall be undertaken individually under the supervision of a faculty guide.
- The project should address a real-world problem or develop a useful software, web, mobile, hardware-assisted, or community-oriented solution.
- Students shall identify a suitable problem statement, define clear objectives, and prepare a project proposal before commencing the work.
- The project should demonstrate the application of fundamental engineering, programming, mathematical, or scientific concepts learned during the first year.
- Students shall perform requirement analysis, system design, implementation, testing, and documentation as part of the project development process.
- Appropriate tools, technologies, programming languages, software packages, or development platforms may be used based on project requirements.
- Regular progress reviews shall be conducted by the faculty guide to monitor planning, execution, and achievement of project milestones.
- Each project shall result in a functional prototype, working model, software application, or demonstrable solution.
- Students shall maintain proper project documentation, including problem statement, objectives, methodology, design details, implementation, testing results, and conclusions.
- A final project report shall be submitted in the prescribed format along with relevant source code, design files, and supporting documents.
- Students shall present and demonstrate the project before an evaluation committee and participate in viva-voce examination.
- Evaluation shall be based on problem identification, technical implementation, innovation, teamwork, documentation quality, project demonstration, and oral presentation.



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First Year Computer Science and Engineering			
Exit Program after Semester-II			
Course Title	Office Assistance		
Course Code	EXP2-CSE-604B		
Category	Exit Program		
Scheme and Credits	L	P	No. of Credits
	-	16	08
Prerequisite Courses, if any: Nil			
Companion Course, if any: Nil			
Course Objectives: - To understand the roles, responsibilities, and administrative functions of an office assistant in various organizational settings. - To develop effective verbal, written, and interpersonal communication skills required in professional workplaces. - To perform office documentation, record maintenance, filing, and correspondence management activities efficiently. - To utilize computer applications and office productivity tools for routine office operations. - To apply time management, scheduling, coordination, and problem-solving skills in office environments. - To demonstrate professional conduct, workplace ethics, teamwork, and lifelong learning attitudes.			
Course Outcomes: After successful completion of the course, students will be able to: CO1: Explain office organization structures, office procedures, and the duties of an office assistant. CO2: Communicate effectively using verbal, written, electronic, and interpersonal communication techniques. CO3: Maintain office records, documents, correspondence, and filing systems using standard office procedures. CO4: Use office productivity software and digital tools for document preparation, data management, communication, and scheduling. CO5: Apply planning, coordination, time management, and problem-solving techniques for efficient office operations. CO6: Demonstrate workplace professionalism, ethical behavior, teamwork, and customer-oriented service practices.			



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Unit No.	Unit Title & Contents	Hours
1	Introduction to Office Administration Role and Responsibilities of an Office Assistant, Types of Office Environments, Organizational Structure and Reporting, Office Supplies and Equipment Handling, Basic Filing Systems, Importance of Confidentiality and Professionalism.	06
2	Communication Skills Verbal and Non-Verbal Communication, Telephone Etiquette and Message Taking, Email and Business Letter Writing, Listening and Interpersonal Skills, Handling Visitors and Clients, Internal Communication Techniques.	08
3	Office Procedures and Documentation Maintaining Office Records and Registers, Document Filing and Retrieval Systems, Mail Handling (Inward/Outward), Photocopying, Scanning, and Printing, Preparing Reports and Memos, Maintaining Attendance and Logs.	08
4	Computer and Typing Skills Basic Computer Operations (Windows OS), Typing Practice and Speed Building, MS Word for Document Formatting, MS Excel for Data Entry and Calculations, MS Outlook for Email and Calendar, Introduction to Internet and Online Tools.	08
5	Time and Task Management Daily Work Planning and Scheduling, Prioritizing and Delegating Tasks, Managing Office Appointments, Organizing Meetings and Taking Minutes, Coordination Between Departments, Problem-Solving and Decision-Making.	08
6	Professional Conduct and Workplace Ethics Workplace Etiquette and Behavior, Dress Code and Grooming, Teamwork and Collaboration, Handling Confidential Information, Understanding Employer Expectations, Continuous Learning and Career Development.	06



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Laboratory Requirements:

The laboratory should be equipped with **Microsoft Office Suite (Word, Excel, PowerPoint, Outlook)** or equivalent open-source software such as **LibreOffice**, along with modern web browsers and Internet connectivity. Typing tutor software, email clients, and online collaboration platforms such as **Google Workspace** or **Microsoft Teams** should be available to support office administration, communication, documentation, and productivity tasks.

List of experiments to be performed

Office Administration

- 1) Prepare an organizational chart for a selected organization.
- 2) Design a filing structure for maintaining employee records.
- 3) Prepare an inventory register for office supplies and equipment.

Communication Skills

- 4) Draft professional business letters for different office scenarios.
- 5) Compose official emails following business etiquette.
- 6) Conduct role-play exercises on visitor handling and telephone communication.
- 7) Prepare and deliver a short office presentation.

Office Documentation

- 8) Create inward and outward mail registers.
- 9) Design a document filing and indexing system.
- 10) Prepare office memos, notices, and circulars.
- 11) Maintain attendance and leave records.

Computer and Typing Skills

- 12) Practice typing to achieve a minimum target speed (e.g., 30 WPM).
- 13) Format a professional document using MS Word.
- 14) Create employee data sheets using MS Excel.
- 15) Prepare spreadsheets using formulas and basic functions.
- 16) Manage emails, contacts, and calendars using MS Outlook.
- 17) Use online collaboration tools for document sharing.

Time and Task Management

- 18) Analyze workplace ethics case studies.
- 19) Participate in teamwork and collaborative problem-solving activities.
- 20) Prepare a professional resume and cover letter.
- 21) Conduct mock interviews and workplace communication exercises.



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Professional Conduct and Ethics

22) Analyze workplace ethics case studies.

23) Participate in teamwork and collaborative problem-solving activities.

24) Prepare a professional resume and cover letter.

25) Conduct mock interviews and workplace communication exercises.

Learning Resources

Text Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Business Communication	R. C. Bhatia	Ane Books Pvt. Ltd	First	2018
2	Office Management	P. K. Ghosh	Sultan Chand & Sons	First	2010

Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	The Administrative Professional: Technology and Procedures	Rankin, Shumack & Frey	Cengage Learning	Fifteenth	2016
2	Office Management and Secretarial Practice	Vikas Sharma, Bhupender Singh	Y K Publishers	First	2025

MOOC/NPTEL Courses:

- 1) <https://skillcouncil.in/product/certified-office-assistant/>
- 2) <https://workspace.google.com/learning-center>
- 3) <https://www.coursera.org/learn/work-smarter-not-harder>



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Second Year Computer Science and Engineering			
Exit Program after Semester-IV			
Course Title	Full Stack Development Lab		
Course Code	EXP4-CSE-601		
Category	Exit Program		
Scheme and Credits	L	P	No. of Credits
	-	08	04
Prerequisite Courses, if any: Nil			
Companion Course, if any: Nil			
Course Objectives: 1. To Develop the ability to design and implement full-stack web applications using modern technologies. 2. To provide hands-on experience in front-end and back-end development. 3. To enable students to integrate databases with web applications. 4. To introduce RESTful APIs and client-server communication mechanisms. 5. To familiarize students with version control, deployment, and testing practices. 6. To develop industry-oriented skills required for entry-level Full Stack Developer roles.			
Course Outcomes: After successful completion of the course, students will be able to: CO1: Explain the architecture and components of full-stack web applications. CO2: Develop responsive and interactive user interfaces using modern front-end technologies. CO3: Design and implement server-side applications and RESTful APIs. CO4: Create and manage databases and integrate them with web applications. CO5: Utilize development tools, version control systems, testing frameworks, and deployment platforms. CO6: Develop, test, deploy, and document a complete full-stack web application.			



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Unit No.	Unit Title & Contents	Hours
1	Introduction to Full Stack Development Introduction to full-stack development, client-server architecture, web application architecture, development environment setup, HTML5 fundamentals, CSS3 styling techniques, responsive web design principles, JavaScript fundamentals, DOM manipulation, browser developer tools, introduction to front-end frameworks.	07
2	Front-End Development using Modern Frameworks Introduction to ReactJS or equivalent framework, components and props, state management, event handling, forms and validation, routing concepts, reusable UI components, API consumption using fetch and axios, responsive interface development, front-end project structuring.	07
3	Back-End Development and REST APIs Introduction to Node.js and Express.js, server-side programming concepts, routing and middleware, handling HTTP requests and responses, RESTful API design principles, CRUD operations, authentication concepts, session management, API testing using Postman, error handling techniques.	08
4	Database Integration and Data Management Database fundamentals, relational and NoSQL databases, MongoDB basics, database schema design, CRUD operations using databases, database connectivity with server applications, data validation, query execution, data modeling, integration of database with REST APIs.	07
5	Version Control, Testing, and Deployment Git fundamentals, GitHub repository management, branching and merging, collaborative development workflows, application testing techniques, unit testing concepts, debugging tools, environment configuration, cloud deployment concepts, deployment using GitHub, Render, Netlify, or equivalent platforms.	08
6	Full Stack Application Development Project Requirement analysis, project planning, UI design, front-end and back-end integration, database integration, user authentication implementation, testing and debugging, deployment of complete application, project documentation, project presentation and demonstration.	08



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Laboratory Requirements:

The laboratory should be equipped with a modern code editor such as **Visual Studio Code**, web browsers (Google Chrome, Mozilla Firefox), and a full-stack development environment including **HTML, CSS, JavaScript, Node.js, Express.js, and a database system such as MySQL or MongoDB**. The lab should also provide **Git and GitHub** for version control, API testing tools such as **Postman**, and Internet connectivity for deployment, collaboration, and package management.

List of experiments to be performed

Front-End Development

1. Create a responsive personal portfolio webpage using HTML, CSS, and JavaScript.
2. Design a responsive navigation menu and landing page.
3. Develop a registration and login form with client-side validation.
4. Build reusable UI components using ReactJS.
5. Implement page navigation using React Router.

API Integration

6. Consume public REST APIs and display data dynamically.
7. Implement CRUD operations using API calls.
8. Develop a weather dashboard using external APIs.

Back-End Development

9. Create a basic Node.js and Express.js server.
10. Develop RESTful APIs for user management.
11. Implement middleware and error handling.
12. Test APIs using Postman.

Database Integration

13. Create MongoDB collections and perform CRUD operations.
14. Integrate MongoDB with Express.js applications.
15. Implement user registration and authentication with database storage.



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Version Control and Deployment

- | |
|--|
| 16. Create and manage Git repositories. |
| 17. Perform branching, merging, and pull requests using GitHub. |
| 18. Deploy a front-end application using Netlify. |
| 19. Deploy a full-stack application using Render or equivalent cloud platform. |
| 20. Deploy an application and present project documentation and demonstration. |

Learning Resources**Text Books:**

No.	Title	Authors	Publisher	Edition	Year
1	Pro MERN Stack: Full Stack Web App Development with MongoDB, Express, React, and Node	Vasan Subramanian	Apress	Second	2020
2	JavaScript: The Definitive Guide	Flanagan David	O'Reilly Media	Seventh	2020

Reference Books:

No.	Title	Authors	Publisher	Edition	Year
1	Learning React: Modern Patterns for Developing React Apps	Alex Banks and Eve Porcello	O'Reilly Media	Second	2020
2	Web Development with Node and Express	Ethan Brown	O'Reilly Media	Second	2019

MOOC/NPTEL Courses:

- | |
|--|
| 1) https://www.udemy.com/topic/full-stack-web-development/ |
| 2) https://fullstackopen.com/en/ |



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Second Year Computer Science and Engineering			
Exit Program after Semester-IV			
Course Title	Android Development Lab		
Course Code	EXP4-CSE-602		
Category	Exit Program		
Scheme and Credits	L	P	No. of Credits
	-	04	02
Prerequisite Courses, if any: Nil			
Course Objectives: 1. To introduce students to Android application development and mobile application architecture. 2. To develop skills in designing user-friendly Android applications using modern development tools. 3. To enable students to implement application logic, event handling, and data management techniques. 4. To familiarize students with local storage, databases, and web service integration in Android applications. 5. To develop testing, debugging, and deployment skills for Android applications. 6. Prepare students to develop and publish complete Android applications for real-world use.			
Course Outcomes: After successful completion of the course, students will be able to: CO1: Explain Android architecture, application components, and the mobile application development lifecycle. CO2: Design and develop user interfaces using Android layouts, widgets, and navigation components. CO3: Implement Android application logic using activities, intents, event handling, and lifecycle management. CO4: Integrate data storage, databases, and web services into Android applications. CO5: Apply testing, debugging, version control, and deployment techniques in Android application development. CO6: Develop, test, deploy, and document a complete Android application for real-world scenarios.			



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Unit No.	Unit Title & Contents	Hours
1	Introduction to Android Development Introduction to mobile application development, Android architecture and ecosystem, Android Studio installation and configuration, project structure and Gradle build system, Android application components, activities and lifecycle, XML layouts, UI widgets and controls, event handling basics, resource management, emulator setup and device configuration.	07
2	Android User Interface and Navigation Layout managers and responsive UI design, buttons, text fields, image views and lists, RecyclerView implementation, menus and dialogs, fragments and fragment lifecycle, navigation components, material design principles, user interaction techniques, handling configuration changes and localization.	08
3	Application Logic and Android Components Activities and intents, explicit and implicit intents, broadcast receivers, services and background processing, event-driven programming, notifications and alerts, permissions management, handling user inputs, application lifecycle management, debugging application behavior and exception handling.	07
4	Data Storage and Web Service Integration Shared preferences, internal and external storage, SQLite database fundamentals, Room database library, CRUD operations, JSON data handling, REST API integration, networking using Retrofit or Volley, asynchronous operations, data synchronization and persistence techniques.	07
5	Testing, Security, and Deployment Android testing fundamentals, unit testing and UI testing, debugging tools and Logcat, performance optimization, application security best practices, authentication concepts, version control using Git and GitHub, APK generation, app signing process, deployment and publishing concepts on Google Play Store.	08
6	Android Application Development Project Requirement analysis, project planning and design, user interface development, implementation of business logic, database integration, API integration, testing and debugging, performance tuning, application deployment, project documentation, project presentation and demonstration.	08



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Laboratory Requirements:

The laboratory should be equipped with **Android Studio** (latest stable version), **Java and/or Kotlin Development Kit (JDK)**, and Android SDK tools for application development and testing. The lab should also provide Android emulators or physical Android devices, **Git and GitHub** for version control, and reliable Internet connectivity for dependency management, deployment, and access to developer resources.

List of experiments to be performed

Android Fundamentals

1. Install Android Studio and configure Android Emulator.
2. Create and run a basic Android application.
3. Design a simple user interface using XML layouts.
4. Implement event handling for buttons and text fields.

User Interface Development

5. Develop a calculator application using Android widgets.
6. Create a registration form with input validation.
7. Implement RecyclerView to display dynamic data.
8. Design a multi-screen application using activities and fragments.
9. Create menus, dialogs, and navigation drawers.

Application Components

10. Implement explicit and implicit intents.
11. Develop applications using broadcast receivers.
12. Create notifications and alerts.
13. Implement background services.

Database and API Integration

14. Store and retrieve data using Shared Preferences.
15. Create SQLite/Room database applications.
16. Perform CRUD operations on local databases.
17. Consume REST APIs using Retrofit.
18. Develop an application displaying real-time data from web services.

Testing and Deployment

19. Debug Android applications using Logcat.
20. Perform unit testing and UI testing.
21. Manage source code using Git and GitHub.



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22. Generate signed APK files.
23. Develop a complete Android application
24. Deploy the application, prepare documentation, and present project demonstration.

Learning Resources

Text Books:

No.	Title	Authors	Publisher	Edition	Year
1	Android Programming: The Big Nerd Ranch Guide	Bill Phillips, Chris Stewart, Kristin Marsicano and Brian Gardner	Addison-Wesley Professional	Fifth	2022
2	Android Programming for Beginners	John Horton	Packt Publishing	Third	2021

Reference Books:

No.	Title	Authors	Publisher	Edition	Year
1	Android Application Development All-in-One For Dummies	Barry Burd	Wiley	Third	2021
2	Head First Android Development	Dawn Griffiths and David Griffiths	O'Reilly Media	Third	2021

MOOC/NPTEL Courses:

https://developer.android.com/courses



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Second Year Computer Science and Engineering			
Exit Program after Semester-IV			
Course Title	Mini Project		
Course Code	EXP4-CSE-603		
Category	Exit Program		
Scheme and Credits	L	P	No. of Credits
	-	04	02
Prerequisite Courses, if any: Nil			
Companion Course, if any: Nil			
Course Objectives: 1. To provide students with an opportunity to apply fundamental engineering and computing concepts to solve practical problems through project-based learning. 2. To develop skills in project planning, design, implementation, testing, and documentation using appropriate tools and technologies. 3. To enhance teamwork, communication, problem-solving, and self-learning abilities through the development and presentation of a mini project.			
Course Outcomes: After successful completion of the course, students will be able to: CO1: Identify, analyze, and develop a solution for a real-world problem using fundamental engineering and computing principles. CO2: Design, implement, test, and document a functional prototype, model, or software application using appropriate tools and techniques. CO3: Demonstrate teamwork, project management, technical communication, and presentation skills through successful project execution and evaluation.			



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Guidelines for Mini Project

- The mini project shall be undertaken individually under the supervision of a faculty guide.
- The project should address a real-world problem or develop a useful software, web, mobile, hardware-assisted, or community-oriented solution.
- Students shall identify a suitable problem statement, define clear objectives, and prepare a project proposal before commencing the work.
- The project should demonstrate the application of fundamental engineering, programming, mathematical, or scientific concepts learned during the first year.
- Students shall perform requirement analysis, system design, implementation, testing, and documentation as part of the project development process.
- Appropriate tools, technologies, programming languages, software packages, or development platforms may be used based on project requirements.
- Regular progress reviews shall be conducted by the faculty guide to monitor planning, execution, and achievement of project milestones.
- Each project shall result in a functional prototype, working model, software application, or demonstrable solution.
- Students shall maintain proper project documentation, including problem statement, objectives, methodology, design details, implementation, testing results, and conclusions.
- A final project report shall be submitted in the prescribed format along with relevant source code, design files, and supporting documents.
- Students shall present and demonstrate the project before an evaluation committee and participate in viva-voce examination.
- Evaluation shall be based on problem identification, technical implementation, innovation, teamwork, documentation quality, project demonstration, and oral presentation.