

IPS Academy, Institute of Engineering & Science
 (A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)
 Scheme Based on AICTE Flexible Curriculum
Department of Computer Science & Information Technology
Bachelor of Technology (B.Tech.)
V Semester
Scheme

Sr. No.	Course Type	Course Code	Course Name	Teaching Scheme			Credits
				L	T	P	
1.	PCC	CI07	Database Management System	2	1	-	3
2.	PCC	CI08	Operating System	2	1	-	3
3.	PCC	CI09	Formal Languages and Automata	3	-	-	3
4.	PCC	CI10	Software Engineering and Project Management	3	-	-	3
5.	HSMC	HS05	Humanities and Social Sciences Open Courses – I	2	-	-	2
6.	IFC	CB01	Interdisciplinary Foundation Course-II	2	-	-	2
7.	LC	CI07(P)	Database Management System Lab	-	-	4	2
8.	LC	CI08(P)	Operating System Lab	-	-	2	1
9.	SBC	CI03(P)	Basics of Web Development	-	-	2	1
10.	PROJ	CI01	Mini Project	-	-	4	2
11.	PROJ	CI02	Seminar	-	-	2	1
12.	MLC	MLC03	Environmental Studies	*1	-	-	Audit
13.	PROJ	-	Internship-I	Credit to be added in sixth semester			
Total Academic Engagement and Credits				14	2	14	23
				30			

Note:

- **Humanities and Social Sciences Open Courses (HSMC) – I, HS05 (Any One Course)**
 - (a) English Language Proficiency
 - (b) German Language
 - (c) French Language
 - (d) Japanese Language
 - (e) Soft Skills and Interpersonal Communication
- **Interdisciplinary Foundation Course-II, IFC-CB01**
 (Offered by Cyber Security IOT including Blockchain Technology Branch.)
 - Blockchain Technology

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V-Semester

PCC-CI07	Database Management System	2L:1T	3 credits
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Course Objective:

The main objective of this course is to understand the fundamentals of the base management system.

Course Contents:

Module 1: (07 hrs.)

Introduction to DBMS, File system vs DBMS, Advantages of database systems, Database System architecture, Data models, Schemas and instances, Data independence, Functions of DBA and designer, Design issues, Entity-Relationship model: Basic concepts, Design process, E-R diagrams, weak entity sets, extended E-R features—generalization, specialization and aggregation.

Module 2: (11 hrs.)

Structure of relational databases, Relation algebra fundamental operators and syntax, relational algebra queries, Tuple calculus, Keys, Types of Keys. SQL: Data retrieval queries, Data extraction from single, multiple tables equi-join, non-equijoin, self-join, outer join. Usage of like, any, all, exists, in Special operators. DDL, DML, DCL and TCL, integrity constraints, Complex queries, Referential integrity.

Module 3: (08 hrs.)

Data Base Design: Functional Dependency (FD), Types of FD, closure of attributes, irreducible set of FD, Decomposition, Dependency preservation and lossless join, problems with null valued and dangling tuples, multivalued dependencies, Introduction to normalization, Normal forms, Basics of Query Optimization.

Module 4: (08 hrs.)

Transaction Processing Concepts: Transaction system, ACID Property, Testing of Serializability, Serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures. Log based recovery. Concurrency Control Techniques: Concurrency Control, locking Techniques for concurrency control, time stamping protocols for concurrency control, validation-based protocol, Recovery with concurrent transaction.

Module 5: (06 hrs.)

Data Storage and Indexes-file organizations, primary, secondary index structures, various index structures-hash-based, dynamic hashing techniques, multi-level indexes, B and B+ trees. Cursor management: nested and parameterized cursors, Triggers, Types of triggers.

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V Semester

Course Outcomes

After completion of the course the student will be able to:

1. Describe basic concepts of DBMS and Design ER model.
2. Solve queries using Relational Algebra and SQL.
3. Understanding of functional dependencies and Explain normalization by applying Normalizations techniques to database.
4. Explain basic the fundamental concepts of transaction processing and concurrency control.
5. Understanding various storage systems and indexing.

List of Text/Reference Books:

1. Date CJ, "An Introduction to Database System", Pearson Educations, 8th Edition, 2003.
2. Korth, Silbertz, Sudarshan, "Fundamentals of Database System", McGrawHill, 5th Edition, 2006.
3. Peter Rob, "Data Base System: Design Implementation & Management", Cengage Learning 4th Edition, 2000.
4. Elmasri, Navathe, "Fundamentals of Database Systems", Pearson Educations, 7th Edition 2017.
5. Atul Kahate, "Introduction to Database Management System", Pearson Educations, 2004.
6. Oracle9i Database Administration Fundamental-I, Volume I, Oracle Press, TMH.
7. Paneerselvam, "Data Base Management System", PHI Learning, 3rd Edition, 2018.
8. J.D. Ullman, "Principles of Database and Knowledge-Based Systems", Computer Science Press, 2nd Edition 1988.
9. Serge Abiteboul, Richard Hull, Victor Vianu, "Foundations of Databases", Addison-Wesley, 1995.

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V-Semester

PCC-CI08	Operating System	2L:1T	3 credits
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Prerequisites: Computer Architecture, Data Structures & Algorithms, C/C++ programming.

Course Objective:

To build a rigorous, implementation-grounded understanding of operating-system design — process and CPU scheduling, synchronization and deadlocks, memory management, and file/I-O systems — so students can reason about real kernels (Linux/Windows) and answer at GATE / interview depth.

Course Contents: (40 hrs.)

Module 1 **(5 hrs.)**

Operating System — functions, evolution, types (Batch, Multiprogrammed, Time-sharing, Real-time, Distributed); OS services and structure; System Calls vs. Function Calls; System-call categories — process control, file, device, information, communication (e.g., fork, exec, wait); Process Concept and PCB.

Module 2 **(9 hrs.)**

Process state transition diagram, schedulers, process queues; Scheduling criteria; Algorithms — FCFS (Convoy Effect), SJF, SRTF, Round Robin, Priority (preemptive/non-preemptive) with Aging, HRRN, Multilevel Queue & Multilevel Feedback Queue; Multiple-processor scheduling; Threads — Process vs. Threads, user-level vs. kernel-level vs. hybrid, multithreading models.

Module 3 **(9 hrs.)**

IPC models — shared memory vs. message passing; Race Condition and the Critical Section Problem; busy-waiting solutions in order of refinement — Lock Variable, Strict Alternation (Turn Variable), Interested Variable, Peterson's Solution, hardware instructions (TSL, XCHG), Disabling Interrupts; Sleep & Wake; Semaphores (binary & counting, Wait/Signal) and Monitors; classical problems — Producer-Consumer, Readers-Writers, Dining Philosophers; Deadlocks — characterization, prevention, avoidance (Banker's Algorithm), Resource-Allocation Graph, detection & recovery.

Module 4 **(10 hrs.)**

Contiguous allocation — fixed/dynamic partitioning, First/Best/Worst-Fit, Buddy System; Overlays; Paging — page table, TLB, multi-level & inverted page tables; Segmentation and Segmented Paging; Virtual Memory — demand paging, page-replacement algorithms, Belady's Anomaly, Thrashing & Working-Set Model.

Module 5 **(07 hrs.)**

File concept, directory structures (single/two-level, tree, acyclic-graph); disk-space allocation (contiguous, linked, indexed), free-space management; Disk scheduling (FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK); Introduction to Network, Distributed & Multiprocessor OS; Case Studies: UNIX/Linux, Windows.

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V Semester

Course Outcomes

- CO1.** Explain the fundamental concepts, evolution, and services of operating systems.
- CO2.** Apply CPU scheduling algorithms and analyze multithreading models for efficient process management.
- CO3.** Design and evaluate synchronization mechanisms and deadlock-handling strategies for concurrent systems.
- CO4.** Analyze memory-management and virtual-memory techniques to optimize system performance.
- CO5.** Describe file-system organization, disk scheduling, and I/O management in contemporary operating systems.

List of Text / Reference Books

1. Operating System Concepts Essentials by Avi Silberschatz, Peter Galvin, and Greg Gagne (10th Edition, 2018).
2. Modern Operating Systems by Andrew S. Tanenbaum (3rd Edition, 2007).
3. Understanding the Linux Kernel by Daniel P. Bovet and Marco Cesati (3rd Edition).
4. William Stallings' Operating Systems: Internals and Design Principles (5th Edition, 2005).
5. Operating Systems: A Modern Perspective by Gary J. Nutt (2 nd Edition)

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V-Semester

PCC-CI09	Formal Language and Automata	3L	3 credits
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Prerequisite: Discrete structure

Course Objective:

The main objective of this course is to understand fundamental of formal languages and automata.

Course Contents:(40hrs.)

Module 1: (08 hrs.)

Introduction of the theory of computation, Finite state automata – description of finite automata, properties of transition functions, Transition graph, designing finite automata, FSM, DFA, NFA, 2-way finite automata, equivalence of NFA and DFA, applications of finite automata, minimization of FSA.

Module 2: (08 hrs.)

Mealy and Moore machines, regular language, regular expressions, regular sets, closure properties of regular expressions, Arden's theorem, Myhill-Nerode theorem, pumping lemma for regular languages, Application of pumping lemma.

Module3: (08 hrs.)

Regular grammars, Introduction of Context-Free Grammar - derivation trees, ambiguity, simplification of CFGs, normal forms of CFGs- Chomsky Normal Form and Greibach Normal forms, pumping lemma for CFLs, decision algorithms for CFGs, designing CFGs, Closure properties of CFL's.

Module 4: (08 hrs.)

Introduction of PDA, formal definition, closure property of PDA, examples of PDA, Deterministic Pushdown Automata, NPDA, conversion PDA to CFG, conversion CFG to PDA.

Module 5: (08 hrs.)

Turing machines - basics and formal definition, language acceptability by TM, examples of TM, variants of TMs – multitape TM, NDTM, Universal Turing Machine, offline TMs, equivalence of single tape and multitape TMs. Recursive and recursively enumerable languages, decidable and undecidable problems – examples, halting problem, reducibility. Introduction of P, NP, NP complete, NP hard problems and Examples of these problems.

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Bachelor of Technology (B.Tech.)
V Semester

Course Outcomes

1. Describe finite automata as DFA and NFA with its applications
2. Design of Mealy and Moore machine. Analyze regular expression representations for regular languages.
3. Translate a context-free grammar from one form to another.
4. Understand Pushdown automata.
5. Understand Turing machine and un-decidable problems.

List of Text/ Reference Books:

1. Daniell. A.Cohen, “Introduction to Computer Theory”, Wiley India, 2nd Edition, 2003.
2. John E Hopcroft, Jeffrey D. Ullman and Rajeev Motwani, “Introduction to Automata Theory, Languages and Computation”, Pearson Education, 2nd Edition, 2001.
3. K.L.P Mishra & N. Chandrasekaran, “Theory of Computer Science”, PHI Learning, 3rd Edition, 2006.
4. Peter Linz, “Introduction to Automata Theory and Formal Languages”, Narosa Publishing. 3rd Edition, 2007.
5. John C Martin, “Introduction to languages and the theory of computation”, TATA McGraw Hill, 3rd Edition 2013.
6. Harry R. Lewis and Christos H. Papadimitriou, “Elements of the Theory of Computation”, Pearson Education Asia, 2nd edition, 1998.
7. Dexter C. Kozen, “Automata and Computability”, Undergraduate Texts in Computer Science, Springer, 1st edition, 2012.
8. Michael Sipser, “Introduction to the Theory of Computation”, PWS Publishing., 3rd edition, 2012.

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V-Semester

PCC-CI10	Software Engineering & Project Management	3L	3 credits
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Course Objective:

The course aims are to develop a broad understanding of the discipline of software engineering and management of software systems.

Course Contents:(45 hrs.)

Module 1: (08 hrs.)

Introduction, Software problem and prospects , software process ,Software process models: Linear Sequential model, Prototyping Model, RAD Model, Evolutionary Process Models like Incremental Model, Spiral Model, the unified process, Open source software development, Agile processes.

Module 2: (08 hrs.)

Measures, Metrics and Indicators, Metrics in the Process and Project Domains, Software Measurement, Metrics of Software Quality, S/W reliability, Software estimation techniques, loc and FP estimation. Empirical models like COCOMO.

Module 3: (10 hrs.)

Software requirements and specification: feasibility study, Informal/formal specifications, pre/post conditions, algebraic specification and requirement analysis models, Specification design tools. Software design and implementation: Software design objectives, design techniques, User interface design, cohesion and coupling, Functional decomposition, Data flow diagram, Object- oriented design: UML diagrams.

Module 4: (09 hrs.)

Coding standard and guidelines, programming style, code sharing, code review, software components, rapid prototyping, specialization, construction, class extensions, intelligent software agents, reuse performance improvement, debugging. Software Testing Strategies: Verification and Validation, Strategic Issues, test plan, white box, black-box testing, unit and integration testing, system testing test case design and acceptance testing.

Module 5: (10 hrs.)

Organizing: Alternatives for project managers, matrix organization, Staffing, Directing: leadership, delegation, motivation, Controlling risk analysis and RMMM plan, project scheduling and tracking plan, SQA and quality planning, SCM activities and plan, project management plan. Re-engineering, reverse engineering, forward engineering, web engineering, Software project management standards.

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Bachelor of Technology (B.Tech.)
V-Semester

Course Outcome:

1. Apply project management concepts and techniques to an IT project.
2. Identify issues that could lead to IT project success or failure.
3. Explain project management in terms of the software development process.
4. Describe the responsibilities of IT project managers.
5. Apply project management concepts through working in a group as team leader or active team member on an IT project.

List of Text/Reference Books:

1. Schwalbe, Kathy "Information Technology Project Management" 8th Edition, 2016.
2. P, S. Pressman "Software Engineering. A Practitioner's Approach" New edition, McGrawHills, 7th edition, 2010/
3. Kieron Conway "Software project Management from concept to development BlackBook" Dreamtech Press.
4. Deepak Jain, "Software Engineering principle and practices" Oxford University Press, 2008.
5. Bell Douglas "Software Engineering for students", Pearson Education, 4th Edition, 2005.
6. Kelkar "Software Project Management," PHI Learning, 3rd edition 2012.

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V-Semester

LC-CI07(P)	Database Management System Lab	4P	2 credits
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Course Objective:

The main objective of this course is to understand ER modeling, SQL, normalization, and transaction management for proficient database design and administration.

Course Content

Module 1: (06 hrs.)

Entity-Relationship Diagrams: Modeling Hospital Management System. Entities, Relationships, and Attributes. Cardinalities and Diagram Representation.

Module 2: (06 hrs.)

SQL Introduction and DDL Commands: Overview of SQL. Data Definition Language (DDL) Commands. Constraints and Schema Design.

Module 3: (06 hrs.)

Data Manipulation Language (DML) and Query Construction: INSERT, UPDATE, DELETE Statements. Constructing SELECT Queries. Clauses: WHERE, ORDER BY, GROUP BY, HAVING, LIKE, IN, BETWEEN etc.

Module 4: (06 hrs.)

Joins, Subqueries, and Views: Join Operations on Tables. Sub queries for Nested Queries. Creating and Utilizing Views.

Module 5: (06 hrs.)

Transactional Control and Data Control Language: Transactional Control Language (T.C.L) commands. Data Control Language (D.C.L) Commands. Managing Access Permissions and Security.

List of Experiments:

1. Design any Database system (like Banking, University etc).
2. Introduction to Oracle and SQL
3. Write the queries for Data Definition language (DDL)
4. Write the queries for Data manipulation language (DML)
5. Use of various types of Integrity Constraints
6. Write the queries for Data Control language (DCL)
7. Use of SELECT command with different clauses.
8. Write SQL queries using logical operation (AND, OR, NOT)
9. Write SQL queries for aggregate functions (Max, Min, Sum, Avg, Count)
10. Write SQL queries for group by and Having
11. Write SQL queries for sub queries and nested queries
12. Write an SQL query to implement JOINS
13. Write SQL queries to create views
14. Implementation of any Database system (like Banking, University etc).

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Department of Computer Science & Information Technology
Bachelor of Technology (B.Tech.)
V-Semester

Course Outcome:

1. Demonstrate high-level competence in constructing Entity-Relationship Diagrams for efficient database design.
2. Understand SQL basics and DDL commands for effective database control.
3. Achieve efficiency in Data Manipulation Language (DML) and SQL queries for data retrieval.
4. Develop expertise in joins, subqueries, and views for intricate data interactions.
5. Understand T.C.L and D.C.L for efficient database management.

List of Text/Reference Books:

1. DateCJ, "AnIntroductiontoDatabaseSystem", PearsonEducations, 8th Edition, 2003.
2. Korth, Silbertz, Sudarshan, "Fundamentals of Database System", McGrawHill, 5th Edition, 2006.
3. PeterRob, "DataBaseSystem: DesignImplementation&Management", Cengage Learning 4th Edition, 2000.

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Bachelor of Technology (B.Tech.)
V-Semester

LC-CI08(P)	Operating System Lab	4P	2 credits
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Course Objective

To equip students with a comprehensive understanding of the fundamental concepts and mechanisms in operating systems, focusing on process management, memory management, and file systems.

Course Contents

Module 1 (06 hrs.)

Process Management: CPU Scheduling, FCFS, Convoy Effect, FCFS with Overhead, SJF, SRTF, Round Robin Algorithm, Longest Job First, Priority Scheduling.

Module 2 (06 hrs.)

Synchronization: Producer Consumer, Reader Writers, Dining Philosophers Problem, Banker's algorithms.

Module 3 (06 hrs.)

Memory Management: Page replacement algorithm, Belady's Anomaly, Stack algorithms.

Module 4 (05 hrs.)

File system IO: Disk scheduling (FCFS, SSTF, Scan, C-scan, Look, C-look).

Module 5 (05 hrs.)

Threads and system calls: Communications related system calls.

List of Experiments

1. To implement FCFS CPU scheduling algorithm.
2. To implement SJF CPU scheduling algorithm.
3. To implement Priority CPU Scheduling algorithm.
4. To implement Round Robin CPU scheduling algorithm.
5. To compare various CPU Scheduling Algorithms over different Scheduling Criteria.
6. To implement classical, inter process communication problem (producer consumer).
7. To implement classical, inter process communication problem (Reader Writers).
8. To implement classical, inter process communication problem (Dining Philosophers).
9. To implement Banker's algorithms.
10. To implement & compare various page replacement algorithms.
11. To implement & Compare various Disk & Drum scheduling Algorithms.
12. To implement Remote Procedure Call (RPC).

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Scheme Based on AICTE Flexible Curriculum
Department of Computer Science & Information Technology
Bachelor of Technology (B.Tech.)
V-Semester

Course Outcomes

1. Master process management and CPU scheduling for efficient resource utilization.
2. Implement synchronization mechanisms to prevent concurrency problems and deadlocks
3. Optimize memory usage through paging and page replacement algorithms.
4. Design and manage efficient file systems for data storage and retrieval.
5. Understand system calls, threads, and advanced OS concepts in network.

List of Text / Reference Books

1. Operating System Concepts Essentials by Avi Silberschatz, Peter Galvin, and Greg Gagne (10th Edition, 2018).
2. Modern Operating Systems by Andrew S. Tanenbaum (3rd Edition, 2007).
3. Understanding the Linux Kernel by Daniel P. Bovet and Marco Cesati (3rd Edition).
4. William Stallings' Operating Systems: Internals and Design Principles (5th Edition, 2005).
5. Operating Systems: A Modern Perspective by Gary J. Nutt (2nd Edition).

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Bachelor of Technology (B.Tech.)
V-Semester

SBC- CI03(P)	Basics of Web Development	2P	1 credits
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Course Objective: This course introduces students to the fundamental concepts and skills necessary to design and create websites. Through a combination of theoretical instruction and hands-on projects, students will learn about the principles of design, HTML, CSS, and basic web development tools.

Course Contents

Module 1: (06 hrs.)

Introduction to Web Design, Overview of the web design process, Understanding the role of a web designer, Historical perspective of web design, Current trends and best practices in web design, Current trends and best practices in web design.

Module 2: (06 hrs.)

HTML Basics, Introduction to HTML (Hypertext Markup Language), Understanding HTML syntax and structure, Creating a basic HTML document, Working with HTML tags and elements.

Module 3: (06 hrs.)

CSS Basics, Introduction to CSS (Cascading Style Sheets), Understanding CSS syntax and selectors, Applying styles to HTML elements, Working with text, colors, and backgrounds in CSS.

Module 4: (06 hrs.)

Images and Multimedia, Optimizing images for the web, Incorporating images and multimedia into web pages, Using CSS for image styling and effects, Accessibility considerations for multimedia content.

Module 5: (06 hrs.)

Introduction to JavaScript, Basics of JavaScript programming language, Adding interactivity to web pages with JavaScript, Working with DOM (Document Object Model), Introduction to JavaScript libraries/frameworks (optional).

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Bachelor of Technology (B.Tech.)
V-Semester

List of Experiments

1. HTML Basics:

1. Create a simple webpage with headings, paragraphs, and lists.
2. Experiment with different HTML tags and attributes.
3. Embed images and links into your webpage.
4. Create a form with various input types (text, checkbox, radio buttons, etc.).

2. CSS Styling:

5. Apply different styles (colors, fonts, margins, padding) to HTML elements.
6. Experiment with CSS selectors (class, ID, element).
7. Create a navigation menu using CSS.
8. Implement basic layout techniques (floats, positioning, flexbox) to structure your webpage.

3. JavaScript Basics:

9. Create a simple "Hello, World!" script.
10. Use JavaScript to manipulate HTML elements (change text, styles, attributes).
11. Create interactive elements like buttons with event listeners.
12. Implement basic form validation using JavaScript.

4. JavaScript Libraries:

13. Explore JavaScript libraries like jQuery for DOM manipulation and event handling.
14. Use jQuery to simplify common JavaScript tasks and animations.

5. Form Handling:

15. Create a form with different input types (text, password, email).
16. Implement client-side form validation using JavaScript.
17. Experiment with form submission methods (GET vs. POST).

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Bachelor of Technology (B.Tech.)
V-Semester

PROJ- CI01	Mini Project	4P	2 credits
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Course Overview:

The mini project is designed to provide hands-on experience in software development, project management, and problem-solving. Students will apply theoretical knowledge to develop a working software prototype.

Module 1: Project Initiation and Planning

- Understand project requirements and objectives.
- Learn project planning and management techniques.
- Develop a project proposal and work breakdown structure (WBS).

Module 2: System Design and Architecture

- Design system architecture and user interface.
- Create system models and diagrams using UML diagrams (use case, class, sequence, activity diagrams).
- Plan the development process.

Module 3: Implementation and Coding

- Implement the system based on the design documents.
- Write and test code in relevant programming languages.
- Develop a functional prototype.

Module 4: Testing and Quality Assurance

- Test the system for defects and issues.
- Ensure the system meets quality standards.
- Prepare for system deployment.

Module 5: Deployment and Presentation

- Deploy the system to a live environment.
- Document the project thoroughly.
- Present the project to an audience.

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Bachelor of Technology (B.Tech.)
V-Semester

Course Outcome:

1. Practical Application of Theoretical Knowledge.
2. Problem-Solving and Critical Thinking.
3. Technical Proficiency and Tool Utilization.
4. Project Management and Teamwork.
5. Innovation and Creativity.

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Bachelor of Technology (B.Tech.)
V-Semester

PROJ- CI02	Seminar	2P	1 credits
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Course Objective:

The course objective of a seminar in a B.Tech Computer Science and Information Technology (CS&IT) program typically aims to enhance students' knowledge, skills, and experiences through presentations, discussions, and research.

Module 1: Topic Selection and Research

- Introduction to seminar objectives and expectations.
- Guidance on selecting a relevant and current topic in CS & IT.
- Techniques for conducting effective research, including literature review and data collection.
- Ethical considerations and plagiarism prevention.

Module 2: Content Development

- Structuring a seminar presentation: Introduction, body, conclusion.
- Developing clear and concise content that communicates key points effectively.
- Use of multimedia and visual aids to enhance the presentation.
- Creating supporting documents: abstracts, bibliographies, and handouts.

Module 3: Presentation Skills

- Training in public speaking and communication skills.
- Techniques for engaging the audience and managing questions.
- Practice sessions with peer and instructor feedback.
- Non-verbal communication and body language tips.

Module 4: Technical Tools and Software

- Familiarization with presentation software (e.g., PowerPoint, LaTeX, Prezi).
- Introduction to tools for creating diagrams, charts, and other visuals (e.g., Visio, Lucidchart).
- Tips for effective use of software to support seminar presentations.

Module 5: Evaluation and Feedback

- Criteria for evaluating seminar presentations (content, delivery, visuals, etc.).
- Peer review sessions and constructive feedback methods.
- Self-assessment techniques to identify strengths and areas for improvement.
- Final presentation assessment and reflection on learning outcomes.

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V-Semester

Course Outcome:

1. Improved Communication Skills.
2. Enhanced Research Skills.
3. Up-to-date Knowledge on Emerging Technologies.
4. Teamwork and Collaboration.
5. Critical Thinking and Problem-Solving Abilities.