RV UNIVERSITY

Go, change the world

an initiative of RV EDUCATIONAL INSTITUTIONS

NEW-AGE GLOBAL UNIVERSITY
FOR LIBERAL EDUCATION

School of Computer Science and Engineering

Where Ideas Ignite Minds

Bachelor of Technology (B.Tech.) (Hons.)

(2026 Scheme)

I and II Semester
Academic Year 2026-27

Syllabus Book

RV UNIVERSITY
Go, change the world
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School of Computer Science and Engineering (SoCSE)

Bachelor of Technology (Honors)

B.Tech(Hons.)

I and II Semester
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RV University (RVU)

RV Educational Institutions (RVEI), governed by Rashtreeya Sikshana Samithi Trust (RSST), is recognised among the few value–based and quality–oriented educational groups in the country. The Trust endeavours to impart quality education to all strata of society. RV University is a State Private University which has been established in Karnataka State with RSST as the sponsoring body through Act No.11 of 2019, passed by the Karnataka Legislature. The Missions of RSST and RV University is "Excellence in Education with Societal Commitment".

RVU Vision

To be a World–class, tech–driven, global university for liberal education, empowering citizens of tomorrow.

RVU Mission

RVU M1:
Strive for excellence in teaching, research, capacity building, and community engagement, benchmarking against global universities to lead across disciplines.

RVU M2:
Utilize digital and emerging technologies to enhance teaching-learning and research, accessible to all, while fostering a multidisciplinary, inclusive environment that meets evolving learner needs.

RVU M3:
Cultivate a diverse, global academic community through strong national and international collaborations that enrich learning, facilitate mobility, and drive institutional growth.

RVU M4:
Integrate theory with practical application to develop self-driven, empathetic problem - solvers equipped to create meaningful societal impact.

School of Computer Science and Engineering (SoCSE)

The School of Computer Science and Engineering (SoCSE) focuses on problem–solving, critical thinking, innovation, creativity, communication, entrepreneurship data science to deal with the VUCA (Volatility, Uncertainty, Complexity, and Ambiguity) world. All programmes of the school offer an opportunity to the students to work closely with all stakeholders – industries, government policymakers, researchers, think tanks and

global organizations. School focuses on imparting 21st century skills through experiential, holistic learning. Curriculum supports interdisciplinary studies with minors from other schools and includes internships and student exchange programs with foreign universities.

SoCSE Vision

To be a pioneering school of Computer Science and Engineering committed to fostering liberal education and empowering the next generation of technologists to make a positive global socio-economic impact.

SoCSE Mission

SoCSE M1:
To be a pioneer in computer science education, fostering multidisciplinary research, innovation and entrepreneurship.

SoCSE M2:
To provide state-of-the-art facilities and dynamic curriculum that enables exemplary pedagogy, integrating advanced technology, theoretical foundations, and hands–on applications to address real-world challenges.

SoCSE M3:
To promote diverse communities of faculty and students through national and international academic, industry collaborations contributing to institution-building.

SoCSE M4:
To cultivate a generation of ethical, self-motivated, and empathetic problem solvers dedicated to achieving sustainable development goals.

About the Program – B.Tech (Hons.)

B.Tech (Hons.) Computer Science and Engineering Program at RV University offers students a firm foundation in computing and specialisation in cutting-edge technologies. The courses also provide an opportunity for interdisciplinary learning by pursuing a minor in other schools at RVU. Latest teaching and learning methods have been incorporated in the course design to enable flipped learning, mastery learning and peer learning using modern world-class facilities. The general core and electives of the program improve 21st-century skills such as communication skills, creativity and innovation, collaboration, social awareness, self-awareness, critical thinking and problem-solving skills — all highly sought after by leading industries for placements. Our innovative assessment methods focus on learner analytics leading to individual target profiles for global careers. Our faculty have hands-on knowledge with industry and research experience and hold degrees from premier universities in India and abroad. Our student clubs and extracurricular activities ensure a memorable campus life.

Program Outcomes (POs)

A graduate of the program will demonstrate:

PO1 — Application of Knowledge:
Apply knowledge from the core/interdisciplinary areas and develop skills to solve complex real-world problems.

PO2 — Critical Thinking & Creativity:
Analyze and evaluate the existing situations, practices and evidence to develop innovative multi-perspective solutions.

PO3 — Research & Innovation:
Cultivate a keen sense of observation and enquiry using appropriate methodology to develop new ideas, processes & solutions in response to contemporary challenges.

PO4 — Digital Transformation:
Instill an ability for confident, critical and responsible use of digital technologies for learning, work and participation in society.

PO5 — Communication & Interpersonal Skills:
Develop skills to effectively express thoughts and ideas both orally and in writing to people from all sections of the society.

PO6 — Leadership & Collaborative Teamwork:
Exhibit skills to set goals and guide people to align effectively in building a team to achieve the goals.

PO7 — Project Management & Entrepreneurial Mindset:
Foster an enterprising spirit by working on diverse projects, demonstrating time management, resource allocation and risk assessment capabilities to create value.

PO8 — Lifelong Learning:
Engage in continuous self-directed learning to adapt to evolving technologies, societal changes and emerging global challenges.

PO9 — Global Perspective & Cultural Awareness:
Acquire knowledge about the values and beliefs of diverse cultures, effectively engaging with empathy.

PO10 — Ethical Reasoning & Social Responsibility:
Demonstrate moral and value-based principles while being socially conscious and accountable.

PO11 — Civic Engagement & Community Service:
Participate actively in civic life exhibiting a commitment to community service, social justice and the common good.

PO12 — Environmental Sustainability:
Show responsibility to manage and work towards achieving the Sustainable Development Goals (SDGs).

Program Educational Objectives (PEOs) – B.Tech (Hons.)

PEO1: Graduates will be able to apply their knowledge and critical thinking to solve real- world problems, demonstrate leadership and ethics, and contribute to societal progress through lifelong learning and interdisciplinary collaboration.

PEO2: Graduates will drive technological innovation and entrepreneurship, leveraging multidisciplinary research to develop sustainable solutions that address societal challenges.

PEO3: Graduates will engage in global academic and industry collaborations, utilizing advanced computing technologies to lead transformative initiatives for organizational development.

Program Specific Outcomes (PSOs) – B.Tech (Hons.)

A graduate of the B.Tech will also demonstrate;

PSO1: Professional Readiness for Evolving Tech Ecosystems:
Demonstrate readiness for professional roles, higher studies, research, or entrepreneurship by continuously adapting to emerging technologies.

PSO2: Tech-Driven Community Engagement:
Engage with societal challenges to develop impactful, technology-driven solutions that serve and empower communities.

PSO3: Design and Innovation in Emerging Technology Landscapes:
Apply engineering principles to build secure and scalable systems and solve complex problems in cutting-edge fields by integrating theory with practical and ethical insights.

Credit Distribution (4-Year UG Honours — 180 Credits)

No.	Category	Credits
1	Core – Major (Core)	95
2	Minor – Minor Stream	32
3	MD – Multidisciplinary	8
4	AEC – Ability Enhancement Courses	8
5	SEC – Skill Enhancement Courses	9
6	VAC – Value Added Courses	6
7	SI – Summer Internship	2
8	Project / Dissertation	12
	Total	**172**

B.Tech (Honours) Course Matrix

Sem	Core	Minors	MD	AEC	SEC	VAC	SI	PD	Credits
SEM 1	16			2	2	2			**22**
SEM 2	20				2	2			**24**
SEM 3	13	6	2		3				**24**
SEM 4	14	6	2		2				**24**
SEM 5	12	6	2				2		**22**
SEM 6	09	6	2	3		2			**22**
SEM 7	11	4		3				6	**24**
SEM 8		4						6	**10**
Total	**95**	**32**	**8**	**8**	**9**	**6**	**2**	**12**	**172**

B.Tech 2026-27 Course Scheme — Semester 1

Type	Code	Subject	Cr.	L–T–P	Internal		Sem. End		Pass
					Max	Min	Max	Min	
Core	CS1812	Discrete Maths and Set Theory	3	2-1-0	70	28	30	12	40
Core	CS1003	Programming in C	4	3-0-2	70	28	30	12	40
Core	CS1309	Web Technology	3	1-1-2	70	28	30	12	40
Core	CS1111	Basic Electrical and Electronics Engineering	3	2-0-2	70	28	30	12	40
Core	CS1841	Engineering Explorations	3	1-1-2	70	28	30	12	40
Core	CS1806	Exploring Science	3	0-2-2	70	28	30	12	40
AEC	CS1927	English Communication	2	0-1-2	70	28	30	12	40
SEC	CS1929	Structured Innovation with Design Thinking	2	0-1-2	70	28	30	12	40
SEC	CS1929	Constitution of India and Professional Ethics	2	1-1-0	70	28	30	12	40
VAC	CS1925	Yoga & Wellbeing	2	0-1-2	70	28	30	12	40
Total			**22**						

L – Lecture, T – Tutorial, P – Practical / Project

The courses **Engineering Explorations** and **Exploring Science** will be delivered in alternate semesters. In each semester, approximately 50% of the students will enroll in Engineering Explorations, while the remaining 50% will enroll in Exploring Science. The groups will interchange in the subsequent semester so that all students complete both courses.

B.Tech 2026-27 Course Scheme — Semester 2

Type	Code	Subject	Cr.	L–T–P	Internal		Sem. End		Pass
					Max	Min	Max	Min	
Core	CS1807	Linear Algebra	3	2-1-0	70	28	30	12	40
Core	CS1006	Data Structures	4	2-1-2	70	28	30	12	40
Core	CS1211	Database Management Systems	4	2-1-2	70	28	30	12	40
Core	CS1103	Operating Systems	3	–	70	28	30	12	40
Core	CS1112	Digital Circuits and Systems	3	2-0-2	70	28	30	12	40
Core	CS1841	Engineering Explorations	3	1-1-2	70	28	30	12	40
Core	CS1806	Exploring Science	3	0-2-2	70	28	30	12	40
SEC	CS1940	Entrepreneurial Mindset	2	1-0-2	70	28	30	12	40
SEC	CS1929	Constitution of India and Professional Ethics	2	1-1-0	70	28	30	12	40
VAC	CS1925	Yoga & Wellbeing	2	0-1-2	70	28	30	12	40
Total			**24**						

L – Lecture, T – Tutorial, P – Practical / Project

The courses **Engineering Explorations** and **Exploring Science** will be delivered in alternate semesters. In each semester, approximately 50% of the students will enroll in Engineering Explorations, while the remaining 50% will enroll in Exploring Science. The groups will interchange in the subsequent semester so that all students complete both courses.

Semester - **I**			
Course: **DISCRETE MATHS AND SET THEORY**			
Program	**B.Tech. (Hons) CSE**	Category	**Major (Core)**
Course Code	**CS1812**	CIE Marks	**70**
Credits (L:T:P)	**3 (2:1:0)**	SEE Marks	**30**
Hours	**30L + 15T + 0P = 45**	SEE Mode	**Theory**

Course Objectives: students will be able to	
1	Introduce the fundamental concepts of discrete mathematics essential for computer science and engineering.
2	Focus on set theory principles to build a strong mathematical foundation for problem-solving in computing disciplines.
3	Describe and analyse fundamental concepts of logic and set theory, including propositions, predicates, set operations, and relations.
4	Explain the concepts of functions and combinatorics, emphasising their role in the development of algorithms, data structures, and computational models.

Module - 1	**4 hours**
Sets and operations on sets, Set-builder notations, types of sets, union, intersection, complement, difference, symmetric difference, their properties and laws, Venn diagrams, Cartesian Product, cardinality; multisets.	

Module - 2	**8 hours**
Propositions and truth tables, tautologies and contradictions, logical equivalence, algebra of propositions, logical implications, predicate logic.	

Module - 3	**6 hours**
Relations, functions–one-to-one, onto functions, Bijective function. The Pigeon-hole principle, composition of functions; invertibility and Inverse of function.	

Module - 4	**6 hours**
The Rules of Sum and Product, Permutations, Permutations with repetitions, Combinations.	

Module - 5	**6 hours**
Combinations – The Binomial Theorem, Combinations with Repetition, The Catalan numbers.	

Course Outcomes: After completing the course, the students will be able to	
1	Apply the concepts of set theory to solve problems in relevant domains.
2	Apply truth tables, logical equivalences, and predicate logic to solve reasoning-based problems.
3	Apply relations, functions, and the pigeonhole principle to solve computational problems.
4	Apply principles of combinatorics to solve basic counting problems.

Text Books	
1	Rosen K, Discrete Mathematics and Its Applications, McGrawHill, 8th edition, 2021, ISBN: 978-9390727353
2	N Ch S N Iyengar, V M Chandrasekaran, Discrete Mathematics, Vikas Publishers, First Edition, 2003, ISBN :978-8125913627

Reference Books and Resources	
1	Michael Huth Camp; Mark Ryan, "Logic in Computer Science: Modelling and Reasoning about Systems", Cambridge University Press, Second 2004, ISBN- (13):978-0521543101
2	Basavaraj S Anami and Venakanna S Madalli "Discrete Mathematics – A Concept based approach", Universities Press, 2016, ISBN-(13): 978-8173719998
3	Lipschitz, Lipson, Discrete Mathematics, McGrawHill, Second 1992, ISBN : 978- 0070380318
4	G. Shanker Rao, Discrete Mathematical Structures, New Age International, 2007 ; ISBN, 8122426697, 9788122426694
5	Discrete Mathematics - https://nptel.ac.in/courses/106108227
6	Discrete Mathematics - https://nptel.ac.in/courses/106106183
7	Introduction to the Theory of Sets - https://nptel.ac.in/courses/111107058

Tutorials	**15 Hours**
1	Venn diagrams.
2	Cartesian Product
3	Propositions and truth tables.
4	Tautologies and contradictions
5	Algebra of propositions
6	Predicate logic.
7	Bijective functions.
8	The Pigeon-hole principle - AI Tools and Visualization

Tutorials (continued)	
9	Inverse of function.
10	The Rules of Sum and Product.
11	Permutations with repetitions - AI Tools and Visualization
12	Combinations.
13	Combinations – The Binomial Theorem. - AI Tools and Visualization
14	Combinations with Repetition - AI Tools and Visualization
15	The Catalan Numbers.

Semester - **I**			
Course: **PROGRAMMING IN C**			
Program	**B.Tech. (Hons) CSE**	Category	**Major (Core)**
Course Code	**CS1003**	CIE Marks	**70**
Credits (L:T:P)	**4 (3:0:2)**	SEE Marks	**30**
Hours	**45L + 0T + 30P = 75**	SEE Mode	**Theory**

Course Objectives: students will be able to	
1	To demonstrate fundamental concepts of C programming for computational problem solving.
2	To enable the use of control structures and data handling techniques for developing efficient C programs.
3	To facilitate the development of modular and reusable programs using functions, pointers, structures, and dynamic memory allocation.
4	To enhance the ability to analyze, test, and debug C programs using structured programming practices.

Module - 1 : Problem Solving Techniques, Fundamentals of C, Data Concepts and Operators	**9 hours**
Problem-solving techniques, Phases of developing a running computer program in C; structure of a 'C' program; memory layout of C programs; execution of C programs; C preprocessor directives; data types, variables, constants; input/output functions; C operators and expressions; Types of errors. AI-Assisted Peer Discussion: Analysing erroneous C code snippets using AI-guided tools to identify and understand syntax, runtime, and logical errors.	

Module - 2 : Decision Control and Loops	**9 hours**
Decision-making constructs: if, if-else, nested if, and switch statements; looping constructs: for, while, and do-while loops; use of break and continue statements; nested loops and pattern generation programs; AI- Guided Activity: Use AI-guided tools to analyze different test cases, evaluate program behavior for varying inputs, and observe the corresponding outputs of decision-making and looping constructs.	

Module - 3 : Arrays and Strings	**9 hours**

One-dimensional and two-dimensional arrays: declaration, initialization, traversal, searching, and basic array operations; strings as character arrays; string input/output and manipulation; standard built-in string functions; AI- Aided Activity: Use debugging tools to identify program errors and AI-guided tools to visualize execution flow, and analyze logic.

Module - 4 : Functions and Pointers	**9 hours**
Functions: declaration, definition, parameter passing; recursion basics; pointers and pointer arithmetic; relationship between arrays and pointers; dynamic memory allocation. AI-Assisted Mini Task: Using AI-guided tools, develop optimised modular C program to solve the problem statement.	

Module - 5 : Structures and File Handling	**9 hours**
Structures and unions; arrays of structures; file handling using text files (read, write, and append operations); programs using structures and file handling for data storage and retrieval. AI-Assisted Demonstration: Use AI-guided tools to visualize and analyze file handling operations, including record storage, retrieval, updating, and searching using structures and text files.	

Course Outcomes: After completing the course, the students will be able to	
1	Demonstrate the fundamental concepts of C programming to understand data types, operators, expressions, and program structure.
2	Apply decision-making and looping constructs to solve computational problems in C programming.
3	Develop programs using arrays, strings, functions, pointers, and dynamic memory allocation for problem solving applications.
4	Analyze and implement programs using structures, unions, and file handling techniques for data storage and processing applications.

Text Books	
1	Kanetkar, Y. Let Us C: Authentic guide to C programming language (21st ed.). BPB Publications. 2025. ISBN: 9388176642
2	Balagurusamy, E. Programming in ANSI C (8th ed.). McGraw Hill Education. 2024. ISBN – 9355326726
3	Thareja, R. Computer fundamentals and programming in C (3rd ed.). Oxford University Press. 2023. ISBN - 9354977898

Reference Books and Resources	
1	Bryant, R. E., & O'Hallaron, D. R. Computer systems: A programmer's perspective (3rd ed.). Pearson. 2023. ISBN - 013409266X

Reference Books and Resources (continued)	
2	Deitel, P., & Deitel, H. C how to program (8th ed.) Pearson. 2024.ISBN - 0134147308
3	Kernighan, B. W., & Ritchie, D. M. The C programming language (2nd ed.). Pearson Education India. 2023. ISBN: 978-9332549449
4	Introduction to Programming in C by Prof. Satyadev Nandakumar ,IIT Kanpur Link: https://onlinecourses.nptel.ac.in/noc25_cs119/preview
5	Problem Solving Through Programming In C by Prof. Anupam Basu, IIT Kharagpur Link: https://onlinecourses.nptel.ac.in/noc26_cs53/preview
6	C Programming: Youtube playlist by Jaspreet Singh, Neso Academy https://www.youtube.com/playlist?list=PLBlnK6fEyqRggZZgYpPMUxdY1CYkZtARR

Lab Programs / Practical	30 Hours
1	Write a C program using basic input/output functions and arithmetic operators to accept two integers, perform arithmetic operations, and display the results with proper formatting and type casting.
2	Write a C program using arithmetic operators and if-else statements to compute an employee's gross salary by calculating allowances and deductions based on given conditions.
3	Write a C program using if-else (including nested if) to accept marks of 5 subjects, calculate percentage, and assign grades based on specified criteria with input validation.
4	Write a C program using loops and conditional statements to check whether a given number is prime, palindrome, and Armstrong.
5	Write a C program using nested loops to generate different patterns (right-angled triangle, inverted right-angled triangle and pyramid) based on user input. AI Integration: Use AI visualization tools to understand loop execution behaviour and preview output patterns.
6	Write a C program using arrays and loops to perform operations such as searching for an element, finding the largest and smallest values, and computing the average of array elements.
7	Write a C program using arrays and loops to perform search operation using binary search. AI Integration: Use AI visualization tools to understand loop execution behaviour
8	Write a C program using two-dimensional arrays and loops to perform matrix addition and display the result in matrix form.

Lab Programs / Practical (continued)	
9	Write a C program using two-dimensional arrays and loops to perform matrix Multiplication, and display the result in matrix form. AI Integration: Use AI-assisted tools for validating matrix computations, debugging indexing errors, and analyzing execution steps.
10	Write a C program using strings and loops (without using built-in string functions) to find the length of a string, reverse it, and check whether it is a palindrome. AI Integration: Use AI debugging and explanation tools to understand character array manipulation and memory handling.
11	Write a C program using iteration to compute factorial and generate the Fibonacci series.
12	Write a C program using recursion to compute factorial and generate the Fibonacci series. AI Integration: Use AI visualization tools to trace recursive calls and understand stack memory behaviour.
13	Write a C program for passing two-dimensional arrays to functions using pointers to perform matrix addition and multiplication. AI Integration: Use AI-assisted code analyzer to understand pointer arithmetic, memory mapping, and function parameter passing.
14	Write a C program using structures, pointers, and dynamic memory allocation to store details of n students (such as name and marks), and compute the sum, average, and top scorer using pointer access.
15	Write a C program using structures and file handling to store electricity consumption details of customers and compute bill amounts based on usage slabs, while maintaining billing records in a file. AI Integration: Use AI tools to verify computational logic, analyze boundary test cases, and identify errors in file processing operations.

Semester - **I**			
Course: **WEB TECHNOLOGY**			
Program	**B.Tech. (Hons) CSE**	Category	**Major (Core)**
Course Code	**CS1309**	CIE Marks	**70**
Credits (L:T:P)	**3 (1:1:2)**	SEE Marks	**30**
Hours	**15L + 15T + 30P = 60**	SEE Mode	**Jury**

Course Objectives: students will be able to	
1	To understand the fundamentals of web development and use HTML to create structured web pages with tables and forms.
2	To apply CSS for styling web pages, including layouts, text formatting, and responsive design.
3	To use JavaScript and React to create interactive web applications and handle DOM manipulation and components.
4	To design responsive and user-friendly web interfaces using Bootstrap and basic UI/UX principles.

Module - 1	**3 hours**
Understanding Web Development, Static Vs Dynamic website, Front end development, back-end development, Full stack development. Understand the basic principles and concepts of the Internet, Introduction to HTML, HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML Tables and Forms.	

Module - 2	**2 hours**
CSS and its Syntax, Location of Styles, Selectors, CSS Text Styling, Font, Background, Border Properties.	

Module - 3	**2 hours**
The Cascade: How Styles Interact, CSS for Links, CSS Styling Tables, CSS forms styling, The Box Model, CSS styling images, Responsive Images. Understand Layout to Style: CSS Layouts, CSS Specificity, CSS Units	

Module - 4	**6 hours**
Introduction to JavaScript, Functions, Arrays, and Objects, ES6 Features (Arrow Functions, Destructuring, Spread Operator), DOM Manipulation and Event Handling, Introduction to Component-Based Development, JSX and Functional Components, Props, State, and React Hooks (useState, useEffect), Basic Routing using React Router.	

Module - 5	2 hours
Bootstrap Usage: Understand Grid System, Responsive Design, Understanding Components, Forms, Buttons, Navigation, Cards, Modals, Carousel. Overview of Figma.	

Course Outcomes: After completing the course, the students will be able to	
1	Build structured web pages using HTML including tables and forms.
2	Apply CSS to create visually appealing, well-structured, and responsive web page designs.
3	Develop interactive and dynamic web applications using JavaScript and React, incorporating event handling, DOM manipulation, and component-based architecture.
4	Design and develop responsive web applications using Bootstrap and create intuitive UI & UX using tools like Figma.

Text Books	
1	J. Robbins, Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics, 5th ed. Sebastopol, CA, USA: O'Reilly Media, 2018, ISBN: 9781491960202.
2	Z. Ruvalcaba and A. Delamater, Murach's HTML and CSS, 6th ed. Fresno, CA, USA: Mike Murach & Associates, 2024, ISBN: 9781943872862.
3	A. Banks and E. Porcello, Learning React: Modern Patterns for Developing React Apps, 3rd ed. Sebastopol, CA, USA: O'Reilly Media, 2023, ISBN: 9781492051725.

Reference Books and Resources	
1	M. Haverbeke, Eloquent JavaScript, 4th ed. San Francisco, CA, USA: No Starch Press, 2024, ISBN: 9781593279509.
2	D. Flanagan, JavaScript: The Definitive Guide, 7th ed. Sebastopol, CA, USA: O'Reilly Media, 2020, ISBN: 9781491952023.
3	S. Krug, Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability, 3rd ed. Berkeley, CA, USA: New Riders, 2014, ISBN: 9780321965516.

Tutorials	**15 Hours**
1	Understand web development concepts, internet basics, and differentiate between static and dynamic websites.
2	Create structured web pages using HTML syntax, elements, and semantic tags.
3	Design and implement HTML tables to display structured data effectively.

Tutorials (continued)	
4	Develop web forms using HTML with various input types and validation features.
5	Apply basic CSS styling using selectors, colors, fonts, backgrounds, and borders.
6	Implement CSS text formatting and font styling to enhance web page appearance.
7	Design layouts using CSS box model, spacing, and positioning techniques.
8	Apply advanced CSS concepts including specificity, units, and responsive design principles.
9	Style links, tables, forms, and images using CSS for better user interface design.
10	Implement JavaScript basics including variables, functions, arrays, and objects.
11	Perform DOM manipulation and event handling using JavaScript to create interactive web pages.
12	Apply ES6 features such as arrow functions, destructuring, and spread operator.
13	Develop basic React applications using JSX and functional components.
14	Implement props, state, and React hooks (useState, useEffect) in React applications.
15	Design responsive web pages using Bootstrap components and create basic UI/UX prototypes using Figma.

Lab Programs / Practical	**30 Hours**
Part A: Lab Programs	
1	Create a simple web page using HTML that includes headings, paragraphs, lists, links, and images to understand basic structure.
2	Design a web page layout using HTML semantic tags such as header, footer, section, and nav.
3	Apply CSS to style a web page using colors, fonts, backgrounds, and basic layout techniques.
4	Design a responsive layout using CSS Flexbox or Grid.
5	Write JavaScript programs to demonstrate variables, data types, operators, and basic functions.
6	Implement JavaScript event handling such as button clicks, form submission, and keyboard events.

Lab Programs / Practical (continued)	
7	Perform DOM manipulation using JavaScript to dynamically update content, styles, and elements.
8	Create a simple form validation system using JavaScript to validate user inputs.
9	Develop a small interactive project using JavaScript (e.g., calculator or to-do list).
10	Create a basic React application using JSX and functional components.
11	Implement props, state, and React hooks (useState, useEffect) to manage dynamic data.
12	Build a simple React application with basic routing and design a responsive UI using Bootstrap components.
Part B: Mini Project	
Students are required to create a website that effectively integrates and demonstrates their comprehension and application of the topics covered. It is essential that all key concepts from the course are clearly exhibited. The website should be functional and user-friendly.	

Semester - **I**			
Course: **BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**			
Program	**B.Tech. (Hons) CSE**	Category	**Major (Core)**
Course Code	**CS1111**	CIE Marks	**70**
Credits (L:T:P)	**3 (2:0:2)**	SEE Marks	**30**
Hours	**30L + 0T + 30P = 60**	SEE Mode	**Theory**

Course Objectives: students will be able to	
1	Explain fundamental electrical concepts, including circuit laws, electromagnetic induction, and basic electrical machines.
2	Apply circuit analysis techniques to compute electrical parameters such as current, voltage, power, and energy in DC networks and transformers.
3	Analyse the operation and characteristics of semiconductor devices and electronic circuits including diodes, rectifiers, and BJTs.
4	Apply digital electronics concepts and analyse logic circuits using Boolean algebra, number systems, and simplification techniques for real-world applications.

Module-1 :Basic Electrical Fundamentals	**6 hours**
Electrical Circuits: Ohm's Law and Kirchhoff's Laws, analysis of series, parallel and series- parallel circuits excited by independent voltage sources. Power and Energy. Illustrative examples. Electromagnetic induction: Definition of Electromagnetic Induction, Faraday's Laws, Fleming's right-hand rule, Lenz's Law, Statically and dynamically induced emf.	

Module - 2:Electrical Machines	**6 hours**
DC Machines: Principle of operation of generators, constructional details, induced emf expression, types of generators, and the relation between induced emf and terminal voltage. Principle of operation of motors, back emf and torque equations, types of motors. Transformers: Necessity of transformer, principle of operation, types, and construction of single-phase transformers, emf equation, losses, variation of losses with respect to load, efficiency, and condition for maximum efficiency.	

Module - 3: Semiconductor Devices and Application	**6 hours**
Semiconductor Diodes and Applications : Diode approximations, DC load line analysis, Half-wave rectifier, Full-wave rectifier, Bridge rectifier, Capacitor filter circuit. Bipolar Junction Transistors : BJT operation, BJT Voltages and Currents, BJT amplification, Common Base, Common Emitter and Common Collector Characteristics, Numerical examples as applicable.	

Module - 4: Digital Electronics	6 hours
Digital Circuits: Logic gates, NOT Gate, AND Gate, OR Gate, XOR Gate, NAND Gate, NOR Gate, X-NOR Gate. Algebraic Simplification, NAND and NOR Implementation: NAND Implementation, NOR Implementation. Switching and Logic Levels, Digital Waveform. Number Systems: Types and Conversions. Boolean Algebra Theorems, De Morgan's theorem. k-MAP simplification of algebraic expression.	

Module - 5:Real time Applications	6 hours
Voltage regulators, regulated power supplies, transistors as switch and amplifiers. Electricity bill: Power rating of household appliances, electricity tariff units and computations. Equipment Safety measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits.	

Course Outcomes: After completing the course, the students will be able to	
1	Analyze the working principles of DC machines such as motors and transformers and compute the pricing of power consumption
2	Perform analysis of the electrical circuits and compute electromagnetic induction in principle and understand the working of fuse and MCB.
3	Apply the principles of semiconductor diode and transistors to design relevant applications.
4	Apply Boolean algebra and number system conversions in the design of combinational logic circuits.

Text Books	
1	A text book of Electrical Technology by B.L. Theraja, S Chand and Company, reprint edition 2014,ISBN: 8121924413, 9788121924412
2	Mike Tooley "Electronic Circuits Fundamentals & Applications,"5th Edition, Elsevier, 2020.ISBN: 978-0367421984
3	Digital Logic and Computer Design, M. Morris Mano, Pearson Education, 2017, ISBN: 978-93-325- 4252-5

Reference Books and Resources	
1	S. K. Bhattacharya, "Basic Electrical and Electronics Engineering", Pearson, 2012. ISBN:978-81-317-5456-6
2	David Bell, "Electronic Devices and Circuits", 11th Edition, Oxford University Press, 2015. ISBN:978-9332542600
3	Michael Tooley A., "Electronic circuits: Fundamentals and Applications", 9th Edition, Elsevier Limited, 2025.ISBN-978-9367139888.
4	K.Vijayarekha, "Basic Electrical and Electronics Engineering", Cengage, 9th Edition, Pearson, 2025, ISBN: 9789332586505.

Reference Books and Resources (continued)	
5	Web links and Video Lectures (e-Resources): • https://nptel.ac.in/courses/122106025 • https://nptel.ac.in/courses/10
6	www.nptel.ac.in Principle of Electrical Sciences, Prof Sanjay Agrawal, Indira Gandhi National Open University. Electricity and Electrical Wiring, Dr. Antara Mahanta Barua, Krishna Kanta Handiqui State Open University, Guwahati.

Lab Programs / Practical	**30 Hours**
1	Verification of Ohm's Law, Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL).
2	Design of Half Wave Rectifier with Filter and Full Wave Rectifier
3	Plot the Input & Output Characteristics of BJT in CE Configuration
4	Verification of Basic Logic Gates (AND, OR, NOT, NAND, NOR, XOR, XNOR)
5	Verification of De Morgan's Theorem
6	Design and Implement of basic gates using universal gates
7	Design and Implement of basic gates using BJT
8	Design and Implement 4-bit Binary to Decimal Conversion circuit
9	Simply and implement boolean expression with k-map using basic gates
10	Simply and implement boolean expression with k-map using Universal gates

Semester - **I**			
Course: **ENGINEERING EXPLORATIONS**			
Program	**B.Tech. (Hons) CSE**	Category	**Major (Elective)**
Course Code	**CS1841**	CIE Marks	**70**
Credits (L:T:P)	**3 (1:1:2)**	SEE Marks	**30**
Hours	**15L + 15T + 30P = 60**	SEE Mode	**Jury**

Course Objectives: students will be able to	
1	To introduce the fundamentals of engineering visualization, BIS conventions, and freehand sketching techniques for accurate graphical representation of engineering components.
2	To develop the ability to construct and interpret orthographic projections of points, lines, planes, and solids using standard projection methods.
3	To enable students to create isometric projections of simple and composite solids for effective 3D visualization of engineering objects.
4	To familiarize students with Computer Aided Engineering Drawing (CAED) tools and additive manufacturing processes for designing, modelling, and 3D printing basic geometric components.

Module - 1	**8 hours**
Importance of Engineering drawing, BIS Conventions of Engineering Drawing, Free-hand sketching of engineering drawing, Scales (Only introduction, Not for CIE & SEE). Introduction to Computer Aided Drafting software, Coordinate system and reference planes HP, VP, RPP & LPP of 2D/3D environment. Selection of drawing sheet size and scale. Orthographic Projections of Points and Lines :Introduction to Orthographic projections: Orthographic projections of points in 1st and 3rd quadrants. Orthographic projections of lines (Placed in First quadrant only). Orthographic Projections of Planes: Orthographic projections of planes viz triangle, square, rectangle, pentagon, hexagon, and circular laminae (Placed in First quadrant only using change of position method).	

Module - 2	**6 hours**
Orthographic projection of right regular solids (Solids Resting on HP only): Prisms & Pyramids (triangle, square, rectangle, pentagon, hexagon, cube).	

Module - 3	**6 hours**

Isometric scale, Isometric projection of hexahedron (cube), right regular prisms, pyramids, cylinders, cones and spheres. Isometric projection of combination of two simple solids. Conversion of simple isometric drawings into orthographic views. Problems on applications of Isometric projections of simple objects / engineering components.

Module - 4	**5 hours**
Create software drawing for real-world objects. Drawing Simple Mechanisms; Bicycles, Tricycles, Gear trains, Ratchets, two-wheeler cart &Four-wheeler carts to dimensions etc Electric Wiring and lighting diagrams; Like, Automatic fire alarm, Call bell system, UPS system, Basic power distribution system using suitable software Basic Building Drawing; Like, Architectural floor plan, basic foundation drawing, steel structures-Frames, bridges, trusses using Auto CAD or suitable software, Electronics Engineering Drawings- Like, Simple Electronics Circuit Drawings, practice on layers concept.	

Module - 5	**5 hours**
Generic Additive Manufacturing (AM) process, the benefits of Additive Manufacturing, the steps in additive manufacturing & importance. Techniques in Additive Manufacturing, Materials and 3D Printing Workflow, Post-processing, Quality Checking & Applications. Project: 3D Printing of Geometric Shapes by Reverse Engineering. CAED for Additive Manufacturing: Introduction to CAED modelling in 3D printing. Introduction to CAD environment, Sketching, Modelling and Editing features, Different file formats, Export/Import geometries, Part orientation, Layer slicing, Process path selection, Printing. Project: 3D Printing of Geometric Shapes like Triangle, Pentagon, and Hexagon	

Course Outcomes: After completing the course, the students will be able to	
1	Apply BIS conventions, freehand sketching, orthographic projections, and computer-aided drafting concepts to visualize and represent engineering components in 2D and 3D.
2	Construct orthographic projections of points, lines, planes, and solids using first-angle projection principles, demonstrating a clear understanding of spatial visualization.
3	Evaluate isometric projections of various solids and their combinations using isometric scale and projection techniques to represent real-world 3D objects.
4	Demonstrate the use of CAED tools in additive manufacturing processes by creating, modeling, and 3D printing simple geometric shapes using proper slicing, orientation, and post-processing methods.

Text Books	
1	Engineering Drawing by N.D. Bhatt. 53rd Edition. Charotar Publishing House. ISBN-10: 9385039270, 2014
2	Additive Manufacturing: Materials, Processes, Quantifications, and Applications by Kun Zhou. 1st Edition. CRC Press. ISBN-10: 1138333448, 2018

Reference Books and Resources	
1	Engineering Graphics with AutoCAD by James D. Bethune. 1st Edition. Pearson Education. ISBN-10: 0134251648. 2019
2	Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing by Ian Gibson, David W. Rosen, and Brent Stucker. 2nd Edition. Springer. ISBN-10: 1493921134, 2015

Lab Programs / Practical	**30 Hours**
1	Orthographic Projections of Points, Lines, Planes and Solids
2	Isometric Projection of Solids
3	Learn to create 3D models using Solid Edge software and prepare them for printing using slicing software.
4	Slicing STL file and study of the effect of process parameters like layer thickness, Orientation and infill on build time using software
5	3D printing of a Simple Cube component by Using Stereolithography (SLA) 3D Printer.
6	Modelling components using 3D Scanner of a real-life object of unknown dimensions in reverse engineering.
7	AI-Based Sketch to CAD Conversion.
8	AI for Conversion of 2D Drawings to 3D Models.

Semester - **I**			
Course: **EXPLORING SCIENCE**			
Program	**B.Tech. (Hons) CSE**	Category	**Major (Elective)**
Course Code	**CS1806**	CIE Marks	**70**
Credits (L:T:P)	**3 (2:0:2)**	SEE Marks	**30**
Hours	**30L + 0T + 30P = 60**	SEE Mode	**Theory**

Course Objectives: students will be able to	
1	Understand the fundamentals of semiconductor physics, including band theory, intrinsic and extrinsic semiconductors, and the operation of devices like diodes, transistors, and optoelectronic components.
2	Analyze crystal structures through Bravais lattices, Miller indices, and X-ray diffraction to determine material properties
3	Explore the synthesis, unique properties, and technological applications of nanomaterials, along with the basics of quantum mechanics and an introduction to quantum computing concepts.
4	Examine environmental issues including pollutants, e-waste management, and sustainable methods for water and waste management

Module - 1	**7 hours**
Introduction to Semiconductor Physics and Device Technology: Classification of solids based on band theory. Intrinsic and extrinsic semiconductors (concept of electrons and holes, mobility). Diode and its characteristics. Zener diode. Transistor and its input and output characteristics. Photodiode, light-emitting diode, and solar cells.	

Module - 2	**7 hours**
Crystal Structure: Properties of Crystals, Crystal Lattice (Primitive Cell and Unit Cell—Lattice Parameters), and Crystal Systems. Bravais lattice (primitive - body-centered - face-centered - base-centered). Miller Indices and Atomic Packing Fraction (SC - BCC – FCC). Bragg's Law and X-ray Diffraction.	

Module - 3	**3 hours**
Nanomaterials: Introduction to Nanomaterials. Advantages of miniaturization. Surface Area to Volume Ratio. Properties of nanomaterials. Techniques of synthesis of nanomaterials (Top down - bottom up - Photolithography - Ball milling - Chemical Vapor Deposition). Nanoscience vs. Nanotechnology and Applications of Nanotechnology.	

Module - 4	**10 hours**

Introduction to Quantum Mechanics and Quantum Computing: Pre-Quantum era experiments (Young's double-slit experiment, blackbody radiation, the Hertz experiment, Planck's law, and Heisenberg's microscope) - Einstein's Photoelectric Equation. Heisenberg's uncertainty principle. Principle of Superposition. Measurement and observables. Hermitian operators, quantum states. Schrodinger equation. Exactly solvable problems (free particle - infinite potential well). A Brief Introduction to Quantum Computing (Qubits, Quantum Gates, Entanglement, and Superposition).

Module - 5	**3 hours**
Earth and Environmental Science: Climate science and modeling. Environmental Pollutants (sulfites, carbides, heavy metals, non-chemical, suspended particles). Water Management. Waste management (sources of e-waste, composition, characteristics, health hazards due to exposure to e-waste, and methods of recycling).	

Course Outcomes: After completing the course, the students will be able to	
1	Explain semiconductor behavior, diode characteristics, and transistor operation based on band theory and charge carrier dynamics.
2	Analyze crystal structures using Miller indices and Bragg's law, and interpret X-ray diffraction patterns to determine material properties.
3	Illustrate fundamental quantum phenomena underlying the properties and applications of nanostructures.
4	Evaluate environmental pollutants, e-waste hazards, and strategies for sustainable water and waste management.

Text Books	
1	P. C. Deshmukh, Quantum Mechanics: Formalism, Methodologies, and Applications. Cambridge, U.K.: Cambridge University Press, 2023. ISBN: 978-1316512258.
2	S. Roy, Environmental Science (AICTE Prescribed Textbook). New Delhi, India: Khanna Book Publishing Co. Pvt. Ltd., 2021. ISBN: 978-9391505653.
3	S. O. Pillai, Solid State Physics. New Delhi, India: New Age International (P) Ltd., 2015. ISBN: 978-8122436976.

Reference Books and Resources	
1	D. A. Neamen, Semiconductor Physics and Devices. New York, NY, USA: McGraw-Hill, 2017. ISBN: 978-0071070102.
2	B. D. Cullity, Elements of X-Ray Diffraction. Noida, India: Pearson Education India, 2014. ISBN: 978-9332535169
3	A. Nouailhat, An Introduction to Nanoscience and Nanotechnology. Hoboken, NJ, USA: Wiley, 2008. ISBN: 978-1848210073.

Reference Books and Resources (continued)	
4	A. Beiser, Concepts of Modern Physics. New York, NY, USA: McGraw-Hill, 1981. ISBN: 978-0072448481
5	National Academies of Sciences, Engineering, and Medicine, Reproducibility and Replicability in Science. Washington, DC, USA: National Academies Press, 2019. ISBN: 978-0309486163.
6	V. Singh, Textbook of Environment and Ecology. Singapore: Springer Nature Singapore, 2024. ISBN: 978-981-99-8845-7.
7	https://nptel.ac.in/courses/115105099
8	https://onlinecourses.nptel.ac.in/noc25_ce141/preview
9	https://onlinecourses.nptel.ac.in/noc25_ph30/preview
10	https://onlinecourses.nptel.ac.in/noc26_cs89/preview
11	https://onlinecourses.nptel.ac.in/noc26_ge27/preview
12	https://onlinecourses.nptel.ac.in/noc26_ce49/preview

Lab Programs / Practical	30 Hours
1	Study of Error Analysis and Propagation using Vernier Callipers.
2	Study of Error Analysis and Propagation Screw Gauge.
3	Measurement of the grating constant of light using a Diffraction Grating.
4	Measurement of the wavelength of light using a Diffraction Grating.
5	Determination of unknown resistances and capacitors connected in series and parallel using SEELab 3.0 module.
6	Input characteristics of a Bipolar Junction Transistor using SEELab 3.0 module.
7	Output characteristics of a Bipolar Junction Transistor using SEELab 3.0 module.
8	Investigation of IV Characteristics of a Photodiode and Determination of Planck's Constant using SEELab 3.0 module.
9	Study of LDR Characteristics Using Different LEDs
10	Measurement of dielectric constant using a RC circuit.
11	Investigation of Zener Diode for Voltage Regulation Properties using SEELab 3.0 module.
12	Measurement of the thickness of the Given Material using Air Wedge.

Others:

Semester - **I**			
Course: **ENGLISH COMMUNICATION**			
Program	**B.Tech. (Hons) CSE**	Category	**AEC**
Course Code	**CS1927**	CIE Marks	**70**
Credits (L:T:P)	**2 (0:1:2)**	SEE Marks	**30**
Hours	**0L + 15T + 30P = 45**	SEE Mode	**Practical**

Course Objectives: students will be able to	
1	Improve students' ability to read, understand, and analyse technical and academic texts.
2	Develop effective writing skills for academic, technical, and professional communication.
3	Enhance grammar, vocabulary, and sentence structure for clear and accurate language use.
4	Train students to organise and present ideas logically and confidently in formal written communication.

Module - 1	**6 hours**
Fundamentals of English Comprehension: Introduction to Reading Strategies, Skimming and scanning, identifying main ideas and supporting details, Understanding Context and Inference, Contextual clues, Making inferences, Analysing Text Structures, Recognizing patterns (cause-effect, compare-contrast), Identifying thesis statements and arguments.	

Module - 2	**6 hours**
Vocabulary Building and Usage: Expanding Technical Vocabulary, Common terms in computer science and IT, using glossaries and technical dictionaries, Synonyms, Antonyms, and Homonyms, Enhancing word choice, Avoiding common errors, Contextual Vocabulary Usage, Application in sentences and paragraphs, Precision in technical writing.	

Module - 3	**6 hours**
Writing Skills Development: Sentence Structure and Clarity, Constructing clear and concise sentences Avoiding run-on sentences and fragments, Paragraph Development, Topic sentences and supporting details Coherence and cohesion, Essay and Report Writing, Structure of essays and technical reports, Writing introductions, body paragraphs, and conclusions	

Module - 4	**6 hours**

Technical Writing and Documentation : Writing Technical Descriptions and Definitions, Describing processes and systems, Defining technical terms clearly, Creating User Manuals and Guides, writing instructional content, Using visuals and diagrams effectively, Research and Citation Skills, conducting research for technical writing, Proper citation and avoiding plagiarism.

Module - 5	**6 hours**
Effective Communication Skills: Presentation Skills, Structuring presentations, Effective use of visual aids, Professional Email and Correspondence, Email etiquette, Writing formal and informal emails, Collaborative Writing and Peer Review, Working in teams, Reviewing and editing peers' work.	

Course Outcomes: After completing the course, the students will be able to	
1	Apply reading strategies to comprehend and analyze technical and academic texts, identifying main ideas and inferring meaning.
2	Use technical vocabulary, synonyms, and antonyms accurately to enhance clarity and precision in writing.
3	Construct clear, coherent sentences and well-structured essays, reports, and technical documents.
4	Demonstrate effective communication skills by delivering presentations, writing emails, and collaborating on professional writing tasks.

Text Books	
1	Simon Greenall and Michael Swan, Effective Reading, Cambridge University Press, 1st Edition, ISBN: 978-0521317603.

Reference Books and Resources	
1	Online course from the Hindu Group, the STEP English course.

Semester - **I**			
Course: **STRUCTURED INNOVATION WITH DESIGN THINKING**			
Program	**B.Tech. (Hons) CSE**	Category	**SEC**
Course Code	**CS1929**	CIE Marks	**70**
Credits (L:T:P)	**2 (1:0:2)**	SEE Marks	**30**
Hours	**15L + 0T + 30P = 45**	SEE Mode	**Jury**

Course Objectives: students will be able to	
1	To apply design thinking methodologies and AI-assisted tools for analyzing, evaluating, and developing user-centered digital and physical products and prototypes.
2	To understand and implement sustainable practices and AI-supported workflows in prototype development and product innovation.
3	To analyze and enhance existing products by improving aesthetics, functionality, usability, and user experience.
4	To innovate within existing frameworks by developing creative prototypes and effectively communicating design processes, outcomes, and solutions.

Module - 1	**3 hours**
Introduction to Design Thinking: Overview of design thinking principles and stages. Use of AI tools for brainstorming, idea generation, and mapping design thinking workflows. Empathy in Design: Techniques for understanding and empathizing with users, including user interviews and persona creation. Use of AI tools for interview transcription, sentiment analysis, empathy mapping, and AI-assisted persona generation. Reverse Engineering of Websites and Apps: Analyzing existing digital products to understand user experience, interface design, workflow logic, and the thought process behind product development and decision-making. Storytelling as a Tool: Using storytelling to convey user needs and problem statements while balancing AI and creative thinking. Case Studies: Analyzing successful design thinking projects that started with empathy.	

Module - 2	**3 hours**
This module introduces recycling and upcycling concepts, their environmental impact, and the role of sustainability in modern product design. Students will explore the triple constraints of design time, scope, and budget and understand how they influence prototype development. The module also integrates AI-assisted prototyping for idea generation, concept visualization, and virtual product development. Through hands-on activities, students will design and create simple prototypes using recycled materials while applying sustainable and AI-supported design practices.	

Module - 3	3 hours
Understanding the influence of aesthetics in consumer behavior and product design. Adaptation of AI tools for visual trend analysis and aesthetic exploration. Dismantling and evaluating existing products to understand their design and functionality. Enhancement Techniques: Methods for improving product design, focusing on aesthetics and functionality. Consumer Feedback: Gathering and utilizing consumer feedback to guide redesign efforts. Reconstruction Projects: Students reconstruct an existing product with improved aesthetics and functionality.	

Module - 4	3 hours
Innovation vs. Invention: Exploring the difference and focusing on innovation within existing frameworks. Analyzing Market Trends: How to use market research to identify opportunities for innovation. Creative Adaptations: Techniques for creative thinking and adaptation of existing products. Prototyping with Purpose: Building prototypes that address specific user needs or market gaps. Case Studies and Discussions: Use of AI tools for market trend analysis, idea generation, rapid prototyping, product visualization, and AI-assisted innovation research using generative AI-based design tools.	

Module - 5	3 hours
This module focuses on storytelling techniques, presentation skills, and effective communication in product development. Students will learn to create compelling narratives, develop engaging presentations, and use AI-based visual and digital tools to enhance communication. The module also covers stakeholder pitching, project documentation, and incorporating feedback for continuous improvement.	

Course Outcomes: After completing the course, the students will be able to	
1	Apply design thinking, AI-assisted analysis, and reverse engineering techniques to evaluate and develop user-centered digital, physical products and prototypes.
2	Process for sustainable & AI prototype development
3	Enhance existing products focusing on market aesthetics
4	Innovate within frameworks to create new prototypes and communicate

Text Books	
1	Jake Knapp, John Zeratsky, and Braden Kowitz, "Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days" Simon & Schuster (2016), ISBN: 978-1501121746, 1st ed.
2	Idris Mootee "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School" Wiley (2013), ISBN: 978-1118620120, 1st ed.

Reference Books and Resources	
1	Jeanne Liedtka and Tim Ogilvie "Designing for Growth: A Design Thinking Toolkit for Managers" Columbia University Press (2011) ISBN: 978-0231158381, 1st ed.
2	Pavan Soni, Design Your Thinking, Penguin Random House India Private Limited (2020), 978-0670094097, 1st ed.

Lab Programs / Practical	30 Hours
1	AI-Assisted Empathy Mapping and Rapid Prototype Visualization
2	Define & Ideate leveraging AI tools
3	Upcycling to create value for increasing existing problems
4	AI-Assisted Product Research and Prototype development
5	Product variation & Testing
6	Product development: A product with purpose

Semester - **I**			
Course: **CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS**			
Program	**B.Tech. (Hons) CSE**	Category	**VAC**
Course Code	**CS1928**	CIE Marks	**70**
Credits (L:T:P)	**2 (1:1:0)**	SEE Marks	**30**
Hours	**15L + 15T + 0P = 30**	SEE Mode	**Theory**

Course Objectives: students will be able to	
1	Provide foundational understanding of the Indian Constitution, including fundamental rights, duties, and directive principles.
2	Explore the evolution of constitutional values and their role in promoting social justice, equality, and cultural diversity.
3	Foster awareness of inclusivity, dignity of labour, and the contributions of marginalized communities through constitutional provisions.
4	Examine ethical principles in professional and research contexts, emphasizing accountability, integrity, and responsible conduct.

Module - 1	**6 hours**
Historical Background and Making of the Constitution, The Preamble: Vision, Philosophy, and Values, Fundamental Rights (Articles 12–35), Directive Principles of State Policy and Fundamental Duties, Separation of Powers, Federalism, and Judicial Review	

Module - 2	**6 hours**
Evolution of Constitutional Values, Constitutional Vision of Social Justice and Equality, Human Rights and Constitutional Safeguards, Promoting Inclusivity and Cultural Diversity, Ethical Frameworks Applied to Constitutional Governance	

Module - 3	**6 hours**
Inclusivity, Unity in Diversity, and Social Integration, Dignity of Labour: Constitutional and Ethical Dimensions, Articles 23 and 24: Prohibition of Forced Labour and Child Labour, Contributions of Marginalized Communities and Unsung Heroes, Social Welfare Legislation and Constitutional Mandate	

Module - 4	**6 hours**
Foundations of Professional Ethics, Workplace Ethics: Accountability, Transparency, and Integrity, Ethics in Research: Principles and Institutional Standards, Research Misconduct: Plagiarism, Falsification, and Fabrication, Case Studies in Ethical Dilemmas	

Module - 5	6 hours
Democratic Institutions and Electoral Process, Judiciary and Constitutional Adjudication, Governance, Accountability, and Anti-Corruption Mechanisms, Environmental Ethics and Sustainable Development, Contemporary Challenges and the Future of Constitutional Democracy	

Course Outcomes: After completing the course, the students will be able to	
1	Interpret the principles of the Indian Constitution, including Fundamental Rights, Duties, and Directive Principles, and their role in shaping governance, social justice, and equality.
2	Analyze the evolution and impact of India's constitutional values and ethical frameworks in fostering inclusivity, social harmony, and respect for cultural diversity.
3	Cultivate empathy and appreciation for societal roles, including the dignity of labor and contributions of unsung heroes to India's social fabric.
4	Examine ethical issues in research and professional life, emphasizing integrity, accountability, and the role of ethics in promoting a just and equitable society.

Text Books	
1	D. D. Basu, Introduction to the Constitution of India, 27th ed. Haryana, India: LexisNexis, 2024.

Reference Books and Resources	
1	Publications Division, Government of India, Ethics in Governance: Innovations and Issues. New Delhi, India: Publications Division.
2	A. K. Thiruvengadam, The Constitution of India: A Contextual Analysis. Oxford, U.K.: Hart Publishing.
3	S. Choudhry, M. Khosla, and P. B. Mehta, The Oxford Handbook of the Indian Constitution. Oxford, U.K.: Oxford Univ. Press, 2016.
4	R. S. Naagarazan, Professional Ethics and Human Values. New Delhi, India: New Age International Publishers.
5	N. Hasnain, Indian Society and Culture: Continuity and Change. New Delhi, India: Jawahar Publishers.

Semester - **I**			
Course: **YOGA AND WELLBEING**			
Program	**B.Tech. (Hons) CSE**	Category	**VAC**
Course Code	**CS1925**	CIE Marks	**70**
Credits (L:T:P)	**2 (0:1:2)**	SEE Marks	**30**
Hours	**0L + 15T + 30P = 45**	SEE Mode	**Practical**

Course Objectives: students will be able to	
1	Develop physical flexibility, reduce stiffness, and enhance overall range of motion through structured yoga practices.
2	Promote relaxation and stress reduction using mindfulness techniques and controlled breathing exercises.
3	Enhance mental clarity, focus, and concentration through regular yoga and meditation practices.
4	Cultivate present-moment awareness and emotional resilience for improved mindfulness and emotional well-being.

Module - 1	**6 hours**
Definition and Meaning of Yoga, Aims and Objectives, Historical development of Yoga, Eight stages of Yoga, Relevance of Yoga in modern age and scope. Prayers: Shanthi Mantra and Loka Kalyana Mantra. Warm-up Poses: Swasa Kriya, Marjalaswasa, Swanaswasa, Urasandhi chalane, Greeva sandhi chalane, Kati chalane, Super Brain yoga. Suryanamaskara/Pragya Yoga: With Mantras & Breathing pattern.	

Module - 2	**6 hours**
Standing Asanas: Trikonasana, Veerabhadrasana, Vrikshasana, Tadasana, Tiryak Tadasana, Utkatasana. Sitting Asanas: Baddha konasana, Bharadwajasana	

Module - 3	**6 hours**
Ardha Chakrasana, Mandukasana, Ushtrasana, Gomukhasana, Janushirasana, Dhanurasana, Shashankasana.	

Module - 4	**6 hours**
Lying Asanas: Pawanamuktasana, Sarvangasana, Naukasana, Halasana, Chakrasana, Bhujangasana, Shalabhasana, Dhanurasana, Yoga Nidra. Relaxative/ Meditative Asanas: Makarasana, Sukhasana, Padmasana, Vajrasana, Shavasana.	

Module - 5	**6 hours**

Mantra, Breathing- Chest, Abdominal & Yogic, Puraka, Rechaka and Kumbhaka, Anulom-Vilom, Nadishodhan, Suryabhedana, Chadrabhedana, Bhastrika, Bhramri, Sheetali, Shitkari and Kapalabhati.

Course Outcomes: After completing the course, the students will be able to	
1	Introduction to Yoga, Prayers, Starting Practice, Suryanamaskara/Pragya Yoga.
2	Standing Asanas, Sitting Asanas.
3	Lying Asanas, Relaxative/ Meditative Asanas, Pranayama
4	Introduction to Yoga, Prayers, Starting Practice, Suryanamaskara/Pragya Yoga.

Text Books	
1	Iyengar, B. K. S. (2019). Light on yoga. HarperCollins Publishers. ISBN 978-0007107001
2	Iyengar, B. K. S. (2013). Light on pranayama. HarperCollins Publishers. ISBN 978-8172235413
3	Saraswathi, S. S. (2002). Asana pranayama mudra bandha (12th ed.). Yoga Publications Trust, Bihar School of Yoga. ISBN 978-81-86336-14-4
4	Saraswathi, S. S. (2001). Yoga nidra (6th ed.). Yoga Publications Trust. ISBN 978-8185787121

Reference Books and Resources	
1	Feuerstein, G. (2012). The yoga tradition: Its history, literature, philosophy and practice.SCB Distributors; Motilal Banarsidass Publishers. ISBN 978-8120819238
2	Ross, A., & Thomas, S. (2010). The health benefits of yoga and exercise: A review of comparison studies. The Journal of Alternative and Complementary Medicine, 16(1), 3–12. https://doi.org/10.1089/acm.2009.0044

Lab Programs / Practical	**15 Hours**
1	Assessing Breath Awareness and Mindfulness in Marjalaswasa Practice.
2	Demonstrating Cognitive Function and Energy Flow in Super Brain Yoga Practice
3	Assessing Physical Abilities and Breath Awareness in Suryanamaskara Practice.
4	Exploring Physical Abilities and Psychological Well-being in Bhujangasana Practice
5	Exploring Balance and Stability in Vrikshasana Practice.

Lab Programs / Practical (continued)	
6	Practicing Twisting and Spinal Flexibility in Bharadwajasana Practice.
7	Assessing Strength and Alignment in Trikonasana Practice.
8	Practicing Back bending and Emotional Release in Ushtrasana Practice.
9	Strengthening Lower Back and Legs in Shalabhasana Practice.

Semester - **II**			
Course: **LINEAR ALGEBRA**			
Program	**B.Tech. (Hons) CSE**	Category	**Major (Core)**
Course Code	**CS1807**	CIE Marks	**70**
Credits (L:T:P)	**3 (2:1:0)**	SEE Marks	**30**
Hours	**30L + 15T + 0P = 45**	SEE Mode	**Theory**

Course Objectives: students will be able to	
1	Introduce solutions to systems of linear equations using Gauss Elimination, Gauss-Jordan Elimination and Gauss-Seidel method.
2	Describe fundamental concepts to matrix subspaces like span and linear independence and rank-nullity theorem.
3	Illustrate linear transformations and describe and solve eigenvalue problems.
4	Describe orthogonal basis sets and construction of one using Gram-Schimdt process to set the stage for QR decomposition, principal axis theorem, SVD and spectral theory.

Module - 1	**8 hours**
System of linear equations; row echelon form; consistent and inconsistent equations; Gaussian elimination; reduced row echelon form; Gauss-Jordan Elimination, Inverse; LU decomposition; Gauss-Seidel method.	

Module - 2	**4 hours**
Homogeneous equations; span; linear independence/dependence of basis; subspaces; dimension, rank and nullity; rank-nullity theorem.	

Module - 3	**6 hours**
Linear transformations, domains; codomains; range and kernel of a linear map; composition of linear maps; Inverse of a linear transformation; eigenvalue equation; Characteristic equation; eigenvalue and eigenvectors; eigenspaces; similarity and diagonalization.	

Module - 4	**6 hours**
Orthogonality; orthogonal and orthonormal: -basis, matrices, projections, decomposition; Gram-Schmidt orthogonalization; QR decomposition; orthogonal diagonalization	

Module - 5	**6 hours**
Spectral theory; quadratic forms; principal axis theorem; norm and distance; least squares approximation; Singular Value Decomposition.	

Course Outcomes: After completing the course, the students will be able to	
1	Apply Gaussian elimination, LU decomposition and others to solve systems of linear equations.
2	Compute the span, basis and dimension of matrix subspaces to solve related problems in computer science.
3	Compute eigenvalues and eigenvectors of a given matrix to solve real world problems.
4	Apply orthogonal projections, Gram-Schmidt processes, and Singular Value Decomposition to solve approximation problems.

Text Books	
1	D. Poole, Linear Algebra - A Modern Introduction 4th Edn, Cengage Learning India (2018), ISBN-13 978-8131530245.
2	Gilbert Strang, Introduction to Linear Algebra (5th Edn), Wellesley-Cambridge, (2021), ISBN-13 978-1733146654.

Reference Books and Resources	
1	Schaum's outline Linear Algebra, 6 Edn; ISBN-978-126-0011-456 (2018).
2	Introduction to Applied Linear Algebra, Stephen Boyd, Cambridge University Press (2018) [link: https://web.stanford.edu/~boyd/vmls/vmls.pdf], ISBN 978-1-316-51896-0.
3	Linear Algebra and its Application (5th Edn), Lay, Lay, McDonald, Pearson, (2016), ISBN 978-0-321-98238-4.
4	Linear Algebra for Computational Sciences and Engineering, Ferrante Neri, Springer (2019), ISBN 978-3-030-21321-3.
5	Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006, ISBN 9780471728979.
6	Basic Linear Algebra: https://nptel.ac.in/courses/111101115
7	Linear Algebra: https://nptel.ac.in/courses/111106135

Tutorials	**15 Hours**
1	Row echelon form.
2	Gauss-Jordan Elimination.
3	Inverse; LU decomposition.
4	Gauss-Seidel method.
5	Linear independence/dependence. - AI Tools and Visualization.
6	Rank-nullity theorem.
7	Image, range and kernel of a linear map.

Tutorials (continued)	
8	Inverse of a linear transformation.
9	Diagonalization.
10	Orthogonal projections and decomposition. - AI Tools and Visualization
11	Gram-Schmidt orthogonalization - AI Tools and Visualization.
12	QR decomposition.
13	Quadratic forms.
14	Least squares approximation. - AI Tools and Visualization
15	Singular Value Decomposition. - AI Tools and Visualization

Semester - **II**			
Course: **DATA STRUCTURES**			
Program	**B.Tech. (Hons) CSE**	Category	**Major (Core)**
Course Code	**CS1006**	CIE Marks	**70**
Credits (L:T:P)	**4 (2:1:2)**	SEE Marks	**30**
Hours	**30L + 15T + 30P = 75**	SEE Mode	**Practical**

Course Objectives: students will be able to	
1	Introduction to non linear data structure and its use case cases along with their memory utilization. In comparison to their linear data structures counterpart
2	Working with linked lists for solving various real world problems involving queues as primary data structure
3	Working with stacks to tackle real world problems. Work with stacks using recursive methods
4	Introduction to the tree data structure (B-Trees and AVL trees) and its operations

Module - 1	**6 hours**
Strategies for choosing the appropriate data structure. Abstract data types. Stack Memory - Compile Time, Static memory allocation. Heap Memory - Runtime, dynamic memory allocation. Arrays – Revision of basic operations. Implementation of basic operations – Create, Insert, Traverse, Delete, Search and Update.	

Module - 2	**6 hours**
Linked lists – Types – Singly Linked List – Doubly Linked List – Circular Linked List n (Circular Singly, Circular Doubly). Implementation of operations – Create, Insert, Traverse, Delete, Search and Update.	

Module - 3	**6 hours**
Introduction to Stacks and Queues. Implementation of their basic operations. Use basic arrays & link list to create stack & queue data structures.	

Module - 4	**6 hours**
Linear Search, Binary Search, Bubble Sort, Selection Sort, Insertion Sort. Hashing – Hash tables, has functions, strategies to avoid and resolve collisions.	

Module - 5	**6 hours**

Binary Tree, Binary Search Tree, AVL Tree, B-Trees, Common operations on these trees such as select min, select max, create, insert, delete. Perform various types of Tree Traversals.

Course Outcomes: After completing the course, the students will be able to	
1	Understand and explore the concepts of linear and non-linear data structures to develop solutions for diverse problems.
2	Apply the concepts of hashing, sorting and searching techniques to get an optimized solution.
3	Demonstrate good coding practices involving lifelong learning
4	Evaluate and apply appropriate data structure(s) for real-world problems.

Text Books	
1	E. Horowitz and S. Sahni, Fundamentals of Data Structures in C, 2nd ed. Hyderabad, India: Universities Press, 2014, ISBN: 978-8173716058.
2	R. F. Gilberg and B. A. Forouzan, Data Structures: A Pseudocode Approach with C, 2nd ed. New Delhi, India: Cengage Learning India Pvt. Ltd., 2014, ISBN: 978-8131503140.
3	Reema Thareja, Data Structures using C, 3rd Edition (2023), Oxford University Press – ISBN: 978-9354977190

Reference Books and Resources	
1	J.-P. Tremblay and P. G. Sorenson, An Introduction to Data Structures with Applications, 2nd ed. New Delhi, India: McGraw Hill, 2013.
2	A. M. Tenenbaum, Data Structures Using C, New Delhi, India: PHI Learning, 1989.
3	https://nptel.ac.in/courses/106106127
4	https://www.mygreatlearning.com/data-structure/free-courses

Tutorials	**15 Hours**
1	Recursion concept using multiple examples (Fibonacci sequence, factorial etc)
2	List using arrays (operations involving insert, search, display and delete)
3	Stack and its operations using arrays
4	Queue and its operations using arrays (implementation of FIFO queue)
5	Application of Stacks and Queues
6	Singly Linked List and its operations (Singly, Doubly & Circular)
7	Doubly Linked List and its operations
8	Singly Circular Linked List and its operations

Tutorials (continued)	
9	Doubly Circular Linked List and its operations
10	Linear search and Binary search (both iterative & recursive)
11	Implementation of Insertion Sort, Selection Sort & Bubble Sort
12	Hashing using Linear Probing, Quadratic Probing
13	Hashing using Double Hashing
14	Binary search Tree – Creation, Traversal, Searching and Deletion
15	AVL Tree and its Rotations
16	B-Trees - Creation, Traversal, Searching and Deletion

Lab Programs / Practical	**30 Hours**
Part A: Lab Programs	
1	Implementation of Recursion concept
2	Implementation of List using arrays
3	Implementation of Stack and its operations using arrays
4	Implementation of Queue and its operations using arrays
5	Implementation of Linked List and its operations (Singly, Doubly & Circular)
6	Implementation of Linear search and Binary search (both iterative & recursive)
7	Implementation of Insertion Sort Implementation of Hash table using Linear Probing
8	Implementation of Binary search Tree – Creation, Traversal, Searching and Deletion
Part B:	
Students are required to prepare a case study demonstrating the selection and application of appropriate data structures for solving real-world problems. The case study should include analysis, justification for the chosen data structure, and its practical relevance. (AI Tools Permitted)	

Semester - **II**			
Course: **DATABASE MANAGEMENT SYSTEMS**			
Program	**B.Tech. (Hons) CSE**	Category	**Major (Core)**
Course Code	**CS1211**	CIE Marks	**70**
Credits (L:T:P)	**4 (2:1:2)**	SEE Marks	**30**
Hours	**30L + 15T + 30P = 75**	SEE Mode	**Jury**

Course Objectives: students will be able to	
1	To describe fundamental concepts of database systems, including data models, architectures, and schema design.
2	To analyse and decompose database designs using normalisation and functional dependencies to eliminate redundancy and improve efficiency
3	To solve real-world problems by applying database management system concepts.
4	To develop the necessary skills for transaction processing and effective database design.

Module - 1	**8 hours**
Database System vs. File System , Database system architecture, Data Models, Schemas, and Instances , Data independence and Database Languages and Interfaces – DDL, DML, DCL, and TCL Overall Database Structure - Storage Components, Metadata, Database Users, Backup, and Recovery Mechanisms. Characteristics of SQL, advantages of SQL. SQL data type and literals, Types of SQL commands, SQL Operators and their usage , Keys constraints, Domain constraints,Characteristics of SQL, advantages of SQL. SQL data type and literals, Types of SQL commands, SQL Operators and their usage,Insert, update and delete operations,	

Module - 2	**6 hours**
ER model concepts, notation for ER diagrams, mapping constraints, reduction of ER diagrams to tables, relationship of higher degree Integrity constraints, entity integrity, referential integrity, Keys constraints, Domain constraints, relational algebra and relational calculus.	

Module - 3	**4 hours**
Functional dependencies, normal forms, First, Second, and Third Normal Forms , BCNF, Inclusion Dependency , lossless join decompositions, Normalization using Functional Dependencies.	

Module - 4	**5 hours**

Tables, views and indexes, Queries and subqueries, Aggregate functions. Tables, views and indexes, Queries and subqueries, Aggregate functions. Insert, update and delete operations, Joins, Unions, Intersection, Minus, Triggers and Procedures in SQL. Nested Queries, Correlated Subqueries, Views, Constraints in SQL, Cursors

Module - 5	**7 hours**
Transactions and ACID Properties , testing of serializability, serializability of schedules, Conflict and View Serializable Schedules , Deadlocks, Locking Techniques for concurrency control, Timestamp-based Protocols for concurrency control.	

Course Outcomes: After completing the course, the students will be able to	
1	Explore the database concepts, architecture and transaction for DBMS.
2	Design a database application to solve real world problems using ER Diagram.
3	Identify and solve the redundancy problem in database tables using normalization.
4	Apply transaction concepts and concurrency control for data integrity and performance in DBMS.

Text Books	
1	A. Silberschatz, H. F. Korth, and S. Sudarshan, Database System Concepts, 7th ed. New York, NY, USA: McGraw-Hill, 2019, ISBN: 978-9390727506.
2	R. Elmasri and S. B. Navathe, Fundamentals of Database Systems, 7th ed. New Delhi, India: Pearson, 2016, ISBN: 978-9332582705.

Reference Books and Resources	
1	R. Ramakrishnan and J. Gehrke, Database Management Systems, 3rd ed. New York, NY, USA: McGraw-Hill, 2002, ISBN: 978-0072465631.
2	https://nptel.ac.in/courses/106106127
3	https://www.mygreatlearning.com/data-structure/free-courses

Tutorials	**15 Hours**
1	Database Architecture & Components
2	ER Model & Diagram Representation
3	Converting ER Diagrams to Tables
4	Integrity Constraints & Keys
5	Introduction to SQL & Basic Queries
6	DML & DDL Commands
7	Joins & Subqueries

Tutorials (continued)	
8	Functional Dependencies & 1NF, 2NF and 3 NF

Lab Programs / Practical	**30 Hours**
Part A: Lab Programs	
1	Implement complete CRUD operations on a student management system using MongoDB shell commands.
2	Build order management system with aggregation, indexing, and complex queries.
3	Implementation of DDL Commands in SQL: Demonstrate the use of DDL commands with suitable examples, including CREATE TABLE, ALTER TABLE, and DROP TABLE.
4	Implementation of DML Commands in SQL: Implement DML commands with suitable examples, including INSERT, UPDATE, and DELETE.
5	Implementation of SQL Functions: Implement various types of functions in SQL with examples, including Number Functions, Aggregate Functions, Character Functions, Conversion Functions, and Date Functions.
6	Implementation of SQL Operators: Demonstrate the use of different types of operators in SQL with examples, including Arithmetic Operators, Logical Operators, Comparison Operators, Special Operators, and Set Operations.
7	Implementation of Different Types of Joins: Implement various types of joins in SQL, including Inner Join, Outer Join, and Natural Join, with suitable examples.
8	Study and Implementation of Grouping and Ordering: Study and implement the GROUP BY and HAVING clauses, ORDER BY clause, and Indexing in SQL.
9	Backup and Recovery for Data Safety: Implement backup and recovery commands in SQL to ensure data safety.
10	Managing Users and Administering Database Tasks: Implement tasks for managing database users and administering database operations.
Part B:	
Explore and demonstrate AI tools for DBMS such as: AI2SQL for natural language to SQL conversion dbdiagram.io for ER diagram generation Chat2DB for AI-assisted database management GitHub Copilot for database application development SQLBolt / HackerRank for SQL practice and assessment	

Semester - **II**			
Course: **DIGITAL CIRCUITS AND SYSTEMS**			
Program	**B.Tech. (Hons) CSE**	Category	**Major (Core)**
Course Code	**CS1112**	CIE Marks	**70**
Credits (L:T:P)	**3 (2:0:2)**	SEE Marks	**30**
Hours	**30L + 0T + 30P = 60**	SEE Mode	**Theory**

Course Objectives: students will be able to	
1	To design combinational circuits using standard techniques.
2	To study and design sequential circuits such as flip-flops, registers, and counters.
3	To understand the operation of memory elements and basic memory system components.
4	To Design and implement interfacing circuits for peripherals

Module - 1	**6 hours**
Combinational logic circuits: Half adder, Full Adder , half subtractor, full subtractor, Parallel binary adder, parallel binary Subtractor, BCD adder, multiplexer/demultiplexer, decoder, encoder, parity checker, parity generators	

Module - 2	**6 hours**
Sequential logic circuits, Latches, Flip-flops , SR, JK, D, T, and Master-Slave, Characteristic table and equation,Application table , Edge triggering , Level Triggering , Realization of one flip flop using other flip flops.	

Module - 3	**6 hours**
Registers and Memory: Registers , shift registers, ROM , ROM organization - PROM , EPROM , EEPROM, RAM, RAM organization Static RAM, Dynamic RAM, Error detection and correction	

Module - 4	**6 hours**
Counters: Asynchronous Ripple, Asynchronous Up/Down counter, Synchronous counters, Synchronous Up/Down counters, Ring counter, Johnson counters	

Module - 5	**6 hours**
Microcontroller: Architecture , I/O Pins Ports and Circuits , Registers & Special Function Registers (SFRs) , Interrupts ,Timers , Serial Communication Interfaces - Instruction set , Addressing modes , Interrupts Programming , Interfacing Microcontroller: 7 Segment, LCD & Hex Keyboard, Use Case using AT89c51	

Course Outcomes: After completing the course, the students will be able to	
1	Comprehend combinational logic circuits (adders, subtractors, MUX/DEMUX, encoder/decoder).
2	Apply design techniques for arithmetic and parity circuits.
3	Analyze microcontroller architecture, instructions, and peripherals.
4	Design microcontroller interfacing with 7-segment, LCD, and keyboard.

Text Books	
1	M. Morris Mano, Digital Logic and Computer Design, Pearson Education, 2022, ISBN: 978-0132145107.
2	Thomas L Floyd, Digital Fundamentals, Pearson, 11th Edition, 2015, ISBN: 978-0132737968.
3	Muhammad Ali Mazidi, The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Pearson, 2nd Edition, 2006, ISBN: 978-0131194021.

Reference Books and Resources	
1	John F. Wakerly, Digital Design: Principles and Practices, Pearson Education, 4th edition, 2005, ISBN: 978-0131863897.
2	Charles H. Roth Jr., Larry L. Kinney, Fundamentals of Logic Design, Cengage Learning, 7th edition, 2013, ISBN: 978-1133628477.
3	R. P. Jain, Modern Digital Electronics, McGraw Hill Education (India), 4th edition, 2010, ISBN: 978-0070682955.

Lab Programs / Practical	15 Hours
1	a. Design of Half Adder and Full Adder b. Design of Half Subtractor and Full Subtractor
2	Design of Multiplexer and Demultiplexer
3	Design of encoder and decoder
4	Verification of state tables of SR, JK, D flip-flops using NAND & NOR gates.
5	To verify the operation of bi-directional shift register.
6	To design & verify the operation of 4-bit synchronous and asynchronous counter.
7	a. Implementation of internal data transfer and exchange using assembly language. b. Implementation of arithmetic and logical operations using assembly Language.
8	Implementation of timers in all modes with and without interrupts.
9	Implementation of serial communication with and without interrupts.

Lab Programs / Practical (continued)	
10	Implement microcontroller interfacing using a. 7 Segment Display b. Matrix Keyboard

Semester - **II**			
Course: **OPERATING SYSTEMS**			
Program	**B.Tech. (Hons) CSE**	Category	**Major (Core)**
Course Code	**CS1103**	CIE Marks	**70**
Credits (L:T:P)	**3 (2:0:2)**	SEE Marks	**30**
Hours	**30L + 0T + 30P = 60**	SEE Mode	**Theory**

Course Objectives: students will be able to	
1	Introduce the fundamental concepts, principles, and architecture of modern operating systems.
2	Explore the design and implementation of key operating system components, including process management, memory management, file systems, and input/output systems.
3	Develop problem-solving skills related to concurrency, synchronization, scheduling, and resource allocation.
4	Provide hands-on experience with operating system tools, system calls, and programming exercises for practical understanding of OS design and implementation.

Module - 1	**6 hours**
Introduction to Operating Systems and System Structures- Operating Systems, Types, Functions, Abstract view of OS, System Structures , System Calls, Virtual Machines.	

Module - 2	**6 hours**
Process Management- Process Concepts, Inter process communication, Threads ,Multithreading, Process Scheduling, First-Come, First-Served (FCFS), Shortest Job First, Round Robin (RR), Priority Scheduling.	

Module - 3	**6 hours**
Synchronization and Deadlocks- Synchronization, Semaphores, Monitors Hardware Synchronization, Deadlocks, Methods for Handling Deadlocks.	

Module - 4	**6 hours**
Memory Management- Memory Management Strategies, Contiguous and Non-Contiguous allocation, Virtual memory Management, Demand Paging, Page Placement and Replacement Policies.	

Module - 5	**6 hours**

Secondary Storage Management- File System- Basic concepts , File System design and Implementation, Linux File Systems, Mass Storage Structure, Disk Scheduling- FCFS, SSTF, Disk Management, and SCAN- I/O Systems, System Protection and Security.

Course Outcomes: After completing the course, the students will be able to	
1	Demonstrate the core functions of an operating system and its structural components to effectively manage system resources.
2	Analyze the various process management techniques and scheduling algorithms to ensure efficient execution and resource allocation.
3	Apply synchronization techniques and solutions to prevent or resolve deadlocks in concurrent systems.
4	Apply memory management strategies, virtual memory techniques, file system design principles, disk scheduling algorithms, and security mechanisms to improve performance and resource utilization.

Text Books	
1	Silberschatz, Galvin, Gagne, Operating System Concepts, John Wiley and Sons, 10th edition, 2023, ISBN: 935746056X
2	William Stallings, Operating Systems –Internals and Design Principles, 9/E, Pearson Publications, March 2017, ISBN: 0134670957
3	Richard Petersen, Linux: The Complete Reference, Sixth Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 6th Edition 2008, ISBN: 007149247X

Reference Books and Resources	
1	Andrew S. Tanenbaum and Herbert Bos, Modern Operating Systems, 4th Edition, Pearson Publisher, 2015, ISBN-13: 978-0-13-359162-0
2	Michael Kerrisk, The Linux Programming Interface, Publisher: William Pollock, First Editions 2010, ISBN-13: 978-1593272203
3	NPTEL: https://nptel.ac.in/courses/106105214
4	MIT: https://ocw.mit.edu/courses/6-828-operating-system-engineering-fall-2012/
5	NPTEL: https://nptel.ac.in/courses/106106144

Lab Programs / Practical	**30 Hours**
Part A: Lab Programs	
1	Exploring Basic Linux Commands
2	Shell Programming
3	CPU Scheduling Algorithms Simulation
4	Process Creation and Management using fork system call

Lab Programs / Practical (continued)	
5	Thread Creation and Management using POSIX thread library
6	Program for IPC using pipe () function
7	Process synchronization using mutex locks and semaphore
8	Implement the Banker's Algorithm for deadlock avoidance
9	Simulations of Page replacement Algorithms
10	Simulate disk scheduling algorithms, such as FCFS, SSTF, and SCAN, and compare their performance
Part B:	
Design and implement a mini operating system simulator integrating process scheduling, memory management, and disk scheduling; analyse and compare system performance under different workloads using appropriate tools (AI tools permitted).	

Semester - **II**			
Course: **ENTREPRENEURIAL MINDSET**			
Program	**B.Tech. (Hons) CSE**	Category	**SEC**
Course Code	**CS1940**	CIE Marks	**70**
Credits (L:T:P)	**2 (1:0:2)**	SEE Marks	**30**
Hours	**15L + 0T + 30P = 45**	SEE Mode	**Jury**

Course Objectives: students will be able to	
1	Analyze market opportunities to gain multiple business model insights
2	Building a business through POCD framework
3	Financing a business through basic understanding of key financial metrics
4	Sources of finance for a startup and calculating value of a startup through a Business model canvas & business plan

Module - 1	**3 hours**
Problem Identification: Techniques for spotting problems worth pursuing and understanding market demand. Market Sizing: Tools and methods for estimating market size and understanding customer willingness to pay. Opportunity Analysis: Case studies on identifying and capitalizing on opportunities within various industries. Value Proposition: Developing compelling value propositions that clearly address identified market needs.	

Module - 2	**3 hours**
Introduction to POCD: Understanding the People, Opportunity, framework. Customer and Consumer Insights: Differentiating between who the customer is and who the consumer is. Case Studies: Examining successful businesses that have effectively utilized the POCD framework	

Module - 3	**3 hours**
Introduction to POCD: Understanding the Context, and Deal framework. Strategic Development: Applying the POCD framework to build robust business strategies. Case Studies: Examining successful businesses that have effectively utilized the Context & Deal framework	

Module - 4	**3 hours**

Financial Literacy: Building comfort with basic financial terms and concepts crucial for entrepreneurs. Key Financial Metrics: Understanding metrics that are essential for evaluating business health. Financial Planning: Tools and techniques for financial forecasting and budgeting. Interactive Workshops: Practical exercises to develop and analyze financial sheets and models.

Module - 5	**3 hours**
Sources of Finance: Overview of different financing options available for startups. Business Model Canvas (BMC): Detailed exploration of the BMC as a tool for articulating business value. Startup Valuation: Methods to calculate the value of a startup, including practical case examples. Funding Strategy: Developing strategies to attract and secure necessary resources for a startup	

Course Outcomes: After completing the course, the students will be able to	
1	Analyze market opportunities to gain multiple business model insights
2	Build and evaluate a business venture using the POCD framework by integrating People, Opportunity, Context, and Deal elements.
3	Financing a business through basic understanding of key financial metrics
4	Sources of finance for a startup and calculating value of a startup through a Business model canvas & business plan

Text Books	
1	The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses by Eric Ries, Crown Business (2011), ISBN: 978-0307887894, 1st Ed.
2	Start with Why: How Great Leaders Inspire Everyone to Take Action by Simon Sinek, Portfolio ,2009, ISBN: 978-1591846444, 1st Ed.

Reference Books and Resources	
1	Freakonomics: A Rogue Economist Explores the Hidden Side of Everything by Steven D. Levitt and Stephen J. Dubner, William Morrow (2005), ISBN: 978-0060731335, 1st Ed.
2	Disciplined Entrepreneurship: 24 Steps to a Successful Startup by Bill Aulet, Wiley (2013), ISBN: 978-1118692288, 1st Ed.

Lab Programs / Practical	**30 Hours**
1	Entrepreneurial Trait Analysis and Mentor Mapping
2	Create an Individual BMC with AI Assistance
3	Numerical Evaluation on Various Case Studies
4	Create a Business Title, Proposition, Finance sheet
5	Create and Present an AI-Enhanced Product Pitch

Lab Programs / Practical (continued)	
6	Startup Idea Formulation and BMC Preparation

Programmes:

1. B.Tech. Honors(CSE)
2. B.Sc. Honors(CSE)
3. B.C.A. Honors(CSE)
4. M.Tech. (CSE)
5. M.Tech. Data Science (in collaboration with upGrad Campus) for working professionals
6. Ph.D.

*Proposed infrastructure under construction

RV University Vision and Mission

Vision

To be a world-class, tech-driven, global university for liberal education, empowering citizens of tomorrow.

Mission

- Strive for excellence in teaching, research, capacity building, and community engagement, benchmarking against global universities to lead across disciplines.
- Utilise digital and emerging technologies to enhance teaching-learning and research, accessible to all, while fostering a multidisciplinary, inclusive environment that meets evolving learner needs.
- Cultivate a diverse, global academic community through strong national and international collaborations that enrich learning, facilitate mobility, and drive institutional growth.
- Integrate theory with practical application to develop self-driven, empathetic problem-solvers equipped to create meaningful societal impact.

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