ANNEXURE –I

Syllabus of III and IV Semester Courses for Four-Year Multidisciplinary Undergraduate B.Tech. Degree Programme in Computer Science Engineering

(In view of NEP-2020)

For students admitted in academic session 2025-26 and onwards



03/09/2026

SHRI JAWAHARLAL DARDA EDUCATION SOCIETY'S
JAWAHARLAL DARDA
INSTITUTE OF ENGINEERING AND TECHNOLOGY, YAVATMAL
AN AUTONOMOUS INSTITUTE
Affiliated to Sant Gadge Baba Amravati University, Approved by AICTE, New Delhi and DTE Maharashtra
93VP+PWF: P6, MIDC Area, Lohara, Yavatmal - 445 001, Maharashtra (www.jdiet.ac.in)

1. Vision

To emerge as a centre of excellence in Computer Science and Engineering education, innovation, and research, producing competent professionals and responsible citizens who contribute to sustainable development and digital transformation.

2. Department Mission

1. To impart quality technical education in Computer Science and Engineering that prepares students for successful careers, higher education, and entrepreneurship.
2. To foster a learner-centric environment through outcome-based curriculum, continuous assessment, and industry-aligned teaching methodologies.
3. To promote research, innovation, and collaboration that address real- world challenges and societal needs.
4. To instill ethical values, leadership skills, and a lifelong learning attitude to enable graduates to adapt to emerging technologies and global demands.

3. Programme Education Objectives

PEO1: Graduates will have successful careers in industry, academia, or entrepreneurship by applying foundational and advanced knowledge in Computer Science and Engineering.

PEO2: Graduates will engage in continuous learning, research, and innovation to keep pace with evolving technologies**.**

PEO3: Graduates will demonstrate ethical values, leadership qualities, teamwork, and effective communication skills in their professional practices.

PEO4: Graduates will contribute to solving real-world problems by developing sustainable and socially responsible technological solutions.

4. SDG of United Nation

1. **No Poverty** – End poverty in all its forms everywhere.
2. **Zero Hunger** – End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.
3. **Good Health and Well-being** – Ensure healthy lives and promote well- being for all at all ages.
4. **Quality Education** – Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
5. **Gender Equality** – Achieve gender equality and empower all women and girls.
6. **Clean Water and Sanitation** – Ensure availability and sustainable

management of water and sanitation for all.

7. **Affordable and Clean Energy** – Ensure access to affordable, reliable, sustainable, and modern energy for all.
8. **Decent Work and Economic Growth** – Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all.
9. **Industry, Innovation, and Infrastructure** – Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.
10. **Reduced Inequalities** – Reduce inequality within and among countries.
11. **Sustainable Cities and Communities** – Make cities and human settlements inclusive, safe, resilient, and sustainable.
12. **Responsible Consumption and Production** – Ensure sustainable consumption and production patterns.
13. **Climate Action** – Take urgent action to combat climate change and its impacts.
14. **Life Below Water** – Conserve and sustainably use the oceans, seas, and marine resources for sustainable development.
15. **Life on Land** – Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss.
16. **Peace, Justice, and Strong Institutions** – Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels.
17. **Partnerships for the Goals** – Strengthen the means of implementation and revitalize the global partnership for sustainable development.

5. WK: Washington Accord Knowledge Profile-Attributes for engineering program

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behaviour and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

6. Programme Outcomes (NBA, Jan 2025)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development.

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required.

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions.

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools,

including prediction and modelling recognizing their limitations to solve complex engineering problems.

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws.

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change.

7. Programme Specific Indicators

Software Development

1. Demonstrate proficiency in programming languages such as Java, Python, and C++.
2. Apply software engineering principles across all stages of the SDLC.
3. Utilize algorithms and data structures to solve complex problems.
4. Develop, debug, test, and maintain software applications.
5. Implement collaborative development practices using Git and other version control tools.

Data Science & Analytics

6. Apply statistical methods and machine learning algorithms to data analysis.
7. Demonstrate skills in data cleaning, pre-processing, and visualization. Utilize tools such as Python, R, and SQL for analytics tasks.

8. Develop predictive models and evaluate their performance.
9. Communicate insights effectively through data storytelling

Cybersecurity

10. Understand and implement network security measures.
11. Perform threat detection, analysis, and mitigation.
12. Apply cryptographic techniques to secure communications.
13. Conduct vulnerability assessments and penetration testing.
14. Monitor systems for compliance with security policies regulations.

Cloud Computing & DevOps

15. Develop and deploy applications on cloud platforms.
16. Implement CI/CD pipelines to automate software delivery.
17. Utilize virtualization and containerization technologies like Docker and Kubernetes.
18. Monitor cloud performance and scale resources effectively.
19. Apply service models such as IaaS, PaaS, and SaaS in real-world solutions.

Web Technologies

20. Develop responsive web applications using HTML, CSS,and JavaScript.
21. Utilize frameworks such as React, Angular, or Django.
22. Implement APIs for data integration and exchange.
23. Apply techniques for web performance optimization.
24. Monitor and enhance web application security.

Mobile Computing

25. Develop mobile applications for Android and iOS platforms.
26. Apply UI/UX design principles for mobile devices.
27. Implement cross-platform solutions using Flutter or React Native.
28. Perform app performance tuning and battery optimization.
29. Integrate mobile apps with backend and cloud services.

Embedded Systems & IoT

30. Develop embedded applications using microcontrollers and sensors.
31. Implement IoT protocols for device communication.
32. Apply embedded C/C++ for hardware control.
33. Monitor real-time data from IoT devices.
34. Build secure IoT systems with device management.

Game Development

35. Develop games using engines like Unity or Unreal Engine.
36. Implement game physics and AI behaviors.
37. Build immersive 2D/3D game environments.
38. Apply storytelling and level design principles.
39. Test and optimize multiplayer and networked games.

Blockchain & Web3

40. Develop block chain-based applications using smart contracts.
41. Apply consensus algorithms in decentralized systems.
42. Implement Apps with secure and scalable architectures.
43. Utilize blockchain platforms like Ethereum or Hyperledger.
44. Perform blockchain security assessments and audits.

Robotics & Automation

45. Build robotic systems with integrated sensors and actuators.
46. Apply kinematics and control algorithms for robot movement.
47. Implement autonomous navigation systems.
48. Utilize robotic operating systems (ROS) for programming.
49. Monitor and maintain automation systems in industrial setups.

Human-Computer Interaction

50. Apply usability principles to interface design.
51. Develop interactive prototypes and wireframes.
52. Conduct usability testing and heuristic evaluations.
53. Implement accessibility features for inclusive design.
54. Monitor and improve user experience through feedback analysis.

Digital Marketing & Analytics

55. Apply SEO strategies to improve search rankings.
56. Develop and monitor social media campaigns.
57. Utilize analytics tools to evaluate marketing performance.
58. Implement content marketing strategies.
59. Build automated workflows for marketing efficiency.

IT Consulting & Services

60. Perform business process analysis for IT transformation.
61. Develop IT strategies aligned with organizational goals.
62. Utilize technology evaluation frameworks for solution selection.
63. Monitor compliance with IT governance standards.
64. Implement effective client communication and service delivery.

E-commerce Technology

65. Develop secure e-commerce platforms.
66. Implement payment gateway and order management systems.
67. Apply personalization algorithms for product recommendations.
68. Monitor online transaction security and fraud detection.
69. Utilize analytics to improve customer engagement.

Bioinformatics & Computational Biology

70. Apply computational tools to analyze biological data.
71. Develop algorithms for sequence alignment and genome mapping.
72. Implement models to simulate biological processes.
73. Utilize visualization tools for biological datasets.
74. Perform statistical validation of bioinformatics results.

Research & Academia

75. Apply research methodologies to investigate problems.
76. Develop structured literature reviews.
77. Implement experiments and analyze results.
78. Utilize academic writing skills for publications.
79. Demonstrate mentoring and collaborative research skills.

Basic Science

80. Apply mathematical techniques such as algebra, trigonometry, calculus, differential equations, linear algebra, probability and statistics to solve problems.
81. Apply physical principles such as motion, forces, energy and materials to solve problems.
82. Apply knowledge of chemical properties and reactions for construction material and environment (Corrosion, polymer, electrochemistry etc.).

Engineering Science Courses

83. Demonstrate proficiency in basic workshop operations (fitting, carpentry, welding, sheet metal, plumbing and machining etc.).
84. Apply the principles of engineering mechanics to analyse and solve problems involving forces, moment, equilibrium, friction, centred and MOI etc.
85. Apply the principles electrical engineering to analyse and maintain electrical systems, circuits, machines and power systems.

86. Demonstrate ability to interpreted and create drawings using geometric constructions, orthographic projections, isometric projections and CAD tools.
87. Demonstrate ability to apply fundamental principles of algorithms, programming, data structures and computing system to solve conceptual problems.

Generic Competencies

A. Problem-Solving Skills

88. Analytical Thinking: Ability to analyze complex problems, break them down into smaller components, and find effective solutions.
89. Critical Thinking: Ability to evaluate multiple solutions to a problem and choose the best course of action based on available data, safety, and cost-efficiency.

B. Communication Skills

90. Oral Communication: Ability to communicate complex technical information clearly to a variety of audiences, including clients, stakeholders, contractors, and team members.
91. Written Communication: Proficiency in drafting reports, proposals, technical specifications, and documentation that are clear, concise, and accurate.
92. Interpersonal Communication: Ability to collaborate effectively with multidisciplinary teams, clients, and project stakeholders.

C. Project Management

93. Time Management: Efficiently managing time and prioritizing tasks to meet deadlines in a dynamic project environment.
94. Resource Management: Ability to plan, allocate, and manage resources such as labour, materials, and equipment to ensure project efficiency.
95. Budgeting and Cost Control: Skills in estimating project costs, monitoring budgets, and ensuring projects are completed within financial constraints.
96. Risk Management: Ability to identify, assess, and mitigate risks during the planning and execution of engineering projects.

D. Teamwork and Leadership

97. Team Collaboration: Working effectively as part of a team,

contributing to the success of the project through collaboration, open communication, and respect for others' expertise.

98. Leadership Skills: Leading and motivating a team of engineers, contractors, and other stakeholders to meet project goals and deadlines.
99. Conflict Resolution: Ability to resolve conflicts between team members, clients, or contractors, ensuring that project objectives are still achieved.

E. Attention to Detail

100. Accuracy: Ensuring all engineering calculations, designs, and project plans are accurate and align with building codes, regulations, and standards.
101. Quality Assurance: Ensuring that the materials and processes used in construction adhere to high standards of quality and safety.

F. Ethical and Professional Integrity

102. Ethical Decision Making: Adhering to a strict code of ethics, ensuring public safety, environmental protection, and transparency in all dealings.
103. Accountability: Taking responsibility for the success or failure of a project, being proactive in addressing issues, and delivering results.

G. Adaptability and Flexibility

104. Openness to Change: Being able to adapt to new technologies, tools, and methods, as well as evolving project requirements or environmental conditions.
105. Learning and Development: Actively seeking opportunities for professional growth, staying current with industry trends, and acquiring new skills to remain competitive.

H. Creativity and Innovation

106. Creative Problem Solving: Thinking outside the box and coming up with novel solutions to engineering challenges.
107. Innovative Design: Contributing new ideas for designs and processes that can improve efficiency, reduce costs, or make better use of resources.

I. Cultural and Environmental Awareness

108. Sustainability Awareness: Knowledge of sustainable construction methods, green building practices, and the importance of reducing the environmental impact of engineering projects.
109. Cultural Sensitivity: Understanding and respecting cultural differences when working in diverse teams or international projects.
110. Environmental Impact Understanding: Considering the environmental consequences of engineering decisions and striving to minimize negative impacts through design and construction methods.

J. Decision-Making Skills

111. Data-Driven Decisions: Using available data, facts, and technical analysis to make informed decisions about the design, execution, and management of projects.
112. Prioritizing Decisions: Knowing which decisions need immediate attention and which can be deferred, especially in a high-pressure environment.

K. Regulatory and Legal Knowledge

113. Familiarity with Building Codes and Standards: Understanding and ensuring compliance with local, national, and international building codes, safety regulations, and legal standards.
114. Health and Safety: Knowledge of safety regulations and best practices for ensuring the health and safety of workers, the public, and the environment throughout the project lifecycle.

L. Client-Focused Mindset

115. Client Management: Building and maintaining strong relationships with clients, understanding their needs, and ensuring their expectations are met throughout the project.
116. Customer Service Orientation: Ensuring that client concerns are addressed promptly, and working toward providing value-added solutions that meet their goals.

8. Scheme of Computer Science Engineering Department

Jawaharlal Darda Institute of Engineering & Technology, Yavatmal (Autonomous Institute)

Curriculum Structure (Scheme) for Four Year Multidisciplinary B. Tech in Computer Science & Engineering Degree Programme

Semester - I (First Year) [Group - A/B]

Sr. No.	Course Name	Course Category	Course Code	Course Plan per Week (Hrs.)					Credits	Theory Evaluation		Theory (Total)		Practical/Term Work Evaluation		Practical/Term Work Evaluation (Total)		Total Max Marks P	Theory Exam Time (Hrs.) SL
										SEE	CIA			EE	PA				
				L	T	P	SL	Total		Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	L	T		
1	Mathematics - I	BSC	1SH101BS1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
2	Applied Physics	BSC	1SH102BS1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
3	Programming for Problem Solving	ESC	1CS103ES1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
4	Engineering Mechanics	ESC	1CE104ES1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
5	Applied Physics Lab	BSC	1SH105BS1	0	0	2	0	2	1					25	25	50	25	50	
6	Programming for Problem Solving Lab	ESC	1CS106ES1	0	0	2	0	2	1					25	25	50	25	50	
7	Engineering Mechanics Lab	ESC	1CE107ES1	0	0	2	0	2	1					25	25	50	25	50	
8	Workshop	ESC	1ME108ES1	0	0	2	0	2	1					25	25	50	25	50	
9	Introduction to Web Technology	VSC	1CS109VS1	1	0	2	1	4	2						50	50	25	50	
10	English Communication	AEC	1SH110AE1	1	0	2	1	4	2					25	25	50	25	50	
11	Sports & Yoga	CC	1SH111CC1	0	0	4	0	4	2						50	50	25	50	
Total				**14**	**0**	**16**	**14**	**0**	**16**	**14**	**44**	**22**			**400**				**350**

Notional Learning Hours : [Workload (teaching/guidance/practicum) 30x15 = 450 Hrs] + [Learner-engaged time 14x15 = 210 Hrs]

Jawaharlal Darda Institute of Engineering & Technology, Yavatmal (Autonomous Institute)

Curriculum Structure (Scheme) for Four Year Multidisciplinary B. Tech in Computer Science & Engineering Degree Programme

Semester - II (First Year) [Group - A/B]

Sr. No.	Course Name	Course Category	Course Code	Course Plan per Week (Hrs.)					Credits	Theory Evaluation		Theory (Total)		Practical/Term Work Evaluation		Practical/Term Work Evaluation (Total)		Total Max Marks	Theory Exam Time (Hrs.)
										SEE	CIA			EE	PA				
				L	T	P	SL	Total		Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks	Min Marks		
1	Mathematics – II	BSC	2SH112BS1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
2	Applied Chemistry	BSC	2SH113BS1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
3	Basic Electrical Engineering	ESC	2EE114ES1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
4	Engineering Graphics	ESC	2ME115ES1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
5	AI Fundamentals	PCC	2CS116PC1	0	0	2	0	2	1					25	25	50	25	50	
6	Indian Knowledge Systems for Computer Applications	IKS	2CS117IK1	0	0	2	0	2	1					25	25	50	25	50	
7	Applied Chemistry – Lab	BSC	2SH118BS1	0	0	2	0	2	1					25	25	50	25	50	
8	Basic Electrical Engineering – Lab	ESC	2EE119ES1	0	0	2	0	2	1					25	25	50	25	50	
9	Engineering Graphics/CAD Lab	ESC	2ME120ES1	1	0	2	1	4	2						50	50	25	50	
10	Basics of Computer Networking	SEC	2CS121VS1	1	0	2	1	4	2					25	25	50	25	50	
11	Digital Wellness	CC	2SH122CC1	0	0	4	0	4	2						50	50	25	50	
Total				**15**	**0**	**14**	**14**	**0**	**16**	**14**	**44**	**22**			**400**				**350**

Notional Learning Hours : [Workload (teaching/guidance/practicum) 29x15 = 435 Hrs] + [Learner-engaged time 15x15 = 225 Hrs]

Exit Option (Level 4.5) for Undergraduate Certificate in Odd Semester of next Academic Year as approved by BOS																			
12	Digital Literacy and Office Automation	EC	3CS123EC1	2	0	4	2	8	4	30	20	50	20	25	25	50	25	100	2 Hrs.
13	Hardware Maintenance & Networking	EC	3CS124EC1	2	0	4	2	8	4	30	20	50	20	25	25	50	25	100	2 Hrs.
OR																			
14	Internship / Apprenticeship in Industry	EI	3CS125EI1	0	0	16	0	288	8					100	100	200	100	200	
OR																			
15	Two MOOC/NPTEL Courses	EC	3CS126OC_	8	0	0	8	16	8										

Jawaharlal Darda Institute of Engineering & Technology, Yavatmal (Autonomous Institute)

Curriculum Structure (Scheme) for Four Year Multidisciplinary B. Tech in Computer Science & Engineering Degree Programme

Semester - III (Second Year)

Sr. No.	Course Name	Course Category	Course Code	Course Plan per Week (Hrs.)					Credits	Theory Evaluation		Theory (Total)		Practical/Term Work Evaluation		Practical/Term Work Evaluation (Total)		Total Max Marks	Theory Exam Time (Hrs.)
										SEE	CIA			EE	PA				
				L	T	P	SL	Total		Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks	Min Marks		
1	Data Structures & Algorithms	PCC	3CS201PC1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
2	Object Oriented Programming (Java)	PCC	3CS202PC1	2	0	0	2	4	2	60	40	100	40					100	3 Hrs.
3	Discrete Mathematics	PCC	3CS203PC1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
4	Multidisciplinary Minor – I	MDM	3CS204MD1	2	0	0	2	4	2	30	20	50	20					50	2 Hrs.
5	Open Elective - I	OE	3_205OE_	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
6	Data Structures & Algorithms Lab	PCC	3CS206PC1	0	0	2	0	2	1					25	25	50	25	50	
7	Object Oriented Programming (Java)	PCC	3CS207PC1	0	0	2	0	2	1					25	25	50	25	50	
8	Programming Laboratory-I (Python Programming Lab)	PCC	3CS208PC1	0	0	2	0	2	1					25	25	50	25	50	
9	Human Resource Management	EEM	3CS209EM1	2	0	0	2	4	2						50	50	25	50	
10	Constitutional Values and Fundamental Duties	VEC	3SH210VE1	2	0	0	2	4	2						50	50	25	50	
11	Field Project	FP	3CS400FP1	0	0	4	0	4	2					25	25	50	25	50	
12	Disaster Management and Preparedness	NC	3AL001NC1	2	0	0	0	2	0						50	50	25	50	
Total				**17**	**0**	**10**	**17**	**44**	**22**			**450**				**300**		**750**	

Notional Learning Hours : [Workload (teaching/guidance/practicum) 27x15 = 405 Hrs] + [Learner-engaged time 17x15 = 255 Hrs]

Optional Course for Double Minor / Honours Degree																			
12	Double Minor / Honours Course - I	DH	3CS211DH1/2	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.

Jawaharlal Darda Institute of Engineering & Technology, Yavatmal (Autonomous Institute)

Curriculum Structure (Scheme) for Four Year Multidisciplinary B. Tech in Computer Science & Engineering Degree Programme

Semester - IV (Second Year)

Sr. No.	Course Name	Course Category	Course Code	Course Plan per Week (Hrs.)					Credits	Theory Evaluation		Theory (Total)		Practical/Term Work Evaluation		Practical/Term Work Evaluation (Total)		Total Max Marks	Theory Exam Time (Hrs.)
										SEE	CIA			EE	PA				
				L	T	P	SL	Total		Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks	Min Marks		
1	Theory of Computation	PCC	4CS212PC1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
2	Operating Systems	PCC	4CS213PC1	2	0	0	2	4	2	60	40	100	40					100	3 Hrs.
3	Design & Analysis of Algorithm	PCC	4CS214PC1	2	0	0	2	4	2	60	40	100	40					100	3 Hrs.
4	Multidisciplinary Minor - II	MDM	4CS215MD1	2	0	0	2	4	2	30	20	50	20					50	2 Hrs.
5	Open Elective - II	OE	4_216OE_	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
6	Operating Systems Lab	PCC	4CS217PC1	0	0	2	0	2	1					25	25	50	25	50	
7	Design & Analysis of Algorithm Lab	PCC	4CS218PC1	0	0	2	0	2	1					25	25	50	25	50	
8	Programming Laboratory-II (Web Designing Lab)	VSC	4CS219VS1	0	0	4	0	4	2						50	50	25	50	
9	Technical Writing	AEC	4SH220AE1	1	0	2	1	4	2						50	50	25	50	
10	Fundamentals of Book Keeping and Accounting	EEM	4SH221EM1	1	0	2	1	4	2						50	50	25	50	
11	Environmental Science	VEC	4CE222VE1	2	0	0	2	4	2	30	20	50	20					50	2 Hrs.
Total				**16**	**0**	**12**	**16**	**44**	**22**			**500**				**250**		**750**	
Notional Learning Hours : [Workload (teaching/guidance/practicum) 28x15 = 420 Hrs] + [Learner-engaged time 16x15 = 240 Hrs]																			
Optional Course for Double Minor / Honours Degree																			
12	Double Minor / Honours Course - II	DH	4CS223DH1/2	4	0	0	4	8	4	60	40	100	40					100	3 Hrs.
Exit Option (Level 5) for Undergraduate Diploma in Odd Semester of next Academic Year as approved by BOS																			
13	Mobile App Development (Android)	EC	5CS224EC1	2	0	4	2	8	4	30	20	50	20	25	25	50	25	100	2 Hrs.
14	Full stack Developer	EC	5CS225EC1	2	0	4	2	8	4	30	20	50	20	25	25	50	25	100	2 Hrs.
OR																			
15	Internship / Apprenticeship in Industry	EI	5CS226EI1	0	0	16	0	288	8					100	100	200	100	200	
OR																			
16	Two MOOC/NPTEL Courses	EC	5CS227OC_	8	0	0	8	16	8										

Jawaharlal Darda Institute of Engineering & Technology, Yavatmal (Autonomous Institute)

Curriculum Structure (Scheme) for Four Year Multidisciplinary B. Tech in Computer Science & Engineering Degree Programme

Semester - V (Third Year)

Sr. No.	Course Name	Course Category	Course Code	Course Plan per Week (Hrs.)					Credits	Theory Evaluation		Theory (Total)		Practical/Term Work Evaluation		Practical/Term Work Evaluation (Total)		Total Max Marks	Theory Exam Time (Hrs.)
										SEE	CIA			EE	PA				
				L	T	P	SL	Total		Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks	Min Marks		
1	Database Management Systems	PCC	5CS228PC1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
2	Advanced Computer Architecture	PCC	5CS229PC1	3	1	0	4	8	4	60	40	100	40					100	3 Hrs.
3	Complier Design	PCC	5CS230PC1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
4	Programme Elective Course - I	PEC	5CS231PE_	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
5	Multidisciplinary Minor - III	MDM	5_232MD_	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
6	Open Elective - III	OE	5_233OE_	2	0	0	2	4	2	30	20	50	20					50	2 Hrs.
7	Database Management Systems Lab	PCC	5CS234PC1	0	0	2	0	2	1					25	25	50	25	50	
8	Complier Design Lab	PCC	5CS235PC1	0	0	2	0	2	1					25	25	50	25	50	
9	Programme Elective Course - I Lab	PEC	5CS236PE_	0	0	2	0	2	1					25	25	50	25	50	
10	Multidisciplinary Minor - III - Lab	MDM	5_237MD_	0	0	2	0	2	1					25	25	50	25	50	
Total				**17**	**1**	**8**	**18**	**44**	**22**			**550**				**200**		**750**	

Notional Learning Hours : [Workload (teaching/guidance/practicum) 26x15 = 390 Hrs] + [Learner-engaged time 18x15 = 270 Hrs]

Optional Course for Double Minor / Honours Degree																			
11	Double Minor / Honours Course - III	DH	5CS238DH1/2	4	0	0	4	8	4	60	40	100	40					100	3 Hrs.

Jawaharlal Darda Institute of Engineering & Technology, Yavatmal (Autonomous Institute)

Curriculum Structure (Scheme) for Four Year Multidisciplinary B. Tech in Computer Science & Engineering Degree Programme

Semester - VI (Third Year)

Sr. No.	Course Name	Course Category	Course Code	Course Plan per Week (Hrs.)					Credits	Theory Evaluation		Theory (Total)		Practical/Term Work Evaluation		Practical/Term Work Evaluation (Total)		Total Max Marks	Theory Exam Time (Hrs.)
										SEE	CIA			EE	PA				
				L	T	P	SL	Total		Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks	Min Marks		
1	Cloud Computing	PCC	6CS239PC1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
2	Internet of Things	PCC	6CS240PC1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
3	Computer Networks	PCC	6CS241PC1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
4	Programme Elective Course - II	PEC	6CS242PE_	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
5	Programme Elective Course - III	PEC	6CS243PE_	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
6	Multidisciplinary Minor - IV	MDM	6_244MD_	2	0	0	2	4	2	30	20	50	20					50	2 Hrs.
7	Cloud Computing Lab	PCC	6CS245PC1	0	0	2	0	2	1					25	25	50	25	50	
8	Internet of Things Lab	PCC	6CS246PC1	0	0	2	0	2	1					25	25	50	25	50	
9	Programme Elective Course - II - Lab	PEC	6CS247PE_	0	0	2	0	2	1					25	25	50	25	50	
10	Creative Thinking & Team Collaboration	SEC	6CS248VS1	1	0	2	1	4	2						50	50	25	50	
Total				18	0	8	18	44	22			550				200		750	
Notional Learning Hours : [Workload (teaching/guidance/practicum) 26x15 = 390 Hrs] + [Learner-engaged time 18x15 = 270 Hrs]																			
Optional Course for Double Minor / Honours Degree																			
11	Double Minor / Honours Course - IV	DH	6CS249DH1/2	4	0	0	4	8	4	60	40	100	40					100	3 Hrs.
Exit Option (Level 5.5) for B. Voc in Odd Semester of next Academic Year as approved by BOS																			
12	Network Engineer	EC	7CS250EC1	2	0	4	2	8	4	30	20	50	20	25	25	50	25	100	2 Hrs.
13	Cloud Engineer	EC	7CS251EC1	2	0	4	2	8	4	30	20	50	20	25	25	50	25	100	2 Hrs.
OR																			
14	Internship / Apprenticeship in Industry	EI	7CS252EI1	0	0	16	0	288	8					100	100	200	100	200	
OR																			
15	Two MOOC/NPTEL Courses	EC	7CS253OC_	8	0	0	8	16	8										

Jawaharlal Darda Institute of Engineering & Technology, Yavatmal (Autonomous Institute)

Curriculum Structure (Scheme) for Four Year Multidisciplinary B. Tech in Computer Science & Engineering Degree Programme

Semester - VII (Final Year)

Sr. No.	Course Name	Course Category	Course Code	Course Plan per Week (Hrs.)					Credits	Theory Evaluation		Theory (Total)		Practical/Term Work Evaluation		Practical/Term Work Evaluation (Total)		Total Max Marks	Theory Exam Time (Hrs.)
										SEE	CIA			EE	PA				
				L	T	P	SL	Total		Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks	Min Marks		
1	Advanced Cyber Security Practices	PCC	7CS301PC1	2	0	0	2	4	2	60	40	100	40					100	3 Hrs.
2	Software Engineering	PCC	7CS302PC1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
3	Programme Elective Course - IV	PEC	7CS303PE_	2	0	0	2	4	2	60	40	100	40					100	3 Hrs.
4	Programme Elective Course - V	PEC	7CS304PE_	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
5	Multidisciplinary Minor - V	MDM	7_305MD_	2	0	0	2	4	2	30	20	50	20					50	2 Hrs.
6	Software Engineering Lab	PCC	7CS306PC1	0	0	2	0	2	1					25	25	50	25	50	
7	Programme Elective Course - IV Lab	PEC Lab	7CS307PE_	0	0	2	0	2	1					25	25	50	25	50	
8	Research Methodology	RM	7CS401RM1	2	0	4	2	8	4	30	20	50	20		50	50	25	100	2 Hrs.
9	Project	PR	7CS402PR1	0	0	8	0	8	4					50	100	150	75	150	
Total				**14**	**0**	**16**	**14**	**44**	**22**			**500**				**300**		**800**	

Notional Learning Hours : [Workload (teaching/guidance/practicum) 30x15 = 450 Hrs] + [Learner-engaged time 14x15 = 210 Hrs]

Optional Course for Double Minor / Honours Degree																			
10	Double Minor / Honours Course - V	DH	7CS308DH1/ 2	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
Optional Course for Honours with Research Degree																			
11	Research Project	RP	7CS403RP1	0	0	18	0	18	9	0	0	0	0	100	100	200	100	200	

Jawaharlal Darda Institute of Engineering & Technology, Yavatmal (Autonomous Institute)

Curriculum Structure (Scheme) for Four Year Multidisciplinary B. Tech in Computer Science & Engineering Degree Programme

Semester - VIII (Final Year)

Sr. No.	Course Name	Course Category	Course Code	Course Plan per Week (Hrs.)					Credits	Theory Evaluation		Theory (Total)		Practical/Term Work Evaluation		Practical/Term Work Evaluation (Total)		Total Max Marks	Theory Exam Time (Hrs.)
										SEE	CIA			EE	PA				
				L	T	P	SL	Total		Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks	Min Marks		
1	Software Testing & Quality Assurance (Online)	PCC	8CS309PC1	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
2	Programme Elective Course - VI (Online)*	PEC	8CS310PE_	3	0	0	3	6	3	60	40	100	40					100	3 Hrs.
3	Multidisciplinary Minor - VI (Online)	MDM	8_311MD1_	2	0	0	2	4	2	30	20	50	20					50	2 Hrs.
4	On Job Training (Internship/Apprenticeship)	OJT	8CS404IN1	0	0	24	0	24	12					100	100	200	100	200	
Total				**8**	**0**	**24**	**8**	**40**	**20**			**250**				**200**		**450**	
Notional Learning Hours : [Workload (teaching/guidance/practicum) 32x15 = 480 Hrs] + [Learner-engaged time 8x15 = 120 Hrs]																			
Optional Course for Honours with Research Degree																			
5	Research Project	RP	8CS405RP1	0	0	18	0	18	9	0	0	0	0	100	100	200	100	200	

9. List of Programme Elective Courses

Students will have an option to choose the PEC offered by their respective Major Discipline offered during semester V to VIII Programme Elective Courses offered by Computer Science Engineering.

Sr. No.	Courses Offered Under	Programme Elective Course/Subjects Name	Course Code
1	V	Machine Learning (PEC-I)	5CS231PE1
2		Machine Learning Lab (PEC-Lab-I)	5CS236PE1
		OR	
3		Distributed Systems (PEC-I)	5CS231PE2
4		Distributed Systems Lab (PEC-Lab-I)	5CS236PE2
5	VI	Natural Language Processing (PEC-II)	6CS242PE1
6		Natural Language Processing Lab (PEC-Lab-II)	6CS246PE1
		OR	
7		Big Data Analytics (PEC-II)	6CS242PE2
8		Big Data Analytics Lab (PEC-Lab-II)	6CS246PE2
9		Image Processing (PEC-III)	6CS243PE1
		OR	
10		Dataware Housing & Mining (PEC-III)	6CS243PE2
11	VII	Artificial Network & Neural Networks(PEC-IV)	7CS303PE1
12		Artificial Network & Neural Networks Lab (PEC-Lab-IV)	7CS307PE1
		OR	
13		Augmented Reality & Virtual Reality (PEC-IV)	7CS303PE2
14		Augmented Reality & Virtual Reality Lab (PEC-Lab-IV)	7CS307PE2
15		Deep Learning (PEC-V)	7CS304PE1
		OR	
16		Management Information System (PEC-V)	7CS304PE2
17	VIII	Generative Artificial Intelligence (PEC-VI)	8CS310PE1
		OR	
18		Blockchain Fundamentals (PEC-VI)	8CS310PE2

14.5 Syllabus for Semester III & IV

Level: **5**	Course Code: **3CS201PC1**		Course Category: **PCC**		
Course Name	**Data Structures & Algorithms**				
Credits	**03**	Total L:T:P Hours	3:0:0 **45 Hrs**	Total SL Hours	**45 Hrs**
Total Credit Hours	**90 Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**-**	PA Marks	**-**	Total Marks	**100**

Course Description:
Subject Code 3CS201PC1 Data Structures & Algorithms is a compulsory Engineering Science Course for Second Year B. Tech, Computer Science & Engineering.

Course Objectives:
The objective of this course is to build foundational object-oriented programming skills in Java by applying key concepts like abstraction, encapsulation, inheritance, and polymorphism to create modular, reusable, and interactive applications.

Course Outcomes:
After completing the course students will be able to:

CO	**Course Outcome**	**Domain Level**
3CS201PC1.1	Explain basic concepts of data structures and algorithms for effective problem solving.	C-2
3CS201PC1.2	Implement operations on arrays, linked lists, stacks, and queues to develop functional programs.	C-3
3CS201PC1.3	Design tree and graph structures for solving real-world applications.	C-3
3CS201PC1.4	Compare searching and sorting algorithms for evaluating efficiency	C-3
3CS201PC1.5	Choose suitable data structures and algorithms to solve computational problems.	C-4
3CS201PC1.6	Classify and organize data using structures for file handling applications.	C-4

Course Contents:

Unit 1	**Introduction to Algorithms and Complexity:** Algorithm: Definition, characteristics, and importance Steps in algorithm development, Time and space complexity analysis, Asymptotic notations (O, Ω, Θ), Recursion and recursive algorithms, Divide and conquer concept (examples: binary search, merge sort)	7 Hrs
Unit 2	**Arrays and Linked Lists:** Introduction to Arrays, One-Dimensional Arrays, Two-Dimensional Arrays, Multi-Dimensional Arrays Representation and operations on arrays, Sparse matrices, String handling and operations, Linked List: concept, representation, and types Singly Linked List, Doubly Linked List, Circular Linked List, Operations: insertion, deletion, traversal, searching, Applications: polynomial addition, memory management	7 Hrs
Unit 3	**Stacks and Queues:** **Stack:** definition, operations, applications, Implementation using array and linked list, Applications: infix → postfix conversion, postfix evaluation, recursion. **Queue:** definition and operations, Simple queue, circular queue, priority queue, dequeue, Implementation using array and linked list, Applications: scheduling, simulation	7 Hrs
Unit 4	**Trees and Graphs:** Basic terminology (nodes, edges, height, degree, etc.), Binary tree representation and traversal (inorder, preorder, postorder), Binary Search Tree (BST): creation, insertion, deletion, searching, Expression trees and Huffman coding**,** Introduction to AVL trees and B-trees.	8 Hrs
Unit 5	**Graph:** Basic concepts and terminology, Memory Representation of graph: adjacency matrix, adjacency list, Traversal algorithms: DFS, BFS, Spanning Trees: Introduction, minimum cost spanning trees, Prim's Method and Kruskal's Method for MSTs. Applications of graphs (networking, path finding).	8 Hrs
Unit 6	**Searching, Sorting, & Hashing:** Linear and Binary Search algorithm **Sorting Algorithms:** Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort. **Hashing:** Hash tables, hash functions, collision handling (chaining, open addressing)	8 Hrs

Text Books:

1. E. Balagurusamy, *Data Structures Using C, McGraw* Hill.
2. Seymour Lipschutz: Data Structures, Schaum's Outline Series, McGraw-Hill, International Editions. Reema Thareja, *Data Structures Using C*, Oxford University Press.

Reference Books:

1. Ellis Horowitz, Sartaj Sahni, Fundamentals of Data Structures, CBS Publications.
2. Thomas H. Cormen et al., *Introduction to Algorithms*, MIT Press..
3. Narasimha Karumanchi, *Data Structures and Algorithms Made Easy*.

E Resources :

1. **Data Structures and Algorithms** – Prof. Naveen Garg (IIT Delhi) https://nptel.ac.in/courses/106102064
2. *Data Structures and Algorithm Specialization* – University of California, San Diego https://www.coursera.org/specializations/data-structures-algorithms
3. **Design and Analysis of Algorithms** – Prof. Madhavan Mukund (IIT Madras) https://nptel.ac.in/courses/106106131

Mapping of COs with Pos:

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
3CS103ES1.1	3	2	1	-	1	-	-	-	-	-	1	3	3	3
3CS103ES1.2	3	3	2	1	2	-	-	-	1	-	1	3	3	1
3CS103ES1.3	3	3	3	2	2	-	-	-	2	-	1	3	3	1
3CS103ES1.4	3	3	2	2	2	-	-	-	-	-	1	3	2	1
3CS103ES1.5	3	3	3	2	3	-	-	-	2	1	2	3	3	2
3CS103ES1.6	3	3	2	2	3	1	-	-	1	-	3	3	2	3
3CS103ES1CO	3	3	2	2	3	1	-	-	1	1	1	3	3	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code: **3CS202PC1**			Course Category: **PCC**	
Course Name	**Object Oriented Programming (Java)**				
Credits	**02**	Total L:T:P etc. Hours	2:0:0 **30 Hrs**	Total SL Hours	**30 Hrs**
Total Credit Hours	**60 Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**-**	PA Marks	**-**	Total Marks	**100**

(1,4,120-PO1, PO3, PO4, PO5, PO9[Cognitive])

Course Description:
Subject Code 3CS202PC1 Object Oriented Programming (Java) is a compulsory Engineering Science Course for Second Year B. Tech. Computer Science and Engineering Branch.

Course Objectives:
Couse objective of this subject is to build a strong foundation in Object-Oriented Programming using Java by understanding core OOP principles and applying them to develop modular, reusable, and interactive software applications.

Course Outcomes:
After completing the course students will be able to:

CO	**Course Outcome**	**Domain Level**
3CS201PC.1	Explain OOP principles and Java basics to understand object-oriented programming.	C3
3CS201PC.2	Apply classes, objects, constructors, and arrays to develop structured Java programs.	C3
3CS201PC.3	Implement inheritance, interfaces, abstract classes, and packages to achieve code reusability.	C4
3CS201PC.4	Analyze exceptions and use I/O streams for reliable file handling.	C4
3CS201PC.5	Develop Java applets using lifecycle and graphics to create interactive applications.	C5
3CS201PC.6	Design GUI applications with event handling to build user-friendly interfaces.	C6

Course Contents:

Unit 1	**Introduction to Object-Oriented Programming:** Need of OOP, Principles of OOP, Procedural vs Object-Oriented Programming, Java Virtual Machine, Java Features, Basic Program Structure, Variables, Data Types, Identifiers, Operators and Expressions, Type Conversion & Casting, Flow Control Statements	5 Hrs
Unit 2	**Classes and Objects:** Classes & Objects, Creating Objects, Methods Constructors, Garbage Collection, Class Variables & Methods, this Keyword, Arrays, Command Line Arguments	5 Hrs
Unit 3	**Inheritance, Interfaces & Packages:** Inheritance & Aggregation, Method Overriding, super & final Keywords, Abstract Classes, Interfaces: Defining, Implementing, Extending, Accessing Interface Variables Packages & java.lang Package	5 Hrs
Unit 4	**Exception Handling & I/O Streams:** Exception Types, Exception Handling Techniques, User-Defined Exceptions, Exception Enrichment, java.io. File Class, File Reading/Writing, Random Access Files, Input/Output Streams	5 Hrs
Unit 5	**Applets:** Introduction, Applet Class, Applet structure, Applet Life cycle, Common Methods used in displaying the output, paint (), update () and repaint (), More about applet tag, getDocumentBase () and getCodeBase () methods, Applet Context Interface, Audio clip, Graphic Class, Color, Font, Font Metrics	5 Hrs
Unit 6	**Event Handling:** Introduction, Event delegation Model, java.awt.event Description, Sources of events, Event Listeners, Adapter classes, Inner Classes. Abstract Window Toolkit: Introduction, Components and Containers, Button, Label, Checkbox, Radio Buttons, List Boxes, Choice Boxes, Textfield and Textarea, Container Class, Layouts, Menu, Scrollbar	5 Hrs

Text Books:

4. Sachin Malhotra and Saurabh Choudhary, Programming in Java, Oxford University Press 2010.
5. Herbert Schildt, Java Complete References (McGraw Hill)

Reference Books:

1. H. M. Dietel and P. J. Dietel, “Java How to Program”, Pearson Education/PHI, Sixth Edition.
2. E. Balagurusamy, Programming with Java (McGraw Hill)
3. Dr. R. NageswaraRao, Core Java an Integrated Approach (Dreamtech)

4. Khalid Mughal, A Programmer's Guide to Java Certification, 3rdEdition (Pearson)
5. Sharnam Shah and Vaishali Shah, Core Java for Beginners, (SPD),2010.

E Resources:

1. https://www.tutorialspoint.com/java/index.htm
2. https://www.geeksforgeeks.org/java/java/
3. https://www.w3schools.com/java/

Mapping of COs with POs

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
3CS201PC.1	3	3	2	1	2	-	-	1	1	-	1	3	1	1
3CS201PC.2	3	2	2	-	3	-	-	1	1	-	1	3	2	1
3CS201PC.3	3	3	3	2	3	-	-	1	1	-	1	3	3	1
3CS201PC.4	3	3	2	3	3	-	-	1	1	-	2	3	3	2
3CS201PC.5	2	2	3	1	3	-	-	2	2	1	1	2	3	2
3CS201PC.6	2	2	3	1	3	-	-	1	2	-	1	2	3	2
3CS201PC.CO	3	3	3	2	3	-	-	1	1	1	1	3	3	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code: **3CS203PC1**		Course Category: **PCC**		
Course Name	**Discrete Mathematics**				
Credits	**03**	Total L:T:P Hours	3:0:0 **45 Hrs**	Total SL Hours	**45 hrs**
Total Credit Hours	**90 Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**-**	PA Marks	**-**	Total Marks	**100**

Course Description:
Subject Code 3CS203PC1 Discrete Mathematics is a compulsory Program Core Course for Second Year B.Tech. Computer Science And Engineering.

Course Objectives:
The objective of this course is to provide a foundational understanding of discrete structures such as logic, sets, relations, functions, counting, probability, graphs, and trees. To develop analytical skills using mathematical reasoning, proofs, and induction for solving discrete and computational problems.

Course Outcomes:
After completing the course students will be able to:

CO	**Course Outcome**	**Domain Level**
3CS203PC1.1	Apply propositional logic, predicates, and rules of inference to construct and validate mathematical arguments.	C-3
3CS203PC1.2	Analyze and apply concepts of sets, relations, and functions to solve mathematical and computational problems.	C-4
3CS203PC1.3	Demonstrate understanding of algebraic systems and apply them in coding and computation to solve mathematical and programming problems.	C-3
3CS203PC1.4	Breakdown and design logical circuits using Boolean algebra and Karnaugh maps to optimize digital circuits.	C-4
3CS203PC1.5	Apply tree structures for efficient data organization, traversal, and encoding applications such as Huffman coding.	C-3
3CS203PC1.6	Analyze and solve problems involving graphs, including connectivity, traversals, and graph coloring applications.	C-4

Course Contents:

Unit 1	**The Foundations: Logic and Proofs:** Propositions, Truth Tables, Compound Propositions, Logical Operators, Logic and Bit Operations; Logical Equivalences, De Morgan's Laws, Satisfiability: Applications and Solving Problems; Predicates, Quantifiers: Restricted Domains, Precedence, Logical Equivalences; Rules of Inference for Propositional Logic, Use to Build Arguments, Resolution, Combination for Propositions and Quantified Statements	7 Hrs
Unit 2	**Sets, Functions and Relation :** Introduction, Venn Diagrams, Subsets, Size of a Set, Power Sets, Cartesian Products, Set Notation with Quantifiers, Truth Sets and Quantifiers, Set Operations, Partial Functions; Sequences, Recurrence Relations, Special Integer Sequences, Summations; Countable Sets, An Uncountable Set; Functions as Relations, Relations on a Set, Operations on n- ary Relations; Representing Relations Using Matrices; Relations and Their Properties, n-ary Relations and Their Applications,	8 Hrs
Unit 3	**Algebraic Structures:** Algebraic Systems: Examples and General Properties; Semigroups and Monoids: Homomorphism of Semigroups and Monoids, Subsemigroups and Submonoids; Groups: Definitions, Subgroups and Homomorphisms, Cosets and Lagrange's Theorem, Normal Subgroups, algebraic Systems with Two Binary Operations; Group Codes: The Communication Model and Basic Notions of Error Correction, Hamming Distance.	8 Hrs
Unit 4	**Boolean Algebra:** Lattices, Boolean Algebra: Boolean Functions, Representing Boolean Functions, sum of product expansions, Functional Completeness, Logic Gates, Combinations of Gate, Minimization of Circuits, Karnaugh Maps.	7 Hrs
Unit 5	**Tree :** Introduction, Rooted Tree, ordered rooted tree, tree as model, Properties of Trees, Applications of tree, Binary Search Trees, Decision Trees, Prefix Codes, Huffman Coding, Game Trees, Tree traversal, Preorder Traversing, In order Traversing, Post order Traversing, Spanning Tree, Minimum spanning tree	7 Hrs
Unit 6	**Graph:** Graph Models; Basic Terminology, Special Simple Graphs, Bipartite Graphs, Matchings, Applications of Special Types of Graphs, New Graphs from Old; Graph Representation, Adjacency and Incidence Matrices, Isomorphism of Graphs, Determining Isomorphism; Paths, Connectedness in Undirected Graphs and Directed	8 Hrs

	Graphs, Paths and Isomorphism, Counting Paths Between Vertices; Euler Paths and Circuits,	

Text Books:

1. Kenneth H. Rosen, Discrete Mathematics and Its Applications, 7th Edition, McGraw-Hill.
2. J. P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw-Hill Edition, McGraw-Hill.

Reference Books:

1. Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press.
2. Seymour Lipschutz and Marc Lars Lipson, Schaum's Outline of Theory and Problems of Discrete Mathematics, 3rd Edition, Schaum's Outlines Series, McGraw-Hill
3. C. L. Liu and D. P. Mohapatra, Elements of Discrete Mathematics, A Computer Oriented Approach, 3rd Edition, Tata McGraw-Hill, McGraw-Hill.

E-Resources:

1.GeeksforGeeks: Discrete Mathematics Tutorials

2. Course: Discrete Mathematics by Prof. Kamala Krithivasan, IIT Madras
Link: https://nptel.ac.in/courses/106/106/106106183/

Mapping of COs with POs

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
3CS203PC1.1	3	3	2	2	1	-	-	-	1	-	1	3	1	1
3CS203PC1.2	3	3	2	3	1	-	-	-	1	-	1	3	2	1
3CS203PC1.3	3	2	2	2	2	-	-	-	1	-	1	3	2	1
3CS203PC1.4	3	2	2	2	2	-	-	-	1	-	2	3	2	2
3CS203PC1.5	3	2	2	2	2	-	-	-	1	-	2	3	2	2
3CS203PC1.6	3	3	2	3	2	-	-	-	1	-	2	3	3	2
3CS203PC1CO	3	3	2	3	2	-	-	-	1	-	1	3	2	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code: **3CS204MD1**	Course Category: **MDM-I**

Course Name	**Operating System**				
Credits	**02**	Total L:T:P etc. Hours	2:0:0 **30 Hrs**	Total SL Hours	**30 hrs**
Total Credit Hours	**60 Hrs**				
SEE Marks	**30**	SEE Time	**2 Hrs**	CIA Marks	**20**
EE Marks	**-**	PA Marks	**-**	Total Marks	**50**

Course Description:
Subject Code 3CS204MD1 Operating System is a compulsory Multi-Disciplinary Minor Course offered by the department of Computer Science & Engineering for other Second Year B.tech. Major discipline

Course Objectives:
The objective of this course is to provide a fundamental understanding of operating system structures, functions, and services, including process, memory, file, and device management. To develop problem-solving skills in process scheduling, synchronization, deadlocks, security, and system performance.

Course Outcomes:
After completing the course students will be able to:

CO	**Course Outcome**	**Domain Level**
3CS204MD1.1	Apply process and thread management concepts for multitasking and communication	C-3
3CS204MD1.2	Apply and compare different scheduling algorithms to improve CPU efficiency.	C-3
3CS204MD1.3	Explain memory management schemes like paging, segmentation to Analyze file and I/O management techniques	C-2

Course Contents:

Unit 1	**Introduction to OS** Introduction: Operating System definition, OS Evolution, Components and Services, Process Concept, Process Scheduling, Operations on Processes, Cooperating Processes, Interprocess Communication, Threads Overview, Multithreading Models, Threading Issues, Java Threads	10 Hrs
Unit 2	**Process Scheduling :** Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR, Priority,	10 Hrs

	Multilevel Queue, Multilevel Feedback Queue Scheduling	
Unit 3	**Memory & File Management:** Memory Management: Paging, Segmentation, Virtual Memory, Page ReplacementFile System: File Concepts, Directory Structure, File Operations, File ProtectionI/O Management: Disk Scheduling and Management Basics Overview of Modern OS (Windows, Linux, Android) Memory and File Systems	10 Hrs

Text Books:

Avi Silberschatz, P.B.Galvin, G.Gagne, Operating System Concepts (9/e) John-Wiley & Sons.

Reference Books:

1. A.S.Tanenbaum, Modern Operating Systems, Pearson Education.
2. William Stallings, Operating Systems, Prentice-Hall.
3. D. M. Dhamdhere, Operating Systems, Tata McGraw-Hill. 4. P. Balkrishna Prasad, Operating Systems, Scitech Publications (I) Pvt. Ltd.

E-Resources:

1. Topic: Operating System Concepts
   Link: https://www.tutorialspoint.com/operating_system/
2. Course: Operating System Fundamentals by Prof. Rajib Mall, IIT Kharagpur
   Link: https://nptel.ac.in/courses/106105214

Mapping of COs with POs

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
3CS204MD1.1	3	2	3	2	1	-	-	-	1	1	1	3	2	1
3CS204MD1.2	3	3	3	2	1	-	-	-	1	1	1	3	2	1
3CS204MD1.3	3	2	2	2	2	-	-	-	1	-	1	2	2	1
3CS204MD1CO	3	2	3	2	1	-	-	-	1	1	1	3	2	1

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level:	5	Course Code:	3SH205OE1	Course Category:	OE
Course Name	**Soft Skills & Profile Building**				
Credits	**03**	Total L:T:P Hours	3:0:0 **45 Hrs**	Total SL Hours	**45 Hrs**
Total Credit Hours	**90 Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**--**	PA Marks	**--**	Total Marks	**100**

Course Description:
Subject Code 3SH205OE1Soft Skills & Profile Building is a compulsory Open Elective Course for the Second Year B. Tech All Branch Students.

Course Objectives:
The objective of this course is to focus on developing advanced communication skills, leadership qualities and professional etiquette among engineering graduates. The course emphasizes workplace communication, interview preparedness, personal branding, and employability skills aligned with industry expectations. It integrates emotional intelligence, digital professional identity, and strategic career planning for holistic professional development.

Course Outcomes:
After completing the course students will be able to:

CO	Course Outcome	Domain Level
3SH205OE1.1	Apply advanced interpersonal, analytical, and persuasive communication techniques in professional contextsfor effective professional interactions.	C-3
3SH205OE1.2	Demonstrate professional workplace etiquette, business communication, and group discussion skillsto enhance employability.	C-3 A-3
3SH205OE1.3	Analyze leadership styles, emotional intelligence, and team dynamics for effective collaboration.	C-4 A-3
3SH205OE1.4	Design a structured and realistic career plan aligned with industry expectations and personal goalsfor professional growth.	C-6
3SH205OE1.5	Create ATS-friendly résumés, professional portfolios, and digital profiles for personal branding.	C-6 P-4
3SH205OE1.6	Perform effectively in interviews, workplace simulations, and job-search processes with professional confidencefor enhanced employability.	C-3 P-3 A-3

Course Contents:

Unit 1	**Advanced Communication Dynamics:** Advanced interpersonal communication strategies; speech articulation; structuring thoughts and fluency techniques; analytical and critical communication; storytelling techniques for impactful presentations; persuasive communication models.	7Hrs
Unit 2	**Global Workplace Etiquettes, Email Writing & GD–PI Perspective:** Professional greetings and workplace conduct; giving and receiving feedback; handling criticism and adaptability issues; professional values such as punctuality and attire; types of handshakes and significance; effective business email writing; types of Group Discussions, purpose of GDs; mock GDs (video-based); interview strategies and techniques.	8Hrs
Unit 3	**Leadership, Team Dynamics & Corporate Skills:** Personality types using 9/9 matrix; leadership styles; emotional intelligence and leadership relationship; conflict resolution and negotiation techniques; team-building skills (Johari Window perspective); cross-cultural communication; creativity and design thinking; structured problem-solving and decision-making**.**	7 Hrs
Unit 4	**Strategizing Career Planning:** SMART goal setting; mapping skills to career paths; understanding industry expectations; emerging futuristic soft and hard skills (domain-wise); personalized career roadmap; certification planning (technical and non-technical); networking skills and participation in professional communities	7 Hrs
Unit 5	**Profile Building, Portfolio & Personal Branding:** ATS-friendly résumé preparation and common mistakes; video résumé creation and self-marketing pitch; LinkedIn profile optimization and networking strategies; developing online portfolios using platforms such as GitHub, Behance, Google Sites, and Toastmasters	8 Hrs
Unit 6	**Employment Readiness & Industry Integration:** Workplace simulation activities (mock emails, meetings, discussions); mock personal interviews; understanding sector-specific industry dynamics; unconventional career opportunities after engineering; job-hunting strategies and popular job platforms	8 Hrs

Text Books:

1. Alex K., Soft Skills, S. Chand Publishing
2. Meenakshi Raman & Prakash Singh, Business Communication, Oxford University Press

Reference Books:

1. Stephen R. Covey,The 7 Habits of Highly Effective People,Free Press Publication
2. Daniel Goleman, Emotional Intelligence,published by Bantam Books.
3. Shiv Khera, You Can Win,published by Bloomsbury Publishing
4. Richard N. Bolles, What Color Is Your Parachute? Published by Ten Speed Press, Crown Publishing Group

E Resources:

1. NPTEL: Soft Skills and Personality Development
2. LinkedIn Learning – Communication & Career Development Courses
3. Harvard Business Review – Communication & Leadership Articles
4. Coursera /edX – Career Development & Employability Skills Modules

Mapping of COs with POs & PSO

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
3SH205OE1.1	2	3	2	–	–	–	–	2	3	–	–	2	2	3
3SH205OE1.2	–	2	–	–	–	2	3	3	3	–	–	1	2	3
3SH205OE1.3	–	3	2	–	–	2	2	3	–	–	–	2	3	3
3SH205OE1.4	–	3	3	–	–	2	–	–	–	2	3	2	3	2
3SH205OE1.5	–	2	3	–	3	–	–	–	2	–	2	1	2	2
3SH205OE1.6	–	2	2	–	2	2	–	2	3	–	2	2	3	3
3SH205OE1CO	1	3	2	-	1	2	1	2	2	1	1	1	2	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level:	5	Course Code:	3SH205OE2	Course Category:	OE
Course Name	**Team Building & Management**				
Credits	**03**	Total L:T:P Hours	3:0:0 **45 Hrs**	Total SL Hours	**45 Hrs**
Total Credit Hours	**90 Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**--**	PA Marks	**--**	Total Marks	**100**

Course Description:
Subject Code 3SH205OE2Team Building & Management is a compulsory Open Elective Course for Second Year B. Tech All Branch Students.

Course Objectives:
The Objective of the course is to develop teamwork capabilities, leadership and managerial skills, collaborative problem-solving abilities, conflict management techniques, and effective decision-making skills required in professional and organizational settings.

Course Outcomes:
After completing the course students will be able to:

CO	Course Outcome	Domain Level
3SH205OE2.1	Explain the principles and importance of effective team building in organizations to foster collaborative work culture.	C-2
3SH205OE2.2	Apply team dynamics and collaboration strategies to achieve common goals.	C-3 A-3
3SH205OE2.3	Analyze leadership styles and managerial roles for effective team performance.	C-4
3SH205OE2.4	Demonstrate conflict resolution, negotiation, and interpersonal management skills for effective team performance.	C-3 A-3
3SH205OE2.5	Apply motivation and performance management techniques in team-based environments for achieving organizational goals.	C-3
3SH205OE2.6	Perform effectively as a team member or leader in simulated managerial scenarios to develop leadership competencies	C-3 P-3 A-3

Course Contents:

Unit 1	**Fundamentals of Team Building:** Concept of teams; types of teams; stages of team development; characteristics of effective teams; roles and responsibilities of team members; barriers to effective teamwork; team norms and values.	7Hrs

Unit 2	**Team Dynamics & Interpersonal Relationships:** Group behaviour and dynamics; interpersonal communication in teams; trust and collaboration; listening as a team skill; diversity and inclusion in teams; cross-cultural team management	8Hrs
Unit 3	**Leadership in Teams:** Leadership concepts; leadership styles; emotional intelligence and leadership; situational leadership; influence and power in teams; leadership ethics and responsibilities.	7 Hrs
Unit 4	**Conflict Management & Negotiation:** Sources and types of conflict; conflict resolution techniques; negotiation strategies; managing difficult team members; stress management; maintaining team harmony	7 Hrs
Unit 5	**Motivation, Performance & Team Effectiveness:** Motivation theories; team motivation techniques; goal setting and performance measurement; feedback and appraisal systems; decision-making in teams; problem-solving techniques.	8 Hrs
Unit 6	**Managerial Skills & Team-Based Applications:** Managerial roles and functions; planning, organizing, and controlling teams; delegation and coordination; workplace simulations (team meetings, role plays); case studies on team management; team performance evaluation.	8 Hrs

Text Books:

1.Stephen P. Robbins, Organizational Behaviour, Pearson Education

2. L.M. Prasad, Management Principles and Practices, published by Sultan Chand & Sons

Reference Books:

1. Patrick Lencioni, The Five Dysfunctions of a Team, published by Jossey-Bass

2. Peter G. Northouse, Leadership, published by SAGE Publications

3. Daniel Goleman, Emotional Intelligence, published by Bantam Books

E Resources:

1. NPTEL – Organizational Behavior& Management Courses
2. LinkedIn Learning – Team Leadership & Management Modules
3. Harvard Business Review – Teamwork & Leadership Articles
4. Coursera / edX – Team Management and Leadership Courses

Mapping of COs with POs & PSO

CO	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
3SH205OE2.1	2	–	–	–	–	–	–	–	–	–	–	1	2	3
3SH205OE2.2	–	2	2	–	–	–	–	3	2	–	–	2	3	3
3SH205OE2.3	–	3	3	–	–	–	–	2	–	–	–	2	3	3
3SH205OE2.4	–	2	2	–	–	2	3	3	–	–	–	2	3	3
3SH205OE2.5	–	2	2	–	–	–	–	2	–	2	–	2	3	3
3SH205OE2.6	–	2	2	–	–	2	–	3	2	–	2	2	3	3
3SH205OE2 CO	1	2	2	-	-	1	1	2	1	1	1	2	3	3

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course code: **3CS206PC1**		Course Category: **PCC**		
Course Name	**Data Structures & Algorithms Lab**				
Credits	**01**	Total L:T:P Hours	0:0:2 **30 Hrs**	Total SL Hours	-
Total Credit Hours	**30 Hrs**				
SEE Marks	-	SEE Time	-	CIA Marks	-
EE Marks	**25**	PA Marks	**25**	Total Marks	**50**

Course Description:
Subject Code 3CS206PC1 Data Structures & Algorithms Lab provides hands-on practice of core data structures and algorithms using C/C++, strengthening problem-solving skills through practical implementation.

Course Objectives:
The objective of the course is to implement core data structures and develop algorithms for basic operations, and to apply abstract data types to solve computational and real-life problems.

Course Outcomes:
After completing the course students will be able to:

CO	**Course Outcome**	**Domain Level**
3CS206PC1.1	Implement arrays, linked lists, stacks, and queues for structured data handling.	C-3,P-3,A-2
3CS206PC1.2	Apply tree and graph traversal algorithms to solve real-time problems.	C-4,P-3
3CS206PC1.3	Develop searching, sorting, and hashing programs to compare performance.	C-4,P-4,A-3

List of Practicals:
Minimum Ten practical's from the list mentioned below.

1. Implementation of array operations (insert, delete, search, traverse).
2. Implementation of singly linked list and its operations.
3. Implementation of doubly and circular linked lists.
4. Stack implementation using array and linked list.
5. Applications of stack: infix to postfix conversion, postfix evaluation.
6. Queue implementation using array and linked list.
7. Circular queue and priority queue implementation.
8. Implementation of binary tree and its traversals (inorder, preorder, postorder).
9. Implementation of binary search tree (insertion, deletion, search).
10. Implementation of graph using adjacency list/matrix.
11. Graph traversal algorithms: BFS and DFS.
12. Implementation of linear and binary search.

E Resources:

1. Thomas H. Cormen et al., Introduction to Algorithms (CLRS) – MIT PresseBook.https://mitpress.mit.edu/9780262046305/introductional goriths/
2. Data Structures and Algorithms – Prof. Naveen Garg (IIT Delhi) https://nptel.ac.in/courses/106102064
3. *Programming,* Data Structures and Algorithms using C – Prof. Anupam Basu (IIT Kharagpur) https://nptel.ac.in/courses/106105085
4. Comprehensive tutorials, problems, and practice questions. https://www.geeksforgeeks.org/data-structures

Mapping of COs with POs

CO	**PO**											**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
3CS206PC1.1	3	2	2	1	3	-	-	-	3	1	1	3	2	1
3CS206PC1.2	3	2	3	2	2	-	-	-	2	1	1	3	3	1
3CS206PC1.3	3	3	3	2	3	-	-	-	3	2	1	3	3	2
3CS206PC1CO	3	2	3	2	3	-	-	-	3	1	1	3	3	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code: **3CS207PC1**		Course Category: **PCC**		
Course Name	**Object Oriented Programming Lab (Java)**				
Credits	**01**	Total L:T:P etc. Hours	0:0:2 **30 Hrs**	Total SL Hours	**-**
Total Credit Hours	**30 Hrs**				
SEE Marks	**-**	SEE Time	**-**	CIA Marks	**-**
EE Marks	**25**	PA Marks	**25**	Total Marks	**50**

Course Description:
Subject Code 3CS207PC1 Object Oriented Programming Lab (Java) is a compulsory Program Core Course for Second Year B.Tech. Computer Science and Engineering.

Course Objectives:
To build a strong foundation in Object-Oriented Programming using Java by understanding core OOP principles and applying them to develop modular, reusable, and interactive software applications.

Course Outcomes:
After completing the course students will be able to:

CO	**Course Outcome**	**Domain Level**
3CS207PC1.1	Apply core object-oriented programming concepts—such as classes, objects, overloading, inheritance, interfaces, and abstraction—to design and implement Java programs.	C-3, P-4, A-2
3CS207PC1.2	Use Java features including arrays, command-line input, exception handling, file I/O, and GUI components (AWT/Swing) to develop, test, and debug structured applications.	C-3, C-4, P-5, A-3
3CS207PC1.3	Develop interactive applications incorporating applets, graphics, event handling, and essential OOP mechanisms to solve foundational real-world problems	C-4, C-5, P-6, A-4

List of Practical's:
Minimum Ten practical's from the list mentioned below.

1. Introduction to Object Oriented Programming and installation of JDK. Write a program to print a message "Hello World..."
2. Develop a program to explain use of Operators in java.
3. Develop a program to demonstrate the concept of Class, Method and Object.
4. Develop a program to study and implement the concept of Method Overloading.
5. Develop a program to study and implement concept of Constructor Overloading in Java.

6. Develop a program to study and implement the Array in Java.
7. Develop a Program on various ways to accept data through keyboard (Command Line Argument)
8. Develop a Program to study and implement the concept of Inheritance.
9. Develop a Program to study and implement the concept of Method Overriding.
10. Develop a Program to study and implement the Abstract Class.
11. Develop a Program to study and implement the concept of Interface in Java.
12. Develop a Program to study and implement Exception Handling Mechanism in Java.

E Resources:

1. https://www.w3schools.com/java/
2. https://www.geeksforgeeks.org/java/
3. https://www.tutorialspoint.com/java/index.htm

Mapping of COs with POs

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
3CS207PC1.1	3	2	2	–	3	–	–	–	–	–	1	3	2	1
3CS207PC1.2	3	3	2	2	3	–	–	1	1	–	2	3	3	1
3CS207PC1.3	2	3	3	2	3	1	–	1	2	–	3	3	3	2
3CS207PC1CO	3	3	2	2	3	1	-	1	2	-	2	3	3	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code: **3CS208PC1**		Course Category: **PCC**		
Course Name	**Programming Laboratory-I (Python Programming Lab)**				
Credits	**01**	Total L:T:P etc. Hours	0:0:2 **30 Hrs**	Total SL Hours	-
Total Credit Hours	**30 Hrs**				
SEE Marks	-	SEE Time	-	CIA Marks	-
EE Marks	**25**	PA Marks	**25**	Total Marks	**50**

Course Description:
Subject Code 3CS208PC1 Programming Laboratory-I (Python Programming Lab) is a compulsory Program Core Course for Second Year B.Tech. Computer Science and Engineering.

Course Objectives:
The objective of this course is to develop practical proficiency in Python by applying core syntax, data structures, functional and object-oriented concepts, and modules with file handling to build structured and efficient programs.

Course Outcomes:
After completing the course students will be able to:

CO	Course Outcome	Domain Level
3CS208PC1.1	Demonstrate the use of the Python interpreter, apply basic syntax, perform string operations, and manipulate built-in data structures	C3,P3, A2
3CS208PC1.2	Apply functional programming concepts, list/tuple/dictionary processing, and problem-solving techniques to implement computational logic in Python programs	C3,P4, A2
3CS208PC1.3	Develop Python programs using OOP concepts, modules, packages, and file-handling techniques.	C4,P4,P5, A3

List of Practical's:
Minimum Ten practicals from the list mentioned below.

1. Introduction of Python Programing and Write a program to understand basic Python interpreter
2. Write a program to perform String Manipulation and Functions
3. Write a program to implement Python Data structures
4. Write a program to find the maximum, minimum, and average of elements in a list.
5. Write a program to convert a list into a tuple and display its elements
6. Write a program to create a dictionary of student names and marks, then display the student with highest marks

7. Implement Classes and Objects using Python
8. Design a program to understand Overloading in Python
9. Design a program to understand Overriding in Python
10. Implement Inheritance using Python
11. Develop a Python code for Information hiding
12. Implement Python's Modules and Packages
13. Write a program to illustrate concept of File handling

E Resources:

1. https://www.w3schools.com/java/
2. https://www.geeksforgeeks.org/java/
3. https://www.tutorialspoint.com/java/index.htm

Mapping of COs with POs

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
3CS208PC1.1	3	2	2	2	1	–	–	–	–	1	1	3	2	1
3CS208PC1.2	3	3	3	2	2	–	–	–	–	1	1	3	3	1
3CS208PC1.3	3	2	3	2	2	–	–	–	1	2	2	3	3	2
3CS208PC1 CO	3	2	3	2	2	–	–	–	1	1	1	3	3	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code: **3CS209EM1**		Course Category: **EEM**		
Course Name	**Human Resource Management**				
Credits	**02**	Total L:T:P etc. Hours	2:0:0 **30 Hrs**	Total SL Hours	**30 Hrs**
Total Credit Hours	**60 Hrs**				
SEE Marks		SEE Time		CIA Marks	
EE Marks	**50**	PA Marks	**50**	Total Marks	**50**

Course Description:
Subject Code 3CS209EM1 Human Resource Management is a compulsory Management Course for Second Year B. Tech.

Course Objectives:
The objective of this course is to introduce students to the principles and practices of Human Resource Management (HRM) and its application in technical and industrial organizations.

Course Outcomes:
After completing the course students will be able to:

CO	**Course Outcome**	**Domain Level**
3CS209EM1.1	Understand the nature and role of HRM in engineering contexts	C-2
3CS209EM1.2	Apply concepts of manpower planning, recruitment, training, and performance appraisal to technical teams.	C-3
3CS209EM1.3	Analyze contemporary issues and digital trends in HRM	C-4

Course Contents:

Unit 1	**Fundamentals of HRM:** Concept, scope and significance of HRM , Role of HR in engineering & technology-based organizations, HR Planning, Recruitment and selection process, Challenges in modern HRM.	10 Hrs
Unit 2	**Training, Performance & Compensation:** Training & Development, Evaluating training effectiveness (Kirkpatrick's levels), Performance Management, Compensation & rewards, Employee engagement and retention strategies.	10 Hrs
Unit 3	**Legal, Ethical & Emerging HRM Issues:** Overview of key labour laws: Factories Act, Wages Act, Maternity Benefit Act, Industrial relations & employee welfare, HR Information Systems (HRIS), Change management, Emerging trends	10 Hrs

Text Books:

1. K. Aswathappa, Human Resource Management: Text & Cases, Tata McGraw Hill.
2. P. Subba Rao, Personnel and Human Resource Management, Himalaya Publishing House, Latest Edition.
3. A. K. Singh, Human Resource Management, Laxmi Publications.
4. Gary Dessler, Human Resource Management, Pearson Education (Indian Edition).

Reference Books:

1. Bohlander & Snell, Managing Human Resources, Cengage Learning.
2. C. B. Mamoria & S. V. Gankar, Human Resource and Personnel Management, Himalaya Publishing.
3. V. S. P. Rao, Human Resource Management, Excel Books.
4. P. C. Tripathi, Human Resource Development and Management, Sultan Chand & Sons.

E Resources:

1. NPTEL Online Course, Human Resource Management https://nptel.ac.in/courses/110105053
2. SWAYAM (AICTE), Human Resource Management https://swayam.gov.in
3. https://ekumbh.aicte-india.org/ebooks
4. https://egyankosh.ac.in

Mapping of COs with POs

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
3CS209EM1.1	2	1	1	1	-	2	2	1	2	2	1	2	2	2
3CS209EM1.2	2	2	2	2	1	2	2	1	3	3	2	2	3	2
3CS209EM1.3	2	2	2	2	1	2	3	2	2	3	2	2	2	3
3CS209EM1CO	2	2	2	2	1	2	2	1	2	3	2	2	2	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code:	**3SH210VE1**	Course Category:	**VEC**
Course Name	**Constitutional Values and Fundamental Duties**			
Credits	**02**	Total L:T:P Hours	2:0:0 **30 Hrs**	Total SL Hours **30 Hrs**
Total Credit Hours	**60 Hrs**			
SEE Marks	--	SEE Time	--	CIA Marks --
EE Marks	**25**	PA Marks	**25**	Total Marks **50**

Course Description:
Subject Code 3SH210VE1 Constitutional Values and Fundamental Duties is a compulsory Valus enhancement Course for Second Year B. Tech.

Course Objectives:
The objective of the course is to introduce the Indian Constitution, its historical background, fundamental values, rights, and duties.

Course Outcomes:
After completing the course students will be able to:

CO	Course Outcome	Domain Level
3SH210VE1.1	Explain the historical background, making, and significance of the Indian Constitution to Understand the Constitution, Preamble, and core values.	C2
3SH210VE1.2	Interpret Fundamental Rights and Duties (Articles 12–35, 51A) to evaluate their implications through case studies in professional and civic life.	C3
3SH210VE1.3	Apply constitutional principles to engineering ethics, sustainability concerns (Articles 48A, 51A(g)), and demonstrate social commitment, innovation, and inclusive growth as nation builders.	C3

Course Contents:

Unit 1	**Introduction to the Constitution and Fundamental Values**: Overview of the Indian Constitution – Historical background and making of the Constitution; Meaning of Constitution; Preamble – Meaning and significance. Core Constitutional Values – Justice (Social, Economic, Political); Liberty (thought, expression, belief, faith, worship); Equality (status and opportunity); Fraternity (dignity and unity of the nation). Relevance of constitutional values for professionals and citizens.	10 Hrs
Unit 2	**Fundamental Rights and Duties**: Fundamental Rights (Articles 12–35) – Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right	10 Hrs

	to Constitutional Remedies. Fundamental Duties (Article 51-A) – Importance and implications; Role of youth and professionals in upholding duties. Case studies highlighting real-life significance of rights and duties.	
Unit 3	**Application of Constitutional Values in Engineering and Public Life**: Ethical Responsibilities and Constitutional Alignment – Engineering ethics and public interest; Environment and sustainability as constitutional concern (Articles 48A, 51A(g)); Engineers as nation builders – Social commitment, innovation, and inclusive growth.	10 Hrs

Text Books:

1. Basu D. D., Introduction to the Constitution of India, LexisNexis Publication, New Delhi (Twenty-Third Edition).
2. Jain M. P., Constitution of India, LexisNexis Publication, New Delhi (Eighth Edition).
3. Laxmikanth M., Indian Polity, McGraw Hill Education, New Delhi (Sixth Edition).
4. Austin Granville, The Indian Constitution: Cornerstone of a Nation, Oxford University Press, New Delhi.
5. Shukla V. N., Constitution of India, Eastern Book Company, Lucknow (Twelfth Edition).
6. Government of India, Constitution of India (Bare Act), Government of India Publication, New Delhi.

Reference Books:

1. Subhash Kashyap, Our Constitution, National Book Trust, New Delhi.
2. Durga Das Basu, Shorter Constitution of India, LexisNexis Publication.
3. P. M. Bakshi, The Constitution of India, Universal Law Publishing.
4. J. N. Pandey, Constitutional Law of India, Central Law Agency.
5. Seervai H. M., Constitutional Law of India, N. M. Tripathi Pvt. Ltd. (Vols. I–III).
6. B. Shiva Rao, The Framing of India's Constitution: A Study, Indian Institute of Public Administration.
7. D. C. Wadhwa, Political Science and Constitutional Law, Eastern Book Company.
8. Madhav Khosla, The Indian Constitution: Oxford India Short Introductions, Oxford University Press.

E Resources :

4. NPTEL course on Constitutional Studies, Prof. Sudhir Krishnaswamy, National Law School of India University
5. Constitutional Values and Fundamental Duties (University of Delhi – aligned with NEP 2020, available via NPTEL/DU open learning) https://kmc.du.ac.in/kmcouter/collnews/download/40727448169063791359.pdf/LinkedContents/pdf/All/All

Mapping of COs with POs & PSOs

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
3SH210VE1.1	3	2	-	1	-	-	-	-	-	-	-	2	2	
3SH210VE1.2	-	3	2	2	-	2	3	3	-	-	-	3	2	-
3SH210VE1.3	-	-	3	3	-	2	3	2	-	2	-	3	3	2
3SH210VE1CO	1	2	2	2	-	2	2	2	-	1	-	3	2	1

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code: **3CS400FP1**		Course Category:	**FP**	
Course Name	**Field Project**				
Credits	**02**	Total L:T:P Hours	0:0:4 **60 Hrs**	Total SL Hours	**-**
Total Credit Hours	**60 Hrs**				
SEE Marks	**-**	SEE Time	**-**	CIA Marks	**-**
EE Marks	**25**	PA Marks	**25**	Total Marks	**50**

Course Description:
Subject Code 3CS400FP1 Field Project is an Experiential Learning Courses for Second Year B.Tech. Computer Science and Engineering.

Course Objectives:
The objective of this course is to equip students with practical skills to address rural challenges through digital tools, smart technologies, and sustainable practices and to foster social responsibility and innovation for effective community development.

Course Outcomes:
After completing the course students will be able to:

CO	**Course Outcome**	**Domain Level**
3CS400FP1.1	Apply digital and smart technologies to solve basic rural community problems.	C-3, P-3, A-2
3CS400FP1.2	Perform field activities in digital literacy, agriculture support, health, and resource management.	C-2, P-5, A-3
3CS400FP1.3	Work with communities to create simple, practical solutions for local development.	C-4, P-4, A-4

Course Contents:

Module	**Description**	**Hours**
Module 1	Orientation & Sensitization	4
Module 2	Field Visit & Problem Identification	24
Module 3	Problem–Solution Design & Implementation	20
Module 4	Documentation, Presentation & Reflection	12

Note:

1. Students must collaborate within their assigned practical batches. Each batch should be further divided into subgroups, with five students per subgroup, Students are required to select any one of the project types/domains listed below in accordance with the prescribed guidelines

2. Projects

1. Digital Empowerment: Training on mobile banking, UPI, and government e-services (Aadhaar, PM-KISAN).
2. Smart Agriculture: AI-based chatbots for crop queries or IoT-based soil sensors.
3. Cyber Security: Workshops on fraud, phishing awareness, and secure online transactions
4. Health & Hygiene: Developing AI-powered health apps in local languages.
5. E-Commerce: Assisting farmers and artisans with online listings (eNAM, Etsy, Meesho).
6. Smart Water Literacy & Conservation Mapping: Resource Management & Traditional Wisdom
7. The "Green School" STEM Initiative: Focus: Education & Renewable Energy
8. Circular Economy: "Waste-to-Wealth" Workshop: Waste Management & Entrepreneurship
9. Career Bridge: Digital Readiness for Rural Youth: Skill Development & Career Guidance
10. Smart Infrastructure: GIS-Based Village Resource Mapping: Community Development & Infrastructure

3. Documentation /Project Report Format:

The Documentation /Project Report shall contain the following sections:

1. Title Page
2. Certificate & Declaration
3. Abstract
4. Introduction (Community + E&TC relevance)
5. Objectives
6. Literature Survey
7. Methodology (Survey + Technical)
8. Problem Identification
9. Proposed E&TC Solution
10. Implementation / Simulation
11. Results & Analysis
12. Community Feedback & Social Impact
13. Conclusion & Future Scope
14. References
15. Appendices (Photos, questionnaires, certification letter issued by the Gram Panchayat office)

Course Plan:

Lecture No.	Module Title	Topic	Hours
1	**Module1: Orientation & Sensitization**	NEP 2020: Community Engagement & Role of Engineers, Ethics, Social Responsibility & SDGs for Computer Science and Engineering, Overview of Rural & Urban Communication Infrastructure, Identification of Community Institutions (GP, School, Self Help Group (SHG), Health Centre), Field Safety, Team Formation, Area & Theme Allocation, Reorganization	4
2	**Module 2: Field Visits & Problem Identification**	Pre-Visit Study: Planning for digital literacy workshops and tech-driven farming surveys. Digital Empowerment: Initial assessment of villager awareness regarding UPI, mobile banking, and government e-services	24
3		Site Identification: Mapping the digital divide; documenting layouts of local businesses and traditional water bodies for revival	
4		Technical Observation: Evaluating existing digital infrastructure, internet connectivity, and current literacy levels in local schools.	
5		Data Recording: Documenting community needs in Cyber Security (fraud awareness) and E-Commerce (market linkage for artisans).	
6		Analysis: Comparing local access to technology against Digital India mission standards and government e-service availability	
7		Problem Identification: Selecting a specific challenge in Education & Skill Development (e.g., STEM kits or digital literacy)	
8	**Module3: Engineering Problem–Solution Design & Implementation-**	Data Analysis: Processing field data to define technical requirements for AI/IoT solutions in rural settings	20
9		Design: Preparing logic flows and UI sketches for Cyber Security	

		(password safety) or E-Commerce platforms for SHGs.	
10		Implementation (Community-Driven Innovation): Developing prototypes like AI chatbots for crops, IoT soil sensors, or GIS-based village mapping.	
11		Resource Estimation: Cost and hardware/software estimates for low-cost water filters or solar-powered irrigation prototypes.	
12		Evaluation: Assessing feasibility and community benefits, such as improved efficiency in farming or secure digital transactions.	
13	**Module4: Documentation, Presentation & Reflection**	Documentation: Data analysis and graphical representation of project impact (e.g., number of villagers trained).	12
14		Finalization: Formatting the project report (Introduction, Objectives, Methodology, Execution, Results).	
15		Evaluation: Final presentation to community institutions and Viva Voce.	

Mapping of COs with POs

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
3CS400FP1.1	2	2	1	0	2	1	2	1	2	1	1	1	2	2
3CS400FP1.2	1	1	2	0	2	2	3	3	2	1	2	0	2	3
3CS400FP1.3	1	2	2	1	2	3	3	3	3	2	2	0	3	3
3CS400FP1CO	1	2	2	0	2	2	3	2	2	1	2	0	2	3

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code: **3AL001NC1**		Course Category: **NC**		
Course Name	**Disaster Management and Preparedness**				
Credits	--	Total L:T:P Hours	2:0:0 **30 Hrs**	Total SL Hours	--
Total Credit Hours	--				
SEE Marks	--	SEE Time	--	CIA Marks	--
EE Marks	--	PA Marks	--	Total Marks	--

Course Description:
Subject Code 3AL001NC1 Disaster Management and Preparedness is a Compulsory Non-Credit course for Second Year B. Tech all disciplines.

Course Objectives:
The objective of this course is to provide students with a comprehensive understanding of disasters, their types, impacts, the complete disaster management cycle, and the roles of various agencies in Disaster Risk Reduction.

Course Outcomes:
After completing the course students will be able to:

CO	Course Outcome	Domain Level
3AL001NC1.1	Identify the concepts of disaster, hazard, vulnerability and risk, and classify disasters to understand the basic nature, causes and profiles of disasters in India.	C-2
3AL001NC1.2	Analyze the disaster management cycle for risk assessment, mitigation, preparedness, response, recovery, and international disaster management frameworks.	C-4
3AL001NC1.3	Apply disaster management practices, including stakeholder roles, national policies, engineers' responsibilities, and preparedness measures for effective disaster risk reduction.	C-3

Course Contents:

Unit 1	**Introduction to Disaster Management:** Concepts and definitions – disaster, hazard, vulnerability, risk, severity, frequency, exposure, capacity, and impact; classification of disasters- Natural disasters: earthquakes, tsunami, landslides, mining, Hydro-Meteorological Disasters: floods, draught, cyclones, coastal erosion. Biological Disaster: epidemics, pest attacks, forest fire, Manmade disasters: Industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, vulnerability profile of India, ecological fragility; principles of disaster prevention and mitigation	10 hrs

Unit 2	**Disaster Management Cycle and Framework:** Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development. Awareness During Disaster – Evacuation, Disaster Communication, Search and Rescue, Emergency Operation Centre, Incident Command System, Relief and Rehabilitation. Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure, Early Recovery, Reconstruction and Redevelopment; IDNDR, Yokohama Strategy, Hyogo Framework of Action Phases of disaster management; vulnerability and capacity assessment, post-disaster environmental response	12 hrs
Unit 3	**Disaster Management practices:** Roles and responsibilities of government, community, local bodies, NGOs, and other stakeholders, National Policy on Disaster Management Act 2005 Mega Disasters of India and Lessons Learnt, Disaster Management practices at working and residential places. Key responsibility of engineers in disaster reduction techniques, medical preparedness aspect of disaster.	8 hrs

Textbooks:

1. Sharma, S. C. (2022). Disaster Management, Khanna Publication.
2. Subramanian, R. (2024). Disaster Management. Vikas Publication.

Reference Books:

1. Gaur, R. C. (2018). Environmental Engineering and Disaster Management. New Age International.
2. Pradeep Sahni, 2024, Disaster Risk Reduction in South Asia, Prentice Hall.
3. Mondal, D. (2022). Disaster Management. New Delhi: CBS Publishers & Distributors
4. Manual on natural disaster management in India, M C Gupta, NIDM, New Delhi
5. An overview on natural & man-made disasters and their reduction, R K Bhandani, CSIR, New Delhi
6. Natural Disaster Management Policy , 2009,GOI
7. H.N. Shrivastava& G.D. Gupta, Management of Natural Disasters in developing Countries, Daya Publishers , Delhi
8. S.L. Goyal, Encyclopedia of disaster Management, Vol I,II & III Disaster Managemnt Policy and administration, Deep & Deep, New Delhi,2006
9. Coppola D P, Introduction to International Disaster Management, Elsevier Science (B/H), London, 2007
10. Disaster Mitigation in Asia & Pacific, Asian Development Bank

Course Assignments

Internal Assessment at Institute level will be based on following assignments:

1.Study of Recent Disasters (at local, state and national level)

2.Preparation of Disaster Risk Management Plan of an Area or Sector

3.A Case study on Disaster Management

E Recourses:

1. https://onlinecourses.swayam2.ac.in/ntr25_ed61/preview

Mapping of COs with POs & PSOs

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
3AL001NC1.1	3	2	-	-	-	3	2	-	-	-	3	1	1	2
3AL001NC1.2	3	3	-	-	-	3	3	-	-	-	3	2	2	3
3AL001NC1.3	3	3	-	-	-	3	3	-	-	3	3	2	2	3
3AL001NC1.CO	3	3	-	-	-	3	3	-	-	1	3	2	2	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code: **3CS211DH1**		Course Category: **DH**		
Course Name	**Network Security**				
Credits	**03**	Total L:T:P etc. Hours	3:0:0 **45 Hrs**	Total SL Hours	**45 Hrs**
Total Credit Hours	**90 Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**-**	PA Marks	**-**	Total Marks	**100**

Course Description:

Subject Code 3CS211DH1 Network Security is a compulsory Double Minor / Honours Course offered by the department of Computer Science and Engineering for Second Year B.Tech., of all discipline.

Course Objectives:

The objective of this course is to introduce core principles and practices of network security, including cryptography, secure protocols, access control, firewalls, intrusion detection, and security management for modern networks.

Course Outcomes:

After completing the course students will be able to:

CO	**Course Outcome**	**Domain Level**
3CS211DH1.1	Explain basic concepts of network security, threats, vulnerabilities, and attack models to understand security risks.	C-2
3CS211DH1.2	Apply cryptographic techniques to secure data and network communications.	C-5
3CS211DH1.3	Analyse authentication, access control, and secure protocols for protecting network resources.	C-3
3CS211DH1.4	Evaluate firewall, IDS/IPS, and monitoring techniques to mitigate network threats.	C-4
3CS211DH1.5	Explain security issues in wireless, web, and emerging technologies to improve system security.	C-2
3CS211DH1.6	Explain security issues in wireless, web, and emerging technologies to improve system security.	C-5

Course Contents:

Unit 1	**Introduction to Network Security** Security goals: Confidentiality, Integrity, Availability, Types of attacks: Passive, Active, Insider, Outsider, Threats, vulnerabilities, and risk assessment, Security services and mechanisms, Overview of network security architecture	8 Hrs
Unit 2	**Cryptography Fundamentals** Symmetric key cryptography: DES, AES, Asymmetric key cryptography: RSA, Diffie–Hellman, Hash functions and message authentication codes, Digital signatures and certificates, Public Key Infrastructure (PKI)	8 Hrs
Unit 3	**Authentication and Secure Communication** User authentication techniques, Password-based and multi-factor authentication, Access control models, Secure communication protocols: SSL/TLS, HTTPS Email security basics	7 Hrs
Unit 4	**Network Security Mechanisms** Firewalls: Packet filtering, stateful, proxy firewalls, Intrusion Detection and Prevention Systems (IDS/IPS), Virtual Private Networks (VPNs), Network monitoring and logging, Security policies and configuration management	8 Hrs
Unit 5	**Wireless and Web Security (7 Hrs)** Wireless security: WEP, WPA, WPA2, WPA3, Web security threats: SQL Injection, XSS, CSRF, Secure web application practices, Security issues in cloud and IoT networks	7 Hrs
Unit 6	**Case Studies and Emerging Trends (7 Hrs)** Network security breaches and incident analysis, Security management and compliance, Cyber laws and ethical considerations, Emerging trends: Zero Trust, AI in security Future challenges in network security	7 Hrs

Text Books:

1. William Stallings, Cryptography and Network Security, Pearson Education.
2. Behrouz A. Forouzan, Cryptography and Network Security, McGraw-Hill.
3. Charlie Kaufman, Radia Perlman & Mike Speciner, Network Security, Pearson

.**Reference Books:**

1. Andrew S. Tanenbaum, Computer Networks, Pearson Education.
2. Wenliang Du, Computer & Internet Security, Pearson.
3. Mark Stamp, Information Security: Principles and Practice, Wiley.

E Resources :

1. NPTEL – Network Security Courses,
   https://nptel.ac.in/courses?search=network%20security
2. Cisco Networking Academy – Security Modules
   https://www.netacad.com/courses/security
3. OWASP Foundation – Web Security Resources
   https://owasp.org
4. CERT-In – Advisories and Security Reports
   https://www.cert-in.org.in

Mapping of COs with POs

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
3CS211DH1.1	2	2	1	–	1	–	–	–	–	–	1	2	1	–
3CS211DH1.2	3	3	2	1	3	–	–	–	–	–	2	3	3	–
3CS211DH1.3	2	3	2	1	2	–	–	–	–	–	2	2	3	–
3CS211DH1.4	2	3	3	2	3	1	–	–	–	–	2	2	3	1
3CS211DH1.5	1	2	1	–	2	2	1	–	–	–	2	1	2	2
3CS211DH1.6	1	3	2	2	2	2	1	–	–	1	3	1	2	3
3CS211DH1CO	2	3	2	2	3	2	1	–	–	1	2	3	3	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code: **3CS211DH2**		Course Category: **DH**		
Course Name	**System Design**				
Credits	**03**	Total L:T:P etc. Hours	3:0:0 **45 Hrs**	Total SL Hours	**45 Hrs**
Total Credit Hours	**90 Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**-**	PA Marks	**-**	Total Marks	**100**

Course Description:
Subject Code 3CS211DH2 System Design is a compulsory Double Minor / Honours Course offered by the department of Computer Science and Engineering for Second Year B.Tech., of all discipline.

Course Objectives:
The course introduces software architecture and system design within the development life cycle. It emphasizes architectural styles, design principles, and data management concepts.

Course Outcomes:
After completing the course students will be able to:

CO	**Course Outcome**	**Domain Level**
3CS211DH2.1	Explain system design concepts and requirement types for efficient software development.	C-2
3CS211DH2.2	Compare architecture styles for effective real-world system design.	C-5
3CS211DH2.3	Apply modular design, cohesion, and coupling with UML for structured development.	C-3
3CS211DH2.4	Analyze scalability, load balancing, and performance for reliable systems.	C-4
3CS211DH2.5	Describe data management methods for efficient data-driven applications.	C-2
3CS211DH2.6	Evaluate case studies like library, chat, and e-commerce systems for practical design understanding.	C-5

Course Contents:

Unit 1	**Introduction to System Design:** System Design and Software Architecture: Definition, structure, characteristics, Role of architect in software development life cycle. System Development Life Cycle: Process models, Waterfall, Incremental, Spiral, Agile, Where architecture fits in SDLC phases, Functional requirements – behaviour and features of the system,	8 Hrs

	Non-functional requirements, Architecture Characteristics	
Unit 2	**Software Architecture Styles:** Monolithic Architecture: Characteristics, Pros, Cons, Layered Architecture: Common layers, Principles of separation of concerns, Client–Server Architecture: Two-tier and three-tier models, Communication protocols and request/response pattern, Micro-services Architecture: Service decomposition strategies, Communication mechanisms, deployment and scalability, Service-Oriented Architecture: service contract, registry, orchestration, Compare and contrast with micro-services	8 Hrs
Unit 3	**Principles of Modular Design:** Modularity Principles Benefits: flexibility, maintainability, parallel development, Cohesion and Coupling: Types of Cohesion and Coupling, Designing for high cohesion and low coupling, Component and Interface Design, UML Basics: Use-case diagrams for capturing requirements, Class diagrams for structural view, Sequence diagrams for interactions, Component and deployment diagrams for high-level architecture	7 Hrs
Unit 4	**Scalability and System Reliability:** Scalability Concepts: Vertical vs. horizontal scaling, Stateless vs. stateful services, Load Balancing: DNS-based, hardware, software load balancers, round-robin, least-connections, consistent hashing, Global vs. local load balancing, Performance: Response time, throughput, latency, Performance bottlenecks and mitigation strategies, Reliability & Availability: Redundancy, replication, active-passive and active-active failover.	8 Hrs
Unit 5	**Basics of Data Management:** Relational Databases,NoSQL Databases, Partitioning and Sharding, Replication, Consistency Models, Data-Layer Performance Considerations	7 Hrs
Unit 6	**Theoretical Case Discussions on Small-Scale Systems:** Case Study 1: Library Management System, Case Study 2: E-Commerce Platform, Case Study 3: Chat / Messaging System, Visualization and Documentation.	7 Hrs

Text Books:

5. Mark Richards & Neal Ford, Fundamentals of Software Architecture, O'Reilly
6. Len Bass, Paul Clements & Rick Kazman, Software Architecture in Practice, Addison-Wesley
7. Ian Sommerville, Software Engineering, Pearson (or Pressman ,Software Engineering, A Practitioner's Approach)
8. Martin Kleppmann, Designing Data-Intensive Applications, O'Reilly
9. Martin L. Abbott & Michael T. Fisher , The Art of Scalability / Scalability Rules
10. sAlex Xu, System Design Interview (Vol. 1 & 2) / S. Narayanan , Grokking the System Design Interview

Reference Books:

1. Eric Evans, Domain-Driven Design, Addison-Wesley
2. Gregor Hohpe, Software Architecture: The Hard Parts, O'Reilly
3. George Coulouris et al., Distributed Systems: Concepts and Design
4. Andrew Tanenbaum, Modern Operating Systems (for scalability and reliability fundamentals

E Resources:

1. O'Reilly Online Learning Library – Software Architecture & Data-Intensive Applications, https://www.oreilly.com/online-learning/
2. ThoughtWorks Insights – Software Architecture Articles & Blogs https://www.thoughtworks.com/insights/architecture
3. Public GitHub Repositories for Architecture Diagrams & UML Models**,**https://github.com/topics/system-design, https://github.com/topics/uml

Mapping of COs with POs

CO	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
3CS211DH2.1	2	2	1	–	1	–	–	–	–	–	1	2	2	–
3CS211DH2.2	2	3	3	2	2	–	–	–	–	–	2	2	3	–
3CS211DH2.3	2	3	3	2	3	–	–	–	–	–	2	2	3	–
3CS211DH2.4	2	3	3	3	3	1	–	–	–	–	2	2	3	1
3CS211DH2.5	2	2	2	1	2	–	–	–	–	–	1	2	2	–
3CS211DH2.6	2	3	3	3	2	2	1	–	–	1	3	2	3	2
3CS211DH2CO	2	3	3	2	3	2	1	–	–	1	2	2	3	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code: **4CS212PC1**			Course Category:	**PCC**
Course Name	**Theory of Computation**				
Credits	**03**	Total L:T:P Hours	3:0:0 **45 Hrs**	Total SL Hours	**45 Hrs**
Total Credit Hours	**90 Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**-**	PA Marks	**-**	Total Marks	**100**

Course Description:
Subject Code 4CS212PC1 Theory of Computation is a compulsory Program Course for Second Year B. Tech, Computer Science & Engineering.

Course Objectives:
The Objective of this course is to develop the ability to model and analyze the behavior of abstract computing devices such as finite automata, pushdown automata, and Turing machines.

Course Outcomes:
After completing the course students will be able to:

CO	Course Outcome	Domain Level
4CS212PC1.1	Design DFA, NFA, and Mealy/Moore machines and apply minimization techniques for efficient computation.	C-6
4CS212PC1.2	Analyze regular expressions and grammars and show their equivalence with finite automata for language representation.	C-4
4CS212PC1.3	Develop and simplify CFGs and explain derivations, normal forms, and the Chomsky hierarchy for syntax analysis.	C-6
4CS212PC1.4	Design pushdown automata and establish equivalence with CFGs for parsing applications.	C-6
4CS212PC1.5	Apply Turing machines to construct and simulate computational models for problem solving.	C-3
4CS212PC1.6	Analyze decidability and undesirability of problems to understand computational limits.	C-4

Course Contents:

Unit 1	**Finite State Machines:** Alphabet, String, Formal and Natural Language, Operations, Definition and Design DFA (Deterministic Finite Automata), NFA (Non-Deterministic Finite Automata), Equivalence of NFA and DFA: Conversion of NFA into DFA, Conversion of NFA with epsilon moves to NFA, Minimization Of DFA, Definition and Construction of Moore and Mealy Machines, Inter conversion between	7 Hrs

	Moore and Mealy Machines. Minimization of Finite Automata. (Construction of Minimum Automaton).	
Unit 2	**Regular Expression and Regular Grammar:** Definition and Identities of Regular Expressions, Construction of Regular Expression of the given Language, Construction of Language from the RE, Conversion of FA to RE using Arden's Theorem, Inter-conversion RE to FA, Pumping Lemma for RL, Closure properties of RLs (proofs not required), Regular grammar, Equivalence of RG (RLG and LLG) and FA.	7 Hrs
Unit 3	**Context Free Grammar and Language:** Introduction, Formal Definition of Grammar, Notations, Derivation Process: Leftmost Derivation, Rightmost Derivation, Derivation Trees, Construction of Context-Free Grammars and Languages, Pumping Lemma for CFL, Simplification of CFG, Normal Forms (CNF and GNF), Chomsky Hierarchy.	7 Hrs
Unit 4	**Pushdown Automata:** Introduction and Definition of PDA, Construction of PDA, Acceptance of CFL, Equivalence of CFL and PDA: Inter-conversion, Introduction of DCFL and DPDA, Enumeration of properties of CFL, Context Sensitive Language, Linear Bounded Automata.	7 Hrs
Unit 5	**Turing Machines:** Formal definition of a Turing Machine, Design of TM, Computable Functions, Church's hypothesis, Counter machine, Variants of Turing Machines: Multi-tape Turing machines, Universal Turing Machine.	7 Hrs
Unit 6	**Decidability and Un-Decidability:** Decidability of Problems, Halting Problem of TM, Un-Decidability: Recursive enumerable language, Properties of recursive & non-recursive enumerable languages, Post Correspondence Problem, Introduction to Recursive Function Theory	7 Hrs

Text Books:

1. Hopcraft H.E. & Ullman J, Introduction to Automata Theory, Languages and Computation
2. Peter Linz, An Introduction to Formal Languages and Automata

Reference Books:

1. Rajesh K. Shukla, Theory of Computation, CENGAGE Learning, 2009.
2. K V N Sunitha and N Kalyani, Formal Languages and Automata Theory, McGraw Hill,2010
3. Lewis H.P. and Papadimition C.H., Elements of Theory of Computation
5. C. K. Nagpal, Formal Languages and Automata Theory, Oxford University Press, 2011.
6. Vivek Kulkarni, Theory of Computation, OUP India, 2013

Mapping of COs with POs

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
4CS212PC1.1	3	2	3	2	1	-	-	-	-	-	1	3	2	1
4CS212PC1.2	3	3	2	2	1	-	-	-	-	-	1	3	2	1
4CS212PC1.3	3	3	2	2	1	-	-	-	-	-	1	3	2	1
4CS212PC1.4	3	3	3	2	1	-	-	-	-	-	1	3	3	1
4CS212PC1.5	3	3	3	2	2	-	-	-	-	-	1	3	3	1
4CS212PC1.6	3	3	2	2	1	-	-	-	-	-	2	3	2	1
4CS212PC1CO	3	3	3	2	1	-	-	-	-	-	1	3	3	1

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **4.5**	Course Code: **4CS213PC1**		Course Category: **PCC**		
Course Name	**Operating System**				
Credits	**02**	Total L:T:P etc. Hours	2:0:0 **30 Hrs**	Total SL Hours	**30 hrs**
Total Credit Hours	**60 Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	-	PA Marks	-	Total Marks	**100**

Course Description:
Subject Code 4CS213PC1 Operating System is a compulsory Program Core Course for Second Year B. Tech. Computer Science and Engineering.

Course Objectives:
The objective of this course is to understand core operating system functions, processes, memory, files, and devices and develop skills to solve problems in scheduling, synchronization, deadlocks, and system performance.

Course Outcomes:
After completing the course students will be able to:

CO	**Course Outcome**	**Domain Level**
4CS213PC1.1	Summarize OS concepts, structure, and process management to understand system operation.	C-2
4CS213PC1.2	Apply CPU scheduling algorithms for improving system performance.	C-3
4CS213PC1.3	Analyse synchronization issues and apply mechanisms to avoid deadlocks.	C-4
4CS213PC1.4	Compare memory management techniques for efficient memory use.	C-2
4CS213PC1.5	Describe file system structures and apply allocation methods for effective file storage.	C-2
4CS213PC1.6	Summarize I/O organization and apply disk scheduling for faster data access.	C-2

Course Contents:

Unit 1	**Introduction to OS** Introduction: Operating System definition, OS Evolution, Components and Services, Process Concept, Process Scheduling, Operations on Processes, Cooperating Processes, Interprocess Communication, Threads Overview, Multithreading Models, Threading Issues, Java Threads	5 Hrs

Unit 2	**Process Scheduling :** Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR, Priority, Multilevel Queue, Multilevel Feedback Queue Scheduling	5 Hrs
Unit 3	**Process Synchronization:** Process Synchronization Basics: The Critical-Section Problem, Synchronization Hardware, Semaphores, Monitors, Deadlocks: Definition & Characterization, Deadlocks Prevention, Avoidance, Detection and Recovery from Deadlock	5 Hrs
Unit 4	**Memory Management:** Memory Management Background, Swapping, Contiguous Memory Allocation Schemes, Paging, Segmentation, Virtual Memory Management: Background, Demand paging scheme, Process Creation, Page Replacement Policies, Allocation of Frames, Thrashing	5 Hrs
Unit 5	**File System:** File-System Interface; Directory Structure, File-System Mounting, File Sharing &Protection, File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management. File Recovery	5 Hrs
Unit 6	**I/O System:** I/O Systems: Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O to Hardware Operations, Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure	5 Hrs

Text Books:

1. Avi Silberschatz, P.B.Galvin, G.Gagne, “Operating System Concepts” (9/e) John-Wiley & Sons.

Reference Books:

1. A.S.Tanenbaum, “Modern Operating Systems” Pearson Education.
2. William Stallings, “Operating Systems” Prentice-Hall.
3. D. M. Dhamdhere, “Operating Systems” Tata McGraw-Hill.
4. P. Balkrishna Prasad, “Operating Systems” Scitech Publications (I) Pvt. Ltd.

E-Resources:

1. Topic: Operating System Concepts
   Link: https://www.tutorialspoint.com/operating_system/
2. Course: Operating System Fundamentals by Prof. Rajib Mall, IIT Kharagpur Link: https://nptel.ac.in/courses/106105214

Mapping of COs with POs

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
4CS213PC1.1	3	2	2	1	1	-	-	-	1	1	1	2	2	1
4CS213PC1.2	3	3	3	2	1	-	-	-	1	1	1	3	3	1
4CS213PC1.3	3	3	3	2	2	-	-	-	1	1	1	3	3	1
4CS213PC1.4	3	2	2	2	2	-	-	-	1	-	1	2	2	1
4CS213PC1.5	3	2	2	2	2	-	-	-	1	-	1	2	2	1
4CS213PC1.6	3	2	2	2	2	-	-	-	1	-	1	2	2	1
4CS213PC1 CO	3	3	3	2	2	-	-	-	1	1	1	3	3	1

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code: **4CS214PC1**		Course Category: **PCC**		
Course Name	**Design & Analysis of Algorithm**				
Credits	**02**	Total L:T:P etc. Hours	2:0:0 **30 Hrs**	Total SL Hours	**30 Hrs**
Total Credit Hours	**60 Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**-**	PA Marks	**-**	Total Marks	**100**

Course Description:
Subject Code 4CS214PC1 Design & Analysis of Algorithm is a compulsory Program Core Course for Second Year B. Tech Computer Science & Engineering.

Course Objectives:
The objective of this course is to enable students to design, analyze, and evaluate efficient algorithms using key strategies and complexity analysis for effective problem solving.

Course Outcomes:
After completing the course students will be able to:

CO	Course Outcome	Domain Level
4CS214PC1.1	Analyze iterative and recursive algorithms using time estimation and order notations for efficiency evaluation.	C-4
4CS214PC1.2	Apply divide-and-conquer strategies to solve problems such as multiplication and convex hulls.	C-3
4CS214PC1.3	Solve optimization and multistage problems using dynamic programming techniques.	C-3
4CS214PC1.4	Solve multistage and optimization problems using dynamic programming techniques.	C-3
4CS214PC1.5	Apply backtracking for combinational search and traversal problems.	C-3
4CS214PC1.6	Evaluate sorting algorithms using time–space complexity and worst/average case analysis.	C-5

Course Contents:

Unit 1	Iterative Algorithm Design Issue Introduction, Use of Loops, Efficiency of Algorithms, Estimating & Specifying Execution Times, Order Notations.	5 Hrs
Unit 2	Divide And Conquer Introduction, Multiplication Algorithm and its analysis, Binary Search, Mergesort, Quick Sort, Convex Hulls.	5 Hrs
Unit 3	Greedy Methods Introduction, Knapsack Problem, Job sequencing with	5 Hrs

	deadlines, Minimum Spanning Trees, Prim's Algorithms, Kruskal's Algorithm.	
Unit 4	Dynamic Programming Introduction, Multistage Graphs, Traveling Salesman, Matrix multiplication, Single Source Shortest Paths.	5 Hrs
Unit 5	Backtracking Combinational Search, Search & Traversal, Backtracking Strategy, Backtracking Framework.	5 Hrs
Unit 6	Efficiency of Algorithm Polynomial Time & Non Polynomial Time, Efficiency of Recursion, Complexity, Time-Space Trade off.	5 Hrs

Text Books:

1. Dave and Dave, "Design and Analysis of Algorithms" Pearson Education.

Reference Books:

1. Aho, Hopcroft & Ullman, "The Design & Analysis of Computer Algorithms", Addison-Wesley.
2. G. Brassard, P.Bratley, "Fundamentals of Algorithmics" , PHI.
3. Horowitz & Sahani, " Fundamental Algorithms" , Galgotia.

E Resources:

1. Design & Analysis of Algorithm, OpenCourseware Link:https://ocw.mit.edu/courses/6-046j-design-and-analysis ofalgorithms- spring-2015/?
2. Introduction to Algorithms Link: https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/

Mapping of COs with POs

CO	**PO**											**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	1	2	3
4CS214PC1.1	3	3	1	2	1	-	-	-	1	1	2	3	2	1
4CS214PC1.2	3	2	2	1	1	-	-	-	1	1	2	3	2	1
4CS214PC1.3	3	3	2	1	2	1	-	-	1	1	2	3	3	1
4CS214PC1.4	3	3	2	2	1	1	-	-	1	1	2	3	3	1
4CS214PC1.5	3	2	2	1	1	1	-	-	1	1	2	3	2	1
4CS214PC1.6	3	3	1	3	1	-	-	-	1	1	3	3	2	2
4CS214PC1CO	3	3	2	2	1	1	-	-	1	1	2	3	3	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5.0**	Course Code: **4CS215MD1**		Course Category: **MDM-II**		
Course Name	**Computer Architecture & Organization**				
Credits	**02**	Total L:T:P etc. Hours	2:0:0 **30 Hrs**	Total SL Hours	**30 Hrs**
Total Credit Hours	**60 Hrs**				
SEE Marks	**30**	SEE Time	**2 Hrs**	CIA Marks	**20**
EE Marks	**-**	PA Marks	**-**	Total Marks	**50**

Course Description:
Subject Code 4CS215MD1 Computer Architecture & Organization is a compulsory Multi-Disciplinary Minor Course offered by the department of Computer Science & Engineering for other Second Year B.tech. Major discipline

Course Objectives:
The objective this course is to demonstrate understanding of Computer Architecture & Organization by explaining computer structure, processor arithmetic operations, addressing modes, and memory organization techniques.

Course Outcomes:
After completing the course students will be able to:

CO	**Course Outcome**	**Domain Level**
4CS215MD1.1	Understand and explain the basic structure of a computer, its functional units, memory addressing, and instruction sequencing for system design.	C-2
4CS215MD1.2	Analyze and explain memory hierarchy and processing unit operations to optimize system speed and efficiency.	C-4
4CS215MD1.3	Apply and execute arithmetic algorithms, interrupt handling, and DMA techniques for efficient I/O and computation to enhance I/O performance.	C-3

Course Contents:

Unit 1	**Basic Structure of Computer:** H/W & S/W: Functional Units, Bus structures, Addressing Methods and Machine Program Sequencing: Memory Locations, Addresses, Instruction and instruction sequencing, Addressing Modes. Basic I/O Operations.	09 Hrs.
Unit 2	**Memory & Processing Unit:** Basic Concepts, Memory Hierarchy, Semiconductor RAM Memories, Internal Organization of Memory Chips, Static Memories, Dynamic Memories, Read Only Memories, Speed, Size and Cost. Fundamental Concepts, Execution of a Complete Instruction, Hardwired Control, Performance Consideration, Micro programmed Control, Microinstructions, and Micro program Sequencing.	11 Hrs.
Unit 3	**I/O Organization and Arithmetic** Accessing I/O Devices, Interrupts, Enabling and Disabling Interrupts, Handling Multiple Devices, DMA, Design of Fast Adders, Signed Addition and Subtraction, Multiplication of Positive Numbers, Restoring and Non-Restoring Division	10 Hrs.

Text Books:

1. Carl Hamacher, Zvonko Vranesic, and Safwat Zaky, Computer Organization, 5th Edition, McGraw Hill.
2. William Stallings**,** Computer Organization and Architecture: Designing for Performance, 10th Edition, Pearson.

Reference Books:

1. William Stallings, Computer Organization and Architecture: Designing for Performance‖, Eighth Edition, Pearson.
2. John P. Hayes, Computer Architecture and Organization‖, McGraw Hill Publication.
3. DA Patterson and JLHennessy, Computer Organization and Design, Morgan Kaufmann Publisher, 2nd edition
4. A.S. Tanenbaum, "Structured Computer Organization", PHI Publication.

E Resources:

1. Lecture notes – “COMPUTER ORGANISATION” (PDF) covering memory organisation, arithmetic and I/O. mrecacademics.com+1
2. Chapter on Input-Output Organisation (PDF) – covers accessing I/O devices, interrupts, DMA etc. Jagdish Kapadnis+1
3. Online tutorial – “Computer Organization & Architecture” on GeeksforGeeks, with modules including CPU, memory, buses and I/O. GeeksforGeeks
4. Online course – “Computer Architecture” on Coursera (free to audit) covering modern architecture, useful for advanced context. Coursera
5. ARM Education Kit – teaching materials for architecture including memory, control units and I/O. arm.com

Mapping of COs with POs & PSOs

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
4CS215MD1.1	3	2	2	1	2	–	–	1	1	–	2	2	2	1
4CS215MD1.2	3	3	2	2	3	–	–	1	1	–	2	3	3	1
4CS215MD1.3	3	3	3	2	3	–	–	2	2	1	2	3	3	2
4CS215MDCO	3	3	3	2	3	–	–	1	1	1	2	3	3	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level:	5	Course Code:	4SH216OE1	Course Category:	OE
Course Name	**Quantitative and Logical Reasoning**				
Credits	**03**	Total L:T:P Hours	3:0:0 **45 Hrs**	Total SL Hours	**45 Hrs**
Total Credit Hours	**90 Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**--**	PA Marks	**--**	Total Marks	**100**

Course Description:
Subject Code 4SH216OE1 Quantitative and Logical Reasoning is a compulsory Open Elective Course for the Second Year B. Tech All Branch Students.

Course Objectives:

The Objective of the Course is to develop quantitative aptitude, logical reasoning, problem-solving efficiency, and decision-making skills for placements, competitive exams, and real-life applications

Course Outcomes:
After completing the course students will be able to:

CO	Course Outcome	Domain Level
4SH216OE1.1	Apply arithmetic and numerical techniques to solve quantitative problems accurately.	C-3
4SH216OE1.2	Solve algebraic and equation-based problems using simplification and approximation methods to improve problem-solving efficiency.	C-3
4SH216OE1.3	Analyze logical reasoning problems using structured and critical thinking approaches to improve decision-making skills.	C-4
4SH216OE1.4	Interpret and analyze data using graphical and tabular methods for decision making for strategic planning.	C-4
4SH216OE1.5	Solve complex logical puzzles and advanced reasoning problems efficiently for competitive examination success.	C-3
4SH216OE1.6	Demonstrate effective aptitude test strategies integrating quantitative and logical reasoning skills for career advancement opportunities.	C-3

Course Contents:

Unit 1	**Number System & Arithmetic Foundations:** Number system fundamentals; LCM and HCF applications; divisibility rules; percentage calculations; ratio and proportion; averages; profit and loss; simple and compound interest; speed mathematics and shortcut techniques.	7Hrs
Unit 2	**Algebra, Equations & Simplification Techniques:** Linear and quadratic equations; algebraic expressions; simplification and approximation; indices and surds; inequalities; time and work; pipes and cisterns; time, speed and distance; mixtures and allegation.	7 Hrs
Unit 3	**Logical Reasoning: Analytical & Critical Thinking:** Coding–decoding; blood relations; direction sense; series and pattern recognition; analogies; ranking and ordering; syllogisms; statement and assumption; statement and conclusion; cause–effect reasoning.	7 Hrs
Unit 4	**Data Interpretation & Analytical Aptitude:** Tables; pie charts; line graphs; bar graphs; caselets; data sufficiency; DI shortcut techniques; approximation in data interpretation; comparative and predictive data analysis.	8Hrs
Unit 5	**Advanced Logical Reasoning & Puzzle Solving:**Seating arrangements (linear, circular, and complex); floor-based puzzles; scheduling puzzles; selection-based puzzles; Venn diagrams; logical grouping; critical reasoning frameworks	8 Hrs
Unit 6	**Placement Aptitude Mastery & Test Strategies:** Integrated quantitative and logical reasoning practice; decision-making and elimination strategies; speed improvement techniques; mock placement aptitude patterns (TCS, Infosys, Wipro, Accenture, Capgemini); common error analysis; test-taking strategies; aptitude and reasoning simulations.	8 Hrs

Text Books:

1. R. S. Aggarwal, Quantitative Aptitude for Competitive Examinations, S. Chand Publishing
2. Arun Sharma, Logical Reasoning and Data Interpretation, McGraw Hill

Reference Books:

1. Arun Sharma, How to Prepare for Quantitative Aptitude,published by McGraw Hill Education.
2. R.S. Aggarwal, A Modern Approach to Logical Reasoning, published by S. Chand Publishing
3. M.K. Pandey, Analytical Reasoning, published by BSC Publishing Co. Pvt. Ltd.
4. Rajesh Verma, Fast Track Objective Arithmetic, published by Arihant Publications

E Resources:
1. NPTEL – Quantitative Aptitude & Logical Reasoning Courses
2. IndiaBIX – Quantitative and Logical Reasoning Practice
3. CareerRide – Aptitude Preparation Modules
4. PrepInsta / HackerEarth – Placement Aptitude Practice Platforms

Mapping of COs with POs & PSO

CO	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
4SH216OE1.1	3	3	2	–	–	–	–	–	–	–	–	2	3	1
4SH216OE1.2	3	3	2	–	–	–	–	–	–	–	–	3	2	1
4SH216OE1.3	–	3	3	–	–	–	–	–	–	–	–	2	3	2
4SH216OE1.4	–	3	2	–	–	–	–	–	–	–	–	3	3	2
4SH216OE1.5	–	3	3	–	–	–	–	–	–	–	–	2	3	2
4SH216OE1.6	–	3	2	–	–	–	–	–	–	2	3	2	3	2
4SH216OE1 CO	1	3	3	–	–	–	–	–	–	1	1	2	3	1

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level:	**5**	Course Code:	**4SH216OE2**	Course Category:	**OE**
Course Name	**Critical Thinking & Decision Making**				
Credits	**03**	Total L:T:P Hours	3:0:0 **45 Hrs**	Total SL Hours	**45 Hrs**
Total Credit Hours	**90 Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**--**	PA Marks	**--**	Total Marks	**100**

Course Description:
Subject Code 4SH216OE2 Critical Thinking & Decision Making is a compulsory Open Elective Course forSecond Year B. Tech All Branch Students.

Course Objectives:
The objective of this course is to develop critical thinking and decision-making competencies by strengthening analytical reasoning and structured problem-solving skills applicable to professional and real-world situations.

Course Outcomes:
After completing the course students will be able to:

CO	Course Outcome	Domain Level
4SH216OE2.1	Apply critical thinking frameworks to analyze problems systematically.	C-3
4SH216OE2.2	Evaluate information, assumptions, and arguments for logical consistency and validity.	C-5
4SH216OE2.3	Analyze complex situations and identify feasible alternatives for decision making.	C-4
4SH216OE2.4	Design rational and ethical decision-making strategies under uncertainty to ensure sustainable organizational outcomes.	C-6 A-3
4SH216OE2.5	Apply quantitative and qualitative tools to support decision-making processes.	C-3
4SH216OE2.6	Demonstrate effective decision making in simulated professional and team-based scenarios to resolve workplace challenges effectively	C-3 P-3 A-3

Course Contents:

Unit 1	**Foundations of Critical Thinking:** Concept of critical thinking; elements of reasoning; logical vs illogical thinking; assumptions and inferences; inductive and deductive reasoning; common cognitive biases; barriers to critical thinking.	7Hrs

Unit 2	**Analytical Reasoning & Problem Framing:** Problem identification and structuring; root cause analysis; issue trees; questioning techniques; systems thinking; analytical reasoning models.	7 Hrs
Unit 3	**Decision Making Models & Techniques:** Rational decision-making model; intuitive decision making; bounded rationality; decision trees; cost–benefit analysis; risk and uncertainty; heuristics.	7 Hrs
Unit 4	**Data-Driven & Ethical Decision Making:** Use of data in decision making; qualitative vs. quantitative data; basic decision matrices; ethical frameworks; professional ethics; social and environmental considerations in decisions.	8Hrs
Unit 5	**Creativity, Innovation & Strategic Thinking:** Creative thinking techniques; lateral thinking; design thinking approach; scenario planning; strategic decision making; innovation in problem solving.	8 Hrs
Unit 6	**Applied Decision Making & Case Analysis:** Case studies from industry and management; individual and group decision simulations; conflict resolution through decision frameworks; decision-making under pressure; reflection and feedback	8 Hrs

Text Books:

1.Alec Fisher, Critical Thinking, published by Cambridge University Press.
2. John Adair, Decision Making and Problem Solving, published by Kogan Page.

Reference Books:

1Daniel Kahneman, Thinking, Fast and Slow published by Farrar, Straus and Giroux.
2. Rolf Dobelli, The Art of Thinking Clearly,published by Sceptre.
3. John S. Hammond, Ralph L. Keeney, Howard Raiffa, Smart Choices, published by Harvard Business School Press.
4. Ken Watanabe, Problem Solving 101, published by Portfolio.

E Resources:

1. NPTEL – Critical Thinking &Decision Making Courses
2. Coursera – Critical Thinking and Decision-Making Modules
3. Harvard Business Review – Decision Making Articles
4. MIT OpenCourseWare – Decision Analysis

Mapping of COs with POs & PSO

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
4SH216OE2.1	2	3	2	–	–	–	–	–	–	–	–	3	2	2
4SH216OE2.2	–	3	3	–	–	–	–	–	–	–	–	3	2	2
4SH216OE2.3	–	3	2	–	–	–	–	–	–	–	–	3	3	2
4SH216OE2.4	–	3	3	–	–	2	3	–	–	–	–	2	3	3
4SH216OE2.5	–	2	2	–	2	–	–	–	–	–	–	3	3	2
4SH216OE2.6	–	2	2	–	–	2	–	2	2	–	2	3	3	3
4SH216OE2. CO	1	3	3	-	1	1	1	1	1	-	1	3	3	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code: **4CS217PC1**		Course Category: **PCC**		
Course Name	**Operating System Lab**				
Credits	**01**	Total L:T:P Hours	0:0:2 **30 Hrs**	Total SL Hours	**-**
Total Credit Hours	**30 Hrs**				
SEE Marks	**-**	SEE Time	**-**	CIA Marks	**-**
EE Marks	**25**	PA Marks	**25**	Total Marks	**50**

Course Description:

Subject Code 4CS217PC1 Operating System Lab is a compulsory Program Core Course for Second Year B.Tech. Computer Science and Engineering.

Course Objectives:

The objective of the course is to enhance understanding of processes, threads, memory management, CPU scheduling, synchronization, and file systems by enabling learners to implement and analyse these mechanisms directly.

Course Outcomes:

After completing the course students will be able to:

CO	**Course Outcome**	**Domain Level**
4CS217PC1.1	Apply Linux commands and system-level C programming to manage files, processes, threads, and synchronization.	C-3
4CS217PC1.2	Analyze and simulate CPU scheduling, memory management, and page replacement algorithms to evaluate system performance.	C-4
4CS217PC1.3	Implement file allocation, disk scheduling, and deadlock avoidance techniques to ensure efficient and safe OS operations.	C-6

List of Practical's:

Minimum 10 practicals from the list mentioned below.

1. To study Linux Operating System along with its installation.
2. To Study and Execute basic file commands and process related open source Ubuntu commands
3. Commands to view all executing, block and suspended process, Command to check and change the priority of process CPU utilization for executing processes, other basics commands related to processes
4. Write a program for multithreading using C.
5. To simulate First Come First Serve & Shortest Job First process scheduling algorithm
6. To simulate Shortest Job First process scheduling algorithm
7. To implement Round Robin Process scheduling Algorithm
8. To implement and analyze multi-level queue scheduling algorithm
9. To implement all page replacement policies.

10. To implement Dining-Philosophers problem to deal with concurrency control mechanism.
11. To implement All Disk Scheduling algorithm
12. To simulate Bankers algorithm for deadlock avoidance

E Resources:

1. Topic: Operating System Concepts
   Link: https://www.tutorialspoint.com/operating_system/
2. Course: Operating System Fundamentals by Prof. Rajib Mall, IIT Kharagpur
   Link: https://nptel.ac.in/courses/106105214

Mapping of COs with POs & PSOs

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
4CS217PC1.1	3	2	3	2	2	-	-	1	1	1	1	3	2	1
4CS217PC1.2	3	3	3	3	2	-	-	1	1	1	1	3	3	1
4CS217PC1.3	3	2	3	2	2	-	-	1	1	1	1	3	3	2
4CS217PC1 CO	3	2	3	2	2	-	-	1	1	1	1	3	3	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code: **4CS218PC1**		Course Category: **PCC**		
Course Name	**Design & Analysis of Algorithm Lab**				
Credits	**01**	Total L:T:P etc. Hours	0:0:2 **30 Hrs**	Total SL Hours	**-**
Total Credit Hours	**30 Hrs**				
SEE Marks	**-**	SEE Time	**-**	CIA Marks	**-**
EE Marks	**25**	PA Marks	**25**	Total Marks	**50**

Course Description:

Subject Code 4CS218PC1Design & Analysis of Algorithm Lab is a compulsory Program Core Course for Second Year B. Tech Computer Science & Engineering.

Course Objectives:

The objective of this course is to enable students to design, analyze, and evaluate efficient algorithms using key strategies and complexity analysis for effective problem solving.

Course Outcomes:

After completing the course students will be able to:

CO	**Course Outcome**	**Domain Level**
4CS218PC1.1	Implement searching, sorting, matrix multiplication, and basic optimization algorithms using C with correct recursive and divide-and-conquer techniques.	C-3, P-4, A-2
4CS218PC1.2	Apply greedy and graph algorithms (Kruskal, Prim, Dijkstra, BFS, DFS, Floyd-Warshall) to solve MST and shortest-path problems through effective programming.	C-3, P-4, A-2
4CS218PC1.3	Analyze algorithm performance by comparing time complexity, behavior, and correctness for different inputs.	C-4, P-5, A-3

List of Practicals:

Minimum eight practicals from the list mentioned below.

1. Implement C programs to perform recursive calls using the following searching algorithms. 1. Linear Search when the list is given. 2. Binary Search when the given list is not sorted.
2. Study and analyze to sort an array of integers using merge sort.
3. Implement and analyze to sort an array of integers using quicksort.
4. Write a C program for Implementing (n X n) matrix multiplication using the Strassen matrix multiplication algorithm.
5. Explain the knapsack algorithm to find an optimal solution of getting maximum profit and implement using the program.
6. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm and implement using C.

7. Implement programs to find minimum cost spanning trees from a given graph using Prim's algorithm.
8. Implement Prim's algorithm to find the Minimum Cost Spanning Tree of an undirected graph using the program.
9. Develop a program to implement Floyd's algorithm which will produce the shortest distance between all vertex pairs of a weighted graph.
10. Implement programs to find the shortest path in a given graph using Dijkstra's algorithm.

E Resources:

1. Introduction to Algorithms (CLRS) Link: https://edutechlearners.com /download/Introduction_to_algorithms-3rd%20Edition.pdf
2. Introduction to Algorithms Link: https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/

Mapping of COs with POs

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
4CS218PC1.1	3	2	2	1	3	–	–	–	2	1	1	3	2	1
4CS218PC1.2	3	3	3	2	3	–	–	–	2	1	1	3	3	1
4CS218PC1.3	3	3	2	2	3	–	–	–	3	2	1	3	3	2
4CS218PC1CO	3	3	3	2	3	–	–	–	2	1	1	3	3	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level:**5**	Course Code: **4CS219VS1**		Course Category: **VSC**		
Course Name	**Programming Laboratory –II (Web Designing Lab)**				
Credits	**02**	Total L:T:P etc. Hours	0:0:4 **60 Hrs**	Total SL Hours	**-**
Total Credit Hours	**60 Hrs**				
SEE Marks	**-**	SEE Time	**-**	CIA Marks	**-**
EE Marks	**-**	PA Marks	**50**	Total Marks	**50**

Course Description:
Subject Code 4CS219VS1 Programming Laboratory –II (Web Designing Lab) is a Vocational Skill Course for Second Year B.Tech Computer Science and Engineering.

Course Objectives:
The objective of the course is to introduce the fundamental web technologies and PHP programming for handling forms, performing computations, managing files, and designing interactive web pages and to develop, analyse, and implement dynamic web applications using authentication, sessions, cookies, CSS styling, and database connectivity with proper testing and documentation.

Course Outcomes:
After completing the course students will be able to:

CO	Course Outcome	Domain Level
4CS219VS1.1	Understand basic web technologies, HTML, PHP syntax, and file handling to create simple dynamic pages.	C-2, P-6, A-4
4CS219VS1.2	Analyse and implement authentication, sessions, cookies, and input validation to ensure secure and accurate web applications.	C-4, P-3, A-1
4CS219VS1.3	Design modular PHP web applications using CSS, file operations, and proper testing to build usable and creative websites.	C-6, P-5, A-5

List of Practical's:
Minimum eight practical's from the list mentioned below.

1. Get name of the user from a form and show greeting text.
2. Write a PHP program for mathematical calculation and to manipulate arrays.
3. Write a program for display our personal information using various tags in PHP, HTML.
4. Create a php program for login page A) with SQL connection B) Without using SQL connection.
5. Write a program for display the date and time and create a php program for displaying our curriculum vitae.

6. Write a program for counting the visiting page using cookie.
7. Write a php program to Read from existing file and Write a php program to write a file.
8. Write a PHP program demonstrating the use of CSS for styling.
9. Create a web page for software company websites.
10. Create a PHP page for login system using session.

Text Books:

1. Vikram Vaswani, PHP and MySQL for Beginners.
2. Stevan Holzer, PHP (Complete Reference).

Reference Books:

1. Vikram Vaswani, PHP: A Beginner's Guide (Indian Edition), Tata McGraw Hill
2. Vijay Joshi, PHP Programming Lab Manual, TechMax Publications

E Resources:

1. PHP Spoken Tutorial (IIT Bombay), https://spoken-tutorial.org/tutorial-search/?search_foss=PHP
2. .PHP Lab Manuals (PDFs), https://www.msubaroda.ac.in/academics/syllabus
3. https://www.vlab.co.in/?utm_source=chatgpt.com
4. https://spoken-tutorial.org/?utm_source=chatgpt.com
5. https://swayam.gov.in

Mapping of COs with POs & PSOs

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
4CS219VS1.1	3	2	2	2	3	1	1	1	2	1	2	3	2	1
4CS219VS1.2	3	3	3	3	2	1	1	2	3	2	2	3	3	2
4CS219VS1.3	2	2	3	2	3	2	1	2	2	2	1	3	3	2
4CS219VS1CO	2	2	3	2	3	1	1	2	2	2	2	3	3	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code:	**4SH220AE1**	Course Category:	**AEC**
Course Name	**Technical Writing**			
Credits	**02**	Total L:T:P Hours	1:0:2 **45 Hrs**	Total SL Hours	**15 Hrs**
Total Credit Hours	**60 Hrs**			
SEE Marks	--	SEE Time	--	CIA Marks	--
EE Marks	--	PA Marks	**50**	Total Marks	**50**

Course Description:
Subject Code 4SH220AE1 Technical Writing is common Ability Enhancement Course for Second Year B. Tech.

Course Objectives:
The objective of the course is to enhance students' ability to write effective technical documents, professional correspondence, and research-oriented content with clarity, accuracy, and ethical standards.

Course Outcomes:
After completing the course students will be able to:

CO	Course Outcome	Domain Level
4SH220AE1.1	Apply principles of technical writing in engineering documents.	C-3 P-2 A-2
4SH220AE1.2	Apply technical writing skills to prepare professional documents.	C-4 P-2 A-2
4SH220AE1.3	Create ethical, well-structured technical and research documents using IEEE referencing for professional and academic communication.	C-3 P-3 A-3

Course Contents:

Unit 1	**Fundamentals of Technical Writing:** Nature and importance of technical communication, characteristics of technical writing, audience analysis, technical vocabulary, grammar and style, clarity and conciseness, paragraph structure, coherence, technical descriptions, instructions and manuals.	7 Hrs
Unit 2	**Professional and Research Writing:** Technical reports and documentation, structure of reports, abstracts and summaries, research papers, project proposals, resumes and cover letters, business emails, documentation ethics, plagiarism, referencing styles (IEEE), editing and proofreading.	8 Hrs

List of Practicals:

Minimum eight practicals from the list mentioned below.
1. Analysis of Technical Communication to Identify the nature, purpose of given technical documents and evaluate their effectiveness.

2. Editing technical text for clarity and brevity
3. Technical description of an engineering device/system
4. Writing step-by-step technical instructions
5. Preparation of structured technical reports
6. Resume and cover letter drafting
7. Technical report writing based on laboratory work, case study, or project work
8. Abstract and executive summary writing for technical documents
9. Referencing and citation using IEEE format
10. Editing, proofreading, and plagiarism check of technical documents

Text Books:

1. Rizvi A. M. & Patnaik P., Effective Technical Communication, McGraw Hill Education (India), New Delhi (Second Edition).
2. Verma S., Technical Communication for Engineers, Vikas Publishing House Pvt. Ltd., New Delhi (First Edition).
3. Misra P. & Tyagi K., Advanced Technical Communication, PHI Learning Pvt. Ltd., New Delhi (Second Edition).

Reference Books:

1. Chauhan G. S., Kashiramka S. & Thimmesha L., Technical Communication, Cengage Learning India Pvt. Ltd., New Delhi (First Edition).
2. Alred G. J., Brusaw C. T. & Oliu B., Handbook of Technical Communication, Oxford University Press, New Delhi (Second Edition).
3. IEEE Editorial Style Manual, IEEE Standards Association, IEEE, USA (Latest Edition).
4. Joseph G. & Joseph B., Grammar and Usage for Technical Communication, Cambridge University Press India, Delhi (First Edition).

E Resources :

1. NPTEL–SWAYAM, IIT Roorkee, Technical Communication for Engineers.
2. https://owl.purdue.edu
3. https://ieeeauthorcenter.ieee.org

Mapping of COs with POs & PSOs:

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
4SH220AE1.1	-	-	-	-	-	-	-	-		3	-	2	2	1
4SH220AE1.2	-	-	-	-	-	-	-	-	3	3	-	1	3	2
4SH220AE1.3	-	-	-	-	-	-	-	3		3	3	3	3	3
4SH220AE1 CO	-	-	-	-	-	-	-	1	1	3	1	2	2	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code: **4SH221EM1**			Course Category:	**EEM**
Course Name	**Fundamentals Of Book Keeping And Accounting**				
Credits	**02**	Total L:T:P etc. Hours	1:0:2 **45 Hrs**	Total SL Hours	**15 Hrs**
Total Credit Hours	**60 Hrs**				
SEE Marks	-	SEE Time	-	CIA Marks	-
EE Marks	-	PA Marks	**50**	Total Marks	**50**

Course Description:
Subject Code 4SH221EM1 Fundamentals of Book Keeping and Accounting is a compulsory Skill Enhancement Course for Second Year B.Tech. Computer Science and Engineering.

Course Objectives:
The objective of this course is to provide students with a strong foundation in basic accounting principles and bookkeeping techniques.

Course Outcomes:
After completing the course students will be able to:

CO	Course Outcome	Domain Level
4SH221EM1.1	Understand and follow the Concepts and Principles of Bookkeeping	C-2
4SH221EM1.2	Apply and perform the Double-Entry System of Accounting	C-3
4SH221EM1.3	Understand and execute Financial Statements.	C-3

Course Contents:

Unit 1	**Fundamentals of Bookkeeping** Concept and Principles of Bookkeeping: Definition and objectives of bookkeeping, Difference between bookkeeping and accounting Types of accounts: Real, Personal, and Nominal, The Golden Rules of Accounting Bookkeeping Terminology: Key terms: Assets, Liabilities, Owner's Equity, Revenues, Expenses, Understanding Debits and Credits.	7 Hrs
Unit 2	**Basics Of Accounting** The Accounting Cycle: Steps in the accounting cycle, Journalizing transactions, Posting to the ledger, Trial balance preparation Source Documents and Books of Accounts: Types of source documents (Invoices, Receipts, Bank statements) Primary books: Cash Book, Purchase Book, Sales Book, Journal Book Double-Entry System of Accounting: Introduction to the	8 Hrs

	double-entry system, Understanding dual aspect concept, Practical examples of double-entry Introduction to Financial Statements: Purpose and types of financial statements, Understanding Profit and Loss Account (Income Statement),Balance Sheet (Statement of Financial Position) Preparation of Financial Statements: Preparing a Trading Account, Preparing a Profit and Loss Account, Preparing a Balance Sheet.	

List of Practical's:

Minimum eight practicals from the list mentioned below

1. Understand how to record transactions in the journal.
2. Learn how to transfer entries from the journal to the ledger.
3. Understand how to prepare a trial balance and ensure the books are balanced.
4. Record cash receipts and payments in a cash book.
5. Identify and use source documents to record transactions.
6. Learn to record credit sales and credit purchases in their respective books.
7. Understand and apply the double-entry accounting system.
8. Prepare the profit and loss account and balance sheet based on financial data.
9. Focus on recording and posting nominal accounts like expenses, revenues, and gains or losses.
10. Calculate gross profit or loss by preparing a Trading Account.

Text Books:

1. B.S.Khanna, I.M.Pandey,G.K.Ahuja,S.C.L.Batra, Practical Costing.
2. B.K.Bhar, Cost Accounting.

Reference Books:

1. N.M.Soni, Introduction to Accounting.
2. T.S.Grewal, Principles of Accounting.
3. N.P.Jain, Basic Accounting.

E- Resources:

1. https://www.icai.org
2. https://www.khanacademy.org/college-careers-more/personal-finance/pf-accounting
3. https://quickbooks.intuit.com
4. https://training.sap.com
5. https://www.inflibnet.ac.in

Mapping of COs with POs & PSOs

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
4SH221EM1.1	3	3	2	2	2	-	-	1	-	-	-	1	2	2
4SH221EM1.2	2	2	-	2	3	-	-	2	1	1	-	2	2	2
4SH221EM1.3	2	-	-	-	2	2	-	-	-	-	-	1	2	2
4SH221EM1CO	2	2	1	1	2	1	1	1	-	-	-	1	2	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code: **4CE222VE1**		Course Category: **VEC**		
Course Name	**Environmental Science**				
Credits	**02**	Total L:T:P Hours	2:0:0 **30 Hrs**	Total SL Hours	**30 Hrs**
Total Credit Hours	**60 Hrs**				
SEE Marks	**30**	SEE Time	**2 Hrs**	CIA Marks	**20**
EE Marks	**--**	PA Marks	**--**	Total Marks	**50**

Course Description:
Subject Code 4CE222VE1 Environmental Science is a Value Education course for Second Year B. Tech Computer Science & Engineering.

Course Objectives:
The objective of this course is to develop understanding of environmental systems, natural resource management, ecological balance, and sustainable development practices to promote awareness and responsibility toward environmental protection and societal well-being.

Course Outcomes:
After completing the course students will be able to:

CO	Course Outcome	Domain Level
4CE222VE1.1	Analyze renewable and non-renewable natural resources and associated problems to promote sustainable utilization for future generations.	C-4
4CE222VE1.2	Analyze food chains, webs, and ecological pyramids to evaluate ecological interactions and succession processes.	C-4
4CE222VE1.3	Examine shift from unsustainable to sustainable development to promote responsible resource planning for society.	C-3

Course Contents:

Unit 1	Renewable and non-renewable resources Environmental Science, Definition, scope and importance, Need for public awareness, Renewable and non-renewable resources, Natural resources and associated problems. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable life styles.	10 hrs
Unit 2	**Ecosystem:** Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of	10 hrs

	the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem.	
Unit 3	**Social Issues & Environment:** From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions, Environment Protection Act. Air (Prevention and Control of Pollution) Act., Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, public awareness.	10 hrs

Text Books:

1. Suresh K. Dhameja, Environmental Studies, Katson Books
2. Benny Joseph, Environmental Studies, McGraw Hill Education

Reference Books:

1. Masters & Wendell Ela, Introduction to Environmental Engineering and Science, Pearson Education
2. William Cunningham & Mary Cunningham, Environmental Science, McGraw Hill

E Recourses:

https://www.vlab.co.in/broad-area-civil-engineering

Mapping of COs with POs & PSOs

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
4CE222VE1.1	3	2	-	-	-	2	2	-	-	-	-	-	-	-
4CE222VE1.2	3	2	-	-	-	3	2	-	-	-	-	-	1	-
4CE222VE1.3	3	2	-	-	-	3	3	-	-	-	-	-	1	-
4CE222VE1.CO	3	2	-	-	-	3	3	-	-	-	-	-	1	-

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code: **4CS223DH1**		Course Category: **DH**		
Course Name	**Intrusion Detection & Prevention System**				
Credits	**04**	Total L:T:P etc. Hours	3:0:0 **60 Hrs**	Total SL Hours	**60 Hrs**
Total Credit Hours	**120 Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**-**	PA Marks	**-**	Total Marks	**100**

Course Description:
Subject Code 4CS223DH1 Intrusion Detection & Prevention System is a compulsory Double Minor / Honours Course offered by the department of Computer Science and Engineering for Second Year B.Tech., of all discipline.

Course Objectives:
The objective of this course is to provide in-depth knowledge of intrusion detection and prevention techniques, including attack modeling, IDS/IPS architectures, detection methods, log analysis, and real-world IDPS deployment.

Course Outcomes:
After completing the course students will be able to:

CO	**Course Outcome**	**Domain Level**
3CS211DH1.1	Explain intrusion types, attack patterns, and threat modeling techniques to understand advanced cyber threats.	C-2
3CS211DH1.2	Analyze IDS and IPS architectures and detection methodologies for effective intrusion detection.	C-5
3CS211DH1.3	Apply signature-based, anomaly-based, and hybrid detection techniques to identify intrusions accurately.	C-3
3CS211DH1.4	Evaluate IDS/IPS tools for network, host, and cloud environments to select appropriate security solutions.	C-4
3CS211DH1.5	Analyze logs, alerts, and traffic data to detect and respond to intrusions.	C-2
3CS211DH1.6	Assess real-world intrusion cases and design mitigation strategies for improved system security.	C-5

Course Contents:

Unit 1	**Intrusion Concepts and Threat Modeling** Intrusion definition and classification, Difference between attacks, intrusions, and incidents, Threat modeling and attack surfaces, Cyber kill chain and MITRE ATT&CK framework, Advanced persistent	10 Hrs

	threats (APT), Attack vectors beyond basic network security	
Unit 2	**IDS and IPS Architectures** Intrusion Detection vs Intrusion Prevention Systems, Host-Based IDS (HIDS), Network-Based IDS (NIDS), Inline vs passive deployment, IDS/IPS placement strategies, Performance and scalability challenges	10 Hrs
Unit 3	**Detection Techniques and Algorithms** Signature-based detection, Anomaly-based detection, Specification-based detection, Statistical models for intrusion detection, Machine learning techniques for IDS, False positives, false negatives, and tuning IDS rules	10 Hrs
Unit 4	**IDS/IPS Tools and Technologies** Snort architecture and rule writing, Suricata features and performance comparison, OSSEC and Wazuh for host-based detection, SIEM integration with IDS/IPS, Cloud-based IDPS solutions, IDS in SDN and virtualized networks	10 Hrs
Unit 5	**Log Analysis, Incident Response & Prevention** Network traffic analysis, Log correlation and alert management, Incident response workflow, Automated blocking and prevention mechanisms, Forensics basics in intrusion analysis, Security orchestration and response (SOAR)	10 Hrs
Unit 6	**Case Studies and Emerging Trends** Enterprise intrusion case studies, Web application intrusion scenarios, Insider threat detection, AI-driven intrusion detection, Zero Trust and adaptive security Future challenges in intrusion prevention	10 Hrs

Text Books:

1. Rebecca Gurley Bace & Peter Mell, Intrusion Detection Systems, Pearson Education.
2. Earl Carter & Jonathan Hogue, Intrusion Prevention Fundamentals, Cisco Press.
3. Richard Bejtlich, The Practice of Network Security Monitoring, No Starch Press.

Reference Books:

1. Rafeeq Rehman, Intrusion Detection with Snort, Prentice Hall.
2. Tao Peng, Machine Learning for Intrusion Detection, Springer.
3. Wenliang Du, Computer & Internet Security, Pearson.

E Resources:

1. NPTEL – Advanced Network & Intrusion Detection Courses
   https://nptel.ac.in
2. Cisco Networking Academy – Cybersecurity & IDPS
   https://www.netacad.com
3. OWASP – Attack Detection & Prevention
   https://owasp.org
4. MITRE ATT&CK Framework
   https://attack.mitre.org

Mapping of COs with POs

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
3CS211DH1.1	2	2	2	–	–	–	–	–	–	–	–	2	–	1
3CS211DH1.2	3	3	2	2	2	–	1	–	–	–	–	3	2	–
3CS211DH1.3	3	3	3	2	3	–	–	–	–	–	–	3	3	2
3CS211DH1.4	2	3	3	3	3	1	–	–	–	–	–	2	3	1
3CS211DH1.5	2	3	2	3	3	1	–	–	–	–	–	2	3	1
3CS211DH1.6	2	3	3	3	2	2	1	–	–	1	2	2	3	2
3CS211DH1CO	3	3	3	3	3	2	1	–	–	1	2	3	3	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code: **4CS223DH2**		Course Category: **DH**		
Course Name	**Software Testing**				
Credits	**04**	Total L:T:P etc. Hours	4:0:0 **60 Hrs**	Total SL Hours	**60 Hrs**
Total Credit Hours	**120 Hrs**				
SEE Marks	**60**	SEE Time	**3 Hrs**	CIA Marks	**40**
EE Marks	**-**	PA Marks	**-**	Total Marks	**100**

Course Description:
Subject Code 4CS223DH2 Software Testing is a compulsory Double Minor / Honours Course offered by the department of Computer Science and Engineering for Second Year B.Tech., of all discipline.

Course Objectives:
The course aims to build a strong foundation in software verification, validation, and testing techniques. It also focuses on assessing non-functional aspects such as performance, security, and usability.

Course Outcomes:
After completing the course students will be able to:

CO	Course Outcome	Domain Level
4CS223DH2.1	Define errors, faults, failures and verification vs validation to understand software defects and QA basics.	C-2
4CS223DH2.2	Distinguish unit, integration, system, acceptance, regression testing for choosing correct testing levels.	C-2
4CS223DH2.3	Apply equivalence partitioning and boundary value analysis to design black-box test cases.	C-3
4CS223DH2.4	Use path coverage and cyclomatic complexity for effective white-box testing.	C-3
4CS223DH2.5	Explain test automation need, benefits, challenges to improve testing speed and reliability.	C-2
4CS223DH2.6	Describe performance, security, and usability testing for ensuring non-functional quality.	C-2

Course Contents:

Unit 1	**Introduction to Testing:** Definition of errors, faults, and failures, Types of software errors (logical, syntax, runtime),Sources of faults in software development, Difference between verification and validation, Static vs. dynamic testing techniques Importance of early testing in SDLC, Cost of defect detection at different phases, Quality assurance vs quality control, Role of standards in QA (ISO,	10 Hrs

	IEEE),Process-oriented vs product-oriented approaches, Testing principles (early testing, defect clustering, pesticide paradox)	
Unit 2	**Testing Levels :** Unit testing: drivers, stubs, isolation of modules, Integration testing: incremental and non-incremental strategies, System testing: functional, non-functional, recovery and compatibility checks, Acceptance testing: user acceptance, contract and regulatory compliance, Regression testing : automation in regression, selection of regression test suite, Continuous testing in DevOps pipelines, End-to-end workflow validation, Smoke and sanity testing, Differences between alpha, beta testing.	10 Hrs
Unit 3	**Black-box Testing:** Equivalence partitioning: dividing input domains, Boundary value analysis: edge condition testing, Decision table testing: rules and outcomes, State transition testing: events and states, Use-case based testing, Error guessing technique, Random testing methods, Exploratory testing approaches, Advantages and limitations of black-box testing, Guidelines for effective test case design, Comparison of black-box and white-box testing techniques.	10 Hrs
Unit 4	**White-box Testing:** tatement coverage: executing all statements, Branch coverage: decision points, Path coverage: independent paths, Cyclomatic complexity: measuring control flow complexity, Loop testing techniques, Condition coverage and multiple condition coverage, Basis path testing, Control flow graph construction, Data flow testing, Mutation testing, Advantages and limitations of white-box testing, Comparison with black-box testing techniques.	10 Hrs
Unit 5	**Test Automation Concepts:** Need for automation: efficiency, repeatability, Benefits: faster execution, reliability, reusability, Challenges: maintenance, tool selection, cost, Overview of tools: JUnit, Selenium, TestNG, Framework design and architecture for automation, Continuous integration and automated testing pipelines, Test script maintenance and version control, Limitations of test automation, Criteria for selecting automation tools.	10 Hrs
Unit 6	**Non-functional Testing:** Performance testing: load, stress, scalability, Security testing: vulnerabilities, penetration testing, Usability testing: user experience evaluation, Test metrics: defect density, coverage, reliability metrics, Reliability testing and recovery testing, Compatibility testing across platforms and environments, Maintainability and	10 Hrs

	portability testing, Scalability and endurance testing, Accessibility testing for differently abled users, Compliance testing with standards and regulations, Importance of monitoring and reporting in non-functional testing, Tools and frameworks for non-functional testing.	

Text Books:

1. Dorothy Graham, Erik van Veenendaal, Isabel Evans, Rex Black – Foundations of Software Testing
2. Srinivasan Desikan, Gopalaswamy Ramesh – Software Testing: Principles and Practice
3. Richard Szeliski – Computer Vision: Algorithms and Applications
4. Srinivasan Desikan, Gopalaswamy Ramesh – Software Testing: Principles and Practice

Reference Books:

1. Glenford J. Myers, The Art of Software Testing
2. Mauro Pezze, Michal Young, Software Testing and Analysis
3. Paul Ammann, Jeff Offutt, Introduction to Software Testing (Cambridge University Press)
4. Aditya P. Mathur, Foundations of Software Testing (Pearson)

E Resources:

1. Course Introduction to Software Testing – NPTEL (Prof. Rajiv Misra, IIT Patna) https://nptel.ac.in/courses/106105150
2. Black-box & White-box Testing Techniques – GeeksforGeeks Tutorials https://www.geeksforgeeks.org/software-testing-basics

Mapping of COs with POs & PSOs

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
4CS223DH2.1	2	2	–	–	–	–	–	–	–	–	1	2	1	–
4CS223DH2.2	2	2	1	–	–	–	–	–	–	–	1	2	2	–
4CS223DH2.3	3	3	2	–	2	–	–	–	–	–	1	3	3	–
4CS223DH2.4	3	3	2	2	2	–	–	–	–	–	1	3	3	–
4CS223DH2.5	2	2	1	–	2	–	–	–	–	–	2	2	2	1
4CS223DH2.6	2	3	2	2	2	2	1	–	–	–	2	2	3	2
4CS223DH2CO	3	3	2	2	2	2	1	–	–	–	2	3	3	2

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Level: **5**	Course Code: **5CS224EC1**		Course Category: **EC**		
Course Name	**Mobile App Development (Android)**				
Credits	**04**	Total L:T:P Hours	2:0:4 **90 Hrs**	Total SL Hours	**30 Hrs**
Total Credit Hours	**120 Hrs**				
SEE Marks	**30**	SEE Time	**2 Hrs**	CIA Marks	**20**
EE Marks	**25**	PA Marks	**25**	Total Marks	**100**

Course Description:
Subject Code 5CS224EC1 Mobile App Development (Android) is a Exit Course in Computer Science and Engineering for Second Year B. Tech.

Course Objectives:
The objective of this course is to develop students' ability to design, build, and deploy Android mobile applications using modern tools, structured UI development, backend integration, and app testing practices.

Course Outcomes:
After completing the course students will be able to:

CO	Course Outcome	Domain Level
5CS224EC1.1	Apply Android basics, UI components, and activity lifecycle to create functional mobile interfaces.	C-3,P-3
5CS224EC1.2	Analyze and implement data storage, background tasks, and API-based communication for dynamic mobile apps.	C-4, P-4
5CS224EC1.3	Design, build, and deploy complete Android apps using multimedia, Firebase, and performance-optimized components.	C-4,P-5

Course Contents:

Unit 1	**Android Basics and User Interface Components** Introduction to Android: Features, architecture, application structure, Android Components: Activities, services, broadcast receivers, content providers., Activity Lifecycle & Intents: Navigation, intent filters, passing data. **User Interface Design**: XML layout system, Constraint Layout, Linear Layout, Relative Layout. UI Elements: TextView, EditText, Button, ImageView, Spinner, CheckBox, RadioButton, Event Handling: Listeners, dialogs, toast, snackbar, Basic Navigation & Screen Management.	10 Hrs

Unit 2	**Data Storage, Background Processing & Networking** Data Storage: SharedPreferences, files, internal & external storage, Database Systems: SQLite database & Room library (CRUD operations), Networking: HTTP basics, JSON parsing, REST APIs using Retrofit/Volley, Background Tasks: Services, foreground services, broadcast receivers, WorkManager, Threading & Asynchronous Operations: Threads, handlers, AsyncTask, Firebase Basics: Authentication & Realtime database integration.	8 Hrs
Unit 3	**Advanced App Development, Multimedia & Deployment** Multimedia Integration: Audio player, video player, camera usage, Advanced UI: Menus, themes, styles, recyclerview, adapters, custom UI components, App Architecture: MVC/MVVM basics, lifecycle-aware components, Location Services: GPS basics, Google Maps integration, Testing & Optimization: Debugging tools, logcat, ANR handling, app performance, Deployment: APK creation, app signing, versioning, publishing overview.	12 Hrs

List of Practical's:

Minimum ten practical's from the list mentioned below.

1. Create a simple Android project with a basic UI layout.
2. Implement activity lifecycle with screen transitions.
3. Design an app using buttons, images, and user inputs.
4. Create multi-screen navigation using intents.
5. Design and implement menus, dialogs, and notifications.
6. Store and retrieve user data using Shared Preferences.
7. Develop a Room/SQLite application with CRUD operations.
8. Build an app that fetches data from a RESTful API (JSON parsing).
9. Integrate Firebase Authentication and Realtime Database.
10. Implement background tasks using Services / WorkManager.
11. Create an audio/video player app.
12. Generate a signed APK and deploy it on a device.

Text Books:

1. Pradeep Kothari, Android Application Development, BPB Publications.
2. Satya Komatineni, Dave MacLean & Reto Meier, Pro Android, Apress (Indian edition available).
3. B. M. Harwani, Android Programming Unleashed, Pearson India.

Reference Books:

1. Ramesh Potnis, Android Apps Development: A Hands-On Guide, Wiley India.
2. Rajiv Sharma, Mobile Application Development (Android), Khanna Book Publishing.
3. Anubhav Singh & Rimjhim Bhadani, Beginning Android Programming, BPB Publications.

E-Resources:

1. NPTEL – Mobile Application Development
   https://nptel.ac.in/courses/106106183
2. Android Developers Official Documentation
   https://developer.android.com
3. GeeksforGeeks – Android Tutorial Series
   https://www.geeksforgeeks.org/android-tutorial/

Mapping of COs with POs:

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
5CS224EC1.1	3	2	2	2	2	-	-	1	-	-	-	3	2	1
5CS224EC1.2	3	3	3	2	3	1	-	1	1	-	-	3	3	1
5CS224EC1.3	3	3	3	2	3	2	-	1	2	2	-	3	3	2
5CS224EC1CO	3	3	3	2	3	1	-	1	1	1	-	3	3	1

Correlation levels- 1: Slight (Low),2: Moderate(Medium),3: Substantial (High)

Level: **5**	Course Code: **5CS225EC1**		Course Category: **EC**		
Course Name	**Full stack Developer**				
Credits	**04**	Total L:T:P Hours	2:0:4 **90 Hrs**	Total SL Hours	**30 Hrs**
Total Credit Hours	**120 Hrs**				
SEE Marks	**30**	SEE Time	**2 Hrs**	CIA Marks	**20**
EE Marks	**25**	PA Marks	**25**	Total Marks	**100**

Course Description:
Subject Code 5CS225EC1 Full stack Developer is an Exit Course for Second Year B. Tech. Computer Science and Engineering.

Course Objectives:
The objective of this course is to enable students to design, develop, and deploy full-stack web applications using HTML, CSS, JavaScript, Node.js/Express, MongoDB/MySQL, REST APIs, authentication, and hosting platforms.

Course Outcomes:
After completing the course students will be able to:

CO	Course Outcome	Domain Level
5CS225EC1.1	Apply HTML, CSS, JavaScript, and frontend frameworks to build responsive user interfaces.	C-3, P-3
5CS225EC1.2	Develop backend services using Node.js/Express and implement database operations using MongoDB/MySQL.	C-4, P-4
5CS225EC1.3	Design, integrate, and deploy full-stack applications with REST APIs, authentication, testing, and cloud hosting.	C-6, P-5

Course Contents:

Unit 1	**Frontend Development: HTML, CSS, JavaScript & Frameworks** HTML Basics: Structure, tags, forms, semantic elements. CSS Styling: Selectors, box model, flexbox, grid, responsive design, animations. JavaScript Programming: Variables, loops, functions, DOM manipulation, events, ES6 features. Frontend Framework Basics: React.js / Angular (components, props, state, routing). UI/UX Essentials: Layout design, accessibility, responsiveness, media queries.	10 Hrs

Unit 2	**Backend Development & Databases** Server-Side Programming: Node.js fundamentals, Express.js routing, middleware, REST APIs. Database Systems: MongoDB CRUD operations, Mongoose schema design OR MySQL structure, joins, queries. Authentication & Security: JWT, sessions, cookies, password hashing, form validation. API Integration: JSON handling, fetch/axios, error handling. Backend Architecture: MVC pattern, environment variables, modular app structure.	8 Hrs
Unit 3	**Full Stack Integration, Deployment & Testing** Connecting Frontend & Backend: API calls, CORS, state management. Advanced Features: File upload, email services, third-party APIs. Testing: Postman, API testing, unit tests basics. Performance: Caching, optimization, debugging tools. Deployment: Cloud hosting using Render, Netlify, Vercel, GitHub Pages, and Heroku alternatives. Version Control: Git basics, branching, pull/merge, GitHub workflows. Project Packaging: Build scripts, environment configs, production deployment checklist.	12 Hrs

List of Practical's:

Minimum ten practicals from the list mentioned below.

1. Create a static website using HTML5 & CSS3.
2. Build a responsive layout using Flexbox/Grid.
3. Implement DOM-based interactivity using JavaScript.
4. Create a React.js or Angular single-page interface.
5. Develop Node.js + Express server with REST APIs.
6. Perform MongoDB/MySQL CRUD operations.
7. Implement JWT-based authentication.
8. Connect frontend with backend using API calls.
9. Deploy frontend and backend apps on cloud platforms.
10. Build a mini full-stack project (e.g., TODO app, blog system).
11. Implement file upload and form validation.
12. Test APIs using Postman and debug backend errors.

Text Books:

4. Navin Sabharwal & Mehak Khurana, Full Stack Web Development, BPB Publications.
5. Vikram Vaswani, MySQL: The Complete Reference, Tata McGraw-Hill.
6. Shyam Seshadri, Angular: Up and Running, O'Reilly (Indian edition available).

Reference Books:

1. Robin Nixon, Learning PHP, MySQL & JavaScript, O'Reilly.
2. Ethan Brown, *Web Development with Node & Express*, O'Reilly.
3. Brad Dayley, *React.js Essentials*, Packt Publishing.

E-Resources:

1. **NPTEL – Full Stack Development**
   https://nptel.ac.in/courses/106105233
2. **MDN Web Docs – Web Development**
   https://developer.mozilla.org
3. **FreeCodeCamp – Full Stack Curriculum**
   https://www.freecodecamp.org/learn

Mapping of COs with Pos & PSOs

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
5CS225EC1.1	3	2	2	2	2	-	-	1	-	-	-	3	2	1
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5CS225EC1.3	3	3	3	2	3	2	-	1	2	2	-	3	3	2
5CS225EC1CO	3	3	3	2	3	1	-	1	1	1	-	3	3	1

Correlation levels- 1: Slight (Low),2: Moderate (Medium),3:Substantial (High)