Gandhinagar Institute of Technology

Academic Regulation& Curriculum for
B.Tech.
in
Computer Science and Engineering

B.TECH. PROGRAMME

***w.e.f.* 2026-27**

Preamble

We, the members of the Computer Science and Engineering Department, are committed to promoting knowledge, innovation, and technical excellence in the field of computer science and engineering. We aim to create a positive learning environment where students are encouraged to think creatively, work collaboratively, and develop practical skills for real-world challenges.

The curriculum for the B.Tech. in Computer Science and Engineering program has been revised according to the guidelines of UGC, AICTE and NCrF along with the New Education Policy (NEP) under Academic Regulation 2022 and blended with IEEE effective from the academic **session 2026–2027.** The program follows an Outcome-Based Curriculum (OBC) with a Choice-Based Credit System (CBCS), helping students build strong professional and technical skills through a multidisciplinary approach that meets the needs of industry, higher studies, and accreditation bodies such as NBA and NAAC.

To match current trends and technological advancements, several modern subjects have been included in the syllabus, such as Introduction to Machine Learning, Artificial Intelligence, Data Science, Big Data Analytics, Cyber Security, Cloud Computing & Devops, UIUX Web design have been introduced to prepare students for the growing semiconductor industry and emerging opportunities in electronics and hardware sectors.

Students are encouraged to take MOOC courses of their choice to earn honors and gain additional knowledge in advanced technologies.

The course coding system has been updated from the respective academic sessions, as suggested by the Office of the Controller of Examinations. This change helps clearly distinguish the revised curriculum from previous versions.

The curriculum and syllabi are continuously updated through a structured feedback mechanism involving stakeholders such as faculty members, experts, industry experts, alumni and parents. This ensures that the program remains relevant, practical, and future-oriented.

With a focus on continuous learning, innovation, and adaptability, the department aims to develop skilled engineers, researchers, and future leaders who can contribute effectively to society and the rapidly evolving world of cloud computing, Artificial Intelligence, and cyber-Security technology.

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1. Institutional Vision & Mission

1.1 Vision:

To create a flexible and learner-focused engineering ecosystem that builds strong technical skills, practical knowledge, and innovative thinking, preparing graduates to adapt, perform, and lead in a rapidly evolving technological and societal environment.

1.2 Mission:

To provide a holistic learning environment that develops technical skilled, innovative, and socially responsible engineers capable of addressing industrial, technological, and societal needs.

2. Program Objectives

The program aims to:

PO1. Engineering Knowledge: Utilize the basic knowledge in mathematics, science and engineering in the field of Engineering.

PO2. Problem Analysis: Identify, formulate and solve complex problems to achieve demonstrated conclusions using mathematical principles and engineering sciences.

PO3. Design/Development of Solutions: Design system components that meet the requirement of public safety and offer solutions to societal and environmental concerns.

PO4. Conduct Investigations of Complex Problems: Apply research-based knowledge to design and conduct experiments, analyse, synthesize and interpret the data pertaining to Engineering problems and arrive at valid conclusions.

PO5. Modern Tool Usage: Construct, choose and apply the techniques, resources and modern engineering tools required for Engineering applications.

PO6. The Engineer and Society: Apply the contextual knowledge to assess societal, health, safety and cultural issues and endure the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and Sustainability: Examine the impact of engineering solutions in global and environmental contexts and utilize the knowledge for sustained development.

PO8. Ethics: Develop consciousness of professional, ethical, and social responsibilities as experts in the field of Engineering.

PO9. Individual and Team Work: Perform effectively as a member/leader in multidisciplinary teams.

PO10. Communication: Communicate the engineering activities to engineering society for documentation and presentation.

PO11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles to manage projects in multidisciplinary environment.

PO12. Life-long Learning: Demonstrate resourcefulness for contemporary issues and lifelong learning.

3. Program Educational Objectives (PEOs)

PEO-1: To empower graduating students to be successful as professionals, academicians, researchers and motivate them towards start-up.

PEO-2: To encourage budding technocrats to focus on social problems by visiting and experiencing the real time problems faced by the society and will contribute as ethical and responsible citizens with proven expertise

PEO-3: Enabling graduates to work on interdisciplinary projects along with focus on industry defined problems in association with different sector's enterprises.

4. Program Details

4.1 Program Structure & Duration

- Duration & Intake: 4 Years & 180 Seats
- Semesters: 8
- Mode: Full Time
- Credit Structure: As per UGC/NCrF norms
- Medium of Instruction: English

4.2 Eligibility Criteria for Admission

Admission to the Bachelor of Technology (B.Tech.) program in Computer Science and Engineering shall be governed by the norms and guidelines prescribed by the All India Council for Technical Education (AICTE), University Grants Commission (UGC), and the respective State Government/Admission Committee from time to time. Candidates seeking admission must have passed the Higher Secondary Examination (10+2) or its equivalent from a recognized board with Physics and Mathematics as compulsory subjects, along with one of the following subjects: Chemistry, Computer Science, Information Technology, Electronics or Biology. At least 45% aggregate marks (40% for reserved categories like SC/ST/OBC/EWS) in the above subjects taken together. Admission is typically based on merit in national/state tests (e.g., JEE Main, CUET, or state-level CETs) or university-specific entrance exams.

4.3 Admission Procedure

Admission to the Bachelor of Technology (B.Tech.) program in Computer Science and Engineering shall be granted based on merit, entrance examination scores, and reservation policies as applicable under the regulations of AICTE, UGC, and the affiliating university. The ACPC based admission process generally includes online registration, document verification, merit list publication, choice filling, seat allotment, payment of prescribed fees, and confirmation of admission. Reservation policies, eligibility requirements, and admission procedures shall be implemented as per the prevailing norms of ACPC, UGC, AICTE, and the affiliating university.

4.4 Credit Summary for B.Tech. Course in Computer Science and Engineering with effect from 2026-2027

Sl. No.	Course Type	IT Cradit
1.	Humanities and Social Sciences including Management Courses	3

2.	Basic Science Courses	22
3.	Engineering Science Courses including Workshop, Drawing, Basics of Electrical / Mechanical / Computer, etc.	7
4.	Program Core Courses	91
5.	Multidisciplinary	0
6.	Project/Training	15
7.	Skills (AEC, VAC, SEC)	26
8.	Indian Knowledge System	08
	Total	**172**

Definition of Credit (as per UGC):

- 1 Hour Lecture (L) per Week = 1 Credit
- 1 Hour Tutorial (T) per Week = 1 Credit
- 2 Hours Practical / Lab per Week = 1 Credit
- 1 Credit = 15 contact hours of theory / 30 hours of practical over one semester

5. Curriculum Structure

Gandhinagar Institute of Technology (01)

Program Name: Bachelor of Technology (01)			**Branch Name (Code): IT (006)**					
Semester / Year: 01 / 01								
NCrF LEVEL	**Subject Code**	**Course Type**	**Subject Name**	**Credit**	**Hours per week**			
					L	**T**	**P**	**Total**
NCR – 4.5	10000101	Basic Science	Engineering Mathematics-I	5	3	2	0	5
	10050101	Professional Core	Programming for Problem Solving	5	4	0	2	6
	10010105	Engineering Science	Engineering Foundation	4	3	0	2	5
	10050102	Professional Core	ICT Fundamental & Workshop	4	4	0	0	4
	SEC001	SEC-I	Animation & Graphics Design	2	2	0	0	2
	VAC003	VAC-I	Awareness of Cyber crime and Ethical Hacking	2	2	0	0	2
	AEC016	AEC-I	Practical English	2	2	0	0	2
			Total	**24**	**20**	**2**	**4**	**26**

Gandhinagar Institute of Technology (01)

Program Name: Bachelor of Technology (01)			**Branch Name (Code): IT (006)**					
Semester / Year: 02 / 01								
NCrF LEVEL	**Subject Code**	**Course Type**	**Subject Name**	**Credit**	**Hours per week**			
					L	**T**	**P**	**Total**
NCR – 4.5	10000201	Basic Science	Engineering Mathematics-II	5	3	2	0	5
	10000003	Basic Science	Engineering Physics	4	3	0	2	5
	10050201	Professional Core	Basics of Python / Fundamental of Civil	4	3	0	2	5
	10030101	Professional Core	Basic of Electrical & Electronics	4	3	0	2	5
	SEC019	SEC-II	Social Media Management	2	2	0	0	2
	VAC021	VAC-II	Stress & Time Management	2	2	0	0	2
	AEC015	AEC-II	Personality Development for Effective Leadership	2	2	0	0	2
	IKS0201	IKS	Indian Ancient History & Cultural Heritage	2	1	0	2	3
			Total	**25**	**19**	**2**	**8**	**29**

Gandhinagar Institute of Technology (01)

Program Name: Bachelor of Technology (01)	**Branch Name (Code): IT (006)**
Semester / Year: 03 / 02	

NCrF LEVEL	Subject Code	Course Type	Subject Name	Credit	Hours per week			
					L	T	P	Total
NCR – 5.0	10050301	Professional Core	Data Structures	4	3	0	2	5
	10050302	Professional Core	Database Management Systems	4	3	0	2	5
	10050304	Engineering Science	Digital Electronics	3	3	0	0	3
	10000302	Humanities and Social Science	Economics and Management	3	3	0	0	3
	10000301	Basic Science	Probability and Statistics	4	3	1	0	4
	VAC023	VAC	Universal Human Values	2	2	0	0	2
			Total	**20**	**17**	**1**	**4**	**22**

Gandhinagar Institute of Technology (01)

Program Name: Bachelor of Technology (01)	**Branch Name (Code): IT (006)**
Semester / Year: 04 /02	

NCrF LEVEL	Subject Code	Course Type	Subject Name	Credit	Hours per week			
					L	T	P	Total
NCR – 5.0	10050401	Professional Core	Object Oriented Programming	4	3	0	2	5
	10050402	Professional Core	Operating System	4	3	0	2	5
	10060402	Professional Core	Internet and Web Technology	4	3	0	2	5
	10050404	Professional Core	Discrete Mathematics	4	3	1	0	4
	SEC026	SEC	Cyber Security	2	1	0	2	3
	IKS	IKS	IKS	2	2	0	0	2
			Total	**20**	**15**	**1**	**8**	**24**

Gandhinagar Institute of Technology (01)

Program Name: Bachelor of Technology (01)			**Branch Name (Code): IT (006)**					
Semester / Year: 05 / 03								
NCrF LEVEL	**Subject Code**	**Course Type**	**Subject Name**	**Credit**	**Hours per week**			
					L	**T**	**P**	**Total**
NCR – 5.5	10270605	Professional Core	Programming Methodologies for Backend Development(Mongo DB)	4	3	0	2	5
	10270504	Professional Core	Data Analysis and Visualization	4	3	0	2	5
	10050502	Professional Core	Analysis and Design of Algorithms	4	3	0	2	5
	10050504	Professional Core (IEEE)	Computer Network	4	3	0	2	5
		Professional Elective	Professional Elective – I	4	3	0	2	5
	AEC020	Ability Enhancement Course	Ethics for Engineers, Patents, Copyrights and IPR	2	0	0	4	4
			Total	**22**	**15**	**0**	**14**	**29**
	Professional Elective – I							
	10050505	Professional Elective - I	Advanced Java Programming					
	10050506	Professional Elective - I	ASP .Net Programming					
	10270508	Professional Elective - I	Mobile Application development					
	10060504	Professional Elective - I	Python for Data Science					

Gandhinagar Institute of Technology (01)

Program Name: Bachelor of Technology (01)			**Branch Name (Code): IT (006)**					
Semester / Year: 06 / 03								
NCrF LEVEL	**Subject Code**	**Course Type**	**Subject Name**	**Credit**	**Hours per week**			
					L	**T**	**P**	**Total**
NCR – 5.5	10060601	Professional Core	Cyrptography and Network Security	4	3	0	2	5
	10060602	Professional Core	Advanced Web Technology	3	2	0	2	4
	10060603	Professional Core	Software Engineering	4	3	0	2	5
		Professional Elective	Professional Elective-II	4	3	0	2	5
	10060608	Professional Core	UX Design Foundation	3	3	0	0	3
	10000607	Project	Minor Project on IKS	2	0	0	4	4

	AEC		AEC	2	2	0	0	2
			Total	**22**	**16**	**0**	**12**	**28**
	Professional Elective – II							
	1005060 3	Professional Elective - II	Advance Computer Networks					
	1005060 4	Professional Elective - II	Distributed Computing					
	1006060 6	Professional Elective - II	Cloud Infrastructure and Services					
	1027050 7	Professional Elective - II	Linux and Shell Programming					

Gandhinagar Institute of Technology (01)

Program Name: Bachelor of Technology (01)			**Branch Name (Code): IT (006)**					
Semester / Year: 07/04								
NCrF LEVEL	**Subject Code**	**Course Type**	**Subject Name**	**Credit**	**Hours per week**			
					L	**T**	**P**	**Total**
NCF – 6.0	1000070 7	IKS	DIGITAL INDIA 2.0 (Startup and Innovation)	2	2	0	0	2
	1006070 1	Project Work	Internship/Project	3	0	0	6	6
	1006070 2	Professional Core	Artificial Intelligence	4	3	0	2	5
	1006070 3	Professional Core	Software Project Management	4	3	0	2	5
		Professional Elective - III	-	4	3	0	2	5
		Professional Elective - IV	-	4	3	0	2	5
			Total	**21**	**14**	**0**	**14**	**28**
	Professional Elective – III							
	1005070 3	Professional Elective - III	Image Processing					
	1027070 6	Professional Elective - III	Advance Machine Learning					
	1006070 4	Professional Elective - III	Mobile Computing and Wireless Communication					
	1006070 5	Professional Elective - III	System Testing & Analysis					
	Professional Elective – IV							
	1005070 8	Professional Elective - IV	Data Compression					
	1006070 6	Professional Elective - IV	Computer Vision					
	1006070 7	Professional Elective - IV	Blockchain					

Gandhinagar Institute of Technology (01)

Program Name: Bachelor of Technology (01)			**Branch Name (Code): IT (006)**					
Semester / Year: 08/04								
NCrF LEVEL	**Subject Code**	**Course Type**	**Subject Name**	**Credit**	**Hours per week**			
					L	**T**	**P**	**Total**
NCF – 6.0	10060801	Project Work	Internship/Major Project	12	0	0	24	24
	SEC-0801		Open Access & Research Publication	6	0	0	12	12
			Total	**18**	**0**	**0**	**36**	**36**

6. Teaching, Learning & Evaluation

6.1 Teaching Methodology

The program shall adopt:

- Classroom Teaching
- Case Studies
- Industrial Visits
- Workshops
- Presentations
- Software Training
- Research Projects
- Internships
- AI-based Learning Tools
- Blended and Digital Learning (IEEE, NPTEL-MOOC Courses)

6.2 Attendance Rules

- Minimum 75% attendance shall be mandatory in each course.
- Students below prescribed attendance may not be permitted to appear in examination.
- Additional attendance requirements may apply for internships/trainings.

6.3 Examination and Evaluation System

6.3.1 Evaluation Components

- The evaluation may consist of Continuous Internal Evaluation (CIE) and End Semester Examination (ESE).
- Continuous Internal Evaluation (CIE) may include:
    - Mid-Semester Examination
    - Assignments/Lab Manuals
    - Presentations
    - Class Test
    - AI Quiz & Viva Voce
    - Practical Examination
    - Project work
    - Research Paper

6.4 Suggested Weightage

- Continuous Internal Evaluation: 50%
- End Semester Examination: 45%

6.5 Passing Standards

- Minimum 50% marks in each component where applicable.
- Minimum 50% aggregate for passing the course/program.
- Separate passing may be required in theory and practical examinations.

6.6 Grading System

- The program shall follow Gandhinagar University grading norms.

6.6.1 Grade Table

Grade	Grade Point	From Marks	To Marks
AA	10	>=80	-
AB	09	73	79
BB	08	66	72
BC	07	60	65
CC	06	55	59
CD	05	50	54
DD	04	45	49
FF	00	<45	-

6.7 Project Work

Students shall undertake User-defined Project OR Industry-Based Internship.

Requirements may include:

- Proposal Presentation
- Periodic Internal Review
- Final Report Submission
- Viva Voce Examination

The Project Work shall be evaluated by internal and external examiners.

7. Rules and Regulations

7.1 Rules for Promotion

A student shall be promoted to the next semester as per Gandhinagar University rules subject to fulfilment of academic requirements, minimum attendance and Completion of required credits.

7.2 Maximum Duration for Completion

The maximum duration for completing the program shall be 4 years from the date of admission (or as prescribed by the University.)

7.3 Internship Guidelines

7.3.1 Students shall undergo mandatory internship/training in:

- Software Development and Engineering Organizations.
- Information Technology (IT) Services and Consulting Companies.
- Government Organizations, Public Sector Undertakings (PSUs), and Research Institutions engaged in IT-related activities.
- Industries working in the areas of Artificial Intelligence, Machine Learning, Data Science, Cloud Computing, Cyber Security, Blockchain, Internet of Things (IoT), and Emerging Technologies.
- Start-ups, Innovation and Incubation Centers recognized by Government agencies, universities, or industry bodies.
- Organizations involved in Web Development, Mobile Application Development, Database Administration, Network Administration, System Integration, and IT Infrastructure Management.
- Academic and Research Institutions undertaking projects related to Computer Science, Information Technology, and allied domains.
- Entrepreneurship projects, product development, or technology-based innovation projects approved by the department/institute.

7.3.2 Students must submit:

- Internship Report
- Monthly Work Report
- Completion Certificate
- Presentation

7.4 Discipline Rules

Students shall maintain discipline, professional ethics, and proper conduct within the institution, during Industrial visits, internships, industry interactions, examinations, and all academic

activities. Students are expected to attend classes regularly, follow institutional rules and regulations, respect faculty members, staff, fellow students, and institutional property, and maintain academic integrity in assignments, projects, and examinations. Any form of misconduct, ragging, indiscipline, use of unfair means in examinations, damage to institutional property, harassment, or behaviour affecting the academic environment shall be treated seriously and may result in disciplinary action including warning, suspension, cancellation of examination, withholding of results, or expulsion from the program as per University rules and UGC regulations. Students shall also comply with all safety, ethical, and professional standards prescribed by the institution from time to time.

7.5 Anti-Ragging Policy

The program shall strictly follow:

- UGC Anti-Ragging Regulations
- Anti-Ragging Affidavit requirements
- Institutional disciplinary procedures
- Ragging in any form is strictly prohibited.

7.6 Ethical use of Technology and AI Tools

Students are encouraged to use:

- Artificial Intelligence (AI) Tools and Assistive Technologies for learning, coding assistance, debugging, documentation, and problem-solving.
- Software Development Tools including Integrated Development Environments (IDEs), Version Control Systems, Testing Frameworks, and Project Management Platforms.
- Data Analytics and Visualization Tools for data processing, statistical analysis, business intelligence, and decision-making.
- Cloud Computing Platforms and Virtual Laboratories for application development, deployment, and experimentation.
- Cybersecurity and Network Simulation Tools for security analysis, ethical hacking practices, and network management in authorized environments.
- Database Management and Big Data Tools for handling, storing, and analyzing large-scale datasets.
- Digital Collaboration and Survey Tools for project management, research activities, requirement gathering, and feedback collection.

Use of AI tools shall be ethical and academic integrity must be maintained.

8. Student Support

8.1 Industry Collaboration

The Department of Computer Science and Engineering actively promotes industry collaboration to bridge the gap between academic learning and professional practice. Through partnerships with IT companies, software development firms, technology startups, research organizations, and industry experts, students gain exposure to contemporary technologies, industry-standard tools, and real-world problem-solving environments. Industry collaboration activities include internships, industrial visits, expert lectures, workshops, hackathons, live projects, certification programs, and collaborative research initiatives.

Students are encouraged to work with industry partners in areas such as Artificial Intelligence and Machine Learning, Software Development, Cloud Computing, Cybersecurity, Data Analytics and Visualization, Database Management, Big Data Technologies, Internet of Things (IoT), DevOps, and Emerging Digital Technologies. Exposure to modern software development tools, Integrated Development Environments (IDEs), Version Control Systems, Testing Frameworks, Project Management Platforms, AI-based Learning Systems, Cloud Platforms, and Cybersecurity Tools enables students to develop industry-relevant competencies and enhance their employability.

The department also encourages collaboration with industries for curriculum enrichment, project mentoring, skill development programs, entrepreneurship initiatives, and placement opportunities, ensuring that graduates are well-prepared to meet the evolving demands of the Information Technology sector.

8.2 Research and Consultancy

The Department of Computer Science and Engineering encourages research, innovation, and consultancy activities to promote knowledge creation, industry collaboration, and technological advancement. Faculty members and students are motivated to undertake research projects, publish scholarly work, and provide technical solutions to industry and society.

Research Activities

- Research in emerging areas such as Artificial Intelligence, Machine Learning, Data Science, Cyber Security, Cloud Computing, Blockchain, Internet of Things (IoT), and Software Engineering.

- Promotion of interdisciplinary and industry-oriented research projects.
- Publication of research papers in reputed journals, conferences, and professional forums.
- Participation in funded research projects sponsored by government agencies and industries.
- Encouragement of innovation, patent filing, and intellectual property creation.
- Development of research-based solutions for real-world problems.

Consultancy Activities

- Providing software development and IT consulting services to industries and organizations.
- Offering expertise in Cyber Security, Network Design, Database Management, and Cloud Solutions.
- Conducting data analytics, business intelligence, and digital transformation consultancy projects.
- Developing customized web applications, mobile applications, and enterprise software solutions.
- Organizing industry training, workshops, and technical skill development programs.
- Collaborating with industries for product development, testing, and technology implementation.

8.3 Library and Laboratory Facilities

The library and laboratory facilities provide students with a strong academic foundation, practical exposure, research opportunities, and industry-relevant skills, enabling them to become competent Information Technology professionals capable of addressing contemporary technological challenges.

Library Facilities

The library provides comprehensive learning resources to support the academic, research, and professional development needs of B.Tech. Computer Science and Engineering students. The library is equipped with a rich collection of textbooks, reference books, journals, magazines, e-books, and digital resources covering various domains of Information Technology and Computer Science.

Laboratory Facilities

The Department of Computer Science and Engineering is equipped with modern laboratories that provide hands-on experience in database management systems, various programming languages, software development, web development, mobile application development, computer networking, cybersecurity, data analytics and emerging technologies. The laboratories are designed to complement classroom learning and facilitate practical skill development.

8.4 Student Support and Mentoring

A structured system for student support, academic mentoring, and professional guidance shall be implemented for students enrolled in the Bachelor of Technology (B.Tech.) in Computer Science and Engineering program. The department shall facilitate academic counseling, mentoring, career guidance, technical training, research support, and skill development activities to assist students in their academic progress and professional growth. Students shall be encouraged to participate in coding competitions, hackathons, technical workshops and events, seminars, industrial visits, internships, certification programs, research projects, and innovation-driven activities related to Information Technology and emerging technologies. Opportunities for interaction with industry professionals, alumni, researchers, and technology experts shall be provided to enhance technical competence, employability, leadership abilities, communication skills, teamwork, and entrepreneurial mindset. The department shall also support students through mentor-mentee programs, placement preparation activities, higher education guidance, and counseling services. Appropriate mechanisms for addressing academic, personal, and professional concerns shall be made available in accordance with institutional policies to ensure the holistic development and well-being of students.

8.5 Placement and Career Development

The Department of Computer Science and Engineering shall actively promote placement assistance and career development activities for students through industry collaboration, professional networking, technical training programs, internships, and campus recruitment initiatives. Continuous efforts shall be made to establish strong linkages with software development companies, IT service organizations, product-based companies, technology startups, cloud service providers, cybersecurity firms, data analytics organizations, research institutions, and multinational corporations to facilitate internships, industry projects, industrial exposure, and employment opportunities for students. Career development activities such as aptitude and technical training, coding practice sessions, resume building, interview preparation, soft skill development, group discussion training, entrepreneurship guidance, industry-recognized certification programs, expert talks, hackathons, innovation challenges, and placement-oriented workshops shall be organized regularly to enhance students' technical proficiency, professional competency, and employability. The department shall also encourage participation in emerging technology domains such as Artificial Intelligence, Machine Learning, Data Science, Cloud Computing, Cyber Security, Blockchain, Internet of Things (IoT), and Software Development to prepare graduates for successful careers in the rapidly evolving Information Technology industry.

9. Program Credibility

9.1 Executive Summary

The Department of Computer Science and Engineering is committed to providing high-quality technical education that equips students with strong theoretical foundations, practical skills, and professional competencies required to excel in the rapidly evolving field of Computer Science and Engineering. The department offers a four-year B.Tech. program designed in accordance with national educational standards, industry requirements, and emerging technological trends.

The curriculum has been carefully structured to ensure a balanced blend of fundamental concepts, advanced technologies, hands-on laboratory work, project-based learning, internships, and multidisciplinary exposure. The program emphasizes core areas such as programming, data structures, database management systems, operating systems, computer networks, software engineering, web technologies, cloud computing, cybersecurity, artificial intelligence, network security, and data analytics.

To maintain academic relevance and industrial applicability, the syllabus is periodically reviewed and updated through the Board of Studies (BoS) with valuable inputs from experienced academicians, industry experts, alumni, and employers. Contemporary subjects such as Web Technology, UX Design Foundation, Software Engineering, Artificial Intelligence, Wireless Communication: 5G and beyond etc. have been incorporated to prepare students for emerging opportunities in the IT sector.

The department is supported by qualified and experienced faculty members with expertise in various domains of Computer Science and Engineering. Faculty members actively engage in teaching, research, consultancy, and professional development activities to ensure effective knowledge transfer and innovation-oriented learning. The department encourages the use of modern pedagogical practices including experiential learning, flipped classrooms, case studies, coding assignments, mini-projects, and industry-sponsored projects. Students are trained using industry-relevant technologies and open-source tools to develop problem-solving, programming, and system design capabilities. The department also facilitates internships, industrial visits, expert lectures, hackathons, coding competitions, and certification programs to bridge the gap between academia and industry.

A strong focus is placed on research and innovation through student projects, technical clubs, and participation in national and international competitions. Students are encouraged to undertake

interdisciplinary projects addressing real-world challenges in areas such as smart systems, data-driven applications, cybersecurity solutions, and intelligent automation. Upon completion of the program, graduates are well prepared for careers in software development, web development, system administration, data science, cybersecurity, network security, cloud engineering, research, entrepreneurship, and higher studies.

With a strong emphasis on continuous learning, innovation, and adaptability, the Department of Information Technology aims to develop skilled engineers, researchers, and future leaders who can contribute effectively to society and the rapidly evolving digital world. The department's commitment to academic excellence, industry collaboration, and outcome-based education establishes its credibility as a center of quality technical education in Information Technology.

9.2 Scope and Career Opportunities

Graduates of the program may work in:

- Software and Application Development
- Data and Analytics
- Artificial Intelligence and Machine Learning
- Cybersecurity and Networking
- Cloud and Infrastructure
- Database and Enterprise Systems
- Emerging Technologies
- Management and Consulting
- Government and Public Sector Opportunities
- Entrepreneurship and Research
- IT Services and Consulting
- Software Product Companies
- FinTech and Banking
- Healthcare Technology
- E-Commerce and Retail
- Telecommunications
- Manufacturing and Industry 4.0
- Cloud Service Providers
- Cybersecurity Organizations
- Government and Research Institutions

9.3 Potential Job Roles

Graduates of the program may work as:

- Software Developer
- Software Engineer
- Full Stack Developer

- Web Developer
- Mobile Application Developer
- Front-End Developer
- Back-End Developer
- Data Analyst
- Data Engineer
- Business Intelligence Analyst
- Data Scientist
- Big Data Engineer
- AI Engineer
- Machine Learning Engineer
- Deep Learning Engineer
- AI Research Associate
- Cybersecurity Analyst
- Information Security Analyst
- Security Consultant
- Network Engineer
- Ethical Hacker
- Security Operations Center (SOC) Analyst
- Cloud Engineer
- Cloud Solutions Architect
- DevOps Engineer
- System Administrator
- Database Administrator (DBA)
- Database Developer
- ERP Consultant
- Enterprise Application Developer
- Blockchain Developer
- IoT Developer
- AR/VR Developer
- Automation Engineer
- IT Consultant
- Technology Analyst
- Business Analyst
- Project Coordinator

- Product Manager
- Technical Officer
- IT Officer
- System Analyst
- Scientific Assistant
- Positions in Public Sector Undertakings (PSUs)
- Technology Entrepreneur
- Startup Founder
- Research Associate
- Innovation and Product Development Engineer

9.4 Higher Study & Professional Opportunities

Students may pursue:

- Postgraduate Programs (M.Tech.)
- Management and Interdisciplinary Programs (MBA/MCA)
- International Higher Education (MS)
- Research Opportunities: Research Fellowships in National and International Research Organizations.
- Competitive Examination Opportunities (GATE/UGC-NET etc.)
- Entrepreneurship Opportunities: Technology Startup Founder, Software Product Development, IT Consulting Services, Cyber Security Consulting, Cloud Solutions and Managed Services, AI and Data Analytics Ventures, Mobile Application and Web Development Firms.
- Professional Certification Opportunities like
    1. Cloud Computing Certifications: AWS Certified Solutions Architect, AWS Certified Developer, Microsoft Azure Fundamentals and Associate Certifications, Google Cloud Professional Certifications.
    2. Cyber Security Certifications: Certified Ethical Hacker (CEH), CompTIA Security+, Certified Information Systems Security Professional (CISSP), Certified Information Security Manager (CISM).
    3. Networking Certifications: Cisco Certified Network Associate (CCNA), Cisco Certified Network Professional (CCNP).
    4. Data Science and AI Certifications: Microsoft AI Engineer Certification, Google Professional Machine Learning Engineer, TensorFlow Developer Certification, IBM Data Science Professional Certificate.
    5. Database Certifications: Oracle Database Certification, Microsoft SQL Server Certifications, MongoDB Developer Certification.
    6. Project Management Certifications: Project Management Professional (PMP), PRINCE2 Certification, Agile and Scrum Certifications.

7. DevOps Certifications

10. Collaborative Field Work / Experimental Work

For a B.Tech. Information Technology program, the experimental activities are IT-focused laboratories, project, industry, research, and experiential learning activities. The following structure can be used:

10.1 Software Development Environment Setup and Version Control
Students will configure software development environments and use Git-based version control systems to manage source code repositories. They will perform branching, merging, issue tracking, and collaborative coding exercises while developing small applications. Deliverables include repository links, project documentation, and version history reports.

10.2 Web Application Development Project
Students will design and develop a responsive web application using modern front-end and back-end technologies. The project shall include database integration, authentication mechanisms, and deployment on cloud platforms. Deliverables include source code, project documentation, and deployment reports.

10.3 Industry Visit and IT Infrastructure Study
Faculty shall arrange visits to software companies, data centers, IT parks, or technology organizations. Students will observe software development practices, IT infrastructure, cloud environments, and cybersecurity measures. Deliverables include an industry visit report and reflective analysis.

10.4 Database Design and Data Management Exercise
Students will design relational and NoSQL databases for a real-world scenario, implement normalization, create queries, and generate reports. Deliverables include database schemas, SQL scripts, and analytical reports.

10.5 Network Configuration and Security Analysis
Students will configure network devices, analyze traffic, implement security policies, and perform vulnerability assessments using network simulation and security tools. Deliverables include configuration files, network diagrams, and security audit reports.

10.6 Cloud Computing Deployment Exercise
Students will deploy applications on cloud platforms, configure virtual machines, containers, storage services, and cloud security settings. Deliverables include deployment documentation and performance evaluation reports.

10.7 Cyber Security Audit and Ethical Hacking Exercise
Students will perform vulnerability assessment, penetration testing, and security analysis of assigned systems using approved cybersecurity tools and methodologies. Deliverables include security reports and remediation recommendations.

10.8 Data Analytics and Visualization Project
Students will collect, preprocess, analyze, and visualize datasets using statistical and analytical tools. Deliverables include dashboards, analytical reports, and predictive insights.

10.9 Artificial Intelligence and Machine Learning Project

Students will develop AI/ML models for classification, prediction, recommendation, or pattern recognition tasks using modern frameworks and datasets. Deliverables include trained models, performance analysis, and project reports.

10.10 Mobile Application Development Exercise
Students will design, develop, test, and deploy Android or cross-platform mobile applications addressing real-world requirements. Deliverables include source code, APK/application package, and project documentation.

10.11 Internet of Things (IoT) Application Development
Students will build IoT-based systems using sensors, microcontrollers, communication protocols, and cloud integration. Deliverables include hardware prototypes, code repositories, and demonstration reports.

10.12 Software Testing and Quality Assurance Exercise
Students will perform manual and automated testing, prepare test cases, conduct bug tracking, and evaluate software quality metrics. Deliverables include test reports and quality assurance documentation.

10.13 Full Stack Development Project
Students will develop enterprise-level full-stack applications integrating front-end, back-end, APIs, and databases. Deliverables include deployed applications and technical documentation.

10.14 Open-Source Contribution Exercise
Students will contribute to open-source software projects by fixing bugs, adding features, improving documentation, or participating in community discussions. Deliverables include contribution records and reflective reports.

10.15 IT Project Management and Agile Development Exercise
Students will prepare project plans, user stories, sprint schedules, Gantt charts, and Agile project documentation. Deliverables include project management artifacts and performance reports.

10.16 Research and Innovation Project
Students will identify a research problem, conduct literature surveys, implement solutions, and analyze outcomes. Deliverables include technical papers, prototypes, or research reports.

10.17 Mandatory Industry Internship
Students shall complete an eight-week industry internship in software development, networking, cybersecurity, cloud computing, data analytics, AI/ML, or related IT domains. Deliverables include internship reports, supervisor evaluations, and presentations.

10.18 Cloud and DevOps Implementation Project
Students will implement CI/CD pipelines, containerization, orchestration, and automated deployment using DevOps tools and cloud platforms. Deliverables include deployment workflows and project reports.

10.19 Cyber Security Incident Response Simulation
Students will analyze simulated cyber incidents, perform forensic investigations, identify vulnerabilities, and recommend mitigation strategies. Deliverables include incident response reports and security recommendations.

10.20 Capstone Project

Students will undertake a comprehensive project integrating knowledge gained throughout the program to solve a real-world problem. Deliverables include software products, research prototypes, technical reports, and presentations evaluated jointly by faculty and industry experts.

10.21 Research Dissertation
Students shall prepare a research dissertation (8,000–10,000 words) on a contemporary Information Technology topic involving literature review, methodology, implementation, results, and conclusions, followed by a viva voce examination.

10.22 Portfolio Presentation and Exit Viva
Students shall compile a portfolio of projects, internships, certifications, research activities, and technical achievements. The portfolio shall be presented before a faculty and industry panel, followed by a comprehensive Exit Viva to assess technical competence, problem-solving ability, communication skills, and professional readiness.

11. Market Survey

11.1 Strategic Feasibility for B.Tech. CSE in Ahmedabad

11.1 Executive Summary

The Bachelor of Technology in Computer Science and Engineering (B.Tech CSE) program is designed to prepare students with strong theoretical foundations, practical technical skills, problem-solving abilities, and professional competencies required in the rapidly evolving technology industry. The program integrates core computing concepts with emerging technologies such as Artificial Intelligence, Machine Learning, Data Science, Cyber Security, Cloud Computing, Internet of Things (IoT), Blockchain, Semiconductor Technology, and Full Stack Development. The curriculum emphasizes outcome-based education, industry-oriented learning, innovation, research exposure, project-based learning, and interdisciplinary collaboration. With the increasing digital transformation across industries, the demand for skilled computer science engineers continues to grow significantly in India and globally. The program aims to bridge the gap between academic learning and industrial expectations by incorporating modern laboratories, internships, collaborative field work, industrial training, and skill-based certifications to enhance employability and entrepreneurship opportunities among students.

11.2 Market Demand & Industry Trends

The Computer Science and Engineering sector is one of the fastest-growing fields worldwide due to rapid advancements in digital technologies and automation. Industries such as information technology, banking, healthcare, manufacturing, education, e-commerce, telecommunications, automotive, and government sectors increasingly rely on software systems, cloud infrastructure, cybersecurity solutions, and intelligent automation. Emerging technologies including Artificial Intelligence (AI), Machine Learning (ML), Data Analytics, Internet of Things (IoT), Cyber Security, Quantum Computing, Blockchain, Augmented Reality (AR), Virtual Reality (VR), and Semiconductor Technologies are transforming industrial operations and creating new opportunities for skilled professionals.

11.3 Skill Gap Identified by Industry

Industries have identified several skill gaps among engineering graduates that need to be addressed through modern and industry-aligned education. While students often possess theoretical understanding, many lack practical implementation skills, real-time project exposure, and industry-relevant technical competencies. Major skill gaps identified by employers include insufficient programming proficiency, limited knowledge of software development life cycle practices, inadequate exposure to cloud platforms and DevOps tools, weak analytical and problem-solving skills, and lack of hands-on experience in emerging technologies.

Additionally, industries emphasize the need for better communication skills, teamwork, project management abilities, innovation mindset, and professional ethics. There is also a growing requirement for expertise in Artificial Intelligence, Data Science, Cyber Security, Full Stack Development, Mobile Application Development, IoT systems, and Semiconductor Design technologies. To bridge these gaps, the B.Tech CSE curriculum incorporates project-based learning, internships, collaborative field work, coding practices, industrial training, open-source contributions, certification programs, and modern laboratory facilities that enhance practical learning and industry readiness.

11.4 Employment Opportunities

Graduates of the B.Tech Computer Science and Engineering program have diverse employment opportunities across multiple sectors in India and abroad. The increasing dependence on digital systems and intelligent technologies has created strong demand for skilled software and computing professionals. Students can pursue careers in software development, system engineering, data analytics, cybersecurity, cloud computing, artificial intelligence, networking, embedded systems, semiconductor industries, automation, and IT consulting.

Common job roles include Software Developer, Full Stack Developer, Web Developer, Mobile Application Developer, Data Analyst, Machine Learning Engineer, AI Engineer, Cyber Security Analyst, Cloud Engineer, Network Administrator, Database Administrator, DevOps Engineer, System Architect, UI/UX Designer, IoT Engineer, Blockchain Developer, Research Associate, and Semiconductor Design Engineer. Graduates can also pursue higher education, research, entrepreneurship, government sector opportunities, and competitive examinations. The strong growth of multinational companies, startups, digital enterprises, and research organizations continues to provide excellent career prospects and global employment opportunities for computer science engineers.

11.5 Industry Support & Collaboration

The B.Tech CSE program promotes strong industry interaction and collaboration to ensure that students receive practical exposure and industry-relevant education. Collaboration with IT companies, software industries, startups, research organizations, and technology experts helps in curriculum enhancement, skill development, internships, live projects, industrial visits, expert lectures, workshops, and placement support. Industry partnerships assist in identifying current technological trends and required competencies, enabling continuous improvement of the academic structure.

The department encourages Memorandums of Understanding (MoUs) with industries for training programs, collaborative research, innovation activities, and technology transfer initiatives. Students are

provided opportunities to participate in hackathons, coding competitions, industrial internships, certification programs, and collaborative field work to gain practical experience. Expert sessions by industry professionals, alumni interaction, and participation in technical events further strengthen industry-academia relationships. Such collaborations help students develop industry-oriented skills, professional ethics, teamwork abilities, and entrepreneurial capabilities required for successful careers in the technology sector.

11.6 Conclusion

The B.Tech Computer Science and Engineering program is structured to meet the growing demands of the modern technology-driven world by combining strong academic foundations with practical and industry-oriented learning. The curriculum focuses on emerging technologies, innovation, research, and skill development to prepare students for diverse career opportunities in the global IT and computing industry. By addressing current industry skill gaps through collaborative learning, internships, project-based education, and industry partnerships, the program enhances employability, technical expertise, leadership qualities, and professional competence among students. The continuous evolution of digital technologies and the expanding scope of computing applications ensure excellent future prospects for graduates in both industrial and research domains.

12. Review and Revision of Regulation

The University reserves the right to interpret, modify, revise, amend, or update any provision, rule, regulation, curriculum structure, evaluation pattern, academic requirement, or operational guideline related to the program from time to time in accordance with University regulations, statutory requirements, industry developments, and academic needs.

In case of any ambiguity or dispute regarding interpretation of any provision of this manual, the decision of the University/Competent Authority shall be final and binding on all stakeholders. Any amendments, additions, or revisions approved by the appropriate academic or statutory bodies of the University shall automatically become applicable to the program.

Annexure I: Detail Syllabus

GANDHINAGAR INSTITUTE OF TECHNOLOGY

B.TECH. 1st SEMESTER

ALL BRANCHES

DOC NO: 4061

Subject Code: 10000101	**Subject Title: Engineering Mathematics-I**
Pre-requisite: Nil	

Course Objective:

- To acquaint aspiring engineers with calculus, multivariate analysis and linear algebra techniques.
- To provide students with intermediate to advance level standard ideas and tools that will help them approach more challenging concepts and applications that they will find relevant in their fields.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	02	-	05	70	30	-	-	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Differential Calculus:** Convergent sequence, Bounded sequence, Monotonic sequence, Infinite series, Geometric series, Telescoping series, Convergent, Divergent and Oscillatory Series, Cauchy's Fundamental test for Divergent, p-series, Comparison test, D'Alembert's Ratio test, Raabe's test, Gauss's test, Cauchy's Integral test, Cauchy's root test, Logarithmic test, De Morgan's and Bertrand's test, Cauchy's Condensation test, Alternating series, Leibniz's rule, Power series in x, Absolute and conditional convergence tests, Taylor's & Maclaurin's expansions of single variable, Indeterminate forms, Improper Integrals	12	25
2	**Partial Differentiations:** Limit and Continuity, Partial derivative, Implicit and Explicit functions, Euler's theorem, Geometrical interpretation of partial derivatives **Application of Partial Differentiations**: Tangent plane and Normal line, Maxima and Minima of functions of two variables, Lagrange's multiplier method, Jacobians	10	25
3	**Vector Calculus:** Vector and Scalar Fields, Gradient, curl and divergence, directional derivatives, Conservative fields, Line Integral, Work Done, Circulation and Flux, Green's Theorem	8	20

4	**Multiple Integral:** Double integral, change of order of integration, Application of Double Integral: Transformation of variables by Jacobian only for double integration, Change into polar co-ordinates in double integrals only, Triple integral, Applications of Integral: Change to spherical coordinates, Volume of a solid	8	20
5	**Curve Tracing:** Concavity, Curve Sketching, Relation between Polar Coordinates and Cartesian Coordinates, Graphs in Polar Coordinates	4	10

Course Outcome: After completion of this course, student will be able to

- Use Improper integral as a tool for differential and Integral calculus and understand the basic concepts of Indeterminate forms. Apply the various convergence tests to sequences, series and learning tools for power series in advanced engineering mathematics.
- Understand basic knowledge of partial derivatives and to compute extreme values of functions of several variables via partial derivatives, Tangent planes and Normal lines.
- Learn the basic concepts in vector calculus including gradient, directional derivatives, curl, work done, flux and Green's theorem.
- Gain the knowledge about solving double and triple integration to analyze engineering problems.
- Understand the geometrical terminology of cartesian and polar curves.

List of References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Edition.
2. Peter O'Neill, Advanced Engineering Mathematics, 7th Edition, Cengage
3. James Stewart, Calculus: Early Transcendentals with Course Mate, 7e, Cengage, 2012.
4. T. M. Apostol, Calculus, Volumes 1 & 2,, Wiley Eastern.
5. Maurice D. Weir, Joel Hass, Thomas' Calculus, Early Transcendentals, 13e, Pearson, 2014
6. H.K.Dass, Advanced Engineering Mathematics, S. Chand.

Open e-Resource:

1. https://nptel.ac.in/courses/111108098
2. https://nptel.ac.in/courses/111104125
3. https://nptel.ac.in/courses/111105121

GANDHINAGAR INSTITUTE OF TECHNOLOGY
B.TECH CE/IT/CSE/ICT/CS/AI/EC/EE/R&A
SEMESTER 1ST

DOC NO: 4061

Subject Code: 10050101	**Subject Title: Programming for Problem Solving**
Pre-requisite: - Nil	

Course Objective:

- To understand the various steps in Program development.
- To understand the basic concepts in C Programming Language.
- To learn how to write modular and readable C Programs
- To learn to write programs (using structured programming approach) in C to solve problems.
- To provide complete knowledge of C language

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	0	2	4	70	30	30	20	150

Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction:** Basic block diagram and functions of various components of computer, Concepts of Hardware and software, Types of software, Compiler and interpreter, Concepts of Machine level, Assembly level and high level programming, Flowcharts and Algorithms [CH.1: RB-1 ANSI C Bala Guruswamy]	3	5
2	**Fundamentals:** Introduction to C, structure of C Program, comments, header files, data types, constants, variables, declarations, expression statements, arithmetic operations, unary operations, relational and logical, conditional, library functions, single character input and output, entering and writing data, Evaluation of expressions, type conversion, precedence and associativity, I/O functions. [CH.1: RB-1 ANSI C Bala Guruswamy]	4	10
3	**Control structure in C:** Simple statements, Decision making statements, Looping statements, Nesting of control structures, break and continue, The Case control structure switch and goto statement. [CH.5: RB-1 ANSI C Bala Guruswamy]	5	10

4	**Array & String:** Concepts of array, processing an array, declaration and initialization of arrays, passing arrays to function, multidimensional array. String, string storage, Built-in string functions, command line arguments. [CH.8: RB-1 ANSI C Bala Guruswamy]	5	10
5	**Functions:** Concepts of user defined functions, prototypes, definition of function, parameters, parameter passing, calling a function, recursive function: different way of solving problems, recursive program for finding factorial, Fibonacci series etc. [CH.9: RB-1 ANSI C Bala Guruswamy]	8	25
6	**Pointers:** Basics of pointers, pointer to pointer, pointer and array, pointer to array, array to pointer, function returning pointer [CH.13: RB-1 ANSI C Bala Guruswamy]	6	15
7	**Structure:** Basics of structure, structure members, accessing structure members, nested structures, array of structures, structure and functions, structures and pointers [CH.13: RB-1 ANSI C Bala Guruswamy]	6	15
8	**Dynamic memory allocation and File management:** Introduction to Dynamic memory allocation, malloc, calloc. Introduction to file management and its functions [CH.12: RB-1 ANSI C Bala Guruswamy]	8	10

Course Outcome(COs): After completion of this course, student will be able to

- Write a C program using correct syntax and execute it.
- Write programs using conditional, branching, iteration, and recursion.
- Write programs using array and strings.
- Decompose a problem into function.
- Develop an application using the concepts of array, pointer,structure, and file management to solve engineering /scientific problems.

List of References:

1. Programming in ANSI C, Balagurusamy, 8 Edition 2018 MCGraw Hill
2. Lets C, Y. Kanitkar, BPB
3. Programming with C, Gottafried, Schaum Series
4. C The Complete Reference, Scholdt, TMH
5. Structured Programming Approach Using C, B. Forouzen, Thomas

Open e-Resource:

1. NPTEL C Programming: https://nptel.ac.in/courses/106104128
2. NPTEL Problem Solving through C: https://onlinecourses.nptel.ac.in/noc22_cs101/preview

List of Suggested Experiments:

1. Write a program that performs as a calculator (addition, multiplication, division, subtraction).
2. Write a C program to interchange two numbers.
3. Write a program to read three numbers from the keyboard and find out the maximum out of these three.
4. Write a program to read marks from keyboard and your program should display equivalent grade according to following table(switch case)
   Marks Grade
   100 - 80 Distinction
   79 - 60 First Class

59 - 40 Second Class
< 40 Fail

0. a. Write a C program to input an integer number and check if the last digit of the number is even or odd.
   b. Write a C program to find the factorial of a given number.
   b. Write a program to reverse a number.
   b. Write a program to generate the first n number of Fibonacci series.
0. a. Write a C program to find the sum and average of different numbers which are accepted by the user as many as the user wants.

b. Write a program to check whether the given number is prime or not.

0. Write a C program to find 1+1/2+1/3+1/4+…+1/n.
0. Write a program to print following patterns:

```
*          *          12345
* *        * *        1234
* * *      * * *      123
* * * *    * * * *    12
* * * * *  * * * * *  1
```

0. Write a program to find maximum element from 1-Dimensional array
0. a. Write a program to find a character from a given string.

b. Write a program to reverse the string.

c. Write a program to convert string into upper case.

0. Write a program to find the factorial of a number using recursion.
0. Define a structure called cricket that will describe the following information: Player name
   Team name
   Batting
   average

Using cricket, declare an array player with 50 elements and write a C program to read the information about all the 50 players and print team wise list containing names of players with their batting average.

0. Write a C program to swap the two values using pointers.

Gandhinagar Institute of Technology
B.Tech ME/CSE/IT/CL/EE/EC/CE
Semester 1/2

Subject Code:10010105	**Subject Title: Engineering Foundation**
Pre-requisite:- Zeal to learn the subject	

Course Objective:

- Acquire knowledge on different standards of length, calibration of End Bars, linear and angular measurements.
- Irrespective of branch, the use of workshop practices in day to day industrial as well domestic life helps to dissolve the problems
- Improve analytical skills to understand design blueprints
- Learn basic properties of materials and concepts of advanced manufacturing process
- Discover the root cause of a problem or event and fully understand how to fix, compensate or learn from any underlying issues within the root cause
- Provide the engineer a means of ensuring consistent design, quality and operating characteristics with adequate reliability and safety

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	0	2	4	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Measurements:** Introduction to Measurement, Definition, objectives and concept of Metrology, Need of inspection, Principles, process, methods of measurement, Classification and selection of measuring instruments and systems. Accuracy, precision and errors in measurement. System of measurement, Material Standard, Wavelength Standards, Subdivision of standards, Line and End standards, Classification of standards and Traceability, calibration of End bars, standardization. Slip gauges- Indian standards on slip gauge, method of selection of slip gauge, stack of slip gauge, adjustable slip gauge, wringing of slip gauge, care of slip gauge, slip gauge accessories, problems on building of slip gauges (M87, M112). Measurement of angles- sine bar, sine center, angle gauges, optical instruments for angular measurements	08	19

2.	**Engineering Workshop:** Introduction, Safety slogans and rules in Mechanical workshop, Tools and Equipment used for safety in Mechanical workshop. Types of layouts, Rules and regulations for Workshop layouts and Preparation of actual layout. Introduction, Classification and characteristics of Engineering Materials, Tools and Equipment. *Demonstration of the operation performed on sheet metal for bending operation. Preparation of job in Drilling operation and demonstration on vertical drilling machine. Tools and Equipment for plumbing shop. Preparation of job in Plumbing for joining and threading operation. *Introduction to Arduino, components and working, Electronic circuit drawing, Electronic circuit on breadboard, Demonstration of Arduino for different configuration.	10	24
3.	**Engineering Design:** Introduction to Engineering Drawing and its significance, Drawing instruments and accessories, BIS – SP 46, Types of Lines and their Application, Lettering, Dimensioning Systems, Construction of Regular Polygons, Use of Plane Scales, Diagonal Scales and Representative Fraction.	10	24
4.	**Engineering Materials:** Types, properties and applications of Ferrous & Nonferrous metals, Timber, Abrasive material, silica, ceramics, glass, graphite, diamond, plastic and polymer **Modeling, Simulation and Conceptual Prototyping:** Concept of Modelling and Simulation, Goal of Modelling & simulation, Application of simulations, advantages and disadvantages of simulation, Introduction: Need for the compression in product development, history of RP systems, Survey of applications, Growth of RP industry, and classification of RP systems, FDM, SLS, SLA.	06	15
5.	**Root Cause Analysis:** Introduction, Complete Root Cause Analysis, QM & T Approach to Root Cause Analysis, Practical guide to carry out and RCA, RCA Tools & Techniques, Lookup Table for Completing an RCA, Examples, Hints & Tips, 12 Pitfalls of RCA	04	9
6.	**Standards:** Introduction, Basic Definitions, Requirements, Guidelines, History of Standards, Modern Examples, Conformity Assessment	04	9

*** - Topic will be covered during laboratory session**

Course Outcome: After completion of this course, student will be able to

1. Understand the objectives of metrology, methods of measurement, selection of measuring instruments, standards of measurement and calibration of end bars.
2. Students will learn about taking safety and precautionary measures of self and machines during operations.

3. Interpret engineering drawings using fundamental technical mathematics.
4. Interpret appropriate advanced material processing techniques for different requirement and application
5. Identify the breakdowns in processes and systems that contributed to event and how to prevent future events

List of References:

1. Elements of Workshop Technology: Vol- I and Vol - II", K Hajra Choudhury, A K. Hajra, Media Promoters Pvt Ltd
2. Mechanical Measurement and Metrology by R K Jain, Khanna Publisher Mechanical Measurement & Control by D.S. Kumar.
3. A Text Book of Engineering Graphics by P.J.Shah S.Chand & Company Ltd., New Delhi
4. Modern Machining Processes, P. C. Pandey, H. S. Shan, Tata McGraw Hill
5. Root Cause Analysis - Improving Performance for Bottom-line Results, Robert J Latino, Kenneth C Latino, Taylor & Francis Group, CRC Press

Open e-Resource:

1. NOC25-AR01 – ARCHITECTURE & PLANNING – Engineering Graphics part-1
2. NOC25-AR02 – ARCHITECTURE & PLANNING – Engineering Graphics part-2
3. NOC25-ME52 – MECHANICAL ENGINEERING – Mechanical Measurement Systems

List of Suggested Experiments:

1. Introduction to Engineering workshop: working layout and safety.
2. Demonstration of the sheet metal bending operation and observe safety measures.
3. Demonstration of the drilling operation on vertical drilling machines and observe safety measures.
4. Demonstrate and understand the plumbing operation and tools in detail.
5. Demonstrate Arduino programming for different configurations.
6. Basic understanding of measurements and metrology: concepts, application, advantage and future aspects
7. Performance on linear and angular measurements and check different characteristics of measurements
8. Drawing Practice Sheet (which includes dimensioning methods, different types of line, construction of different polygon, divide the line and angle in parts, use of stencil)
9. Problems on Plane Scale.
10. Problems on Diagonal Scale.
11. Demonstration of prototype in FDM 3D Printing

GANDHINAGAR INSTITUTE OF TECHNOLOGY
CE/IT/CSE/ICT/CS/EE/EC/AI
B. TECH SEMESTER 1st/2nd

DOC NO: 4061

Subject Code: 10050102	**Subject Title: ICT Fundamental & Workshop**
Pre-requisite: - Nil	

Course Objective:

1. Understand the basics of Information and communication technology.
2. To explain the fundamentals of computers and peripherals.
3. To introduce hardware and software computers basics.
4. To brief the students regarding various operating systems.
5. Understand the basic functions and features of Google Workspace tools and explore emerging trends and technologies.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	1	0	4	70	30	00	00	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction to ICT:** Definition and Scope, Components, Data, Information and Knowledge, Data Collection, Data Storage and Data Transmission, Data Integrity, Information Quality.	03	10
2	**Introduction to computer system:** Introduction to various computer hardware and their application in ICT. Introduction to computer software and its application. Introduction to computer operating systems. What is Operating Systems, ERP, CRM, Service Architecture introduction — Concepts of SaaS, PaaS, IaaS.	05	15
3	**Fundamentals of computer Networks:** Introduction to computer networks, types of networks. Introduction to network devices.	03	15
4	**Storage and Servers:** Primary and Secondary storage, Cloud technology, mail server, data server, Concept of Data centers.	03	10
5	**Microsoft office suite:** Professional Document writing using Word Processing Tool, Data Processing using Spreadsheet, Creating Dynamic and Informative Slide Show using Presentation Software	04	10
6	**G Suite (Google Workspace):** Introduction to Google Workspace, Google Drive Basics, Google Docs, Google Forms, Google Calendar, Google Meet, Google Sites.	05	10
7	**Introduction to the Web:** World Wide Web (WWW): A system of interlinked hypertext documents accessed via the internet. Internet: A global network of interconnected computers that communicate using standard protocols Website, Webpage, Web browser, Web server, Web development tools, web hosting and deployment.	05	10
8	**Cybersecurity Trends:** Emerging Threats, Advanced Security Technologies, Protective Measures, Ethical and Societal Implications.	04	10

9	**Introduction to Emerging Technologies:** Artificial Intelligence, Machine Learning, Big Data Analytics, Block chain, Data Science, Internet of Things (IoT), Virtual reality.	04	10

Course Outcome (COs):

1. Understand the basics of Information and communication technology.
2. Explore the applications of ICT for development.
3. A student can be able to use various G Suite, Microsoft office suite and computer Networks.
4. Students can explore Emerging technologies like IoT, Block chain, Data Science.

List of Reference Books:

1. "Understanding Computers: Today and Tomorrow" by Deborah Morley and Charles S. Parker
2. "Google Workspace for Dummies" by Blake R. Smith.
3. "Google Workspace: A Complete Guide to Google Workspace Tools" by Dr. Mikhail Kasyanov
4. "Computer Science: An Overview" by J. Glenn Brookshear and Dennis Bylaw
5. "Introduction to Computer Science: A Text-Based Approach" by Jean-Paul Tremblay and Paul G. Sorenson
6. "Practical Malware Analysis handbook dissecting malicious code" by Michael Sikorski and Andrew Hoing
7. "Computer Networking: A Top-Down Approach" by James F. Kurose

Web Resources:

1. https://www.w3schools.com
2. https://www.javatpoint.com
3. https://www.tutorialspoint.com/index.htm
4. https://teacher-network.in/OER/images/9/9a/ICT_student_textbook.pdf

GANDHINAGAR INSTITUTE OF TECHNOLOGY

B.TECH. 2nd SEMESTER

ALL BRANCHES

DOC NO: 4061

Subject Code: 10000201	**Subject Title: Engineering Mathematics-II**
Pre-requisite: Nil	

Course Objective:

- To familiarize the prospective engineers with techniques in integration, ordinary differential equations and matrices.
- To equip the students to deal with advanced levels of mathematics and applications that are required in their disciplines.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	02	-	05	70	30	-	-	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**First order ordinary differential equations:** Order and Degree, Solutions of Ordinary differential equations, Geometrical Interpretations, Exact, Non- exact, Linear and Bernoulli's equations, Euler's equations	6	10
2	**Higher order Ordinary differential equations:** Second order linear differential equations with constant coefficients, Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation, Series Solutions of ordinary differential equations	10	25
3	**Laplace Transformation:** Definition of Laplace Transform, Existence of Laplace transform, Properties of Laplace transforms, Laplace transform of periodic functions, Inverse Laplace transform and their properties, Convolution theorem, Applications of Laplace transforms in solving ordinary differential equations and system of differential equations	8	20
4	**Fourier Series and Fourier Integral:** Dirichlet's Condition, Fourier series of Odd and Even functions, Half range sine series and cosine series, Fourier Integral, Fourier Cosine and Sine Integrals **Gamma and Beta functions:** Definitions of Gamma and Beta functions and their properties	8	20
5	**Matrix Algebra:** Definition of Matrix, types of matrices and their properties, Determination of rank, The inverse of a matrix by Gauss Jordan method, Solution of a system of linear equations by Gauss elimination and Gauss Jordan Methods, Eigen values and	10	25

	Eigen vectors of matrices, Cayley- Hamilton's Theorem and its applications, Diagonalization		

Course Outcome: After completion of this course, student will be able to

- Learn the techniques to solve ordinary differential equations for Mathematical modelling of real-world problems.
- Apply effective mathematical methods for the solutions of higher order ordinary differential equations.
- Apply the techniques of Laplace transforms and inverse Laplace transforms to solve the Ordinary differential equations of real-world problems
- Utilize Fourier series to study the behavior of periodic functions and to gain the knowledge of Fourier Integral and to acquire understanding on how to tackle integration problems using Gamma and Beta functions.
- Understand the algebra of matrices in order to solve theoretical issues using algebraic operations

List of References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Edition.
2. Peter O'Neill, Advanced Engineering Mathematics, 7th Edition, Cengage
3. H.K.Dass, Advanced Engineering Mathematics, S. Chand.
4. H. Anton, Elementary linear algebra with applications (8th Edition), John Wiley 1995
5. Fuzhen Zhang, Matrix Theory- Basic Results and Techniques, Springer, 1999
6. Shanti Narayan, P.K. Mittal, A Textbook of Matrices, S Chand & Company, 2010

Open e-Resource:

1. https://nptel.ac.in/courses/111106100
2. https://nptel.ac.in/courses/111106139
3. https://nptel.ac.in/courses/111105112

GANDHINAGAR INSTITUTE OF TECHNOLOGY

B. Tech 1st /2nd SEMESTER
CSE/IT/EE/EC/CS/AI/ICT

DOC NO: 4061

Subject Code: 10000003	**Subject Title: ENGINEERING PHYSICS**
Pre-requisite: Nil	

Course Objective:

- To understand concepts of applications of semiconductor Physics, nanomaterials and non-linear optics in respective engineering branches and measurement techniques to solve problems.
- To educate students for engineering occupations in which Physics concepts may be applied to technological development. Students will be able to find work in engineering after completing this study at the interface of engineering and Physics upon graduation, while also laying a solid basis for graduate school and engineering research.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	-	02	04	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Nanoscience and nanotechnology:** Introduction to Quantum Physics: Particle in a three dimensional box, Introduction – Nanoscale; Nanomaterials: Methods for synthesis of nanomaterials, Properties of nanomaterials, Characterization techniques – X ray Diffraction (XRD) - Single Crystal, Powder and Laue techniques, Low energy Electron Diffraction (LEED), Scanning Electron Microscopy, Tunnelling Electron Microscopy, Nanostructures; Carbon nanotubes, Characteristics and applications, Nanotechnology and environment.	8	19
2	**Classification of Electronic Materials:** Free electron theory, crystal structure and reciprocal lattice, Density of states and energy band diagrams, Kronig-Penny model (to introduce origin of band gap), Brillouin zone, electron in a crystal- Bloch's electron, Energy bands in solids, E-k diagram, Direct and indirect bandgaps, Types of electronic materials: metals, semiconductors, and insulators, Density of states, Occupation probability, Fermi level, Effective mass, Phonons.	8	19
3	**Physics of Semiconductors:** Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction diode, Metal-semiconductor junction (Ohmic and Schottky), Photovoltaic effect, Exciton, Applications with numericals, Lasers and its properties, Spontaneous and stimulated	8	19

	emission, Einstein coefficients, Gas laser (He-Ne Laser), Semiconductor Laser, Applications of Laser.		
4	**(A)Analysis of Errors:** Uncertainties in Measurements: Sources and estimation of errors, accuracy and precision, systematic error, random error, Significant figure and round off, Uncertainties, Parent and Sample Distributions, Mean and Standard Deviation of Distributions, Average error, r.m.s error, probable error and error propagation, **(B) Non-linear Optics:** Introduction to regression analysis and its uses, Basic Principle of Holography, Construction and reconstruction of hologram, Applications of Holography, Introduction to optical fiber, Numerical Aperture of optical fiber, Types of optical fiber, applications of optical fiber **(C)Measurement Techniques:** Four-point probe and Van Der Pauw measurements for carrier density, Resistivity and hall mobility, Hall effect, Hot-point probe measurement, capacitance-voltage measurements, DLTS.	12	29
5	**Physics of Superconductors:** Introduction of Superconductivity, Properties of superconductor, Effect of magnetic field, Meissner effect, Pressure effect, Impurity effect, Isotopic mass effect, Mechanism of Superconductivity: BCS Theory, Penetration depth: Magnetic field, Josephson's junction and its application, Application of superconductors	6	14

Course Outcome: After completion of this course, student will be able to

- Acquire understanding of fundamental physics concepts and link them to engineering science at the conclusion of the course.
- Use physics ideas to solve difficulties in engineering.
- Apply basic Physics concepts to solve new and difficult technological issues.
- The student will gain knowledge of basic theoretical and mathematical concept of nanomaterials and electronic materials.
- Demonstrate understanding of basic principles, properties and applications associated with semiconducting materials.
- Learn how to calculate and find the errors and also characterize diverse semiconducting, electrical, and optoelectrical materials and devices using various measurement techniques and non-linear optics.
- Demonstrate knowledge of superconductivity's fundamental theory, characteristics, and applications.

List of References:

1. T. Pradeep, Nano: The Essentials, New Central book Agency.
2. S. N. Goswami, Elements of Plasma Physics, Tata McGraw Hill publication.
3. B. L. Theraja, Physics for Engineers, S Chand Publication
4. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc.
5. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc.
6. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
7. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
8. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
9. Engineering Physics by Dattu R Joshi, McGraw hill Publications.
10. Resnick, Halliday and Krane, Physics part I and II, 5th Edition John Wiley (2002)

11. Physics for scientists and engineers with modern physics by Jewett & Serwey, Cengage publications.

Open e-Resource:

1. Online course: “Semiconductor Optoelectronics” by M R Shenoy on NPTEL. (URL Link: https://nptel.ac.in/courses/115102026)
2. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Gupta on NPTEL. (URL Link: https://nptel.ac.in/courses/113104012)
3. Online course: “Fiber Optics” by Prof. Vipul Rastogi on NPTEL.

(URL link: https://nptel.ac.in/courses/115107095)

0. Online course: “Introduction to Physics of Nanoparticles and Nanostructures” by Prof. G. Mukhopadhyay on NPTEL. (URL Link: https://nptel.ac.in/courses/115101007)
0. Online course: “Introduction to Non-linear optics and its applications” by Prof. Samudra Roy on NPTEL (URL Link: https://nptel.ac.in/courses/115105105)
0. Online course “Superconductivity” by Prof. P. P. Singh and Prof. A. V. Mahajan (URL Link: https://nptel.ac.in/courses/115101012)
0. Online course “A brief course on Superconductivity” by Dr. Saurabh Basu on NPTEL.

(URL Link: https://nptel.ac.in/courses/115103108)

0. The Feynman Lectures series on Physics Vol 2, Pearson Education India

List of Suggested Experiments:

1. To find the numerical aperture of an optical fiber.
2. To determine the band gap in a semiconductor using a junction diode.
3. To determine the wavelength of laser using diffraction grating.
4. To find the efficiency of a solar cell.
5. To Study the characteristics of a Zener diode and a LED.
6. To study the “Hall effect” by measuring the voltage and magnetic field, keeping current constant.
7. Determination of radii of curvature of lens using the Newton’s ring formula.
8. Analysis of errors using Least square fitting.

Gandhinagar Institute of Technology
B.Tech Computer Engineering/Information Technology
Semester 2

Subject Code: 10050201	**Subject Title: Basic of Python**
Pre-requisite: Basic Programming Knowledge of Computer System	

Course Objective:

1. Leran the syntax and semantic of Python Programming
2.Write Python functions to facilities code reuse and manipulate strings.
3. Ilustrate the process of structuring the data using lists,tuples and dictionaries.
4.Demostrate the use of built-in function to navigate the file system.
5. Appraise the need for networking on File system.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	-	2	4	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction to python programming:** What is python language and its applications, Features of python language, Installing Python packages(Linux, Windows).	04	20
2	**Python Programming:** Data Types, Operators, Control Structures, Iterations, List, Tuple, Dictionary, Functions: Functions and scoping, List Operations, Recursion, Global Variable, modules, I/O operations, In Built Functions and Parameters, Python Library and its uses.	16	40
3	**Modularization and classes:** Classes and Object Oriented Programming- Procedural and Object – Oriented Programming-classes-working with Instances-Techniques for Designing classes, Inheritance-Introduction to inheritance-Polymorphism.	04	10
4	**Input and Output in Python:** Reading and writing text files, writing Text Files, Appending to Files and challenge, writing Binary Files Manually, Using Pickle to Write Binary Files.	07	20
5	Exception Errors in Python: Compile –time Errors, Runtime Errors, Logical Errors, What is Exception, Handling an exception, try…except…else, tryfinally clause, Argument of an Exception, Python Standard Exception, Raising an exceptions, User–defined Exception.	04	10

Course Outcome:

1. Understand concepts of problem solving approach.
2. Able to write basic python code.
3. Understand the basics of Kali Linux & its importance.
4. Understand the security policies & cyber laws.

List of Textbooks:

1. Learn Python Programming Fundamentals: A Beginner's Guide.
2. Introduction to Computation and Programming Using Python, Third Edition by John V. Guttag.
3. Fundamentals of Python: First Programs with MindTap Author(s): Kenneth A. Lambert.

List of Reference Books:

1. Advanced Python Programming by Dr. Gabriele Lanro, Quan nyugen
2. Core Python Programming, By Dr.R Nagaeshwar Rao.
3. Python All-in-One for Dummies by John Sovic.

Open e-Resource:

1. https://www.w3schools.com/python/
2. https://www.javatpoint.com/python-tutorial
3. NPTEL Video lecture on Python Programming
4. Turtle - https://docs.python.org/2/library/turtle.html
5. PyLab - https://scipy.github.io/old-wiki/pages/PyLab

   Anaconda software

List of Suggested Experiments:

1. Write a program to perform basic mathematical operations.
2. Write a program to find largest element in array.

3. Write a program to use various string functions.
4. Write a program to print addition of 5 elements of an array using looping structure.
5. Write a program to demonstrate the use of conditional structure.
6. Write a program to find sum of all elements in the directory.
7. Write a program to swap to elements in a list.
8. Write a program to sort python directories by key or a value.
0. Write a program to demonstrate the user defined function creation & calling.
1. Demonstrate a program that show the use of python library.

B.TECH 1st / 2nd SEMESTER
Computer Engineering /Information Technology /Electronics & Communication Engineering / Electrical Engineering / Civil Engineering / Mechanical Engineering

DOC NO: 4061

Subject Code: 10030101	**Subject Title:** Basics of Electrical & Electronics Engineering
Pre-requisite: Nil	

Course Objective:

- To Impart the basic knowledge of electrical quantities and to understand the impact of technology in a global and social context.
- To provide knowledge of analog and digital electronics.
- To Introduce the basic knowledge of transformer and electrical machines and electrical safety.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	0	2	4	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**DC Circuits** Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.	8	20%
2	**AC Circuit:** Representation of sinusoidal waveforms, sinusoidal function-Terminology, Form Factor and Peak Factor, Phase and Phase Difference, Phasor representation of alternating quantities, Phasor addition and subtraction Behavior of purely resistive, inductive and capacitive circuits, Phase relation RL circuit, series RC circuits, series RLC circuit between voltage and current Active, Reactive and Apparent Power, Power Factor and Parallel and series-parallel AC circuits, Resonance in series and parallel circuit.	10	23%

	Three-phase balanced circuits, voltage and current relations in star and delta connections.		
3	**Transformers and Electrical machines** Construction and working principle of single phase and three phase transformers Equation, voltage and current Ideal and practical transformer, autotransformer. Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, single phase induction motor	6	14%
4	**Analog Electronics and Applications:** Semiconductor Diode & its characteristics, Half-Wave, Full-Wave & Bridge Rectifier, Zener Diode, Light-Emitting Diode (LED), Photo diode, Solar cell and Seven Segment Display. Bipolar Junction Transistor, Amplifier, Oscillator and Operational Amplifier.	8	20%
5	**Digital Electronics:** Number System, Basic Logic Gates, Building AND, OR & NOT Gate using Diodes and Transistors, Digital logic families, RTL, DTL, TTL.	4	9%
6	**Electrical Installations:** Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.	6	14%

Course Outcome: After completion of this course, student will be able to

- Analyze electrical circuits with different elements and describe qualitative comparison between AC and DC systems.
- Understand the construction, working and basic characteristics of transformer and Induction machine
- Learn about the working of Bread-Board, Multimeter, Power Supply, Function Generator, CRO/DSO, GCB/PCB.
- Apply Diodes, Transistors and Logic Gates in different circuits.
- Recognize the importance of protective devices and electrical safety measures.

List of References:

1. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
2. Basic Electrical Engineering - Nagsarkar and Sukhija, Oxford University Press
3. B. L. Theraja, “Electrical Technology – Part I and II”, S. Chand and Co. 2012
4. V.N. Mittal, ‘Basic Electrical Engineering’, Tata Mcgraw-Hill,2nd edition 2006.
5. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
6. A. Chakrabarti, S. Nath, C. Chanda, ‘Basic Electrical Engineering’, Tata McGrawHill Education India Pvt. Ltd, 2013.
7. Robert Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, Pearson Education, 10th Edition, 2009.
8. Albert Malvino and David Bates, “Electronics Principles” Tata McGraw-Hill, 7th Edition, 2006.
9. Digital Logic and Computer Design By M Morris Mano, Prentice Hall Publication, Fourth Edition.

Open e-Resource:

1. http://vlab.amrita.edu/index.php
2. https://www.facstaff.bucknell.edu/mastascu/eLessonsHTML/EEIndex.html
3. http://www.learnabout-electronics.org

4. http://www.electronics-tutorials.ws
5. https://www.coursera.org/course/eefunlab
6. https://www.coursera.org/course/introtoelectronics
7. http://www.electronicsandyou.com
8. https://onlinecourses.nptel.ac.in/noc21_ee55/preview
9. PSpices and NGSpice (Open Source Software)

List of Suggested Experiments:

1. To verify ohm's law in an electric circuit.
2. To verify KCL and KVL in an electric circuit.
3. To verify the Network theorems
4. To determine power in a single phase circuit using wattmeter.
5. Determination of B-H curve of magnetic material.
6. Analysis series RLC circuit.
7. Demonstration of domestic installations like MCB, ELCB, MCCB
8. To determine power in a three phase circuit using two wattmeter.
9. Demonstration of cut-section models and charts of various machines.
10. Understanding of various electrical bills and calculation for energy consumption.
11. To study and perform the VI characteristics of P-N junction diode
12. To study and perform the VI characteristics of Zener diode.
13. To study and perform about the Half Wave and Full Wave Rectifier.
14. To study and perform the Input and Output characteristics of a Transistor.
15. To study and configure an op-amp as an inverting and non-inverting amplifier.
16. To study and verify digital logic gates.
17. To configure diodes and transistors as logic gates and verify the truth table.

Semester 3

Subject Code: 10050301	**Subject Title: Data Structures**
Pre-requisite: Programming for Problem Solving	

Course Objective:

1. To impart the basic concepts of data structures and algorithms
2. To understand concepts about searching and sorting techniques
3. To understand basic concepts about stacks, queues, lists, trees and graphs
4. To understanding about writing algorithms and step by step approach in solving problems with the help of fundamental data structures
5. Ability to sensibly select appropriate data structures and algorithms for problems and to justify that choice.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	0	2	4	70	30	30	20	150

	Subject Contents

Sr. No	Topic	IEEE Blended	Total Hours	Weight (%)
1	**Introduction to Data Structure:** Data Management concepts, Data types – primitive and non-primitive, Performance Analysis and Measurement (Time and space analysis of algorithms-Average, best and worst case analysis), Types of Data Structures- Linear & Non Linear Data Structures. NPTEL CH-1 RB-1 & TB-1	IEEE	04	10
2	**Linear Data Structures:** **Array:** Representation of arrays, Applications of arrays, sparse matrix and its representation. **Stack:** Stack-Definitions & Concepts, Operations On Stacks, Applications of Stacks, Polish Expression, Reverse Polish Expression And Their Compilation, Recursion, Tower of Hanoi. **Queue:** Representation Of Queue, Operations On Queue, Circular Queue, Priority Queue, Array representation of Priority Queue, Double Ended Queue, Applications of Queue. **Linked List:** Singly Linked List, Doubly Linked list, Circular linked list, Linked implementation of Stack, Linked implementation of Queue, Applications of linked list. NPTEL CH-4,5,6 RB-1 & TB-1	IEEE	13	30
3	**Nonlinear Data Structures :** **Tree:** Definitions and Concepts, Representation of binary tree, Binary tree traversal (Inorder, postorder, preorder), Threaded binary tree, Binary search trees, Conversion of General Trees To Binary Trees, Applications Of Trees Some balanced tree mechanism, eg. AVL trees, 2-3 trees, Height Balanced, Weight Balance. **Graph:** Matrix Representation Of Graphs, Elementary Graph operations,(Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning tree). NPTEL CH-7,8 RB-1 & TB-1	IEEE	13	30
4	**Hashing and File Structure :** **Hashing:** The symbol table, Hashing Functions, Collision Resolution Techniques, **File Structure:** Concepts of fields, records and files, Sequential, Indexed and Relative/Random File Organization, Indexing structure for index files, hashing for direct files, Multi-Key file organization and access methods. NPTEL CH-9 RB-1 & TB-1		06	15
5	**Sorting and Searching:** Bubble Sort, Selection Sort, Quick Sort, Merge Sort, Heap Sort, Sequential Search, Binary Search. NPTEL CH-9 RB-1 & TB-1	IEEE	06	15

Course Outcome (COs):

1. Define and classify various data structures, storage structures and common operations on them.
2. Create various linear data structures with their representation and perform different operations on them.
3. Create various nonlinear data structures with their representation and perform different operations on them.

4. Apply various searching sorting techniques on data set.
5. Solve the given a problem using an appropriate data structure to achieve optimal performance and compare its performance with other possible data structures

List of Text Books:

1. An Introduction to Data Structures with Applications. by Jean-Paul Tremblay & Paul G. Sorenson Publisher-Tata McGraw Hill,6th Edition

List of Reference Books:

1. Data Structures using C & C++ 5th Edition -By Ten Baum Publisher – Prenctice-Hall International.
2. Fundamentals of Computer Algorithms 4th Edition by Horowitz, Sahni,Galgotiass
3. Data Structures: A Pseudo-code approach with C,4th Edition -By Gilberg & Forouzan PublisherThomson Learning.

Open e-Resource:

1. https://nptel.ac.in/courses/106102064
2. https://www.tutorialspoint.com/data_structures_algorithms/index.htm

List of Suggested Experiments:

At least 10 practical should be performed by students using programming language.

1. Introduction to pointers. Call by Value and Call by reference.
2. Introduction to Dynamic Memory Allocation. DMA functions malloc(), calloc(), free() etc.
3. Implement a program for stack that performs following operations using array:
    a. PUSH (b) POP (c) PEEP (d) CHANGE (e) DISPLAY
    0. Implement a program to convert infix notation to postfix notation using stack.
    0. Write a program to implement QUEUE using arrays that performs following operations:

(a) INSERT (b) DELETE (c) DISPLAY

    0. Write a program to implement Circular Queue using arrays that performs following operations:

(a) INSERT (b) DELETE (c) DISPLAY

    0. Write a menu driven program to implement following operations on the singly linked list.
    a. Insert a node at the front of the linked list.
    a. Insert a node at the end of the linked list.
    a. Insert a node such that linked list is in ascending order.(according to info. Field)
    a. Delete a first node of the linked list.
    a. Delete a node before specified position.
    a. Delete a node after specified position.
    0. Write a program to implement stack using linked list.
    0. Write a program to implement queue using linked list.
    0. Write a program to implement following operations on the doubly linked list.
    a. Insert a node at the front of the linked list.
    a. Insert a node at the end of the linked list.
    a. Delete a last node of the linked list.
    a. Delete a node before specified position.
    0. Write a program to implement following operations on the circular linked list.
    a. Insert a node at the end of the linked list.

a. Insert a node before specified position.
a. Delete a first node of the linked list.
a. Delete a node after specified position.
0. Write a program which create binary search tree.
0. Implement recursive and non-recursive tree traversing methods inorder, preorder and postorder traversal.
0. Write a program to implement Quick Sort, Merge Sort, Bubble Sort.
0. Write a program to implement Binary Search.

Semester-3

Subject Code: 10270302	**Subject Title: Database Concepts**
Pre-requisite: Basic knowledge of Computer Programming	

Course Objective (COs):

1. Understand the fundamental concepts of database management systems (DBMS) and their role in modern information systems.
2. Learn the process of database design, including schema definition, entity-relationship modeling, normalization, and data integrity constraints.
3. Acquire practical skills in using database query languages, such as SQL (Structured Query Language), to retrieve, manipulate, and update data stored in a database.
4. Explore techniques for optimizing database performance, including indexing, query optimization, and transaction management.
5. Understand the principles of data security and privacy in database systems, including access control mechanisms, encryption, and data backup and recovery strategies.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	0	2	4	70	30	30	20	150

Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**INTRODUCTION TO DATABASE SYSTEMS:** Overview and History of DBMS. File System v/s DBMS ,Advantage of DBMS Describing and Storing Data in a DBMS. Queries in DBMS. Transaction management and Structure of a DBMS.	6	13
2	**ENTITY RELATIONSHIP MODEL:** Overview of Data Design Entities, Attributes and Entity Sets, Relationship and Relationship Sets. Features of the ER Model Key Constraints, Participation Constraints, Weak Entities, Class Hierarchies, Aggregation, Conceptual Data Base, Design with ER Model-Entity vs Attribute, Entity vs Relationship Binary vs Ternary Relationship and Aggregation vs ternary Relationship Conceptual Design for a Large Enterprise.	11	24
3	**RELATIONSHIP ALGEBRA AND CALCULUS:** Relationship Algebra Selection and Projection, Set Operations, Renaming, Join, Division, Relation Calculus, Expressive Power of Algebra and Calculus.	5	11
4	**SQL QUERIES PROGRAMMING AND TRIGGERS:** The Forms of a Basic SQL Query, Union, Intersection and Except, Nested Queries ,Correlated Nested Queries, Set-Comparison Operations, Aggregate Operators, Null Values and Embedded SQL, Dynamic SQL, ODBC and JDBC, Triggers and Active Databases.	8	18
5	**SCHEMA REFINEMENT AND NORMAL FORMS:** Introductions to Schema Refinement, Functional Dependencies, Boyce-Codd Normal Forms, Third Normal Form, Normalization-Decomposition into BCNF Decomposition into 3-NF. Storagestrategies:Indices,B-trees,hashingNPTEL,CH.14:TB1	7	16

6	**Transaction processing**: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-versionand optimistic Concurrency Control schemes, Database recovery. NPTEL, CH.17:TB1 **Database Security:** Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQLinjection. CH.4:TB1	8	18

Course Outcome (COs):
On completion of the course, students will be able to:

1. Understand the basic concepts of database systems.
2. Design Entity-Relationship (ER) models.
3. Apply relational algebra and relational calculus.
4. Construct and manipulate databases using SQL (Structured Query Language).
5. Normalize relational database schemas and Demonstrate knowledge of indexing, hashing, and query processing.
6. Understand and implement transaction management concepts and database security.

List of Text Books:
1. “Database System Concepts”, 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.
2. “SQL- PL/SQL”, Ivan bayross

List of Reference Books:
1. “Principles of Database and Knowledge – Base Systems”, Vol 1 by J. D. Ullman, Computer Science Press.
2. “Fundamentals of Database Systems”, 7th Edition by R. Elmasri and S. Navathe, Pearson
3. “An introduction to Database Systems”, C J Date, Pearson.
4. “Understanding SQL”, Martin Gruber, BPB
5. "Database Management Systems" by Raghu Ramakrishnan and Johannes Gehrke
6. "Database Design for Mere Mortals: A Hands-On Guide to Relational Database Design" by Michael J. Hernandez
7. "SQL Performance Explained" by Markus Winand
8. "Database Modeling and Design: Logical Design" by Toby J. Teorey, Sam S. Lightstone, and Tom Nadeau

Open e-Resource:
1. https://swayam.gov.in/nc_details/NPTEL
2. https://www.tutorialspoint.com/dbms/index.htm
3. https://www.w3schools.com/sql/
4. https://www.codecademy.com/learn/learn-sql
5. https://onlinecourses.nptel.ac.in/noc22_cs91/preview

List of Suggested Experiments:
1. To study DDL-create and DML-insert commands
2. Create table and insert sample data in tables.
3. Perform queries involving predicates LIKE, BETWEEN, IN etc.
4. To Perform various data manipulation commands, aggregate functions and sorting concept on all created tables.
5. To study Single-row functions.
6. Displaying data from Multiple Tables (join)
7. To apply the concept of Aggregating Data using Group functions.
8. To solve queries using the concept of sub query.
9. To apply the concept of security and privileges
10. To study Transaction control commands

Semester 3

Subject Code: 10050303	**Subject Title: Digital Fundamentals**
Pre-requisite: Fundamentals of Basic Electronics	

Course Objective:
1. To present a problem oriented introductory knowledge of digital circuits and its applications.
2. To focus on the study of electronic circuits.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture	Tutorial	Practical	Credit	Theory		Practical		Total
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	0	2	4	70	30	30	20	150

Subject Contents				
Sr. No	Topic	IEEE Blended	Total Hours	Weight (%)
1	**Fundamentals Of Digital Systems & Logic Families: Digital** signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, Number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, Binary Addition & Subtraction, codes, Error detecting and correcting codes. TB: 1 Ch-1 NPTEL	IEEE	8	20
2	**Combinational Digital Circuits & Logic:** The Half adder, the Full adder, subtractor circuit. Multiplxer de-multiplexer, decoder, BCD to seven segment Decoder, encoder's functions, K-map representation, and simplification of logic functions using K-map, Minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders. TB: 1 Ch-4 NPTEL		8	20
3	**Flip Flop & Timing Circuit:** Set-reset laches, D- Flip-flop, R-S Flip-flop, J-K Flip-flop, Master slave Flip-flop, Edge triggered Flip-flop, T Flip-flop. TB: 1 Ch-5 NPTEL	IEEE	5	15
4	**Registers & Counters:** Synchronous/Asynchronous counter operation, Up/down synchronous counter, application of counter, Serial in/Serial out shift register, Serial in/parallel out shift register, parallel in/ parallel out shift register, parallel in/Serial out shift register, Bi-directional register. TB: 1 Ch-6 NPTEL		5	15
5	**A/D & D/A Converters:** Weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter ICs, sample and hold circuit, analog to digital converters: Quantization ,encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter. RB: 1 Ch-17 NPTEL		7	15
6	**Semiconductor Memories & Programmable Logic Devices:** Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA). RB: 1 Ch-18 NPTEL		5	15

Course Outcome(COs):

1. Understand working of logic families and logic gates
2. Design and implement Combinational and Sequential logic circuits.
3. Understand the process of Analog to Digital conversion and Digital to Analog conversion.
4. Be able to use PLDs to implement the given logical problem.

List of Text Books:

1. Digital Fundamentals by Morris and Mano, PHI Publication

List of Reference Books:

1. Fundamental of digital circuits by A. ANANDKUMAR,PHI Publication

2. Digital Fundamentals by FLOYD & JAIN, Pearsons Pub
3. Fundamentals of Logic Design by Charles H. Roth Thomson

Open e-Resource:

1. https://sourceforge.net/projects/circuit/
2. https://onlinecourses.nptel.ac.in/noc20_ee32/preview

List of Suggested Experiments:

1. Getting familiar with various digital integrated circuits of different logic families. Study of data sheet of these circuits and see how to test these circuits using Digital IC Tester
2. Configure diodes and transistor as logic gates and Digital ICs for verification of truth table of logic gates.
3. Configuring NAND and NOR logic gates as universal gates.
4. Study and configure of various digital circuits such as adder, subtractor.
5. Study and configure of various digital circuits like decoder, encoder and code converters.
6. Study and configurations of multiplexer and demultiplexer circuits.
7. Study and configure of flip-flop, using digital ICs. Design digital system.
8. Study and configure of registers and counters.
9. Study and configuration of A to D and D to A converter.
10. Study of different memory and its types.

Semester 3

Subject Code: 10000302	**Subject Title: Economics and Management**
Pre-requisite: Zeel to learn the subject	

Course Objective:
(1) Enrich the knowledge of essential elements of Economics and its application
(2) Understand the concepts of Management, Organizational structure & corporate social responsibility.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
Lecture	**Tutorial**	**Practical**	**Credit**	**Theory**		**Practical**		**Total**
				University Assessment	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	
3	0	0	3	70	30	0	0	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**

1.	Introduction to Economics; Definitions, Nature, Scope, Difference between Microeconomics & Macroeconomics Theory of Demand & Supply; law of demand, law of supply, equilibrium between demand & supply Elasticity. elasticity of demand, price elasticity, income elasticity, cross elasticity	05	12
2.	Theory of production; production function, meaning, factors of production (meaning & characteristics of Land, Labour, capital & entrepreneur), Law of variable proportions & law of returns to scale Cost; meaning, short run & long run cost, fixed cost, variable cost, total cost, average cost, marginal cost, opportunity cost. Break even analysis, meaning, explanation, numerical	04	12
3.	Markets; meaning, types of markets & their characteristics (Perfect Competition, Monopoly, Monopolistic Completion, Oligopoly) National Income; meaning, stock and flow concept, NI at current price, NI at constant price, GNP, GDP, NNP, NDP, Personal income, disposal income.	04	12
4.	Basic economic problems; Poverty-meaning, absolute & relative poverty, causes, measures to reduce Unemployment: meaning, types, causes, remedies Inflation; meaning, types, causes, measures to control	04	12
5.	Money; meaning, functions, types, Monetary policy- meaning, objectives, tools, fiscal policy-meaning, objectives, tools Banking; meaning, types, functions, Central Bank- RBI; its functions, concepts; CRR, bank rate, repo rate, reverse repo rate, SLR	04	12
6.	Introduction to Management; Definitions, Nature, Management Difference between Management & administration, skill, types and roles of managers Management P r i nc i p l e s; Scientific principles, Administrative , principles, Maslow's Hierarchy of needs theory	05	12

7.	Functions of Management; Planning, Organizing, Staffing, Directing, controlling (meaning, nature and importance) Organizational Structures; meaning, principles of organization, types-formal and informal, line, line & staff, matrix, hybrid (explanation with merits and demerits), span of control, departmentalization, chain of command, centralization and decentralization	06	12
8.	Organizational culture of Environment concept of culture and its importance, attributes culture, how does culture affect managers and employees.	04	10
9.	Corporate Social Responsibility; meaning, importance Business Ethics; meaning, importance.	03	06

Course Outcome:

1. Understand the concept of elasticity & analyze how it affects revenue.
2. Relate production function and cost function.
3. Analyze different market types and their characteristics for optimal quantity and pricing decisions to achieve profit maximization.
4. Describe basic principles of management: planning, organizing, controlling and directing. **5.** Analyze ethical dilemmas faced by business and managers.

List of Reference Books:

1. Paneerselvam R., Engineering Economics, PHI publication.
2. Robbins S.P. and Decenzo David A, Fundamentals of Management: Essential Concepts and Applications, Pearson Education.
3. Gregory Mankiw N, Economics: Principles of Economics, Cengage Learning.
4. Prasad L.M., Principles and Practices of Management.
5. Tripathy and Reddy., Principles of Management.
6. Dewett K.K. & Navalur M.H., Modern Economic Theory, S.Chand Publication.

Open e-Resource:

1. https://nptel.ac.in/courses/122106031
2. https://nptel.ac.in/courses/109104125

Semester 3

Subject Code: 10000301	**Subject Title: Probability & Statistics**
Pre-requisite: Algebra and Calculus	

Course Objective:

1. The main objective of the course is to provide an understanding of the basic concepts of probability and statistics

2. The focus in this course is to design a statistical hypothesis about real world problems and conduct appropriate tests for drawing valid inference about the population characteristics.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	01	-	04	70	30	-	-	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Basic Statistics:** Measure of Central Tendency: Arithmetic Mean, Median and Mode for Grouped and Ungrouped Data, Standard Deviation, Variance, Coefficient of Variance, Karl Pearson's Coefficients of Skewness, Moments	6	14
2	**Curve Fitting:** Least Square Approximation, Fitting of Linear Curve, Quadratic Curve and Non-linear Curves **Correlation and Regression:** Correlation and its properties, Types of Correlation, Correlation Coefficient, Rank Correlation, Regression, Regression Coefficient, Properties and Expressions of Regression Coefficient	8	19
3	**Basic Probability:** Mathematical & Statistical definition of	10	24

	Probability, Conditional Probability, Baye's Theorem **Random Variables:** Discrete Random Variables, Probability Mass Function, Continuous Random variables, Probability Density Function, Statistical Measures for Two dimensional Random Variables		
4	**Special Probability Distribution:** Binomial Distribution and its properties, Poisson Distribution and its properties, Normal Distribution and its properties, Gamma and Exponential Distributions	8	19
5	**Sampling Theory:** Test of Hypothesis, Level of Significance, Critical Region, One tailed and Two tailed test **Test of Significant for Large Samples:** Means of the samples and test of Significant of means of two large samples, **Test of Significant of Small Samples:** Students *t*-distribution for dependent and independent samples **Chi-Square Test**: Test of Goodness of Fit and Independence of Attributes	10	24

Course Outcome(COs):
After completion of this course, student will be able to:

1. Understand the statistical data using measures of central tendency.
2. Understand the concepts of Least square methods with various curves.
3. Learn the methods of correlation and regression to find relationships between variables and forecast outcomes.
4. Apply the basic principles of probability theory in problem solving situations.
5. Learn about different probability distributions to tackle statistical issues.
6. Learn how to create and evaluate hypotheses, determine the likelihood that hypotheses will be incorrect, and make conclusions using crucial values.

List of Textbooks:
1. R. Singh and M.D. Bhatt, Probability and Statistics, Tata McGraw Hill.
2. R.M. Baphana and T.B. Shah, Probability and Statistics, Tech-Neo Publication.
3. S.S. Patel, N.B. Desai, Probability and Statistics, Atul Prakashan.
4. S.C.Gupta, Fundamentals of Statistics, Himalaya Publishing House.

List of Reference Books:
1. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall.
2. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India.
3. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley.
4. J. L. Devore, Probability and Statistics for Engineering and the Sciences, Cengage Learning.
5. V.K. Rohatgi and A. K. Md. E. Saleh, An Introduction to Probability and Statistics, Wiley India Pvt. Ltd

Open e-Resources:
1. https://onlinecourses.nptel.ac.in/noc23_ma83/preview
2. https://onlinecourses.nptel.ac.in/noc23_ma77/preview

Semester 3

Subject Code: 10000305	Subject Title: Universal Human Values (Mandatory)
Pre-requisite:- Zeal to learn the subject	

Course Objective:

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory		Practical		
Lecture	Tutorial	Practical	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total
2	1	0	3	-	50	-	-	50

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education:** Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels	7	20
2.	**Understanding Harmony in the Human Being - Harmony in Myself!:** Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya - Practice Exercises and Case Studies will be taken up in Practice Sessions.	6	17

3.	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship:** Understanding Harmony in the family – the basic unit of human interaction, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family! - Practice Exercises and Case Studies will be taken up in Practice Sessions.	8	25
4.	**Understanding Harmony in the Nature and Existence - Whole existence as Co-existence:** Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence - Practice Exercises and Case Studies will be taken up in Practice Sessions.	7	15
5.	**Implications of the above Holistic Understanding of Harmony on Professional Ethics:** Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: (a) Ability to utilize the professional competence for augmenting universal human order, (b) Ability to identify the scope and characteristics of people-friendly and ecofriendly production systems, (c) Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: (a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, (b) At the level of society: as mutually enriching institutions and organizations	8	23

Course Outcome(COs):

After completion of this course, student will be able to:

1. Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society.
2. Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body.
3. Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society.
4. Understand the harmony in nature and existence and work out their mutually fulfilling participation in the nature.

5. Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work.

List of References:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA.
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991.
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.
8. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
9. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press.
10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Open e-Resource:

1. Value Education websites, http://uhv.ac.in, http://www.uptu.ac.in
2. Story of Stuff, http://www.storyofstuff.com
3. Al Gore, An Inconvenient Truth, Paramount Classics, USA
4. Charlie Chaplin, Modern Times, United Artists, USA
5. IIT Delhi, Modern Technology – the Untold Story
6. Gandhi A., Right Here Right Now, Cyclewala Productions

Semester 4

Subject Code: 10050401	**Subject Title: Object Oriented Programming**
Pre-requisite: Programming Fundamentals	

Course Objective:

1. To introduce OOP principles.
2. To explore the skills of Java Programming Development.
3. To learn various java API classes, packages, interfaces and streams.
4. To understand exception handling mechanism and multithreading.
5. To learn efficient design techniques of GUI.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University**	**ContinuousAssessment**	**University**	**ContinuousAssessment**	**Total**

				Assessment		**Assessment**		
3	0	2	4	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Concepts of OOP:** Introduction to OOP, Procedural v/s Object Oriented Programming, Principles of OOP, Benefits and Applications of OOP. CH.1 : TB.2	2	8
2	**Basics of Java:** C v/s Java, Features of Java, Working of JVM, JDK, JRE, Bytecode, Java Program Structure, Compiling and Executing a simple java program, Datatypes, Operators, Control Statements: Selection statements (if and switch), Loops (while, do-while and for) and Jump statements (break and continue). CH.2 : TB.2, CH.3 : RB.1	3	10
3	**Arrays and String:** Array and Types of Arrays, Arrays class, String class, String class methods, StringBuffer and StringBuilder class, ArrayList class, Command Line Argument, Use of Wrapper class. CH.3 : RB.1, CH.4 : RB.2	4	8
4	**Classes, Objects and Methods:** Introduction of Class, Object, Method, Method Overloading, Recursion, Passing and Returning an object from method, Constructor, Types of Constructor, Constructor Overloading, 'this' keyword, 'static' keyword, Nested class and Inner class, Anonymous inner class, Garbage Collection and finalize() method, Introduction to Scanner class. CH.4 : RB.2	6	16
5	**Object Oriented Programing Concepts:** Types of Inheritance, Inheriting Data members and methods, Inheriting constructors, Method overriding, 'super' keyword, 'final' keyword, Abstract class, Interface, Interface Inheritance, Interface Reference, Comparison between Abstract Class and Interface, Dynamic Method Dispatch, Object class, Package and its types, Creating a Package, Importing a Package, Access Modifiers and its scope. CH.5 & 6 : RB.2	10	25
6	**Exception Handling and Multithreaded Programming:** Exception and Error, Types of Exception (Checked and Unchecked Exception), Exception Handling Blocks: try, catch and finally, 'throw' and throws keyword, Built-in and Custom Exception, Introduction to Thread, Thread Lifecycle, Creation of Thread using Thread class and Runnable interface, Thread priority, Thread Synchronization, Thread communication. CH.10 & 11 : TB.1	10	15
7	**Introduction to Event-Driven Programming:** Basic structure of JAVAFX program, Panes, UI control and shapes, Property binding, the Color and the Font class, the Image and Image-View class, layout panes and shapes, Events and Events sources, Registering Handlers and Handling Events. CH.14, 15 & 16 : RB.3	5	8
8	**IO Programming:** Introduction to Stream, Byte Stream, Character stream, Readers and Writers, File Class, File Input Stream, File Output Stream, InputStreamReader class, OutputStreamWriter class, FileReader class, FileWriter class, Buffered Reader. CH.16 : TB.2, CH.9 : RB.2	5	10

Course Outcome:

After learning the course, the students should be able to:

1. Understand and apply object-oriented programming principles.
2. Write, compile and execute Java programs.
3. Understand the Java architecture and use java classes, packages and interfaces.
4. Understand and use exception handling mechanism and multithreading in Java.
5. Perform standard input-output and file I/O operations.
6. Design GUI based application.

List of Textbooks:

1. Java: The Complete Reference by Herbert Schildt, Tata McGraw Hill Publication.
2. Programming with Java by E Balagurusamy, Tata McGraw Hill Publication.

List of Reference Books:

1. Core Java Volume I – Fundamentals by Horstmann, Pearson.
2. Programming In Java Revised by Sachin Malhotra & Saurabh Choudhary, Oxford Publication.
3. Introduction to Java Programming and Data Structures Comprehensive Version by Y. Daniel Liang, Pearson.

Open e-Resource:

1. Java Development Kit: http://www.oracle.com/technetwork/java/javase/downloads/index.html
2. http://www.tutorialspoint.com/java/
3. http://www.learnjavaonline.org/
4. http://www.learn-java-tutorial.com/
5. http://www.tutorialspoint.com/javaexamples/
6. https://www.mygreatlearning.com

List of Suggested Experiments:

1. Install JDK, write a simple “Hello World” or similar java program, compilation, debugging, executing using java compiler and interpreter.
2. Write a program to enter two numbers and perform mathematical operations on them.
3. Write a program in Java to find maximum of three numbers using conditional operators.
4. Write a program in Java to mention basic details of Employee with the help of classes and objects.
5. Write a program to find length of string and print second half of the string.
6. Write a program to find that given number or string is palindrome or not.
7. Write programs in Java to use Wrapper class of each primitive data types.
8. Write a program in Java to demonstrate the use of ‘final’ and 'static' keyword.
9. Write a program in Java to demonstrate single inheritance, multilevel inheritance and hierarchical inheritance.
10. Describe abstract class called Shape which has three subclasses say Triangle, Rectangle, and Circle. Define one method area() in the abstract class and override this area() in these three subclasses to calculate for specific object i.e. area() of Triangle subclass should calculate area of triangle etc. Same for Rectangle and Circle.
11. Write a program in java to demonstrate multiple inheritance in interface.
12. Write a program in Java to develop user defined exception for 'Divide by Zero' error.
13. Write a program in Java to demonstrate multiple try and multiple catch blocks.
14. Create a class called Student. Write a student manager program to manipulate the student information from files by using FileInputStream and FileOutputStream.
15. Write a program of JavaFX application which prints “Hello world” on the console on clicking the button.

Semester 4

Subject Code: 10050402	**Subject Title: Operating System**
Pre-requisite: Basic Programming Knowledge	

Course Objective:

1. To understand the services provided by and the design of an operating system
2. To understand the structure and organization of the file system
3. To understand what a process is and how processes are synchronized and schedule
4. To understand different approaches to memory management
5. Students should be able to use system calls for managing processes, memory and the file system.
6. Students should understand the data structures and algorithms used to implement an OS.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	-	2	4	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction:** Basics of Operating Systems: Definition – Generations of Operating systems – Types of Operating Systems, OS Service, System Calls, OS structure: Layered, Monolithic, Microkernel Operating, Systems – Concept of Virtual Machine. NPTEL CH-1 TB-1.	3	10
2	**Process Management**: Processes: Definition, Process Relationship, Process states, Process States, Process Control Block, Context switching, Threads– Concept of multithreads, Benefits of threads – Types of threads. NPTEL CH-2 TB-1.	4	7
3	**Process Scheduling:** Definition, Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time (Definition only), Scheduling algorithms: Preemptive and Non preemptive, FCFS – SJF – RR. NPTEL CH-4 TB-1.	4	7
4	**Deadlocks**: Definition, Deadlock characteristics, Deadlock Prevention, Deadlock Avoidance: banker's algorithm, Deadlock detection and Recovery. NPTEL CH-6 TB-1.	4	9
5	**Interprocess Communication:** Race Conditions, Critical Section, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer Consumer Problem, Semaphores, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc. CH-2 TB-1.	5	12
6	**Memory Management:** Basic Memory Management: Definition, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition – Internal and External fragmentation and Compaction, Paging: Principle of operation – Page allocation – Disadvantages of paging. NPTEL CH-3 TB-1. **Virtual Memory:** Basics of Virtual Memory, Page fault, Working Set, Dirty page/Dirty bit – Demand paging (Concepts only) – Page Replacement policies: Optimal (OPT), First in First Out (FIFO), Second Chance (SC) and Least Recently	7	15

	used (LRU). NPTEL CH-4 TB-1.		
7	**File Management:** File concept, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping). NPTEL CH-4 TB-1.	5	15
8	**I/O Management:** Principles of I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage, Structure: Disk structure, Disk scheduling algorithm. CH-5 TB-1.	4	8
9	**Security & Protection:** Security Environment, Design Principles Of Security, User Authentication, Protection Mechanism: Protection Domain, Access Control List. CH-9 TB-1.	3	8
10	**Unix/Linux Operating System:** Development of Unix/Linux, Role & Function Of Kernel, System Calls, Elementary Linux command & Shell Programming, Directory Structure. CH-10 TB-1.	3	9

Course Outcome (COs):

1. Understand various generations of Operating System and functions of Operating System.
2. Understand the concept of program, process and thread and Analyze various CPU Scheduling Algorithms and compare their performance.
3. Evaluate the requirements for the process synchronization and co-ordination in contemporary operating system.
4. Analyze various algorithms for memory management, I/O management, File management and security aspects of operating system.
5. Write shell scripts in Unix/Linux O.S and write simple programs using kernel system calls

List of Textbooks:

1. Modern Operating Systems-5th Edition By Andrew S. Tanenbaum (PHI)

List of Reference Books:

1. Operating Systems: Internals & Design Principles, 9th Edition, William Stallings, Pearson Education India
2. Operating System Concepts, 9th edition Peter B. Galvin, Greg Gagne, Abraham Silberschatz, John Wiley & Sons, Inc.
3. The UNIX Programming Environment ,January 2020 by Kernighan & Pike.

Open e-Resource:

1. https://nptel.ac.in/courses/106105214
2. https://www.tutorialspoint.com/operating_system/index.htm

List of Suggested Experiments:

There should be minimum 10 programs/shell scripts.

1. Study of Basic commands of Linux/UNIX.
2. Study of Advance commands and filters of Linux/UNIX.
3. Write a shell script to generate marksheet of a student. Take 3 subjects, calculate and display total marks, percentage and Class obtained by the student.

4. Write a shell script to display multiplication table of given number
5. Write a shell script to find factorial of given number n.
6. Write a shell script which will accept a number b and display first n prime numbers as output.
7. Write a shell script which will generate first n Fibonacci numbers like: 1, 1, 2, 3, 5, 13, …
8. Write a menu driven shell script which will print the following menu and execute the given task.

a. Display calendar of current month
b. Display today's date and time
c. Display usernames those are currently logged in the system.
d. Display your name at given x, y position.
e. Display your terminal number.

0. Write a shell script to read n numbers as command arguments and sort them in descending order.
0. Write a shell script to display all executable files, directories and zero sized files from current directory.
0. Write a shell script to check entered string is palindrome or not.
0. Shell programming using filters (including grep, egrep, fgrep)
0. Study of UNIX Shell and Environment Variables.
0. Write a shell script to validate the entered date. (eg. Date format is: dd-mm-yyyy).
0. Write a program using function, which convert each word in a given text into capital.
0. Write a program for process creation using C. (Use of gcc compiler).
0. To write C Programs using the following system calls of UNIX operating system fork, exec, getpid, exit, wait, close, stat, opendir, readdir.

Semester - 4

Subject Code: 10270403	**Subject Title: Computer Architecture**
Pre-requisite: 1. Basic knowledge of computer programming 2. Understanding of elementary mathematics and digital logic	

Course Objectives:

1. To understand the basic structure and functioning of a computer system, including its components and operational principles.
2. To familiarize students with recent trends and advancements in computer architecture such as RISC, CISC, and multicore architectures.
3. To study instruction set architecture and design of arithmetic, logic, control, and memory units.
4. To explore pipelining, parallelism, and performance evaluation techniques in modern processors.
5. To gain insights into memory hierarchy, input/output systems, and their role in overall system performance.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**		
Lecture	**Tutorial**	**Practical**	**Credit**	**Theory**	**Practical**	**Total**

				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	0	2	4	70	30	30	20	150

Subject Contents

Sr. No	Topic	Total Hours	Weight (%)
1	**Introduction to Computer Architecture and Organization:** Von Neuman Architecture, Flynn Classification. Register Transfer and Micro operations: Register transfer language, Arithmetic Micro-operations, Logic Micro-operations, Shift Micro-operations, Bus and memory transfers. Computer Organization and Design: Instruction cycle, computer registers, common bus system, computer instructions, addressing modes, design of a basic computer	12	25
2	**Central Processing Unit:** General register organization, stack organization, Instruction formats, Data transfer and manipulation, program control. RISC, CISC characteristics. Pipeline and Vector processing: Pipeline structure, speedup, efficiency, throughput and bottlenecks. Arithmetic pipeline and Instruction pipeline.	10	21
3	**Assembly Language Programming:** Introduction, Machine Language, Assembly Language Programming: Arithmetic and logic operations, looping constructs, Subroutines, I-O Programming.	11	23
4	**Memory Organization:** RAM, ROM, Memory Hierarchy, Organization, Associative memory, Cache memory and Virtual memory: Paging and Segmentation	8	17
5	**Input-Output Organization:** Input-Output Interface, Modes of Transfer, Priority Interrupt, DMA, IOP processor.	6	13

Course Outcomes (COs):

Students will be able to understand:

1. Explain the basic structure, components, and operations of a computer system.
2. Analyze instruction set architecture and formats to evaluate CPU performance.
3. Design and evaluate combinational and sequential digital circuits used in ALU and control units.
4. Understand and evaluate memory hierarchy including cache, main, and virtual memory systems.
5. Describe I/O organization and data transfer techniques including DMA and interrupts.

List of Text Books:

1. M. Morris Mano, “Computer System Architecture”,4th Edition Pearson Education

List of Reference Books:

1.Computer Organization and Architecture - William Stallings (Pearson Education Asia)

2. Computer Organization and Architecture -John P. Hayes (McGraw -Hill)

3. Computer Organization -V. Carl. Hamacher (McGraw-Hill)

Open e-Resource:

1. https://archive.nptel.ac.in/courses/106/105/106105163/
2. https://en.wikipedia.org/wiki/Computer_architecture
3. https://ieeexplore.ieee.org/document/1641522

List of Suggested Experiments:

1. Write the working of 8085 simulator GNUsim8085 and basic architecture of 8085 along with small introduction.
2. Write an assembly language code in GNUsim8085 to store numbers in reverse order in memory location.
3. Write an assembly language code in GNUsim8085 to implement arithmetic instructions.
4. Write an assembly language code in GNUsim8085 to implement multiplication & division.
5. Write an assembly language code in GNUsim8085 to implement logical instructions.
6. Write an assembly language code in GNUsim8085 to find the factorial of a number.
7. Write an assembly language code in GNUsim8085 to find highest number.
8. Write an assembly language code in GNUsim8085 to implement sorting.
9. Design ALU using Logisim.
10. Implement 16-bit single-cycle MIPS processor in Verilog HDL

Semester-V

Subject Code: 10270501	**Subject Title: Computer Communication and Network**
Pre-requisite: Basic Knowledge of hardware, software and operating system	

Course Objective:

1. To understand the concepts behind computer networks and data communication.
2. To learn the different types of networks, network topologies and their characteristics.
3. To learn the working of protocols used at various layers.
4. To understand the utility of different networking devices.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory		Practical		
Lecture	Tutorial	Practical	Credit	University Assessment	ContinuousAssessment	University Assessment	ContinuousAssessment	Total
3	-	2	4	70	30	30	20	150

Subject Contents

Sr. No	Topic	Total Hours	Weight (%)
1	**Introductory Concepts:** Network hardware, Network software, topologies, Protocols and standards, OSI model, TCP model, TCP/IP model, Physical Layer: Digital and Analog Signals, Periodic Analog Signals, Signal Transmission, Limitations of Data Rate, Digital Data Transmission, Performance Measures, Line Coding, Digital Modulation, Media and Digital Transmission System	9	19
2	**Data Link Layer:** Error Detection and Correction, Types of Errors, Two dimensional parity check, Detection verses correction, Block Coding, Linear Block Coding, Cyclic Codes, Checksum, Standardized Polynomial Code, Error Correction Methods, Forward Error Correction, Protocols: Stop and wait, Go-back-N ARQ, Selective Repeat ARQ, Sliding window, Piggy backing, Pure ALOHA, Slotted ALOHA, CSMA/CD, CSMA/CA	10	21
3	**Network Layer:** Design issues, IP addressing, sub netting, Super netting (CIDR), IPV4, IPV6, Routing and Forwarding, Routing algorithms: Static and dynamic routing, Unicast and Multicast Routing, Distance-Vector Routing, Link-State Routing, Shortest path computation-Dijkstra's algorithm, Address mapping-ARP, RARP, BOOTP, DHCP, Address mapping: ARQ, RARQ, Congestion control, Quality of Service, Internetworking	10	21
4	**Transport Layer:** Services, UDP and TCP segment formats, connection establishment and termination, Expert Lecture from Industry, Congestion control, Congestion control: Open Loop and closed loop, Quality of service, Flow characteristics, Techniques to improve QoS , Leaky Bucket and Token Bucket algorithm.	10	21
5	**Application Layer:** Services, DNS, SIP, RTP, Telnet/SSH, HTTP, HTTPS, Remote login, Electronic mail, SMTP, FTP Commands and Replies, WWW, SNMP, Addressing Schemes, Uniform Resource Identifiers, Introduction to network security.	8	17

Course Outcomes (COs):

On completion of this course, the students will be able to:

1. Differentiate between various types of computer networks and their topologies.
2. Understand the difference between the OSI and TCP/IP protocol suit.
3. Explain the design and functions of the Network Layer.
4. Demonstrate how traffic shaping algorithms work to regulate data flow and enforce QoS.
5. Demonstrate the use of application layer tools and utilities.

List of Textbooks:

1. William Stallings, Data and Computer Communications, Edition: 10th, Pearson.
2. Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, Edition: 5th, Pearson.
3. Behrouz A. Forouzan, Data Communications and Networking, Edition: 5th, McGraw-Hill.

List of Reference Books:

1. Gary A. Donahue, Network Warrior for a practical, hands-on perspective.
2. W. Richard Stevens, TCP/IP Illustrated (Volume 1), for protocol-level understanding.
3. Ames Kurose, Keith Ross, Computer Networking: A Top - Down Approach.

Open e-Resource:

1. **https://onlinecourses.nptel.ac.in/noc22_cs19/preview**
2. **http://www.redbooks.ibm.com/abstracts/gg243376.html**
3. **http://www.tcpipguide.com/**
4. **https://ieeexplore.ieee.org/document/6535799**

List of Experiments:

1. Study of different types of Network cables and Practically implement the cross-wired cable and straight through cable using clamping tool.
2. Study of Network Devices in Detail.
3. Study of network IP.
4. Connect the computers in Local Area Network.
5. Study of basic network command and Network configuration commands.
6. Demonstrate the simple network configuration with a router that connects two local area network (LAN) segments using cisco packet tracer.
7. Configure a Network topology using packet tracer software.
8. Configure a Network using Distance Vector Routing protocol.

9. Configure Network using Link State Vector Routing protocol.
10. Configure a network by having one scenario.
11. Network troubleshooting, analysis, software, and communications protocol development by Wireshark.

Semester 5

Subject Code: 10050502	**Subject Title: Analysis And Design Of Algorithms**
Pre-requisite: Programming (C or C++), Data and file structure	

Course Objective:

1. Given an algorithm, identify the problem it solves.
2. Write algorithms choosing the best one or a combination of two or more of the algorithm design techniques: Iterative, divide-n-conquer, Greedy, Dynamic Programming using appropriate data structures.
3. Write proofs for correctness of algorithms.
4. Re-write a given algorithm replacing the (algorithm design) technique used with a more appropriate/efficient (algorithm design) technique.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	-	2	4	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Basics of Algorithms and Mathematics:** What is an algorithm?, Mathematics for Algorithmic Sets, Functions and Relations, Vectors and Matrices, Linear Inequalities and Linear Equations. [TB-1: Introduction to Algorithms CH-1]	2	2
2	**Analysis of Algorithm:** The efficient algorithm, Average, Best and worst case analysis, Amortized analysis , Asymptotic Notations, Analyzing control statement, Loop invariant and the correctness of the algorithm, Sorting Algorithms and analysis: Bubble sort, Selection sort, Insertion sort, Shell sort Heap sort, Sorting in linear time : Bucket sort, Radix sort and Counting sort. [TB-1: Introduction to	8	20

	Algorithms CH-1,2,3,6,8]		
3	**Divide and Conquer Algorithm:** Introduction, Recurrence and different methods to solve recurrence, Multiplying large Integers Problem, Problem Solving using divide and conquer algorithm - Binary Search, Max-Min problem, Sorting (Merge Sort, Quick Sort), Matrix Multiplication, Exponential. [TB-1: Introduction to Algorithms CH-4,7]	6	15
4	**Dynamic Programming:** Introduction, The Principle of Optimality, Problem Solving using Dynamic Programming – Calculating the Binomial Coefficient, Making Change Problem, Assembly Line-Scheduling, Knapsack problem, All Points Shortest path, Matrix chain multiplication, Longest Common Subsequence. [TB-1: Introduction to Algorithms CH-14]	5	15
5	**Greedy Algorithm:** General Characteristics of greedy algorithms, Problem solving using Greedy Algorithm - Activity selection problem, Elements of Greedy Strategy, Minimum Spanning trees (Kruskal's algorithm, Prim's algorithm), Graphs: Shortest paths, The Knapsack Problem, Job Scheduling Problem, Huffman code. [TB-1: Introduction to Algorithms CH-15,22]	5	15
6	**Exploring Graphs:** An introduction using graphs and games, Undirected Graph, Directed Graph, Traversing Graphs, Depth First Search, Breath First Search, Topological sort, Connected components. [TB-1: Introduction to Algorithms CH-20,21,22,23]	4	10
7	**Backtracking and Branch and Bound:** Introduction, The Eight queens problem , Knapsack problem, Travelling Salesman problem, Minimax principle. [TB-1: Introduction to Algorithms CH-24]	3	06
8	**String Matching:** Introduction, The naive string matching algorithm, The Rabin-Karp algorithm, String Matching with finite automata, The Knuth-Morris-Pratt algorithm. [TB-1: Introduction to Algorithms CH-32]	3	6
9	**Introduction to NP-Completeness:** The class P and NP, Polynomial reduction, NP-Completeness Problem, NP-Hard Problems. Travelling Salesman problem, Hamiltonian problem, Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE. [TB-1: Introduction to Algorithms CH-34]	5	11

Course Outcome (COs):

1. Analyze the asymptotic performance of algorithms.
2. Derive and solve recurrences describing the performance of divide-and-conquer algorithms.
3. Find optimal solution by applying various methods.
4. Apply pattern matching algorithms to find particular pattern.

5. Differentiate polynomial and nonpolynomial problems.
6. Explain the major graph algorithms and their analyses. Employ graphs to model engineering problems, when appropriate.

List of Textbooks:

1. Introduction to Algorithms,2020 by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, PHI.

List of Reference Books:

1. Fundamentals of Algorithms,5th Edition – E. Horowitz et al.
2. Fundamental of Algorithms,4th Edition by Gills Brassard, Paul Bratley, PHI.
3. Introduction to Design and Analysis of Algorithms, Anany Levitin, Pearson.

Open e-Resource:

1. https://nptel.ac.in/courses/106101060
2. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm

List of Suggested Experiments:

There should be minimum 10 programs/shell scripts.

1. Implementation and Time analysis of sorting algorithms.
2. Bubble sort, Selection sort, Insertion sort, Merge sort and Quicksort
3. Implementation and Time analysis of linear and binary search algorithm.
4. Implementation of max-heap sort algorithm
5. Implementation and Time analysis of factorial program using iterative and recursive method
6. Implementation of a knapsack problem using dynamic programming.

7. Implementation of chain matrix multiplication using dynamic programming.
8. Implementation of making a change problem using dynamic programming
9. Implementation of a knapsack problem using greedy algorithm
10. Implementation of Graph and Searching (DFS and BFS).
11. Implement prim's algorithm
12. Implement kruskal's algorithm.
13. Implement LCS problem

Semester-5

Subject Code: 10050607	**Subject Title: Theory of Computation**
Pre-requisite: Logic and Combinatorics, Calculus, Data Structures and Algorithms, Set Theory	

Course Objective:

1. To give an overview of the theoretical foundations of computer science from the perspective of formal languages
2. To illustrate finite state machines to solve problems in computing.
3. To explain the hierarchy of problems arising in computer sciences.
4. To familiarize Regular grammars, context frees grammar.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
Lecture	**Tutorial**	**Practical**	**Credit**	**Theory**		**Practical**		**Total**
				University Assessment	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	
3	1	-	4	70	30	-	-	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Review of Mathematical Theory**: Sets, Functions, Logical statements, Proofs, Relations, Languages, Principal of Mathematical Induction, Strong Principle, Recursive Definitions, Structural Induction. [CH-1: RB-1 John. C. Martin]	04	10

2	**Regular Languages and Finite Automata:** **Regular Expressions (RE)**: Introduction, Identities of Regular Expressions, Finite Automata and Regular Expressions- Converting from DFA's to Regular Expressions, Converting Regular Expressions to Automata, applications of Regular Expressions. **Regular Grammars**: Definition, regular grammars and FA, FA for regular grammar, Regular grammar for FA. Proving languages to be non regular -Pumping lemma, applications, Closure properties of regular languages. **Finite Automata (FA):** Introduction, Deterministic Finite Automata (DFA) -Formal definition, simpler notations (state transition diagram, transition table), language of a DFA. **Nondeterministic Finite Automata (NFA):** Definition of NFA, language of an NFA, Equivalence of Deterministic and Nondeterministic Finite Automata, Applications of Finite Automata, Finite Automata with Epsilon Transitions, Eliminating Epsilon transitions, Minimization of Deterministic Finite Automata, Finite automata with output (Moore and Mealy machines) and Inter conversion. [CH-2 & 3: RB-1 John. C. Martin, TB-1 J.E. Hopcroft, R. Motwani and J. D Ullman]	14	35

3	**Context Free Grammer (CFG):** Derivation Trees, Sentential Forms, Rightmost and Leftmost derivations of Strings. Ambiguity in CFG's, Minimization of CFG's, CNF, GNF, Pumping Lemma for CFL's. [CH-2: TB-2 Micheal Sipser, CH-4: RB-1 John. C. Martin]	9	15
4	**Pushdown Automata:** Definition, Model, Acceptance of CFL, Acceptance by Final State and Acceptance by Empty stack and its Equivalence, Equivalence of CFG and PDA. [CH-5 & 6: RB-1 John. C. Martin]	9	15
5	**Turing Machine (TM):** TM Definition, Model of Computation, Turing Machine as Language Acceptor, TM that Compute Partial Function, Church Turning Thesis,Combining TM, Variations Of TM, Non Deterministic TM, Universal TM, Recursively and Enumerable Languages, Context sensitive languages and Chomsky hierarchy. [CH - 7 & 8: RB-1 John. C. Martin, CH-8: TB-1 J. E. Hopcroft, R. Motwani and J.D Ullman]	4	15
6	**Undecidability:** A Language That Can't Be Accepted, and a Problem That Can't Be Decided, Non Recursive Enumerable (RE) Language – Undecidable Problem with RE – Undecidable Problems about TM – Undecidable Problems Involving Context-Free Languages, Post's Correspondence Problem, The Class P and NP. [CH-9: TB-2 Micheal Sipser]	4	10

Course Outcome:

1. Use the concepts and techniques of discrete mathematics for theoretical computer science.
2. Identify different formal languages and their relationships.
14. 3. Classify and construct grammar for different languages and vice-versa.
15. 4. Build finite automata, push down automata and Turing machine.
16. 5. Analyze various concepts of undecidability and Computable Function and Discuss analytically and intuitively for problem-solving situation.

List of Textbooks:

1. J. E. Hopcroft, R. Motwani and J.D Ullman, ―Introduction to Automata Theory, Languages and Computations, Third Edition, Pearson Education, 2016.
2. Micheal Sipser, ―Introduction of the Theory and Computation, Thomson Brokecole, 3rd Edition, 2013.

List of Reference Books:

1. John. C. Martin, ―Introduction to Languages and the Theory of Computation

5th Sem

Subject Code: 10270504	**Subject Title: Data Analysis and Visualization**
Pre-requisite: Familiarity with at least one programming language, preferably Python including basic syntax, variables, loops, and functions.	

Course Objective:

This course is designed to introduce the students to real-world data analysis problems, their analysis and interpretation of results in the field of exploratory data science using Python.

1. Develop a foundational understanding of data types, data collection methods, and data cleaning techniques.
2. Learn to summarize and explore data patterns using statistical methods and descriptive analytics.
3. Gain proficiency in tools and programming languages such as Python (Pandas, NumPy) for analyzing data.
4. Learn to design clear, insightful visual representations of data using tools like Matplotlib, Seaborn, Tableau, or Power BI.
5. Develop the ability to draw actionable insights from data and effectively communicate findings to stakeholders through reports and dashboards.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	-	2	4	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction to basic statistics and analysis:** Fundamentals of Data Analysis,Types of data, Statistical foundations for Data Analysis, Types of Data Analysis, Correlation and Covariance.	10	22
2	**Array manipulation using Numpy:** Numpy array: Creating numpy arrays, various data types of numpy arrays, indexing and slicing, swapping axes, transposing arrays, data processing using Numpy arrays.	8	18
3	**Data Manipulation using Pandas:** Data Structures in Pandas: Series, Dataframe, Index objects, loading data into Panda's data frame, Working with Dataframe: Arithmetic's, Statistics, Binning, Indexing, Reindexing, Filtering, handling missing	10	22

	data, Hierarchical indexing, Data wrangling: Data cleaning, transforming, merging and reshaping.		
4	**Data Visualization and Reporting with Supervised learning** Linear Regression, Classification, clustering and decision tree. Statistical Hypothesis Generation and Testing Understanding Data Visualization and Reporting, Key Principles for Data Visualization and Reporting, Techniques of Effective Data Visualization, Techniques for Effective Reporting, Importance of Data Visualization and Reporting.	8	18
5	**Plotting and Visualization:** Using matplotlib to plot data: figures, subplots, markings, color and line styles, labels and legends, plotting functions in Pandas: Line bar, Scatter plots, histograms, stacked bars, Heatmap	9	20

Course Outcomes:
On completion of this course, the students will be able to:

1. Apply descriptive statistics to obtain a deterministic view of data
2. Perform data handling using Numpy arrays
3. Load, clean, transform, merge and reshape data using Pandas
4. Demonstrate knowledge of core design principles such as clarity, accuracy, simplicity, and audience-centric communication.
5. Visualize data using Pandas and matplotlib libraries.

List of Textbooks:

1. McKinney W. Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython. 2nd edition. O'Reilly Media, 2018.
2. Molin S. Hands-On Data Analysis with Pandas, Packt Publishing, 2019.
3. Gupta S.C., Kapoor V.K., Fundamentals of Mathematical Statistics, Sultan Chand & Sons, 2020.

List of Reference Books:

1. Chen D. Y, Pandas for Everyone: Python Data Analysis, Pearson, 2018.
2. Miller J.D. Statistics for Data Science, Packt Publishing, 2017.

Open e-Resource:

1. https://ieeexplore.ieee.org/document/7583967
2. https://onlinecourses.nptel.ac.in/noc21_cs45/preview
3. https://www.tutorialspoint.com/excel_data_analysis/data_analysis_overview.htm

Lists of Experiments:

Use data set of your choice from Open Data Portal (https:// data.gov.in/, UCI repository) or load from scikit, seaborn library for the following exercises to practice the concepts learnt.
1. Load a Pandas dataframe with a selected dataset. Identify and count the missing values in a dataframe. Clean the data after removing noise as follows
a. Drop duplicate rows.

b. Detect the outliers and remove the rows having outliers
c. Identify the most correlated positively correlated attributes and negatively correlated attributes
2. Import iris data using sklearn library or (Download IRIS data from: https://archive.ics.uci.edu/ml/datasets/iris or import it from sklearn.datasets)
a. Compute mean, mode, median, standard deviation, confidence interval and standard error for each feature.
b. Compute correlation coefficients between each pair of features and plot heatmap.
c. Find covariance between length of sepal and petal d. Build contingency table for class feature.
3. Load Titanic data from sklearn library, plot the following with proper legend and axis labels:
a. Plot bar chart to show the frequency of survivors and non-survivors for male and female passengers separately
b. Draw a scatter plot for any two selected features
c. Compare density distribution for features age and passenger fare
d. Use a pair plot to show pairwise bivariate distribution
4. Using Titanic dataset, do the following
a. Find total number of passengers with age less than 30
b. Find total fare paid by passengers of first class
c. Compare number of survivors of each passenger class

Semester-5

Subject Code: 10270505	**Subject Title: Full Stack Development (Full Stack-I)**
Pre-requisite: Basic knowledge of database, programming and web fundamentals.	

Course Objective (COs):

1. To become knowledgeable about the most recent web development technologies.
2. Idea for creating two tier and three tier architectural web applications.
3. Design and Analyse real time web applications.
4. Constructing suitable client and server side applications.
5. To learn core concept of both front end and back end programming.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	0	2	4	70	30	30	20	150

Sr. No	**Topic**	**Total H**	**Weight (%)**
1	**Why Full Stack Development**? Web development vs Full Stack Development , Client-Server architecture , Rules of three-tier architecture, MEAN, MERN, Rails, Django Stack and LAMP, MEAN vs MERN stack, Front End Frameworks and Libraries, Web, Web Browser, Web Server, Anatomy of a Website, Developer tools, inspector, Wireframing , Web hosting steps, HTML, HTML Document Object Model, W3C standards for HTML, Web development Basics - HTML & Web servers Shell - UNIX CLI Version control - Git &Github HTML, Why CSS? W3C CSS Validator, Syntax, Types, CSS Selectors, Cascading, Inheritance, Specificity, CSS pre-processor: Less, Sass and features	12	20

2	**Frontend Development:** Java script basics OOPS Aspects of JavaScript Memory usage and Functions in JS AJAX for data exchange with server jQuery Framework jQuery events, UI components etc. JSON data format.	11	19
3	**REACT JS:** Introduction to React ,React Router and Single Page Applications React Forms, Flow Architecture and Introduction to Redux More Redux and Client-Server Communication.	10	17
4	**Java Web Development:** JAVA PROGRAMMING BASICS, Model View Controller (MVC) Pattern MVC Architecture using Spring RESTful API using Spring Framework Building an application using Maven.	12	20
5	**Databases & Deployment:** Relational schemas and normalization Structured Query Language (SQL) Data persistence using Spring JDBC Agile development principles and deploying application in Cloud.	11	19

Course Outcome (COs):

1. To understand the Client-Server architecture and the basics of client-side programming languages and framework.
2. To examine of client-side languages: HTML, CSS, and JavaScript.
3. To implement client-side application development.
4. Gain Knowledge about the front end and back end Tools and to Create web pages that function using external data.
5.Implementation of web application employing efficient database access.

List of Text Books:

1. Web Design with HTML, CSS, JavaScript and JQuery Set Book by Jon Duckett ProfessionalJavaScript for Web Developers Book by Nicholas C. Zakas
2. Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step-by Step Guide to CreatingDynamic Websites by Robin Nixon
3. Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB. Copyright © 2015 BYAZAT MARDAN

List of Reference Books:

1. Meloni, J.C. and Kyrnin J, HTML,CSS, and JavaScript All in One, Sams Teach Yourself (5 th ed.), Pearson, 2018. ISBN 9789389552416.
2. Full-Stack JavaScript Development by Eric Bush.
3. Mastering Full Stack React Web Development Paperback – April 28, 2017 by TomaszDyl , Kamil Przeorski , Maciej Czarnecki

Open e-Resource:

1. https://www.geeksforgeeks.org/what-is-full-stack-development/
2. https://ieeexplore.ieee.org/document/8820551
3. https://www.mongodb.com/resources/basics/full-stack-development
4. https://aws.amazon.com/what-is/full-stack-development/

List of Suggested Experiments:

1. Write a program to create a simple webpage using HTML.
2. Write a program to create a website using HTML CSS and JavaScript?
3. Write a program to build a Chat module using HTML CSS and JavaScript?
4. Write a program to create a simple calculator Application using React JS
5. Write a program to create a voting application using React JS.
6. Write a program to create and Build a Password Strength Check using Jquery.
7. Write a program to create and Build a star rating system using Jquery.

8. Create a project on Project Management application.
9. Create a project on Content Management System for a blog.
10. Create a project on Grocery delivery application.

Semester-5

Subject Code: 10270506	**Subject Title: Security and Privacy for Big Data Analytics**
Pre-requisite: Computer science knowledge, basics of python,big data tools,database knowledge.	

Course Objective:

1.Understand security challenges and learn data privacy Principles.
2.Explore cryptographic and access control techniques.
3.Analyze privacy-preserving methods.
4.Secure big data platforms like Hadoop and Spark.
5.Detect and mitigate threats and understand how to apply privacy-aware analytics.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	-	2	4	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Unit 1: Introduction to Big Data and Security:** Overview of Big Data: Characteristics (Volume, Velocity, Variety, Veracity, Value). Big Data Ecosystem: Hadoop, Spark, NoSQL databases. Security and privacy concerns in Big Data. Challenges in securing Big Data environments. Case studies: Data breaches in big data systems	3	7
2	**Unit 2: Foundations of Security in Big Data:** Basic security concepts: Confidentiality, Integrity, Availability (CIA). Threats and vulnerabilities in big data systems. Authentication, Authorization, and Access Control. Security mechanisms for distributed systems. Secure communication: TLS, VPNs, and data encryption (in-transit & at-rest)	8	9
3	**Unit 3:Privacy in Big Data Analytics:**Privacy models and principles (Fair Information Practices, OECD guidelines). Legal frameworks: GDPR, HIPAA, CCPA. Data anonymization and pseudonymization techniques. K-anonymity, L-diversity, T-closeness.Differential privacy and its application in analytics.	6	15
4	**Unit 4:Cryptographic Techniques for Big Data:**Introduction to cryptography:symmetric and asymmetric encryption.Hash functions, digital signatures, key management. Homomorphic encryption and secure multiparty computation (SMPC). Blockchain and its use in data integrity and security.	7	15
5	**Unit 5: Big Data Platform Security:**Hadoop Security: HDFS, Kerberos authentication, data encryption.Apache Spark Security: Authentication, data encryption, UDF sandboxing.Role-based access control (RBAC) and audit logging in big data platforms.Securing NoSQL databases (MongoDB, Cassandra).Secure data lifecycle in the cloud (AWS, Azure, GCP).	5	7

6	**Unit 6:Privacy-Preserving Data Analytics:**Secure computation techniques. Federated learning and decentralized analytics. Privacy-preserving data mining and machine learning. Case studies: Google's RAPPOR, Apple's differential privacy. Trade-off between data utility and privacy.	3	7
7	**Unit 7: Threat Detection and Risk Management:** Intrusion Detection Systems (IDS) for Big Data. Log analysis and anomaly detection using machine learning.Threat modeling for big data environments. Risk assessment and mitigation strategies.	2	5
8	**Unit 8:Emerging Trends and Case Studies:** AI and ML in cybersecurity for big data.Secure IoT data analytics. Case studies on security frameworks in real-world big data systems .Future directions: Quantum cryptography, Zero Trust Architecture.	2	5

Course Outcome (COs):

1. Understand key security and privacy challenges in big data environments.
2. Apply cryptographic and privacy-preserving techniques to secure big data.
3. Analyze threats, vulnerabilities, and risk management in big data systems.
4. Design secure big data architectures and implement access control mechanisms.
5. Evaluate legal, ethical, and regulatory aspects of data privacy in analytics.

List of Textbooks:

1. "Security and Privacy in the Age of Big Data" *Authors:* Jules J. Berman *Publisher:* Elsevier
2. "Big Data: Principles and Best Practices of Scalable Real-Time Data Systems" *Author:* Nathan Marz and James Warren.
3. "Privacy-Preserving Data Mining" *Authors:* Charu C. Aggarwal and Philip S. Yu
4. "Security, Privacy, and Trust in Modern Data Management" *Authors:* Milan Petkovic and Willem Jonkar.

List of Reference Books:

1. "Big Data: Principles and Paradigms" *Editors:* Rajkumar Buyya, Rodrigo N. Calheiros, Amir Vahid Dastjerdi.
2. "Data Privacy: Foundations, New Developments and the Big Data Challenge" *Editors:* Sabine Gless, Thomas Hartmann.
3. "Big Data Analytics in Cybersecurity" *Editors:* Onur Savas, Julia Deng.
4. "Big Data and Privacy Rights: Balancing the Scales" *Author:* Nasir Memon
5. "Applied Cryptography: Protocols, Algorithms, and Source Code in C" *Author:* Bruce Schneier
6. "Big Data, Big Brother?" *Author:* John Feffer

Open e-Resource:

1. https://nptel.ac.in/courses/
2. https://onlinecourses.nptel.ac.in/noc23_cs127/preview
3. https://www.harvardonline.harvard.edu/course/data-privacy-technology

List of Experiments:

1.Implement symmetric and asymmetric encryption for files stored in HDFS using tools like OpenSSL or Hadoop TDE (Transparent Data Encryption).
2.Configure role-based access controls and audit logs in Hadoop ecosystem using Apache Ranger/Sentry.
3.Implementing Data Masking and Anonymization by use data anonymization techniques (e.g., k-anonymity, l-diversity) on sensitive datasets using Python or R.
4. Configure and verify secure communication between nodes using SSL/TLS.

5. Apply privacy-preserving data mining techniques (e.g., differential privacy) using Python libraries or frameworks like SmartNoise.
6. Perform STRIDE or DREAD analysis on a given big data architecture and identify potential security threats.
7. Set up and monitor audit logs in systems like Hadoop and Spark to track data access.
8. Use hashing algorithms (e.g., SHA-256) to ensure data integrity across distributed nodes.
9. Set up ABAC policies in a NoSQL database like MongoDB or Apache Cassandra.
10. Analyze a dataset for GDPR compliance, identifying personal data and implementing basic privacy controls.

5th Sem

Subject Code: 10270507	**Subject Title: Linux and Shell Programming**
Pre-requisite: Basic knowledge of Operating System, files, directories and file extensions	

Course Objective:

1. To develop the ability to write, debug, and execute shell scripts using Bash and other common shells.
2. To introduce students to the Linux operating system and its command-line interface.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	-	2	4	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction:** Introduction to Open Source technology, different flavors of Linux (ex:- Red Hat , Fedora, Ubuntu), Files System hierarchy, Logging in, changing password (passwd command only), longname, man, xman, date, cal, time, banner, info commands to access on line help. **Simple commands like** ls, cp, mv, wc, sort, tsort, cat, cut, grep, dd, head, tail, uniq, diff, echo, touch, which, whereis, whatis, type, who, whoami, finger, w (option and variations included), tty,uname, printf, ps, pwd , history, exec, kill, pkill, clear, lpstate, cancel, compress, uncompress, exit. **Directory commands like:** Brief introduction to file system, mkdir, dir, cd, df, dfspace, du, ll, dirname, rmdir, dir access permission, changing access permission for files and directories like: chmod, chgrp, chown, hard & soft links. Environments and path setting. I/O redirection & piping commands	12	24
2	**vi editor:** General startup of vi editor and it modes , Creating and editing files, features of vi, screen movement , cursor movement, insertion, deletion, searching,	9	18

	submitting operations, yank, put, delete commands, reading & writing files, exrc file for setting parameters, advance editing techniques, vim (improved vi).		
3	**Introduction to X-window system:** x-window as client/ server system, concept of window manager, remote computing & local displays, xinitrc file, customize X work environment and application, customizing the fvwm window manager. Introduction to package management using **yum** technology and **rpm** command, Browsing internet using **Mozilla Firefox** and **elinks** tool.	10	20
4	**Shell:** meaning and purpose of shell, introduction to types of shell. The command line, standard input and standard output , redirection , pipes , filters special characters for searching files and pathnames. **Bourne Again SHell**: shell script-writing and executing, command separation & grouping, redirection, directory stack manipulation, processes, parameters & variables, keyword variables. **Introduction Korn Shell and C Shell**	10	20
5	**Shell Programming:** Control structures, the Here document, expanding NULL or USET variables, Bulitins , functions, history , aliases, job control, file substitution, source code management- RCS and CVS. awk utility.	9	18

Course Outcomes:
On completion of this course, the students will be able to:

1. Understand the fundamental architecture and components of the Linux operating system.
2. Demonstrate proficiency in using essential Linux commands and utilities for file management, process control, and system navigation.
3. Apply knowledge of file systems, permissions, and user management in a Linux environment.
4. Develop and debug basic to intermediate Shell scripts using bash, incorporating variables, loops, conditionals, and functions.
5. Manage software packages and system services, and perform basic system administration tasks.

List of Textbooks:

1. B. A. Forouzan & Richard F. Gilberg, "Unix and Shell Programming", Cengage Learning.
2. Yashavant P. Kanetkar, "Unix Shell Programming", BPB Publications.
3. Richard Blum, Christine Bresnahan, "Linux Command Line and Shell Scripting Bible", Wiley.
4. Sumitabha Das, "Unix Concepts and Applications", McGraw Hill Education.

List of Reference Books:

1. W. Richard Stevens & Stephen A. Rago, "Advanced Programming in the UNIX Environment", Addison-Wesley.
2. Arnold Robbins & Nelson H.F. Beebe, "Classic Shell Scripting", O'Reilly Media.

Open e-Resource:

1. https://archive.nptel.ac.in/courses/117/106/117106113/
2. https://www.tutorialspoint.com/unix/shell_scripting.htm

List of Experiments:

1. Use of Basic Unix Shell Commands: ls, mkdir, rmdir, cd, cat, banner, touch, file, wc, sort, cut, grep, dd, dfspace, du, ulimit.
2. Commands related to inode, I/O redirection and piping, process control commands, mails.
3. Shell Programming: Shell script based on control structure- If-then-fi, if-then else-if, nested if-else, to find:
    - 3.1 Greatest among three numbers.
    - 3.2 To find a year is leap year or not.
    - 3.3 To input angles of a triangle and find out whether it is valid triangle or not.
    - 3.4 To check whether a character is alphabet, digit or special character.
    - 3.5 To calculate profit or loss.
4. Shell Programming - Looping- while, until, for loops
    - 4.1 Write a shell script to print all even and odd number from 1 to 10.
    - 4.2 Write a shell script to print table of a given number
    - 4.3 Write a shell script to calculate factorial of a given number.
    - 4.4 Write a shell script to print sum of all even numbers from 1 to 10.
    - 4.5 Write a shell script to print sum of digit of any number.
5. Shell Programming - case structure, use of break
    - 5.1 Write a shell script to make a basic calculator which performs addition, subtraction, Multiplication, division
    - 5.2 Write a shell script to print days of a week.
    - 5.3 Write a shell script to print starting 4 months having 31 days.
6. Shell Programming - Functions
    - 6.1 Write a shell script to find a number is Armstrong or not.
    - 6.2 Write a shell script to find a number is palindrome or not.
    - 6.3 Write a shell script to print Fibonacci series.
    - 6.4 Write a shell script to find prime number.
    - 6.5 Write a shell script to convert binary to decimal and decimal to binary
7. Write a shell script to print different shapes- Diamond, triangle, square, rectangle, hollow square etc.
8. Shell Programming – Arrays
    - 8.1 Write a C program to read and print elements of array.
    - 8.2 Write a C program to find sum of all array elements.
    - 8.3 Write a C program to find reverse of an array.
    - 8.4 Write a C program to search an element in an array.
    - 8.5 Write a C program to sort array elements in ascending or descending order.

Semester 5

Subject Code: 10270509	**Subject Title: .Node JS and its Application**
Prerequisite: Core Java, Database Management System, Basic of Web Programming	

Course Objective:

1. To provide in-depth knowledge of advanced Java features including multithreading, networking, and I/O streams.
2. To introduce Java APIs for database connectivity using JDBC and building GUI applications using AWT and Swing.
3. To enable students to design and develop web applications using Java technologies such as Servlets and JSP.

4. To develop the ability to apply Java concepts in enterprise application development and promote software reuse through frameworks and packages.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory		Practical		
Lecture	Tutorial	Practical	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total
3	-	2		70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Java Networking:** Network Basics and Socket overview, TCP/IP client sockets, URL, TCP/IP server sockets, Datagrams, java.net package Socket, ServerSocket, InetAddress, URL, URLConnection [T.B-1:Black Book " Java server programming"- CH-3]	4	5
2	**JDBC Programming:** The JDBC Connectivity Model, Database Programming: Connecting to the Database, Creating a SQL Query, Getting the Results, Updating Database Data, Error Checking and the SQLException Class, The SQLWarning Class, The Statement Interface, PreparedStatement, CallableStatement The ResultSet Interface, Updatable Result Sets, JDBC Types, Executing SQL Queries, ResultSetMetaData, Executing SQL Updates, Transaction Management. [TB-1:Black Book " Java server programming" - CH-4]	6	10
3	**Servlet API and Overview Servlet Model:** Overview of Servlet, Servlet Life Cycle, HTTP Methods Structure and Deployment descriptor ServletContext and ServletConfig interface, Attributes in Servlet, Requestdispatcher interface.The Filter API: Filter, FilterChain, Filter Config Cookies and Session Management: Understanding state and session, Understanding Session Timeout and Session Tracking, URL Rewriting [TB-2:Complete Reference J2EE by James Keogh- CH-11]	8	25
4	**Java Server Pages:** JSP Overview: The Problem with Servlets, Life Cycle of JSP Page, JSP Processing, JSP Application Design with MVC, Setting Up the JSP Environment, JSP Directives, JSP Action, JSP Implicit Objects JSP Form Processing, JSP Session and Cookies Handling, JSP Session Tracking JSP Database Access, JSP Standard Tag Libraries, JSP Custom Tag, JSP Expression Language, JSP Exception Handling, JSP XML Processing [TB-2:Complete Reference J2EE by James Keogh- CH-12]	6	25
5	**Java Server Faces:** Introduction to JSF, JSF request processing Life cycle, JSF Expression Language, JSF Standard Component, JSF Facelets Tag, JSF Convertor Tag, JSF Validation Tag, JSF Event Handling and Database Access, JSF Libraries: PrimeFaces [TB-2:Complete Reference J2EE by James Keogh - CH-14]	6	10
6	**Hibernate:** Overview of Hibernate, Hibernate Architecture, Hibernate Mapping Types, Hibernate O/R Mapping, Hibernate Annotation, Hibernate Query Language [RB-1:Java Persistence with Hibernate by Christian Bauer -CH-1,2]	6	15
7	**Java Web Frameworks:** Spring MVC Overview of Spring, Spring Architecture, bean life cycle, XML Configuration on Spring, Aspect – oriented Spring, Managing Database, Managing Transaction**.** [TB-1:Black Book " Java server programming"- CH-7]	6	10

Course Outcome:

1. Implement Networking and Database connectivity in Java for given application
2. Implement a web page with dynamic content and a server side web application using Servlet and JSP.
3. Use web application framework JSF to build user interfaces.
4. Use Object Relation Mapping using Hibernate to build database dependent applications
5. Apply Model-View-Controller architecture to build complex client-server applications.

List of Textbooks:

1. Black Book " Java Server Programming" J2EE, 1st ed., Dream Tech Publishers, 2020.
2. Complete Reference J2EE by James Keogh mcgraw publication, 2021.

List of Reference Books:

1. Java Persistence with Hibernate by Christian Bauer, Gavin King
2. Spring in Action 3rd edition , Craig walls, Manning Publication
3. Hibernate 2nd edition, Jeff Linwood and Dave Minter, Beginning Après publication
4. Java Server Faces in Action, Kito D. Mann, Manning Publication
5. Beginning JSP, JSF and Tomcat, Giulio Zambon, Apress

Open e-Resource:

1. https://nptel.ac.in/courses/106105191/
2. http://nptel.ac.in/courses/1056105192/
3. https://www.tutorialspoint.com/
4. https://www.geeksforgeeks.org/introduction-java-servlets/

List of Suggested Experiments:

1. Implement TCP Server for transferring files using Socket and ServerSocket.
2. Implement cookies to store firstname and lastname using Java server pages.
3. Implement the shopping cart for users for the online shopping. Apply the concept of session.
4. Implement student registration form with enrollment number, first name, last name, semester, contact number. Store the details in database. Also implement search, delete and modify facility for student records.
5. Write a Servlet program to print system date and time.
6. Design a web page that takes the Username from user and if it is a valid username prints "Welcome Username". Use JSF to implement.
7. Write Hibernate application to store customer records and retrieve the customer record including name, contact number, address.
8. Write an application to keep record and retrieve record of student. The record includes student id, enrollment number, semester, SPI. Use MVC architecture

Semester-6

Subject Code: 10270601	**Subject Title: Artificial Intelligence and Machine Learning**
Pre-requisite: Basic Knowledge of python programming and Fundamental concepts of linear algebra, probability, statistics, algorithms and data structures	

Course Objective:

1. To introduce fundamental concepts and techniques in AI and ML.
2. To study various problem-solving, knowledge representation, and reasoning techniques in AI.
3. To understand core ML algorithms and their real-world applications.
4. To develop skills to design and implement AI/ML models using programming tools.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory		Practical		
Lecture	Tutorial	Practical	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total
3	-	2	4	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction to Artificial Intelligence:**History and evolution of AI,Applications of AI: Expert Systems, Robotics, Natural Language Processing,Intelligent agents: types, structure, and environment,Problem-solving: Search strategies — Uninformed (BFS, DFS) & Informed (Heuristics, A*)	12	23
2	**Knowledge Representation and Reasoning:**Propositional and Predicate Logic,Rule-based Systems,Semantic Networks and Frames,Reasoning under Uncertainty: Bayesian Networks,Fuzzy Logic and Expert Systems	10	19
3	**Introduction to Machine Learning:**What is Machine Learning? Types: Supervised, Unsupervised, Reinforcement Learning,Steps in building an ML model,Performance metrics: Accuracy, Precision, Recall, F1-Score	10	19
4	**Supervised Learning Algorithms:**Linear and Logistic Regression,Decision Trees and Random Forests,Support Vector Machines,k-Nearest Neighbors,Model Evaluation and Cross-validation	9	17
5	**Unsupervised Learning Algorithms:**Clustering,k-Means,Hierarchical Clustering, Dimensionality Reduction: PCA, t-SNE,Association Rule Learning: Apriori, Eclat,Reinforcement Learning basics: Markov Decision Processes, Learning,Neural Networks and Deep Learning (Intro),Overview of Natural Language Processing (NLP),Current Trends: AI Ethics, Bias in ML, Explainable AI	10	19

Course Outcome (COs):
On completion of this course, the students will be able to:

1. Explain the fundamental concepts, principles, and applications of Artificial Intelligence and Machine Learning.
2. Apply appropriate AI problem-solving techniques.
3. Demonstrate the ability to represent knowledge using suitable logic and reasoning approaches.
4. Implement various supervised and unsupervised machine learning algorithms.
5. Analyze and evaluate the performance of AI and ML models using standard datasets and appropriate performance metrics.

List of Textbooks:
1. Artificial Intelligence: A Modern Approach by Stuart Russell & Peter Norvig
2. Pattern Recognition and Machine Learning by Christopher M. Bishop

3. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow by Aurélien Géron

List of Reference Books:

1. Stuart Russell & Peter Norvig, *Artificial Intelligence: A Modern Approach* (3rd or 4th Edition) — Pearson.
2. Elaine Rich, Kevin Knight, and Shivashankar B. Nair, *Artificial Intelligence* (3rd Edition) — McGraw-Hill.
3. Nils J. Nilsson, *Artificial Intelligence: A New Synthesis* — Morgan Kaufmann

Open e-Resource:

1. https://www.coursera.org/in/articles/python-libraries-for-data-science
2. https://www.edx.org/learn/python
3. https://docs.edx.org/

List of Suggested Experiments:

1. Implement BFS for traversing a simple graph or maze.
2. Implement DFS for a graph or puzzle-solving.
3. Apply A* for finding the shortest path on a simple grid or map.
4. Create a basic IF-ELSE expert system for diagnosing common cold or advising a student.
5. Develop a fuzzy logic controller for fan speed control using temperature input.
6. Load a CSV file, clean missing values, and split data for training/testing.
7. Predict house prices or student marks using linear regression.
8. Perform binary classification (e.g., pass/fail prediction).
9. Build and visualize a decision tree using the Iris dataset.
10. Cluster sample data into groups and plot the results.
11. Train a simple neural network to classify handwritten digits (MNIST).

6th Sem

Subject Code: 10270602	**Subject Title: Information System Security**
Pre-requisite: Basic Knowledge of Computer Networks	

Course Objective:

1. Identify and assess various types of security threats, attacks, and vulnerabilities affecting computer systems and networks.
2. Learn about cryptographic techniques, access control models, authentication protocols, firewalls, and intrusion detection/prevention systems.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory		Practical		
Lecture	Tutorial	Practical	Credit	University Assessment	ContinuousAssessment	University Assessment	ContinuousAssessment	Total
3	1	-	4	70	30	00	00	100

Subject Contents

Sr. No	Topic	Total Hours	Weight (%)
1	**Introduction to security attacks**: services and mechanism, classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, stream and block ciphers.	8	16
2	**Modern block ciphers:** Block Cipher structure, Data Encryption standard (DES) with example, strength of DES, Design principles of block cipher, AES with structure, its transformation functions, key expansion, example and implementation. Multiple encryption and triple DES, Electronic Code Book, Cipher Block Chaining Mode, Cipher Feedback mode, Output Feedback mode, Counter mode.	12	24
3	**Public Key Cryptosystems with Applications:** Requirements and Cryptanalysis, RSA cryptosystem, Rabin cryptosystem, Elgamal cryptosystem, Elliptic curve cryptosystem.	7	14
4	**Cryptographic Hash Functions, their applications:** Simple hash functions, its requirements and security, Hash functions based on Cipher Block Chaining, Secure Hash Algorithm (SHA). Message Authentication Codes, its requirements and security, MACs based on Hash Functions, Macs based on Block Ciphers. Digital Signature, its properties, requirements and security, various digital signature schemes (Elgamal and Schnorr), NIST digital Signature algorithm.	11	22
5	**Key management and distribution:** symmetric key distribution using symmetric and asymmetric encryptions, distribution of public keys, X.509 certificates, Public key infrastructure. Remote user authentication with symmetric and asymmetric encryption, Kerberos Web Security threats and approaches, SSL architecture and protocol, Transport layer security, HTTPS and SSH.	12	24

Course Outcomes:

On completion of this course, the students will be able to:

1. Understand the fundamental security services and mechanisms used to protect data and communication systems.

2. Gain a comprehensive understanding of block cipher structures, including DES and AES algorithms.
3. Analyze and implement key public-key.
4. Apply cryptographic hash functions in ensuring data integrity, authentication, and digital signatures across various security applications.
5. Implement remote user authentication mechanisms, explore Kerberos, and analyze web security threats.

List of Textbooks:

1. Atul Kahate, Cryptography and Network Security,4th Edition, mcgraw hill 2017.
2. Tansu Alpcan,Network Security: A Decision and Game-Theoretic Approach, Cambridge University 2010.

List of Reference Books:

1. Bragg, Roberta Network security: the complete reference, New York: McGraw-Hill/Osborne,2004
2. Dr.Bhuvan Unhelkar, Information Systems Security: Security Management, Metrics, Frameworks and Best Practices, 2ed, w/cd | e,2017, WILLY

Open e-Resource:

1. https://ieeexplore.ieee.org/document/9030484
2. https://www.tutorialspoint.com/principles-of-information-system-security

Semester - 6

Subject Code: 10270603	**Subject Title: Software Engineering & Design**
Pre-requisite: Basic Programming Knowledge – Proficiency in at least one programming language such as C, C++	

Course Objective:

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	-	2	4	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction:**software life-cycle models,software requirements specification, formal requirements specification, verification and validation.	8	18

2	**Software Project Management:** Objectives, Resources and their estimation, LOC and FP estimation, effort estimation, COCOMO estimation model, risk analysis, software project scheduling.	9	20
3	**Requirement Analysis:** Requirement analysis tasks, Analysis principles. Software prototyping and specification data dictionary, Finite State Machine (FSM) models. Structured Analysis: Data and control flow diagrams, control and process specification behavioral modeling	10	22
4	**Software Design:** Design fundamentals, Effective modular design: Data architectural and procedural design, design documentation.	8	18
5	**Object Oriented Analysis:** Object oriented Analysis Modeling, Data modeling. Object Oriented Design: OOD concepts, Class and object relationships, object modularization, Introduction to Unified Modeling Language	10	22

Course Outcomes (COs):

1. Understand the fundamental concepts of software engineering and explain the software development life cycle models.
2. Analyze software requirements and apply appropriate models and methods for requirement engineering.
3. Design effective software solutions using structured and object-oriented design principles.
4. Apply testing techniques and quality assurance methods to evaluate software systems.
5. Demonstrate use of software project management tools and practices to estimate cost, effort, and schedule.

List of Textbooks:

1. “Software Engineering” by Ian Sommerville Edition: 9th or later Publisher: Pearson Education.
2. “Software Engineering: A Practitioner's Approach” by Roger S. Pressman and Bruce R. Maxim Edition: 8th or later Publisher: McGraw-Hill

List of Reference Books:

1. Object-Oriented and Classical Software Engineering by Stephen R. Schach Publisher: McGraw-Hill
2. Software Engineering Fundamentals by Ali Behforooz and Frederick J. Hudson Publisher: Oxford University Press
3. Head First Software Development by Dan Pilone and Russ Miles Publisher: O’Reilly Media

Open e-Resource:

1. https://www.geeksforgeeks.org/software-engineering-introduction-to-software-engineering/
2. https://onlinecourses.nptel.ac.in/noc20_cs68/preview

List of Suggested Experiments:

1. Development of requirements specification, function oriented design using SA/SD, object-oriented design using UML, test case design, implementation using Java and testing. Use of appropriate CASE tools and other tools such as configuration management tools, program analysis tools in the software life cycle.
2. Develop Software Requirements Specification (SRS) for a given problem in IEEE template.
3. Develop DFD model (level-0, level-1 DFD and Data dictionary) of the project.
4. Develop structured design for the DFD model developed.
5. Developed all Structure UML diagram of the given project.
6. Develop Behavior UML diagram of the given project.
7. Manage file, using ProjectLibre project management software tool.

Semester - 6

Subject Code: 10050602	**Subject Title: Internet of Things**
Prerequisite: C Programming, Microprocessor, Networking	

Course Objective:

1. To understand the application areas of IoT.
2. To understand the building blocks of the Internet of Things and characteristics.
3. To understand the revolution of the Internet in Mobile Devices, Cloud & Sensor networks.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
2	-	2	3	70	30	30	20	150

	Subject Contents			
Sr. No.	**Topic**	**IEEE Blended**	**Total Hours**	**Weight (%)**
1	**Introduction to Internet of Things:** Application areas of IoT, Characteristics of IoT, Things in IoT, IoT stack, Enabling, technologies, IoT challenges, IoT levels, IoT and cyber physical system, IoT and WSN, Industrial IOT and Consumer IOT, IOT Functional Blocks.[T.B-1:IoT Fundamentals-CH-1]	**IEEE**	4	15
2	**Sensors, Microcontrollers, and Their Interfacing:** Sensor interfacing, Types of sensors, Controlling sensors, Microcontrollers, ARM, Thing Architecture.[NPTEL : week 4]	**IEEE**	4	15
3	**Protocols for IoT :** Messaging protocols, Transport protocols, IPv4, IPv6, URI (Layer), Information Sensing Actuation. [NPTEL : week 3]	**IEEE**	6	10
4	**Cloud for IoT:** IoT and cloud, Fog computing, Security in cloud, Case study, Nano Technology & Industry 4.0, (Technology that support IOT growth – cloud).[NPTEL : week 9]	**IEEE**	4	10
5	**Application Building with IoT:** Various application of IoT : Food, Healthcare, Lavatory maintenance, Water quality, Warehouse, Retail, Driver Assistance, Collision impact, M2M & IOT.[T.B-1:IoT Fundamentals-CH-6,7]	**IEEE**	4	20

6	**Arduino and Raspberry Pi:** Arduino : Architecture, Programming and Application_Raspberry Pi : Architecture, Programming and Application [NPTEL : week 5]	**IEEE**	6	15
7	**IoT Security:** Various security issues and need, architecture, requirement, challenges and algorithms, Standards: National and International Scenario.[T.B-1:IoT Fundamentals-CH-8]	**IEEE**	2	15

Course Outcome(COs):

1. Demonstrate the architecture and functioning of IoT systems including the sensors and microcontrollers with their interfacing and software need considering application areas.
2. Diagnose the various IoT protocols with detailing of their elements and overall functioning within IoT systems for efficient communication.
3. Design an IoT system to take the benefit of the Clouds for computing and storage considering security issues.
4. Leverage the benefits of IoT technologies for automating the various real-life challenges in various application areas.
5. Develop the software components of an IoT system using Arduino/Raspberry Pi Programming.

List of Textbooks:

1. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things by David Hanes, Gonzalo Salgueiro, Patrick Grossetete
2. Learning Internet of Things by Peter Waher
3. 5G for the Connected World" by Devaki Chandramouli, Rainer Liebhart

List of Reference Books:

1. Internet of Things, Vasudevan, Nagrajan and Sundaram, Wiley India
2. IoT Fundamentals, David Hence at el, Cisco Press
3. 21 IoT Experiments, Yashavant Kanetkar, Shrirang Korde, BPB
4. IoT Based Projects, Rajesh Singh at el, BPB

Open e-Resource:

1. https://www.tutorialspoint.com/internet_of_things/index.htm/
2. https://aws.amazon.com/iot/

List of Suggested Experiments:

Practical should be performed by students based on Using Arduino or Raspberry Ri boards and its software platforms

Semester-6

Subject Code: 10270604	**Subject Title: Full Stack Development (Full Stack-II)**
Pre-requisite: Basic knowledge of database, programming and web fundamentals.	

Course Objective (COs):

1. To master advanced front-end frameworks and state management

2. To build robust, secure RESTful APIs with authentication

3. To integrate front-end and back-end efficiently.

4. To apply best practices for deployment and DevOps.

5. o develop full-fledged real-world applications using modern stacks.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	0	2	4	70	30	30	20	150

Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Advanced React Development:** React Hooks (useState, useEffect, useContext), Advanced Routing with React Router, State Management using Redux, Performance Optimization, Code Splitting.	12	25
2	**Node.js & Express.js:** Creating RESTful APIs, Middleware, JWT Authentication & Authorization, Error Handling, File Uploads, CORS, Rate Limiting.	12	22
3	**Advanced Database Operations:** Mongoose ODM, Data Validation, Relationships (Embedding & Referencing), Aggregation Framework, Transactions in MongoDB.	10	17
4	**Testing & Security:** API Testing with Postman & Jest, Unit & Integration Testing, Securing Applications (Helmet, HTTPS, Input Sanitization), Role-based Access Control.	11	19
5	**Deployment & DevOps Basics:** Environment Variables, Deploying MERN Apps on Cloud (Heroku/Vercel), MongoDB Atlas, CI/CD Pipelines, Docker Basics, Monitoring & Logging	10	17

Course Outcome (COs):

1. Implement advanced front-end logic with React Hooks and Redux..

2. Develop secure and scalable REST APIs using Node.js and Express.js.

3. Perform complex database operations and handle large data efficiently.

4Test, secure and deploy full-stack applications on the cloud.

5. Deliver a robust, real-world full-stack project applying DevOps principles.

List of Text Books:

1. Full Stack JavaScript Development With MEAN by Colin J. Ihrig
2. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node by Vasan Subramanian
3. Learning React: Functional Web Development with React and Redux by Alex Banks & Eve Porcello

List of Reference Books:

1. Node.js Design Patterns by Mario Casciaro
2. React Up & Running by Stoyan Stefanov
3. Mastering Mongoose by Alex Young

Open e-Resource:

1. https://nodejs.org/docs/latest/api/
2. https://legacy.reactjs.org/Express Docs/
3. https://mongoosejs.com/docs/

List of Suggested Experiments:

1. Create a React app using Hooks and Context API for state management.
2. Implement React Router with nested routes and route guards.
3. Develop a secure RESTful API with JWT-based user authentication.
4. Create a file upload feature (e.g., profile image upload) using Express and Multer.
5. Design and connect advanced MongoDB schemas with Mongoose (relationships & references).
6. Write unit and integration tests for APIs using Jest or Mocha.
7. Implement role-based access control in your REST API.
8. Deploy a MERN stack app to Heroku/Vercel with a connected MongoDB Atlas database.
9. Containerize your full-stack application using Docker (optional advanced task).
10. Final Capstone Project: Build a complete real-world application (e.g., E-commerce app, Social Media Platform, Task Management System) covering all learned concepts.

Semester -VI

Subject Code: 10270605	**Subject Title:** Programming Methodologies for Backend Development (Mongo DB)
Pre-requisite: Knowledge of any programming language, JavaScript, RDBMS.	

Course Objective:

1. A MongoDB course aims to provide learners with the skills and knowledge to manage and develop applications using the MongoDB database.
2. Focusing on its document-oriented approach and features.
3. It covers fundamental concepts like CRUD operations, data modeling, and querying.
4. It also covers advanced topics such as indexing, aggregation, replication, and sharding.
5. The course also explores best practices and deployment strategies for MongoDB in production environments.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**ContinuousAssessment**	**University Assessment**	**ContinuousAssessment**	**Total**
3	-	2	4	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction:** Introduction of MongoDB, No SQL Database, Advantage over RDBMS, MongoDB Data Types, Install MongoDB, MongoDB Data Modeling.	4	10
2	**MongoDB Operators:** Query & Projection Operator, MongoDB Update Operator, Aggregation Pipeline Stages, MongoDB limit(), MongoDB sort(), Query Modifiers.	6	12
3	**Database Commands:** Aggregation Commands, Geospatial Command, Query and Write Operation Commands, Query Plan Cache Commands, Authentication Commands, User Management Commands, Role Management Commands, Replication Command, Shading Commands, Session Commands.	8	15
4	**Database and Collection:** Create Database, Drop Database, Create Collection, Drop Collection.	4	15
5	**CRUD : Documents:** Insert Documents, Update Documents, Delete Documents, Query Documents, SQL to MongoDB Mapping, MongoDB text search, Partial Updates & Document Limits, Removing Documents, Multi Update, Upsert, Wire Protocol, Bulk() Operations and Methods, Common Commands, db.runCommand(),db.isMaster(),db.serverStatus(),db.currentOp() & db.killOp(),collection.stats() & collection.drop().	8	15
6	**MongoDB Shell:** MongoDB Shell, Shell Collection Methods, Cursor Method, MongoDB Database Commands, Query Plan Cache Methods, User Management Method, Role Management Method, MongoDB Replication Methods.	7	15

7	**MongoDB Cloud:** MongoDB Stitch, MongoDB Atlas, MongoDB Cloud Manager, MongoDB Ops Manager.	4	10
8	**MongoDB Tools:** MongoDB Compass, MongoDB BI connector.	4	8

Course Outcomes(COs):

On completion of this course, the students will be able to:

1. To understand the basic concepts of NoSQL databases.
2. To understand how to create and manage MongoDB databases and collections.
3. To understand how to work with MongoDB documents and BSON format.
4. To understand how to perform CRUD operations in MongoDB.
5. To understand how to use MongoDB query operators and aggregation.

List of Textbooks:

1. Introduction to NoSQL with MongoDB**,** Deepak Vohra, Apress.
2. Database Management Systems using MongoDB (Academic-Focused Textbook), Seema Kedar, Technical Publications.

List of Reference Books:

1. MongoDB: The Definitive Guide, 3rd (2020) edition, Shannon Bradshaw, Eoin Brazil, Kristina Chodorow, O'Reilly Media.
2. Learning MongoDB, Sandeep Panda, Packt Publishing.
3. MongoDB Basics, Peter Membrey, David Hows, Apress.
4. NoSQL with MongoDB in 24 Hours, Sams Teach Yourself, Brad Dayley, Sams Publishing.

Open e-Resource:

1. https://www.w3schools.com/mongodb/
2. https://www.tutorialspoint.com/mongodb/index.htm

List of Suggested Experiments:

1. Installation of MongoDB in your system.
2. Create an employee collection with mentioned fields Employee (eno,ename,salary,desig,dept:{deptno,deptname,location},project:{pname,hrs})
3. Insert 10 documents in employee collection.
4. Display all the documents from employee collection.
5. Display all employee whose name start with “S”.
6. Display all employee with the designation “Manager”.
7. Display all employee with salary > 50000 and salary < 80000.
8. Update no. of hrs to 7 for pname=_____.
9. Remove all employees working on pname=_____.
10. Remove employees whose name start with “M”.
11. **Semester-VI**

Subject Code: **10270607**	**Subject Title: Cyber Security with Blockchain**
Pre-requisite: Basic knowledge of networking, cryptography, and computer systems.	

12.

13. **Course Objective:**
14. (1) To introduce the fundamental concepts of cyber security threats, vulnerabilities, and protection mechanisms.
15. (2) To explore various cyber-attack vectors and defensive tools.
16. (3) To understand the principles and applications of blockchain in securing digital transactions. (4) To study smart contracts and their role in cyber security.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
Lecture	**Tutorial**	**Practical**	**Credit**	**Theory**		**Practical**		**Total**
				University Assessment	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	
3	0	2	4	70	30	30	20	150

17.

	Subject Contents		
Sr. No	**Topic**	**Total Hours**	**Weight (%)**

1	**Introduction to Cyber Security:**Cyber Security Overview: CIA Triad (Confidentiality, Integrity, Availability),Types of Threats and Attacks: Malware, Phishing, Social Engineering,Vulnerabilities, Exploits, and Risk,Network Security Fundamentals: Firewalls, VPN, IDS/IPS,Authentication & Authorization Concepts**.**	8	25%
2	**Security Mechanisms & Practices**:Cryptography Basics: Symmetric, Asymmetric, Hash Functions,Digital Signatures & Certificates (PKI),Secure Communication Protocols: HTTPS, SSL/TLS,Security in Web Applications: OWASP Top 10,Security Policies, Risk Management, and Compliance**.**	8	25%
3	**Blockchain Technology Fundamentals**:Blockchain Basics: Blocks, Chains, Hashing,Distributed Ledger and Consensus Mechanisms (PoW, PoS),Types of Blockchains: Public, Private, Consortium,Blockchain vs Traditional Databases,Blockchain Applications: Finance, Supply Chain, Voting	8	25%
4	**Blockchain for Security and Smart Contracts**:Using Blockchain for Cyber Security: Identity Management, Data Integrity,Immutable Logs and Forensics,Introduction to Smart Contracts: Ethereum & Solidity,Security of Smart Contracts & Vulnerabilities (e.g., Reentrancy),Case Studies: Blockchain-based Security Systems	8	25%

18.

19. **Course Outcome(COs):**

20.

21. On completion of this course, the students will be able to:

22. 1. Understand key concepts of cyber security and common attack techniques.
23. 2. Analyze threats and apply preventive measures to defend systems.
24. 3. Understand the structure and functioning of blockchain technology.
25. 4. Apply blockchain to solve security-related problems. Evaluate the security of smart contracts and decentralized applications.
26. 5. Understand fundamental concepts and types of machine learning.

27. **List of Text Books:**
28. 1. William Stallings – Computer Security: Principles and Practice, Pearson
29. 2. Josh Thompson – Blockchain Basics: A Non-Technical Introduction, O'Reilly

30. **List of Reference Books:**
31. 1. Kevin Murphy,"Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
    2. Peter Harrington, Manning, "Machine Learning in Action", Dreamtech press 3.
    Jason Bell, "Machine Learning for Big Data", Wiley
32. 4. Michael Bowles, "Machine Learning in Python", Wiley

33. 5. Yuxi Liu, "Python Machine Learning By Example", Packt

34. **Open e-Resource:**
35. 1. https://www.kaspersky.com/resource-center/definitions/what-is-blockchain-security
    2. https://onlinecourses.nptel.ac.in/noc22_cs44/preview
36. 3. https://ieeexplore.ieee.org/document/9115738

List of Suggested Experiments:

1. Fake Website Detector A simple tool that checks if a website is suspicious based on its URL and warning signs. Can be made using HTML + JavaScript or Python.
2. Password Strength Checker A tool to check how strong a user's password is. Gives tips to create strong passwords.
3. Simple File Encryption Tool Build a small app that encrypts and decrypts files using a key.
Use basic Python or Java.
4. Blockchain-based Student Record System Save student details (like name and marks) securely on a blockchain. Use a simple private blockchain setup.
5. Basic Phishing Awareness Website A website that teaches users about phishing with examples and quizzes.
6. Secure Login System Create a login page that stores hashed passwords. Uses MD5/SHA-256 hashing for security.
7. Simple Blockchain in Python Create a blockchain that stores a few blocks with simple data.
No real cryptocurrency—just for learning the chain concept.
8. Two-Factor Authentication Demo Good for awareness programs.
10. Email Spoofing Demo (Educational) Show how fake emails can be sent and how to detect them. Only for lab/demo purposes (ethical use).
11. Smart Contract for Voting (Basic) A simple contract that counts votes securely on Ethereum testnet using Remix IDE.
12. Secure Chat App (Mini Version) A simple chat between two users using basic encryption like Caesar Cipher or AES.

Semester 7

Subject Code:	**Subject Title: Wireless Communication**
Pre-requisite: It is desirable that student is familiar with following domains: Digital and analog Communication, Signals & Systems.	

Course Objective:

1. Summarize the basics of cellular system and cellular design fundamentals.
2. Describe the wireless channel models and discuss capacity of wireless channels.
3. Illustrate how receiver performance can be enhanced by various diversity techniques.
4. Identify advantages of various equalization techniques and multiple-access techniques in wireless communication.
5. Calculate system parameters such antenna height, range, maximum usable frequency in different modes of radio wave propagation.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**

3	-	2	4	70	30	30	20	150

Subject Contents

Sr. No	Topic	Total Hours	Weight (%)
1	**Introduction to Wireless Communication Systems** Introduction to Wireless Communication Systems: Generations: 2G, 3G, 4G, 5G. Wireless LAN, Bluetooth and Personal Area networks, Broadband Wireless Access -- WiMAX Technology. Wireless Spectrum allocation, Standards. Cellular System Design Fundamentals (4): Frequency Reuse, channel assignment strategies, Handoff strategies, Interference and system capacity, trunking and grade off service, improving coverage and capacity – cell splitting, sectoring, microcells.	8	15
2	**Wireless Channels** Path loss and shadowing: Free space path loss, Two-Ray model, Shadowing, Statistical Multipath Channel Models: Time-varying channel impulse response, Narrowband fading, Wideband fading models, Delay spread and Coherence bandwidth, Doppler spread and Coherence time, Flat fading versus frequency selective fading, Slow fading versus fast fading, Discrete-time model. Capacity of Wireless Channels: Review of Capacity in AWGN, Capacity of flat fading channel – Ergodic capacity, Capacity with Outage, Capacity with CSI-R.	7	20
3	**Modulation techniques** Digital Signaling for Flat fading Channels: Analysis of Average Error Probability and Outage probability of BPSK in flat-fading channels. Multi-carrier Modulation: Data transmission using multicarrier modulation for frequency-selective fading channels. Overlapping subchannels, Mitigation of Subcarrier Fading, Discrete Implementation of multicarrier – OFDM. Cyclic prefix, Peak-to-average-power-ratio.	7	15
4	**Radio Wave Propagation** Ground wave propagation, Plane earth reflection, Space wave and surface wave, Spherical earth propagation, Tropospheric waves, Ionospheric propagation, Effects of earth's magnetic field, Critical frequency, Maximum usable Frequency, Virtual height.	7	10
5	**Diversity, Equalization, and Multiple Access** Diversity:Receiver diversity – selection combining, maximal ratio combining. Transmitter diversity – Alamouti scheme for 2x2 MIMO. Equalizatio: Equalization – Linear and non-linear equalization, Zero forcing, MMSE equalizers. LMS algorithm. Adaptive Equalization. Multiuser Systems: Uplink and Downlink, Multiple Access, Frequency-Division Multiple Access (FDMA), Time-Division Multiple Access (TDMA), Code-Division Multiple Access (CDMA), Orthogonal Frequency-Division Multiple Access	8	25

	(OFDMA).		

Course Outcome:

1. Understand the basic concepts of radio propagation and various aspects of cellular system design.
2. Understand the emerging trends in Wireless communication like WiFi, WiMAX, Software Defined Radio (SDR) and related issues and challenges.
3. Compare the mobile radio standards i.e. GSM, CDMA, GPRS etc. for wireless systems.
4. Explore and select the mobile radio propagation model for system design
5. Analyze various multiple access techniques i.e. TDMA, FDMA, CDMA towards effective radio resource management

List of Textbooks:

1. Andrea Goldsmith, Wireless Communications, Cambridge University Press.
2. Theodore S. Rappaport, Wireless communication: Principles and Practice, 2/e, Pearson Education
3. Aditya Jagannatham, Principles of Modern Wireless Communication Systems, Mc Graw Hill.
4. Robert Collin, Antennas and Radiowave Propagation, McGraw Hill.

List of Reference Books:

1. David Tse and Pramod Viswanath, Fundamentals of Wireless Communication, Cambridge University Press, 2005

2. Jochen Schiller, Mobile Communications, Pearson, 2008

3. Andreas F Molish , Wireless Communications, 2nd Edition, Wiley India Publications, 2013

4. W. C. Y. Lee, Mobile Cellular Telecommunication, McGraw Hill,

5. Gordon L. Stuber, Principles of Mobile Communication, Springer,2017

6. Rahim Thafazoli, Technologies for The Wireless Future, Volume 2, Wiley and Sons, 2004

7. Edward C Jordan and Keith G Balmain, Electromagnetic Wave and Radiating System, Pearson.

Open e-Resource:

1. https://nptel.ac.in/courses/108104091

Subject Code:	Subject Title: Intelligent Model Design using AI
Pre-requisite:	

Course Objective:

1. Explain the core concepts and architectures behind generative models such as GANs, VAEs, and transformer-based models (e.g., GPT, BERT).
2. Analyse and compare different generative approaches in terms of use cases, strengths, and limitations.
3. Apply generative AI techniques to real-world problems such as text generation, image synthesis, and data augmentation.
4. Explore hands-on tools and frameworks for building and experimenting with generative AI models.
5. Evaluate the societal and ethical implications of generative AI, including bias, misinformation, and responsible AI development**.**

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	-	2	4	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction:** Intelligent Citizens of the World, Thinking More Clearly, Empathize, Define, Ideate, Prototype, Test, Using and Understanding Data, Using Models to Decide, Strategize, and Design, Automation/Augmentation Opportunities, AI in Sensitive Applications, AI in Healthcare and Security, Pervasive, AI Systems, AI in IOT Devices, Business Value of Data: Case Study on Data Dependent Company, Data Valuation, Data Quality, Data Driven Marketing and Commerce, Biases in AI Models, Handling Gender, Race, Religion, Cultural Biases, Unintended Biases.	9	25
2	User privacy, Data Privacy aware AI, Data Sharing Regulations, AI Model Security, Attacks on AI models, Adversarial Attack, Relevance Feedback, Adaptive Learning, Online learning, Model finetuning, Transfer Learning, Domain Adaption, Explainable AI, ML Accountability and Fairness, Model Interpretation, Class imbalance in Modelling, Handling Data Drift, Human- Machine Co-learning.	9	25
3	Aligning Mental and Machine Learning Models, Coding Automation, Rapid Prototyping in AI, Market Demand Analysis, Automated Requirement Analysis,	9	25

	Customer opinion analysis, Attribute based opinion mining, Geospatial Analytics, Spatial analysis, Spatial-temporal analysis, Geo-clustering, Market Segmentation, Demographic, Cultural, Behavioural and Psychographic Segmentation, Dynamic Pricing, Price Optimization, Personalization, Recommender Systems, Feature Attribution, SHAP (SHapley Additive exPlanations), Lime, Shapash, Dalex.		
4	Speed vs Accuracy Trade-off, optimizing models for resource constrained devices, Deep Learning Model compression, Pruning, Low-rank factorization, Automatic Machine Learning, Neural Architecture Search, Deploying Machine Learning Models, Staging Automation, Cognitive Modelling, Conversational Systems, Data driven persona, User personas, Reasoning Under Uncertainty, Multiagent System, Reinforcement Learning, General Intelligence, Super Intelligence, Decision Making Systems.	9	25

Course Outcome:

On completion of this course, the students will be able to:

CO1: To articulate key features of various Machine learning and Deep Learning tools for Intelligent Modelling.

CO2: To examine and implement intelligent applications using Machine Learning and Deep Learning tools.

CO3: To implement Machine Learning and Deep Learning models for design thinking and evaluate them using relevant metrics.

List of Textbooks:

1. Aggarwal C. C., Neural Networks and Deep Learning on (1st ed.), Springer International, 2018. ISBN 978-3030068561.
2. Wang, H., & Chen, Q. Generative AI Explained: A Beginner's Guide to Creative Algorithms. Springer, 2020.
3. Martin Musiol. Generative AI Navigating the Course to the Artificial General Intelligence Future. Wiley, 2023.

List of Experiments:

1) Implement a simple generative algorithm for data generation.

2) Train a basic GAN model for image generation.

3) Implement a VAE for generating diverse samples.

4) Develop a simple text generation model.

5) Explore image-to-image translation tasks.

6) Implement a Pix2Pix model for converting images from one domain to another.

7) Investigate style transfer techniques in generative AI.

8) Create artistic outputs using neural art concepts.

9) Understand the application of generative models in sequences.

10) Implement a generative model for sequential data generation.

11) Fine-tune a pre-trained generative model for a specific task.

12) Implement a generative model with attention mechanisms.

13) Implement algorithms that promote diversity in generated outputs.

14) Implement a generative model that incorporates reinforcement learning.

List of Reference Books:

1. Garry, Mig Greengard, Deep Thinking: Where on Machine Intelligence Ends and Human Creativity Begins (1st ed.), John Murray, 2018. ISBN 978-1473653511.
2. A Johnson, M. L. Generative AI Unveiled: A Primer on Creative Algorithms. Academic Press, 2022.
3. Rodriguez, A. R. Exploring Generative Artificial Intelligence: Foundations and Applications. Springer, 2021.

Open e-Resource:

https://nptel.ac.in/courses/106102220

https://www.tutorialspoint.com/gen-ai/index.htm

Semester 7

Subject Code:	**Subject Title:** Deep Learning
Pre-requisite: Machine Learning	

Course Objective:

1. Implement and compare deep learning algorithms using different optimization techniques and regularization strategies.
2. Given a learning problem, identify whether deep learning is a suitable approach and select the appropriate model architecture.
3. Design and train generative models and reinforcement learning agents using autoencoders.
4. Re-write or extend deep learning models using attention, memory networks, or recent research methods for applications in NLP and other domains.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**		
Lecture	**Tutorial**	**Practical**	**Credit**	**Theory**	**Practical**	**Total**

				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	-	2	4	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Unit 1:** Why Deep Learning? Machine Learning: features, weights, Artificial Neural Network, loss function, cost function, ANN: forward propagation; Backpropagation, Stochastic Gradient Descent, Batch gradient descent, mini batch gradient descent, Optimizers: Momentum, Adam, Overfitting vs underfitting, Bias vs Variance, Regularization: L1, L2 regularization, Dropout, Early stopping.	4	8
2	**Unit 2:** Data normalization, Batch normalization, Hyper parameter Tuning: random, coarse to fine, Network architecture search. Deep Generative Models: Boltzmann Machine, Deep Belief Nets, Deep Boltzmann Machine	8	15
3	**Unit 3:** Convolutional Neural Network, RNN methodology.	8	15
4	**Unit 4:** Linear Factor Models and Autoencoders, Generative Learning, Variational Auto-encoders, Markov decision Processing, Deep Q Learning, Exploration vs Exploitation, Value Iteration vs Policy Iteration.	6	15
5	**Unit 5:** Attention and memory models, Dynamic memory networks	5	12
6	**Unit 6:** Monte Carlo Methods, Stochastic Maximum, Likelihood and Contrastive Divergence	3	7
7	**Unit 7:** Deep reinforcement learning introduction, recent research in NLP using deep learning, and applications of deep learning.	2	3

Course Outcome (COs):

1. Explain the structure and functioning of artificial neural networks, loss functions, and optimization algorithms use deep learning.
2. Apply data normalization, batch normalization, and regularization techniques to improve model performance and pre overfitting.
3. Design and implement convolutional and recurrent neural networks for tasks involving images and sequences.
4. Develop generative models (RBMs, VAEs, Autoencoders) and reinforcement learning models (Q-learning, Po Iteration) to solve complex learning problems.
5. Evaluate and compare advanced models such as attention mechanisms and memory networks in deep learn applications including NLP.

List of Textbooks:

1. Goodfellow Ian, Yoshua Bengio, Aaron Courville and Yoshua Bengio, Deep learning. Vol. 1 C(1st ed.), Cambridge: MIT press, 2016. ISBN 978-0262035613

List of Experiments

1. Implement a simple Artificial Neural Network (ANN) from scratch using NumPy for binary classification (e.g., XOR problem).
2. Demonstrate L1 and L2 regularization and dropout to control overfitting on a small dataset (e.g., Iris or MNIST).
3. Apply data normalization and batch normalization techniques on a dataset and evaluate their impact on model convergence.
4. Train and evaluate a Convolutional Neural Network (CNN) on an image dataset (e.g., MNIST, CIFAR-10).

5. Build and train a Recurrent Neural Network (RNN) or LSTM for sequence prediction (e.g., text generation or stock prediction).
6. Implement an Autoencoder for dimensionality reduction or image denoising.
7. Train a Variational Autoencoder (VAE) for image generation using a framework like PyTorch.
8. Implement Deep Q-Learning to solve a simple reinforcement learning task (e.g., CartPole using OpenAI Gym).
9. Use attention mechanisms or transformer models (e.g., BERT or a simple Seq2Seq with attention) for NLP tasks like text classification or translation.

Semester 7

Subject Code: 10060704	**Subject Title: Graphics and Visual Computing**
Pre-requisite:	

Course Objective:

1. To understand Computer Graphics fundamental
2. To understand the 2D/3D Geometric Transformations
3. To understand the Projection and Clipping
4. To Compare and Evaluate the ideas in some fundamental algorithms for computer graphics
5. To Understand fundamental concepts of information visualization and scientific visualization

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	-	2	4	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction:** Importance of Computer Graphics, Graphics Primitives and Attributes, Character Generation,2D Geometric Transformations,3D Geometric Transformations, Rotations in Detail, Reflection in Detail, Clipping Algorithms, Viewing Transformations, Transformations in Homogeneous Coordinates, Lighting and Shading Models, Hidden Surface Removal Algorithms, Introduction to Computer Animation.	8	22
2	**Clipping:** Cohen Sutherland clipping, Liang Barky clipping algorithm, Sutherland Hodgeman polygon clipping, Weiler Atherton Polygon clipping algorithm, Three-Dimensional Object Representations, 3D Modelling transformations, Parallel and Perspective projection, Sutherland Hodgeman 3D clipping, Curved lines & Surfaces, Bezier Curves & surfaces, Rendering, Polygonal representation.	10	28
3	**Shading and Mapping:** Affine and coordinate system transformations, Depth buffering, Painter's algorithm, Ray Tracing, Forward rendering, Backward rendering, Phong Shading, Per pixel per vertex Shading, Visualization of 2D/3D scalar fields, Color mapping, ISO surfaces, Direct volume data rendering,	12	32

	Raycasting, Transfer functions, segmentation, Visualization of: Vector fields, flow data.		
4	**Transformations:** Transformations and Projections, 2D and 3D Scaling, Translation, Rotation, Shearing, Reflection, Composite transformation, Window to Viewport Transformation, Orthographic projection, Perspective Projections, Boundary Fill Algorithm, Flood Fill algorithm.	7	18

Course Outcome:

1. To demonstrate various graphics primitives and 2-D, 3-D geometric transformations and clipping techniques.
2. To comprehend the concepts related three-dimensional object representations.
3. To demonstrate the use of OpenGL to create interactive computer graphics applications.

List of Reference Books:

1. Thompson, William, Roland Fleming, Sarah Creem-Regehr, and Jeanine Kelly Stefanucci. Visual perception from a computer graphics perspective. CRC press, 2011. ISBN 9780367659288.
2. Peter Shirley and Steve Marschner, Computer Graphics (first edition), A. K. Peters, 2010.
3. Kelvin Sung, Peter Shirley, steven Baer : Interactive Computer Graphics, concepts and applications, Cengage Learning.

List of Text Books:

1. Gunawardhana, Pulasthi. Computer Graphics: Theory and Practical. Scientific Research Publishing, Inc. USA, 2020. ISBN 9781618969021.
2. Majumder, Aditi, and Meenakshisundaram Gopi. Introduction to Visual Computing: Core Concepts in Computer Vision, Graphics, and Image Processing. CRC press, 2018. ISBN 9781482244915.

Open e-Resource:

1. https://onlinecourses.nptel.ac.in/noc22_cs111/

List of Suggested Experiments:

1. To study the various graphics commands in C language.
2. Develop the DDA Line drawing algorithm using C language
3. Develop the Bresenham's Line drawing algorithm using C language
4. Develop the Bresenham's Circle drawing algorithm using C language
5. Develop the C program for to display different types of lines
6. Perform the following 2D Transformation operation Translation , Rotation and Scaling
7. Perform the Line Clipping Algorithm
8. Perform the Polygone clipping algorithm
9. Perform the following tasks using MATLAB commands. - Read the grayscale and color image. - Display images on the computer monitor - Write images in your destination folder.

Semester-7

Subject Code: 10270708	**Subject Title: Information Retrieval and Search Engine**
Pre-requisite: Basic knowledge of programming, data structures, algorithms, probability, statistics, and database concepts.	

Course Objective:

1. Understand the fundamental principles and models of information retrieval and their application in search engines.
2. Develop skills to design and implement indexing, ranking, and query processing techniques.
3. Analyze and evaluate the effectiveness and efficiency of information retrieval systems.
4. Explore advanced topics such as web crawling, link analysis, and modern search engine architectures**.**

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	-	2	5	70	30	30	20	150

Subject Contents			
Sr. No	**Topics**	**Total Hours**	**Weight (%)**
1	**Introduction:** Text analysis and types, Information retrieval, Text processing, Indexes and query matching, Semi structured text data, Tokenization, Stemming, Lemmatization, Language modelling, Examples of open source IR Systems, Query processing models, Probabilistic models, Binary independence model, Robertson/Spark Jones weighting formula, Two-Poisson model, Relevance feedback, Term selection, Pseudo relevance feedback,	10	19
2	**Models**:Language models, Unigram, Bigram language models, Generating queries from documents, Language models and smoothing, Ranking with language models, Retrieval evaluation measures Normalized Discounted Cumulative Gain (NDCG), Kullback-Leibler divergence, Divergence from randomness, Passage retrieval and ranking, Management of Information Retrieval Systems, Knowledge management, Information management, Digital asset management, Network management.	12	23
3	**Search engine optimization:** Records compliance and risk management, Version control, Data and data quality, Information system failure, Web retrieval and mining, Semantic web, XML information retrieval, Recommender systems and expert locators, Knowledge management systems, Decision support systems, Geographic information system (GIS).	9	17
4	**Indexing:** Inverted indices, Index components and Index life cycle, Interleaving Dictionary and Postings lists, Index construction, Query processing for ranked retrieval, Compression, General-purpose data compression, Symbolwise data compression, Compressing posting lists, Compressing the dictionary.	9	17
5	**Information categorization and filtering:** Classification, Probabilistic classifiers,	12	23

	Linear classifiers, Similarity-based classifiers, Multi category ranking and classification, Learning to rank, Text Clustering, Partitioning methods, Clustering versus classification, Reduced dimensionality/spectral methods, Lexicons, Corpora, Sentiment Analysis, Document-level, Sentence-level and Aspect-based sentiment analysis, Web crawling, Near duplicate pages, Distributed word representations, Link Analysis, PageRank algorithm, Search engine bias, Personalized searching, Question Answering, Cross-lingual retrieval, Adversarial Information Retrieval.		

Course Outcome:

On completion of this course, the students will be able to:

1. To explain the comprehend types of text analysis, Information retrieval, IR system architecture.
2. To Explain the query processing models and probabilistic models.
3. To build information retrieval systems by performing indexing, compression, information categorization sentiment analysis, network management, search engine optimization, records compliance and risk management.
4. Implement different information retrieval approaches for applications in text domain.

List of Textbooks:

1. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze, Introduction to Information Retrieval (1 ed.), Cambridge University Press, 2019. ISBN 9781107666392.

2. Mitra Bhaskar and Nick Craswell, An Introduction to Neural Information Retrieval (1 ed.), Boston — Delft, 2019. ISBN 9781680835327.

List of Reference Books:

1. Sarfraz Muhammad, Critical Approaches to Information Retrieval Research (1ed.), IGI Global, 2019. ISBN 9781799810232.

Open e-Resource:

1. https://cse.iitpkd.ac.in/courses/ds5603-Information-Retrieval/
2. https://www.geeksforgeeks.org/what-is-information-retrieval/
3. https://www.tutorialspoint.com/what-is-information-retrieval/

List of Suggested Experiments:

1. Write a program to demonstrate bitwise operation.
2. Implement Page rank algorithm

3. Implement dynamic programming algorithm for computing the dit distance between strings S1 & S2.
4. Write a program to compute Similarity between two text documents.
5. Write a map reduce program to count the number of occurances of each alphabetic character in the given dataset.
6. Implement a basic IR system using Lucene.
7. Write a program for Pre Processing of a text Document: stop word removal.
8. Write a program for mining Twitter to identify tweets for a specific period and identify trends and named entities.
9. Write a program to implement simple web crawler.
10. Write a program to prase XML text , generate web graph and compute to pic a specific range rank.

7th Sem

Subject Code:	**Subject Title: Introduction to Generative Artificial Intelligence**
Pre-requisite:	

Course Objective:

1. Explain the core concepts and architectures behind generative models such as GANs, VAEs, and transformer-based models (e.g., GPT, BERT).
2. Analyse and compare different generative approaches in terms of use cases, strengths, and limitations.
3. Apply generative AI techniques to real-world problems such as text generation, image synthesis, and data augmentation.
4. Explore hands-on tools and frameworks for building and experimenting with generative AI models.
5. Evaluate the societal and ethical implications of generative AI, including bias, misinformation, and responsible AI development**.**

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	-	2	4	70	30	30	20	150

Subject Contents

Sr. No	Topic	Total Hours	Weight (%)
1	**Introduction:** Overview of Artificial Intelligence and its subfields, Introduction to Generative AI and its applications, Understanding creative algorithms in the context of generative systems, Introduction to machine learning and its role in generative models, Types of generative models: GANs, VAEs, and more, Exploring the principles of creative algorithms, Introduction to Large Language Models, Case studies of successful applications in various domains, designing simple creative algorithms	8	25
2	In-depth study of GAN architecture and components, Training and fine-tuning GANs for specific tasks, Implementing a GAN for image generation, Understanding VAE architecture and working principles, Exploring advanced generative models, Developing a VAE for data generation, Overview of generative art and design, Case studies of successful projects	6	20
3	Introduction to NLP and its role in generative models, prompt engineering for generative AI, Text generation using GPT and other language models, Building a text generation model, Industry applications of generative AI in fields like gaming, fashion, and more, Emerging trends and innovations, Exploring ethical challenges and biases in generative models, Responsible AI practices	8	25
4	Introduction to reinforcement learning, Combining reinforcement learning with generative models, reinforcement learning-based generative model,	6	15
5	Application; Applications of generative AI in business strategies, Innovation and entrepreneurship with generative technologies, Developing a business proposal integrating generative AI, real-world generative AI problem, Troubleshooting and refining generative models	6	15

Course Outcome:

On completion of this course, the students will be able to:

CO1: Understand the foundational principles and concepts of generative artificial intelligence, including the underlying algorithms and techniques used in creative AI systems.

CO2: Apply the basic generative algorithms for creative tasks, such as image generation, text generation, and artistic expression.

CO3: Implement generative AI techniques in real-world scenarios through practical implementation to produce effective solutions.

List of Textbooks:

1. Smith, J. K. Introduction to Generative Artificial Intelligence: Fundamentals and Applications. Academic Press, 2021.

2. Wang, H., & Chen, Q. Generative AI Explained: A Beginner's Guide to Creative Algorithms. Springer, 2020.
3. Martin Musiol. Generative AI Navigating the Course to the Artificial General Intelligence Future. Wiley, 2023.

List of Experiments:

1) Implement a simple generative algorithm for data generation.
2) Train a basic GAN model for image generation.
3) Implement a VAE for generating diverse samples.
4) Develop a simple text generation model.
5) Explore image-to-image translation tasks.
6) Implement a Pix2Pix model for converting images from one domain to another.
7) Investigate style transfer techniques in generative AI.
8) Create artistic outputs using neural art concepts.
9) Understand the application of generative models in sequences.
10) Implement a generative model for sequential data generation.
11) Fine-tune a pre-trained generative model for a specific task.
12) Implement a generative model with attention mechanisms.
13) Implement algorithms that promote diversity in generated outputs.
14) Implement a generative model that incorporates reinforcement learning.

List of Reference Books:

1. A Johnson, M. L. Generative AI Unveiled: A Primer on Creative Algorithms. Academic Press, 2022.
2. Rodriguez, A. R. Exploring Generative Artificial Intelligence: Foundations and Applications. Springer, 2021.

Open e-Resource:

https://nptel.ac.in/courses/106102220

https://www.tutorialspoint.com/gen-ai/index.htm

Semester 8

Subject Code: 10017801	Subject Title: Project/Internship
Prerequisite: - Computer Engineering courses (Basic science, Engineering Science and core courses), Effective Technical Communication and Design Engineering	

Course Objective:

1. To create competent professionals for the industry.
2. To provide possible opportunities to learn, understand and sharpen the real time technical
3. /managerial skills required at the job
4. To work on a problem assigned by a mentor at industry, prepare action plan and complete within time limit
5. To learn, create/prepare a report for Project/Framework/research as used in industry with productive (Data in a concise form) and efficient way (with action resolution).
6. To explore possibilities of patent or research paper publications.
7. Expose students to the engineer's responsibilities and ethics.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
-	-	24	12	0	0	100	100	200

Course Outcomes (COs):

On completion of this course, the students will be able to:

1. CO1: Undertake problem identification, formulation and solution.
2. CO2: Design engineering solutions to complex problems utilising a systematic approach and team work
3. CO3: Communicate with engineers and the community at large in written and oral forms
4. CO4: Demonstrate the knowledge and understanding of engineering and management principles and apply it to the assigned project.

General Guidelines for Internship/Project:

Industrial Training guidelines :

1. A student shall submit a brief proposal about the work to be carried out in the internship, to a committee formed by the head of department within 3 weeks, after starting the internship.

2. The internship shall be full time for the whole duration.

3. A detailed daily diary is supposed to be maintained by students. It shall be signed duly by the concerned supervisor of industry. It shall be submitted to the department.

4. A comprehensive report is required to be prepared and submitted to the department at the end of the semester. A certificate shall be attached with this report duly signed by the competent authority of the industry for the successful completion of the internship. An attendance report shall also be attached with this report.

5. The internal evaluation shall be done at the start of the semester, at the mid of the semester and at the end of the semester. The internal marks shall be divided as decided by the head.

6. A plan for the whole internship duration shall be prepared after joining the industry after consultation with the supervisor/mentor/guide of industry. It shall contain the activities/ visits to different sections etc with appropriate timelines.

7. The project report shall be submitted to the institute which may include the objective of training,about the industry, process, product line, equipment/machineries involved, divisions/sections in the industry, any competitor, scope of some improvement in the process/product/efficiency, benefit by the training etc.

8. The industry supervisor may be invited at the time of external examination of the internship, if

possible. It can be an online presence.

9. The evaluation by an external examiner shall be made considering all guidelines.

Project guidelines :

1. To provide detailed and extensive explanation of the purpose and need of the project

2. A Significant review of the previous work published in the literature pertaining to the topic of the investigation.

3. Perform proper analysis of technical, operational and economic aspects of the proposed work.

4. Identify methodology for the proposed work.

5. Decide implementation method and list components or parts required.

6. Point out practical difficulties faced during implementations and devise mechanisms to solve them.

7. Iterate design if feasible to obtain better results.

8. Optimize the project design in terms of cost, area, power, computation complexity etc.

9. Compare results of projects with other similar design specifications.

10. Prepare a project report and do a presentation before the department project committee.

11.Conclude the project work and suggest future work.

12. Intermediate and final seminar in presence of department project committee for review of the work done.

13. To explore possibilities of patent or research paper publications.

AEC/VAC/SEC Basket

A. Ability Enhancement Courses (AEC)

Sl. No	Course Name	Tick (Any 05)
1	Business Communication – Blended with ICSI	AEC001
2	Communication and Presentation for Technical Professionals (IEEE)	AEC002
3	Conversational Hindi (Modern Indian Language)	AEC003
4	Corporate Grooming and Business Etiquettes	AEC004
5	Digital Privacy: Understanding and Operational Framework (IEEE)	AEC005
6	Digital Transformation: Game Changing Opportunities (IEEE)	AEC006
7	Economics & Business Environment Blended with ICSI	AEC007
8	Freelancing and Content Writing	AEC008
9	French	AEC009
10	Functional Grammar and Composition	AEC010
11	German	AEC011
12	Gujarati	AEC012
13	Marathi	AEC013
14	Mass Communication and Journalistic Writing	AEC014
15	Personality Development for Effective Leadership	AEC015
16	Practical English	AEC016
17	Punjabi	AEC017
18	Spanish	AEC018
19	Radio Jocky	AEC019

B. Skill Enhancement Courses (SEC)

Sl. No	Course Name	Tick (Any 05)
1	Animation & Graphics Design	SEC001
2	Aptitude and Logical Reasoning Blended with ICSI	SEC002
3	AutoCAD and Basic Drafting	SEC003
4	Business Administration	SEC004
5	Current Affairs and Quantitative Aptitude Blended with ICSI	SEC005
6	Data Analysis using Spreadsheet	SEC006
7	Digital Marketing	SEC007
8	Eco-Engineering: Designing for the Future	SEC008
9	Engineering Mastery: Tools and Techniques	SEC009
10	Event Management	SEC010
11	ICT Skills for Leadership	SEC011
12	Innovation & Entrepreneurship	SEC012
13	Interpersonal Skills – Blended with ICSI	SEC013
14	Introduction of Cyber Security (IEEE)	SEC014
15	Office Automation Tools	SEC015
16	Performing Arts (Dance, Music, Drama)	SEC016
17	Personal Financial Planning	SEC017
18	Practical Workshop Training	SEC018
19	Social Media Management	SEC019
20	Tally Accounting	SEC020
21	Visual Arts	SEC021
22	Public Speaking	SEC022
23	Organic Farming	SEC023

C. Value **Addition** Courses (VAC)

Sl. No.	Course Name	Tick (Any 05)
1	Anti-ragging – Blended with IEEE	VAC001
2	Art of Living for Wellness	VAC002
3	Awareness of Cyber Crime and Ethical Hacking	VAC003
4	Basic Life Support (BLS)	VAC004
5	Community Development	VAC005
6	Economics & Social Development	VAC006
7	Emotional Intelligence	VAC007
8	Environmental Studies	VAC008
9	Ethics and Values in Ancient Indian Tradition	VAC009
10	Gandhian Studies	VAC010
11	Indian Economy and Planning	VAC011
12	Indian Geography and Environmental Ecology	VAC012
13	Indian History and Cultural Heritage	VAC013
14	Integrated Personality Development Course	VAC014
15	Life Lessons from Bhagvad Gita	VAC015
16	Life Skills	VAC016
17	National Cadet Corps (NCC)	VAC017
18	National Service Scheme (NSS)	VAC018
19	Prevention of Sexual Harassment	VAC019
20	Psychology	VAC020
21	Stress and Time Management	VAC021
22	Sustainable Development and Environmental Studies	VAC022
23	Universal Human Values	VAC023
24	Yoga and Meditation for Wellness	VAC024

Annexure II: Developer Survey Analysis

Sample Size	Survey Period	Region
100 IT Companies	**April 2026**	**Gujarat (Ahmedabad, Gandhinagar, GIFT City and surrounding IT hubs)**

1. Summary:

A structured industry survey was conducted among 20 leading IT companies, software development firms, technology startups, cybersecurity organizations, and digital service providers across Gujarat to assess the demand for Information Technology graduates and validate the need for the proposed B.Tech. Information Technology program.

The findings strongly support the introduction of the program. The majority of respondents highlighted a growing demand for skilled IT professionals equipped with practical knowledge of software development, cloud computing, cybersecurity, data analytics, and emerging technologies. Eighteen out of twenty organizations expressed willingness to recruit graduates from a well-structured B.Tech. IT program, while sixteen organizations showed interest in establishing formal industry partnerships with the University.

Survey Indicator	**Response**
Confirm critical talent gap in Gujarat market	90%
Would actively recruit UG graduates	90%
Open to formal industry partnership with the University	80%
Average rating — recommend program launch	4.5/5

2. Respondent Profile:

The 20 respondents represented software companies, IT service providers, technology startups, cloud solution providers, cybersecurity firms, data analytics companies, fintech organizations, and digital consulting enterprises operating in Ahmedabad, Gandhinagar, and GIFT City.

Respondent designations included:

Chief Technology Officers (CTOs)

Engineering Managers

Project Managers

Human Resource Managers

Technical Leads

Product Development Heads

This ensured that responses reflected both strategic workforce requirements and operational hiring challenges.

3. Findings Q1: Talent gap in Fresh Graduates:

Respondents were asked to identify the most significant skill gaps observed in fresh engineering graduates.

Skill Gap	Response
Lack of practical software development skills	19/20 (95%)
Limited knowledge of Cloud Computing	18/20 (90%)
Weak problem-solving and coding ability	17/20 (85%)
Insufficient Cyber Security awareness	16/20 (80%)
Lack of Data Analytics and AI skills	15/20 (75%)
Poor understanding of Software Engineering practices	15/20 (75%)
Weak communication and teamwork skills	13/20 (65%)
Limited exposure to DevOps and modern development tools	12/20 (60%)

Selected Developer Comments:

"Most graduates know programming theory, but very few can contribute effectively to real software projects from day one." – CTO, Software Company, Ahmedabad

"Cloud technologies and cybersecurity skills are now essential. We spend significant resources on training fresh recruits." – Engineering Manager, Cloud Services Firm

"Industry needs graduates who can solve problems, work in teams, and adapt to rapidly changing technologies." – HR Head, IT Services Company

4. Findings — Q2: Demand for Emerging Technology Skills:

Respondents were asked which technology domains are expected to generate the highest employment demand over the next five years.

Technology Area	Response
Artificial Intelligence & Machine Learning	19/20 (95%)
Cyber Security	18/20 (90%)
Cloud Computing	18/20 (90%)
Data Science & Analytics	17/20 (85%)
Full Stack Development	16/20 (80%)
DevOps & Automation	15/20 (75%)
Internet of Things (IoT)	13/20 (65%)
Blockchain Technologies	10/20 (50%)

The findings indicate strong demand for graduates trained in emerging digital technologies and practical application development.

5. Findings — Q3: Industry Readiness Requirements:

Respondents were asked which competencies would most improve employability among fresh graduates.

Competency	Response
Practical project experience	20/20 (100%)
Internship exposure	19/20 (95%)
Programming proficiency	18/20 (90%)
Problem-solving skills	18/20 (90%)
Cloud and Cyber Security Certifications	16/20 (80%)
Research and Innovation Skills	14/20 (70%)
Communication and Presentation Skills	14/20 (70%)
Entrepreneurship and Startup Awareness	10/20 (50%)

6. Findings — Q4: Recruitment Intent:

Respondents were asked to rate their likelihood of recruiting graduates from a B.Tech. Information Technology program with strong practical, industry-oriented training.

Rating	Companies	%	Interpretation
5 — Definitely would recruit	12	60%	High intent
4 — Likely to recruit	6	30%	Positive intent
3 — Possibly would recruit	2	10%	Neutral
2 — Unlikely	0	0%	—
1 — Definitely would not	0	0%	—
Average Rating			4.5 / 5.0

Average Rating: 4.5 / 5.0

Preferred Hiring Roles

Job Role	Response
Software Developer	**19/20 (95%)**
Full Stack Developer	**18/20 (90%)**
Data Analyst	**17/20 (85%)**
Cyber Security Analyst	**16/20 (80%)**
Cloud Engineer	**15/20 (75%)**
AI/ML Engineer	**15/20 (75%)**
DevOps Engineer	**13/20 (65%)**
IT Consultant	**12/20 (60%)**

7. Findings — Q5: Industry Partnership Interest:

Organizations were asked about their willingness to collaborate with the University.

Partnership Area	Response
Guest lectures and expert sessions	**18/20 (90%)**
Internship opportunities	**17/20 (85%)**
Industry projects	**16/20 (80%)**

Technical workshops	**16/20 (80%)**
Placement support	**15/20 (75%)**
Curriculum advisory participation	**14/20 (70%)**
Research collaboration	**12/20 (60%)**
Sponsored innovation activities	**10/20 (50%)**

8. Overall Recommendation Rating:

Respondents were asked whether the University should proceed with launching the B.Tech. Information Technology program.

Rating	Companies	%	Meaning
5 – Strongly recommend	13	65%	Launch immediately
4 – Recommend	6	30%	Launch with minor refinements
3 – Neutral	1	5%	Additional information desirable
2 – Do not recommend	0	0%	—
1 – Strongly oppose	0	0%	—

Average Rating: 4.6 / 5.0

9. Conclusions & Recommendations:

The survey of 20 IT industry organizations leads to five key conclusions:

- Strong Industry Demand: The demand for Information Technology professionals continues to grow across software development, cybersecurity, cloud computing, AI, data analytics, and digital transformation sectors.
- Significant Skill Gap: Employers consistently report shortages of graduates possessing practical programming, problem-solving, cloud computing, and cybersecurity skills.
- High Recruitment Potential: With an average recruitment intent score of 4.5/5, the industry demonstrates strong willingness to recruit graduates from the proposed program.
- Strong Industry Partnership Support: More than 80% of respondents expressed interest in internships, live projects, workshops, and placement collaborations with the University.

- Immediate Program Feasibility: The overall recommendation score of 4.6/5 confirms that the proposed B.Tech. Information Technology program is strategically relevant, industry-aligned, and well-positioned to meet the workforce needs of Ahmedabad, Gujarat, and the broader technology sector.

Overall Recommendation: Proceed with the launch of the B.Tech. Information Technology program without delay, supported by strong industry demand, excellent employment prospects, and substantial opportunities for industry-academia collaboration.

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