



Gandhinagar Institute of Technology

Academic Regulation& Curriculum

for

B.Tech.

in

Information Technology

B.TECH. PROGRAMME

w.e.f. 2026-27

Preamble

We, the members of the Information Technology Department, are committed to promoting knowledge, innovation, and technical excellence in the field of electronics and communication 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 Information Technology program has been revised according to the guidelines of UGC, AICTE and NCERT 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 align the curriculum with current industry trends and emerging technological advancements, several contemporary subjects have been incorporated into the B.Tech. Information Technology syllabus. These include Introduction to Web Technology, UX Design Foundation, Software Engineering, Artificial Intelligence, Wireless Communication: 5G and beyond etc. In addition, specialized subjects such as Cloud Infrastructure and Services, Cryptography and Network Security, Data Analytics, Backend Development using Mongo DB and Blockchain have been introduced to equip students with the skills required for modern software and IT infrastructure development. These additions prepare students to meet the growing demands of the IT industry and pursue opportunities in areas such as software engineering, data science, network management, and digital transformation.

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 software development, web development, data science, network security, and emerging digital technologies.

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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 formulate degree holders with educational competency in the field of information technology for the better opportunities in the career development.
- **PEO 2.** With the help of prerequisite knowledge of engineering, alumni are provided with the capacity to become pioneers in the technological world.
- **PEO 3.** To up skill understudies with the expertise in the engineering to design and develop the robust systems to solve complex real life problems.
- **PEO 4:** Prepare graduates with high moral values, committed towards work completion and professionalism for the welfare of the society.

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 Information Technology 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 Information Technology 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 Information Technology with effect from 2026-2027

Sl. No.	Course Type	IT Credit
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	Cyrtography 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							
10050603	Professional Elective - II	Advance Computer Networks					
10050604	Professional Elective - II	Distributed Computing					
10060606	Professional Elective - II	Cloud Infrastructure and Services					
10270507	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	10000707	IKS	DIGITAL INDIA 2.0 (Startup and Innovation)	2	2	0	0	2
	10060701	Project Work	Internship/Project	3	0	0	6	6
	10060702	Professional Core	Artificial Intelligence	4	3	0	2	5
	10060703	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							
	10050703	Professional Elective - III	Image Processing					
	10270706	Professional Elective - III	Advance Machine Learning					
	10060704	Professional Elective - III	Mobile Computing and Wireless Communication					
	10060705	Professional Elective - III	System Testing & Analysis					
	Professional Elective - IV							
	10050708	Professional Elective - IV	Data Compression					
	10060706	Professional Elective - IV	Computer Vision					
	10060707	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 Information Technology 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 Information Technology 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. Information Technology 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 Information Technology 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 Information Technology 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 Information Technology 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 Information Technology 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 Information Technology. 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 Information Technology. 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. IT in Ahmedabad

11.1 Executive Summary

The establishment of the Bachelor of Technology (B.Tech.) in Information Technology program in Ahmedabad is strategically feasible and aligned with the growing demand for skilled IT professionals in Gujarat, India, and the global technology sector. Ahmedabad has emerged as a major educational, industrial, and technological hub, supported by a strong ecosystem of IT companies, startups, innovation centers, research institutions, and government initiatives promoting digital transformation. The rapid adoption of technologies such as Artificial Intelligence, Data Science, Cloud Computing, Cyber Security, Internet of Things (IoT), Blockchain, and Software Engineering has significantly increased the demand for qualified Information Technology graduates.

The proposed B.Tech. Information Technology program is designed to meet industry requirements by providing a strong foundation in computing, software development, networking, cybersecurity, data analytics, and emerging technologies. The curriculum emphasizes experiential learning through laboratory work, industry internships, live projects, research activities, and industry collaborations, ensuring that graduates possess both theoretical knowledge and practical skills. Ahmedabad's proximity to major IT parks, software companies, startups, and technology-driven enterprises provides excellent opportunities for industry interaction, internships, placements, and collaborative research.

The program is expected to contribute to the development of a highly skilled workforce capable of supporting the region's digital economy and technological advancement. Furthermore, the availability of qualified faculty, modern laboratory infrastructure, digital learning resources, industry partnerships, and a growing pool of aspiring engineering students makes the program academically viable and operationally sustainable. The B.Tech. Information Technology program will enhance employment opportunities, foster innovation and entrepreneurship, support higher education and research pursuits, and contribute significantly to the socio-economic development of Ahmedabad, Gujarat, and the nation.

11.2 Market Demand & Industry Trends

The market demand for graduates in Information Technology continues to grow rapidly due to the increasing digitalization of businesses, government services, healthcare, education, finance, manufacturing, and other sectors. Organizations across the globe are investing heavily in advanced technologies such as Artificial Intelligence (AI), Machine Learning (ML), Data Science, Cloud Computing, Cyber Security, Blockchain, Internet of Things (IoT), Big Data Analytics, and Software Engineering to improve efficiency, innovation, and competitiveness. This technological transformation has created a strong demand for skilled Information Technology professionals capable of designing, developing, managing, and securing modern digital systems.

Ahmedabad and Gujarat have witnessed significant growth in the Information Technology sector through the establishment of IT parks, startup ecosystems, innovation centers, software development companies, fintech organizations, and government-supported digital initiatives. The presence of technology-driven industries, multinational corporations, and emerging startups has increased the demand for graduates with expertise in software development, data

analytics, cybersecurity, cloud technologies, networking, and digital transformation. Government initiatives such as Digital India, Smart Cities Mission, Startup India, Make in India, and Gujarat's Information Technology policies have further accelerated the adoption of digital technologies and created new employment opportunities.

Current industry trends indicate a growing emphasis on Artificial Intelligence, Generative AI, Cloud Computing, Cyber Security, Data Analytics, DevOps, Edge Computing, Blockchain, and Intelligent Automation. Employers increasingly seek professionals with strong programming skills, analytical capabilities, problem-solving abilities, and hands-on experience with modern development tools and platforms. The demand for certified professionals in cloud technologies, cybersecurity, data science, and software engineering continues to rise across various industry sectors.

The proposed B.Tech. Information Technology program is strategically aligned with these market demands and emerging technology trends. By integrating industry-relevant courses, practical laboratory training, internships, research projects, certifications, and industry collaborations, the program aims to develop highly competent graduates who can successfully contribute to the evolving digital economy. The strong and sustained demand for Information Technology professionals makes the program highly relevant, employable, and future-oriented, ensuring excellent career opportunities for graduates in both national and international markets.

11.3 Skill Gap Identified by Industry

The Information Technology industry has identified a significant gap between academic knowledge and the practical skills required in the workplace. While graduates possess a strong theoretical foundation, employers increasingly seek professionals with hands-on expertise in software development, cloud computing, cybersecurity, data analytics, artificial intelligence, machine learning, DevOps, and emerging digital technologies. Industries also emphasize the need for proficiency in modern programming languages, problem-solving abilities, project management, and real-world application development. Additionally, gaps have been observed in communication skills, teamwork, leadership, innovation, and industry readiness. The proposed B.Tech. Information Technology program addresses these challenges through industry-aligned curriculum design, practical laboratory work, internships, live projects, certification programs, research activities, and continuous interaction with industry experts. This approach aims to bridge the identified skill gaps and develop graduates who are technically competent, professionally adaptable, and readily employable in the rapidly evolving IT sector.

11.4 Employment Opportunities

The B.Tech. Information Technology program offers excellent employment opportunities across diverse sectors of the digital economy. Graduates can pursue careers in software development, web and mobile application development, data analytics, cloud computing, cybersecurity, artificial intelligence, machine learning, networking, and IT consulting. The growing adoption of digital technologies by industries, government organizations, financial institutions, healthcare providers, and startups has created a strong demand for skilled IT professionals. Ahmedabad and Gujarat's expanding IT ecosystem, coupled with national initiatives such as Digital India and Startup India, further enhances career prospects. Graduates may find employment in multinational corporations, software companies, research organizations, technology startups, and public sector enterprises. The program also provides a strong foundation for entrepreneurship, higher studies, professional certifications, and research-oriented careers, ensuring long-term professional growth and employability in the global technology sector.

11.5 Industry Support & Collaboration

The B.Tech. Information Technology program is supported by strong opportunities for collaboration with software companies, IT service organizations, technology startups, research institutions, and industry bodies. Such collaborations facilitate internships, industrial visits, expert lectures, workshops, certification programs, live projects, and research activities, enabling students to gain practical exposure to current industry practices. Partnerships with industry help bridge the gap between academic learning and professional requirements by incorporating emerging technologies such as Artificial Intelligence, Cloud Computing, Cyber Security, Data Analytics, and Software Development into the learning process. Industry interaction also enhances placement opportunities, entrepreneurship development, innovation, and skill enhancement. These collaborations ensure that graduates are industry-ready and equipped to meet the evolving demands of the Information Technology sector at both national and global levels.

11.6 Conclusion

The market survey confirms that B.Tech. in Information Technology offers excellent future scope and robust industry demand. As digital technologies become central to every sector, the need for skilled IT professionals continues to grow. Technologies such as Artificial Intelligence (AI), Machine Learning (ML), Cloud Computing, Cybersecurity, Data Science, Network Security, and Blockchain have created a strong and sustained demand for graduates with core IT skills.

Information Technology focuses on applying computing to solve organizational and societal problems. Compared with broader computer science programs, IT emphasizes: Software development and deployment, Database systems, Computer networks, Information security, Web and mobile technologies, Cloud infrastructure and Enterprise systems integration.

B.Tech. IT graduates are recruited by organizations across multiple sectors like Information Technology Services, Healthcare, Banking and Finance, Telecommunications, E-Commerce, Education, Media and Entertainment field. B.Tech. IT graduates can pursue roles such as Software Developer, Full Stack Developer, Web Developer, Mobile App Developer, Data Analyst, Data Engineer, Cloud Engineer, DevOps Engineer, Cybersecurity Analyst, Security Engineer, Database Administrator, System Administrator, Network Engineer, Quality Assurance Engineer, UI/UX Developer, Business Analyst and IT Consultant etc.

Student benefits from pursuing B.Tech. IT are like Strong analytical and programming skills, Wide-ranging career opportunities, Entrepreneurial potential, Lifelong learning pathways etc.

Therefore, the B.Tech. Information Technology program remains highly relevant and strategically important. It equips students with technical competence, practical skills, and professional readiness to succeed in the global digital economy.

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)				
Lecture	Tutorial	Practical	Credit	Theory		Practical		Total
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
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
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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)				
Lecture	Tutorial	Practical	Credit	Theory		Practical		Total
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
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
5. 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.
6. 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.
7. Write a C program to find $1+1/2+1/3+1/4+\dots+1/n$.
8. Write a program to print following patterns:

```

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

```

9. Write a program to find maximum element from 1-Dimensional array
- 10.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.
11. Write a program to find the factorial of a number using recursion.
12. Define a structure called cricket that will describe the following information:
 - Player name
 - Team name
 - Batting averageUsing 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.
13. 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)				
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.	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)				
Lecture	Tutorial	Practical	Credit	Theory		Practical		Total
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
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	04	10	

	reality.		
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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)				
Lecture	Tutorial	Practical	Credit	Theory		Practical		Total
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
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 Eigen vectors of matrices, Cayley-Hamilton's Theorem and its applications, Diagonalization	10	25

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)				
Lecture	Tutorial	Practical	Credit	Theory		Practical		Total
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
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 emission, Einstein coefficients, Gas laser (He-Ne Laser), Semiconductor Laser, Applications of Laser.	8	19	
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	12	29	

	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.		
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 & Serway, 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>)

4. Online course: “Introduction to Physics of Nanoparticles and Nanostructures” by Prof. G. Mukhopadhyay on NPTEL. (URL Link: <https://nptel.ac.in/courses/115101007>)
5. Online course: “Introduction to Non-linear optics and its applications” by Prof. Samudra Roy on NPTEL (URL Link: <https://nptel.ac.in/courses/115105105>)
6. Online course “Superconductivity” by Prof. P. P. Singh and Prof. A. V. Mahajan (URL Link: <https://nptel.ac.in/courses/115101012>)
7. Online course “A brief course on Superconductivity” by Dr. Saurabh Basu on NPTEL. (URL Link: <https://nptel.ac.in/courses/115103108>)
8. 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. Learn the syntax and semantic of Python Programming
2. Write Python functions to facilitate code reuse and manipulate strings.
3. Illustrate the process of structuring the data using lists, tuples and dictionaries.
4. Demonstrate 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)				
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	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.
9. Write a program to demonstrate the user defined function creation & calling.
10. Demonstrate a program that show the use of python library.

GANDHINAGAR INSTITUTE OF TECHNOLOGY

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)				
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	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. Three-phase balanced circuits, voltage and current relations in star and delta connections.	10	23%
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	8	20%

	and Seven Segment Display. Bipolar Junction Transistor, Amplifier, Oscillator and Operational Amplifier.		
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.electronicandyou.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.

Gandhinagar Institute of Technology
B.Tech CE/IT/CSE/CS/AI
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)				
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 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. <u>NPTEL CH-1 RB-1 & TB-1</u>	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. <u>NPTEL CH-4,5,6 RB-1 & TB-1</u>	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). <u>NPTEL CH-7,8 RB-1 & TB-1</u>	13	30
4	Hashing and File Structure :	06	15

	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		
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	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 – Prentice-Hall International.
2. Fundamentals of Computer Algorithms 4th Edition by Horowitz, Sahni, Galgotia
3. Data Structures: A Pseudo-code approach with C, 4th Edition -By Gilberg & Forouzan Publisher Thomson 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 practicals 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
4. Implement a program to convert infix notation to postfix notation using stack.
5. Write a program to implement QUEUE using arrays that performs following operations:
(a) INSERT (b) DELETE (c) DISPLAY
6. Write a program to implement Circular Queue using arrays that performs following operations:
(a) INSERT (b) DELETE (c) DISPLAY
7. 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.
 - b. Insert a node at the end of the linked list.
 - c. Insert a node such that linked list is in ascending order. (according to info. Field)
 - d. Delete a first node of the linked list.
 - e. Delete a node before specified position.
 - f. Delete a node after specified position.
8. Write a program to implement stack using linked list.
9. Write a program to implement a queue using linked list.

10. Write a program to implement following operations on the doubly linked list.
 - a. Insert a node at the front of the linked list.
 - b. Insert a node at the end of the linked list.
 - c. Delete a last node of the linked list.
 - d. Delete a node before specified position.
11. Write a program to implement following operations on the circular linked list.
 - a. Insert a node at the end of the linked list.
 - b. Insert a node before specified position.
 - c. Delete a first node of the linked list.
 - d. Delete a node after specified position.
12. Write a program which create binary search tree.
13. Implement recursive and non-recursive tree traversing methods inorder, preorder and postorder traversal.
14. Write a program to implement Quick Sort, Merge Sort, Bubble Sort.
15. Write a program to implement Binary Search.

Gandhinagar Institute of Technology
B.Tech CE/IT/CSE/AI/CS/ICT
Semester-3

Subject Code: 10050302	Subject Title: Database Management Systems
Pre-requisite: Basic knowledge of Computer Programming	

Course Objective:

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)				
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	Database system architecture: Purpose of database, File System vs. DBMS, Advantages of a DBMS, Levels of Abstraction in a DBMS, Data Independence. Multi-level architecture, Client/Server architecture, Mapping, Database users and Administrators NPTEL, CH.1: TB1	03	05
2	Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations. NPTEL, CH.6: TB1	04	12
3	Relational query languages: Structure of relational databases, Domains, Relations, Relational algebra – fundamental operators and syntax, relational algebra queries, Tuple and domain relational calculus CH.2: TB1	04	08
4	Relational database design: Introduction, data dependency, Armstrong's axioms, Non loss decomposition and functional dependencies, Normalization- 1NF, 2NF, 3NF, BCNF, Multivalued dependency, 4NF, Join dependency and 5NF. NPTEL, CH.7: TB1	05	10
5	Query processing and optimization: Evaluation of relational algebra expressions, selection operation, sorting, Join strategies, evaluation of expressions, Query optimization NPTEL, CH.15: TB1	04	10
6	Storage strategies: Indices, B-trees, hashing NPTEL, CH.14: TB1	02	05
7	Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery. NPTEL, CH.17: TB1	06	15

8	Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection. CH.4: TB1	03	07
9	SQL Concepts : Basics of SQL, DDL,DML,DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, IN operator, aggregate functions, Built-in functions –numeric, date, string functions, set operations, sub-queries, correlated sub-queries, join, Exist, Any, All , view and its types., transaction control commands. SQL3, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server. NPTEL, CH.3,4: TB1	06	20
10	PL/SQL Concepts : Cursors, Stored Procedures, Stored Function, Database Triggers CH.5: TB1	02	08

Course Outcome:

1. Design and create a relational database using appropriate data modeling techniques and principles, including entity-relationship diagrams and normalization.
2. Construct and execute complex SQL queries to retrieve, manipulate, and update data in a relational database.
3. Apply optimization techniques to enhance the performance of database operations, such as query optimization, indexing, and transaction management.
4. Demonstrate an understanding of data integrity constraints and enforce them effectively in a database system.
5. Design and implement appropriate security measures to protect data in a database, including access control, authentication, and encryption techniques.
6. Design and implement transactional database systems that adhere to the ACID (Atomicity, Consistency, Isolation, Durability) properties.

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://www.tutorialspoint.com/dbms/>
2. <https://www.w3schools.com/sql/>
3. <https://www.codecademy.com/learn/learn-sql>
4. <https://in.udacity.com/>

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.

Gandhinagar Institute of Technology
B.Tech CE/IT/CSE/CS/AI/ICT
Semester 3

Subject Code: 10050304	Subject Title: Digital Electronics
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	0	3	70	30	00	00	100

Subject Contents				
Sr. No	Topic	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	8	20	
2	Combinational Digital Circuits & Logic: The Half adder, the Full adder, subtractor circuit. Multiplexer 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 latches, 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	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	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:

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

Gandhinagar Institute of Technology
B.Tech CSE/CS/AI/CE/IT
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	00	00	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 n c 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>

Gandhinagar Institute of Technology
Bachelor of Technology CE/IT/CSE/AI/CS/ICT
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)				
Lecture	Tutorial	Practical	Credit	Theory		Practical		Total
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
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 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	10	24
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 <i>t</i> -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

Gandhinagar Institute of Technology
B.Tech CE/IT/CSE/AI/CS
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)				
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	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),	10	15

	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		
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.

Gandhinagar Institute of Technology
B.Tech CE/IT/CSE/AI/CS
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)				
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	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, Dining 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.	7	15

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

Gandhinagar Institute of Technology
B. Tech Information Technology
Semester 4

Subject Code: 10060402	Subject Title: Internet and Web Technology
Pre-requisite: Programming, Basic knowledge of Internet and Client Server system is required.	

Course Objective:

1. To understand the concepts of web, internet & web designing.
2. To learn the fundamentals of HTML.
3. To learn developing websites & applying appropriate styles using CSS.
4. To learn client-side & server-side scripts using JavaScript.

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 WEB: Basics of WWW, HTTP protocol, Client-Server architecture, Introduction to web server installation and configuration. Concept of Internet: A brief introduction to the Internet: Computer Networks, Internet, URL (Uniform Resource Locator), Internet Service Provider, Intranet, Extranet, Virtual Private Network.	6	20	
2	Web Design fundamentals: Concepts of effective web design, Web design issues including Browser, Bandwidth and Cache, Display resolution, Look and Feel of the Website, Page Layout and linking, User-centric design, Sitemap, Planning and publishing website, Designing effective navigation.	4	10	
3	Basics of HTML: Introduction to HTML, create a Web page, linking to other Web Pages, Publishing HTML Pages, Text Alignment and Lists, Text Formatting Fonts Control, Email Links and link within a Page, creating a Table, Creating HTML Forms, Creating Web Page Graphics, Putting Graphics on a Web Page, Custom Backgrounds and Colors, Creating Animated Graphics.	8	25	
4	Cascading Style Sheet: Introduction to CSS, Defining Style with HTML Tags, Features of Style Sheet, Style Properties, Style Classes, External Style Sheet.	5	20	
5	JavaScript: Writing First Java Script, External JavaScript, Variables: Rules for variable names, Declaring the variable, assign a value to a variable, Scope of variable, Using Operators, Control Statements, JavaScript loops, JavaScript Functions: Defining a Function, returning a value from function, User define function.	8	25	

Course Outcome:

1. Understand the basic structure of the internet and the use of web technologies in various fields.
2. Use the various HTML tags with appropriate styles to display the various types of content effectively.

3. Develop the website using HTML, CSS and JavaScript applying web design principles to make interactive pages.
4. Write the client-side scripts for designing static web pages for web-based applications.

List of Textbooks:

1. Web Technology, Moseley and Savaliya, Wiley India
2. HTML and CSS By Dick Oliver and Michael Morrison (Pearson Education) 7th edition
3. HTML, DHTML, JavaScript, Perl CGI By Ivan Bayross(BPB) 3rd Edition

List of Reference Books:

1. Internet and Web Design Based on DOEACC III Revised syllabus 'O' Level - Mac Millan India Ltd
2. Teach Yourself HTML 4 in 24 Hours by Dick Oliver (Tech media) 4th edition
3. CSS By Kynn Bartlett (Pearson Education) 2nd Edition

Open e-Resource:

1. HTML:
 - a. <https://www.w3schools.com/>
 - b. <https://developer.mozilla.org/en-US/docs/Web/HTML>
 - c. <https://www.w3schools.com/html/>
 - d. <https://www.tutorialspoint.com/html/index.htm>
2. CSS:
 - a. <https://developer.mozilla.org/en-US/docs/Web/CSS>
 - b. <https://www.manning.com/books/css-in-depth>
 - c. <https://www.w3schools.com/css/>
 - d. <https://www.tutorialspoint.com/css/index.htm>
3. Java Script:
 - a. <https://javascript.info/>
 - b. <https://github.com/getify/You-Dont-Know-JS>
 - c. <https://www.w3schools.com/js/>
 - d. <https://www.tutorialspoint.com/javascript/index.htm>

List of Suggested Experiments:

1. Study of Formatting and fonts, commenting code, color, hyperlink, lists, tables, images.
2. Study about HTML Frame and Framesets.
3. To study About HTML Forms.
4. To study about Style Properties, Style Classes using Cascading Style Sheets (CSS).
5. To study about different types of Cascading Style Sheets (CSS).
6. To study about Basic JavaScript.
7. To study about External JavaScript.
8. To study about JavaScript loops, JavaScript Functions.

Gandhinagar Institute of Technology
B.Tech. Computer Engineering/Information Technology
Semester 4

DOC NO: 4061

Subject Code: 10050404	Subject Title: Discrete Mathematics
Pre-requisite: Basics of algebra and logic	

Course Objective:

- (1) The fundamental ideas of sets, logic, functions, relations, graph theory, and algebraic structures are introduced in this course.
- (2) The advanced concepts of functions and algebraic structures are applied to finite state machines and coding theory.

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	Set Theory: Definition and Properties of Sets, Operations on sets, Venn diagrams, Cartesian product, Relations, Functions Functions: Introduction & definition, Co-Domain, Range, Image, Value of A Function, One-One Onto Correspondence, Composition of Functions, Inverse Function, Identity Map, Inverse of composite functions, Properties of Composition of functions Combinatorics: Basic of Counting, Permutations, Permutations with Repetitions, Circular Permutation, Combinations, Combinations with repetitions, Binomial Coefficient, Pigeonhole Principle	06	12	
2	Relations: Binary Relations, Properties of Binary Relations: Reflexivity, Symmetry, Transitivity, Anti-Symmetric Relations, Equivalence Relations, Equivalence Classes, Composite Relation, Closure of Relation and Properties, Relation Matrix and Graph of a Relation Partial Ordering Relations: Definition, Examples, Simple or Linear Ordering, Totally Ordered Set, Partially Ordered Relations, Representation of Partially Ordered Sets, Hasse Diagrams, Least and Greatest Members, Minimal & Maximal Members, Least Upper Bound, Greatest Lower Bound, Well-ordered Partially Ordered Sets (Posets). Lattice as Posets, Complete, Distributive Modular and Complemented Lattices, Boolean and Pseudo-Boolean Lattices (Definitions and Simple examples only)	10	25	
3	Mathematical Logic: Statements and Notations, Connectives, Well-formed Formulas, Truth tables, Tautology, Equivalence Implication; Normal Forms: Disjunctive Normal Forms, Conjunctive Normal Forms, Principle Disjunctive Normal Forms, Principle Conjunctive Normal Forms; Predicative Logic, Statement Functions, Universal Variables and Quantifiers, Free and Bound Variables, Multiple Quantifiers and Negation	06	13	
4	Graphs: Definition of Different types of Graphs, Incidence and Degree, Basic Concepts Isomorphism and Sub Graphs, Path and Circuits, Euler Graphs, Hamiltonian Graphs, Matrix representations, Warshall's Algorithm to find Shortest Path Trees: Basic properties of Trees, M-ary Tree, Binary Trees, Converting any M-ary Tree to a Binary Tree, Tree traversal: Pre-Order, In-Order, Post-Order Traversal, Spanning Trees, Minimal Spanning Trees	10	25	

5	Algebraic Structures: Algebraic Structures with one Binary Operation- Group, Group, Subgroup, Normal Subgroup, Group Permutations, Semigroup, Monoid, Coset, Homomorphic Subgroups, Lagrange's Theorem, Congruence Relation and Quotient Structures. Algebraic Structures: Ring, Integral Domain and Field (Definitions and Simple examples only)	10	25
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Course Outcome: After completion of this course, Students will be able to

1. Understand the fundamental concepts of sets and use counting principles to calculate probabilities, define a function's domain and range, recognize one-to-one relationships, compose functions, and apply the attributes of functions to practical issues.
2. Classify relations utilizing operations on relations after determining the attributes of the relations to look for equivalence relations and partial order relations. Create a hasse diagram to identify the pertinent partial ordered sets in the binary relation.
3. Identify logical connectives, compound prepositions, formulate truth table and understand equivalency. To express a logic sentence in terms of predicates, quantifiers, and logical connectives.
4. Analyze various traversal strategies for trees and graphs. Utilizing graphs and trees, model computer science issues.
5. Apply the ideas of groups, subgroups, monoids, rings, integral domain and field to the construction of various algebraic structures.

List of Text Books:

1. R.Kenneth, Discrete mathematics and its applications, McGraw hill- New Delhi.
2. S. K. Sarkar, A Textbook of Discrete Mathematics, 9th Edition, S Chand Publication.

List of Reference Books:

1. J. P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw-Hill,1997.
2. S. Lipschutz and M. L. Lipson, Schaum's Outline of Theory and Problems of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill,1999.
3. D.Liben-Nowell, Discrete Mathematics for Computer Science, Wiley publication, July 2017.
4. E.Gossett, Discrete Mathematics with Proof, 2nd Edition, Wiley publication, July 2009.

Open e-Resource:

1. https://onlinecourses.nptel.ac.in/noc23_cs109/preview
2. https://onlinecourses.nptel.ac.in/noc23_cs120/preview

Gandhinagar Institute of Technology
B.Tech Computer Engineering/Information Technology
Semester 5

Subject Code: 10270605	Subject Title: Programming Methodologies for Backend Development (MongoDB)
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)				
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	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, Sharding 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 Outcome:

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".

Gandhinagar Institute of Technology
B.Tech Computer Science & Engineering
Semester 5

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)				
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 basic statistics and analysis: Fundamentals of Data Analysis, Statistical foundations for Data Analysis, Types of data, Descriptive Statistics, Correlation and covariance, Linear Regression, Classification, clustering and decision tree. Statistical Hypothesis Generation and Testing, Python Libraries: NumPy, Pandas, Matplotlib	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 Pandas data frame, Working with DataFrames: Arithmetics, Statistics, Binning, Indexing, Reindexing, Filtering, Handling missing data, Hierarchical indexing, Data wrangling: Data cleaning, transforming, merging and reshaping.	10	22	
4	Data Visualization and Reporting: 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/](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 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 the number of survivors of each passenger class.

Gandhinagar Institute of Technology
B.Tech Information Technology
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)				
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	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 Algorithms CH-1,2,3,6,8]	8	20	
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	5	15	

	algorithm), Graphs: Shortest paths, The Knapsack Problem, Job Scheduling Problem, Huffman code. [TB-1: Introduction to Algorithms CH-15,22]		
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 patterns.
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

Gandhinagar Institute of Technology
B. Tech CE/IT
Semester 5

Subject Code:10050504	Subject Title: Computer Network
Prerequisite: Working experience of any one structured programming language	

Course Objective:

1. Build an understanding of the fundamental concepts of computer networking.
2. Familiarize the student with the basic taxonomy and terminology of the computer networking area.
3. Introduce the student to advanced networking concepts, preparing the student for entry Advanced courses in.

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	Introduction to computer networks and Internet: Understanding of network and Internet, Types of Computer Networks, Data communication techniques, Transmission media, Network Topology, OSI Layer, TCP/IP model, Packet-switching network, [R.B-5: Data Communications and Networking- CH-3] NPTEL	7	15
2	The Link layer and Local area networks: Introduction to link layer services, error-detection and correction techniques, Multiple access protocols, addressing, Ethernet, switches, VLAN [RB-5 Data Communications and Networking CH-10,15,18] NPTEL	8	18
3	Network Layer: Introduction to forwarding and routing, Network Service models, Virtual and Datagram networks, study of router, IP protocol and addressing in the Internet, Routing algorithms, Broadcast and Multicast routing [RB-5 Data Communications and Networking CH-20] NPTEL	10	25
4	Transport Layer: Introduction and transport layer services, Multiplexing and Demultiplexing, Connectionless transport (UDP), Principles of reliable data transfer, Connection-oriented transport (TCP), Congestion control, TCP congestion control [RB-5 Data Communications and Networking CH-23] NPTEL	10	25
5	Application Layer: Principles of computer applications, Web and HTTP, E-mail, DNS, Socket programming with TCP and UDP [RB-3: Computer Networks, Andrew Tanenbaum CH-7] NPTEL	7	17

Course Outcome:

1. Explain the basic terminologies used in networking and layered architecture of computer network
2. Comprehend basic protocols of application layer and how they can be used to assist in network design and implementation.
3. Describe and implement the essential principles of a connectionless and connection-oriented protocols used for reliable data transfer, flow control and congestion control.
4. Design network architecture, assign IP addressing and apply various routing algorithms to find shortest paths for network-layer packet delivery.
5. Illustrate different link layer terminologies like error detection-correction, Multiple access protocol and Link layer addressing used in the network.

List of Reference Books:

1. Computer Networking- A Top-Down approach (6th edition), Kurose and Ross, Pearson
2. Computer Networks- A Top-Down approach, Behrouz Forouzan, McGraw Hill
3. Computer Networks (5th edition), Andrew Tanenbaum, Prentice Hall
4. Computer Networking and the Internet (5th edition), Fred Halsall, Addison Wesley
5. Data Communications and Networking (5th edition), Behrouz Forouzan, McGraw Hill

Open e-Resource:

1. <http://swayam.gov.in/>
2. <https://www.netacad.com/courses/packet-tracer>

List of Suggested Experiments:

1. To study different types of network cables.
2. Implement the cross-wired cable and straight through cable using crimping tool.
3. Write a program to implement the data link layer framing methods using the concept of the following.
 1. Bit stuffing
 2. Character stuffing
4. Introduction of CISCO Packet Tracer Simulator.
5. To Study Network Devices.
6. Designing of various Network Topologies using CPT
7. To Study Network Layer– IPv4 Addressing Scheme and perform an Exercise.
8. Configuration of Static Routing.
9. Configure a network with subnetting along with DNS Server.
10. Configure RIP using packet tracer.
11. Configuration of Frame Relay.

(Professional Elective – I)
Gandhinagar Institute of Technology
B.Tech Information Technology
Semester 5

Subject Code: 10050505	Subject Title: Advanced Java Programming
Prerequisite: Core Java, Database Management System, Basic of Web Programming	

Course Objective:

1. Web applications based on Java use Servlet, JSP, JSF.
2. To store the data database connectivity and database JDBC component is needed. Networking components are needed to transfer data over the network. Model-View-Controller (MVC) architecture gives flexibility and makes the web applications loosely coupled.

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		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 Converter Tag, JSF Validation Tag, JSF Event Handling and Database Access,	6	10	

	JSF Libraries: PrimeFaces [TB-2:Complete Reference J2EE by James Keogh - CH-14]		
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

(Professional Elective – I)
Gandhinagar Institute of Technology
B.Tech Information Technology
Semester 5

Subject Code: 10050506	Subject Title: ASP .Net Programming
Pre-requisite: Basic fundamental knowledge of functional programming, HTML, CSS	

Course Objective:

1. Basics of .NET framework and C#
2. Introduction to Entity Framework Core
3. Introducing Web Development Using ASP.NET Core and Razor Pages

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 .NET Framework: Understanding .NET platforms, Comparing .NET technologies, Downloading and installing Visual Studio, Downloading and installing Visual Studio Code, Building console apps using Visual Studio 2022, Compiling and running code using Visual Studio, Implicitly imported namespaces [T.B-1: “C# 12 and .NET 8 - Modern Cross-Platform Development Fundamentals” - CH-1]	5	5
2	Introducing C# language: Comments, Blocks, Regions, Importing namespaces globally, Working with variables, Data Types, Declaring local variables, console apps, Getting text input from the user, Importing a static type for a single file, Getting key input from the user, Passing arguments to a console app, Operators, Selection statements, Looping statements, Handling exceptions, Writing a function that returns a value. [T.B-1: “C# 12 and .NET 8 - Modern Cross-Platform Development Fundamentals” - CH-2]	8	15
3	Introduction to OOP: Encapsulation, Composition, Aggregation, Inheritance, Abstraction, Polymorphism, Building class libraries, Understanding members: Fields and Methods, Class, Object, Keywords: static, constant, read-only, Initializing fields with constructors, Working with methods and tuples, Controlling access with properties and indexers, Static methods and overloading operators, Inheriting from classes, Understanding the this and base keywords, Inheriting from abstract classes, Inheriting from interfaces. [T.B-1: “C# 12 and .NET 8 - Modern Cross-Platform Development Fundamentals” - CH-5]	8	20

4	Working with Data Using Entity Framework Core: Understanding modern databases, Understanding Entity Framework Core, Using SQLite, Setting up SQLite for Windows, Creating a console app for working with EF Core, Creating the Northwind sample database for SQLite, Choosing an EF Core database provider, Building EF Core models for the Northwind tables, Adding tables to the Northwind database context class. [T.B-1: “C# 12 and .NET 8 - Modern Cross-Platform Development Fundamentals” - CH-10]	8	20
5	Introducing Web Development Using ASP.NET Core Understanding ASP.NET Core, Classic ASP.NET versus modern ASP.NET Core, Environment Setup, New Project, Project Layout, Project.Json, Configuration, Middleware, Exceptions, Static Files, Setup MVC, MVC Design Pattern, Routing, Attribute Routes, Action Results, Views, DbContext [T.B-1: “C# 12 and .NET 8 - Modern Cross-Platform Development Fundamentals” - CH-12]	8	20
6	Building Websites Using ASP.NET Core Razor Pages Razor Layout Views, Razor View Start, Razor View Import, Razor Tag Helpers, Razor Edit Form, Identity Overview, Authorize Attribute, Identity Configuration, Identity Migrations, User Registration, Create a User, Log In and Log Out [T.B-1: “C# 12 and .NET 8 - Modern Cross-Platform Development Fundamentals” - CH-13]	8	20

Course Outcome:

1. Understand the .NET framework and Visual Studio.
2. Introducing C# language : Control flow, Functions,
3. Object Oriented Programming Concepts: Inheritance & Interface
4. Working with Data Using Entity Framework Core
5. Introducing Web Development Using ASP.NET Core
6. Building Websites Using ASP.NET Core Razor Pages

List of Text Books:

1. C# 12 and .NET 8 - Modern Cross-Platform Development Fundamentals - Eighth Edition

List of Reference Books:

1. Head First C# By Andrew Stellman, Jennifer Greene
2. Learning C# Through Small Projects By Denis Panjuta, Jafar Jabbarzadeh
3. FUNDAMENTALS OF COMPUTER PROGRAMMING WITH C#
4. The Favourite A Razor-sharp Suspense Novel that Will Stay with You Long After the Final Page By Rosemary Hennigan

Open e-Resource:

1. https://www.tutorialspoint.com/asp.net_core/index.htm
2. <https://dotnet.microsoft.com/en-us/learn>
3. <https://www.coursera.org/courses?query=net>

List of Suggested Experiments:

1. Write a C# Sharp program to print Hello and your name in a separate line.
2. Write a C# Sharp program to print the results of the specified operations.
3. Write a C# Sharp program that takes four numbers as input to calculate and print the average.
4. Write a C# Sharp program that takes a number and a width also a number. It then displays a triangle of that width using that number.

5. Write a C# Sharp program to accept two integers and check whether they are equal or not.
6. Write a C# Sharp program to find the sum of the first 10 natural numbers.
7. Write a C# Sharp program to read n values in an array and display them in reverse order.
8. Write a program in C# Sharp to create a function to input a string and count the number of spaces within the string.
9. Demonstrate multiple inheritance using interfaces in C#
10. ASP.NET Web Pages - Adding Razor Code as Markup.

(Professional Elective – I)
Gandhinagar Institute of Technology
B.Tech Computer Engineering/Information Technology/Computer Science Engineering
Semester 5

Subject Code: 10270508	Subject Title: Mobile Application development
Pre-requisite: Java or object-oriented programming experience	

Course Objective:

1.This course facilitates classroom and laboratory learning, letting students develop competence and confidence in android programming and understand the entire Android Apps Development Cycle, as well as it would also enable the students to independently create Android Applications.

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	Getting Started with Android Introduction to Android, Android System with Architecture, Android Architecture, Development with Android – Platforms, Tools, Versions, Setup Android Environment, Say Hello to Android Application, Building Blocks of Android Application, Work with Activity, Activity Lifecycle, Intents Fragments, Fragment Lifecycle [RB-2:Android Application Development,DreamTech,RB-3:Beginning Android Application Development-CH-1]	3	10
2	Android Components: Activities, Fragments, and Intents Working with activities, Using Intents, Fragments, Using the Intent Object to Invoke Built –in Application [RB-2:Android Application Development,DreamTech,RB-3:Beginning Android Application Development-CH-2]	4	20
3	UI Development in Android: Views and ViewGroups Working with View Groups, Building data with the AdapterView Class, Designing AutoTextCompleteView, Implementing Screen Orientation, Designing the views programmatically, Handling UI events, Creating Menus [RB-2:AndroidApplicationDevelopment,DreamTech-CH-3,4,RB-3:Beginning Android Application Development-CH-3,4,5]	7	20
4	Persistent Data Storage in Android Introducing the Data Storage Options, Using the internal storage, Using the external storage, Using the SQLite Database, Working with content Provider [RB- 2:Android Application Development,DreamTech-CH-5, RB-3:Beginning Android Application Development-CH-6,7]	7	20
5	Integrating Location and Maps into Android Apps Working with Google Maps, Working with Geocoding and Reverse Geocoding [RB- 2:Android Application Development,DreamTech-CH-7]	5	5
6	Building Interactive Graphics and Animations Working with Graphics, Using the Drawable Object, Using the ShapeDrawable object, Hardware Acceleration, Working with Animation	6	10

	[RB- 2:Android Application Development,DreamTech-CH-8]		
7	Working with Media Components Use Media Player, Recording and Playing sound, Creating a sound pool, Using Camera, Recording Video [RB- 2:Android Application Development,DreamTech-CH-9]	4	10
8	Deploying Android Applications Signing the Android Application, Versioning the Android Application, Publishing the Android Application [RB-2:Android Application Development,DreamTech-CH-16, RB-4:Android Wireless Application Development-CH-5]	4	5

Course Outcome:

1. Understand Android architecture, activities and their life cycle.
2. Use View Groups comprising layouts and Views in application.
3. Manage data binding, user interface events, maps.
4. Work with graphics, animation, still images and video.
5. Publish and distribute Android Application.

List of Textbooks:

1. The Essential Guide to Android App Development: Start from Scratch, Ma Ja
2. MASTERING ANDROID DEVELOPMENT: AN INTERMEDIATE LEARNER'S COMPREHENSIVE GUIDE TO BUILDING HIGH-PERFORMANCE APPS, J P Peterson

List of Reference Books:

1. Android Application Development, Ajit Singh, 2022
2. Android Application Development Black Book by Pradeep Kothari, DreamTech
3. Beginning Android Application Development by Wei Meng Lee, Wrox
4. Android Wireless Application Development By Lauren Darcey, Shane Conder, Pearson

Open e-Resource:

1. <https://developer.android.com/>
2. https://onlinecourses.nptel.ac.in/noc20_cs52/preview
3. https://onlinecourses.swayam2.ac.in/nou21_ge41/preview

List of Suggested Experiments:

There should be minimum 10 programs/shell scripts.

1. Introduction to Android Programming and installation of Android Studio.
2. Develop an android app which displays “Hello, welcome to Android Lab” message.
3. Implement an android application design to showcase the usage of various layouts (Horizontal, Vertical) in android studio.
4. Develop an android app which displays a form to get following information from user. Username, Password, Email Address, Phone Number, Country, State, Gender, Interests, Birthdate, Birth time.
5. Using Android, Create a login Activity. It asks “username” and “password” from user. If username and password are valid, it displays Welcome message using new activity.
6. Develop calculator Android Application.
7. Write an Android application to convert into different currencies for example, Rupees to dollar.
8. Write an Android application to count library overdue.
9. Write an Android application to create and insert data into SQLite Database.
10. Write an application to mark the daily route of travel in map.

(Professional Elective – I)
Gandhinagar Institute of Technology
B.Tech Information Technology
Semester 5

Subject Code: 10060504	Subject Title: Python for Data Science
Prerequisite: Basics of Python	

Course Objective:

1. To familiarize students with Python syntax, data structures, control flow, functions, and object-oriented programming for scientific computing.
2. To teach students how to import, clean, transform, and manage datasets using powerful Python libraries such as Pandas and NumPy.
3. To enable students to create compelling visualizations for data exploration and communication using Matplotlib, Seaborn, and other relevant tools.
4. To build foundational knowledge of statistics and data interpretation using Python for evidence-based decision making.
5. To provide basic understanding and hands-on experience with implementing machine learning models using scikit-learn.

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	Basics of Python: Script and interactive mode, command line arguments, basic data types(Numbers, Strings, Bool), Advance Data types(List, Tuples, set, dictionary), Type casting, Functions, Python Data Structures, Conditional Statements, Looping structures,	8	15
2	Data Science and Python: Discovering the match between data science and python: Considering the emergence of data science, Outlining the core competencies of a data scientist, Linking data science, big data, and AI , Understanding the role of programming, Creating the Data Science Pipeline, Preparing the data, Performing exploratory data analysis, Learning from data, Visualizing, Obtaining insights and data products, Understanding Python's Role in Data Science, Considering the shifting profile of data scientists, Working with a multipurpose, simple, and efficient language, Learning to Use Python Fast ,Loading data, Training a model, Viewing a result. Introducing Python's Capabilities and Wonders: Why Python?, Grasping Python's Core Philosophy, Contributing to data science, Discovering present and future development goals, Working with Python, Getting a taste of the language, Understanding the need for indentation, Working at the command line or in the IDE, Performing Rapid Prototyping and Experimentation, Considering Speed of Execution, Visualizing Power, Using the Python Ecosystem for Data	5	15

	Science, Accessing scientific tools using SciPy, Performing fundamental scientific computing using NumPy, Performing data analysis using pandas, Implementing machine learning using Scikit-learn, Going for deep learning with Keras and TensorFlow, Plotting the data using matplotlib, Creating graphs with NetworkX, Parsing HTML documents using BeautifulSoup.		
3	Getting Your Hands Dirty With Data: Understanding the tools: Using the Jupyter Console, Interacting with screen text, Changing the window appearance, Getting Python help, Getting IPython help, Using magic functions, Discovering objects, Using Jupyter Notebook, Working with styles, Restarting the kernel, Restoring a checkpoint, Performing Multimedia and Graphic Integration, Embedding plots and other images, Loading examples from online sites, Obtaining online graphics and multimedia. Working with Real Data: Uploading, Streaming, and Sampling Data, Uploading small amounts of data into memory, Streaming large amounts of data into memory, Generating variations on image data, Sampling data in different ways, Accessing Data in Structured Flat-File Form ,Reading from a text file Reading CSV delimited format, Reading Excel and other Microsoft Office files, Sending Data in Unstructured File Form, Managing Data from Relational Databases, Interacting with Data from NoSQL Databases, Accessing Data from the Web. Conditioning Your Data: Juggling between NumPy and pandas, Knowing when to use NumPy, Knowing when to use pandas, Validating Your Data, Figuring out what's in your data, Removing duplicates, Creating a data map and data plan, Manipulating Categorical Variables, Creating categorical variables, Renaming levels, Combining levels, Dealing with Dates in Your Data, Formatting date and time values, Using the right time transformation, Dealing with Missing Data, Finding the missing data, Encoding missingness, Imputing missing data, Slicing and Dicing: Filtering and Selecting Data, Slicing rows, Slicing columns, Dicing, Concatenating and Transforming, Adding new cases and variables, Removing data, Sorting and shuffling, Aggregating Data at Any Level. Shaping Data: Working with HTML Pages, Parsing XML and HTML, Using XPath for data extraction, Working with Raw Text, Dealing with Unicode, Stemming and removing stop words, Introducing regular expressions, Using the Bag of Words Model and Beyond, Understanding the bag of words model, Working with ngrams, Implementing TF-IDF transformations, Working with Graph Data, Understanding the adjacency matrix, Using NetworkX basics.	15	30
4	Data Wrangling: Wrangling Data: Playing with Scikit-learn, Understanding classes in Scikit-learn, Defining applications for data science, Performing the Hashing Trick, Using hash functions, Demonstrating the hashing trick, Working with deterministic selection, Considering Timing and Performance, Benchmarkin, with,timeit, Working with the memory profiler, Running in Parallel on Multiple Cores, Performing multicore parallelism, Demonstrating multiprocessing. Exploring Data Analysis: The EDA Approach, Defining Descriptive Statistics for Numeric Data, Measuring central tendency,Measuring variance and range ,Working with percentiles, Defining measures of normality, Counting for Categorical Data,	10	25

	Understanding frequencies, Creating contingency tables, Creating Applied Visualization for EDA ,Inspecting boxplots, Performing t-tests after boxplots, Observing parallel coordinates, Graphing distributions, Plotting scatterplots ,Understanding Correlation, Using covariance and correlation, Using nonparametric correlation, Considering the chi-square test for tables ,Modifying Data Distributions, Using different statistical distributions, Creating a Z-score standardization, Transforming other notable distributions.		
5	Data Visualization: Visualizing Information: Starting with a Graph, Defining the plot, Drawing multiple lines and plots, Saving your work to disk, Setting the Axis, Ticks, Grids, Getting the axes, Formatting the axes, Adding grids, Defining the Line Appearance, Working with line style, Using colors, Adding markers, Using Labels, Annotations, and Legends, Adding labels, Annotating the chart, Creating a legend. Visualizing the Data: Choosing the Right Graph, Showing parts of a whole with pie charts, Creating comparisons with bar charts, Showing distributions using histograms, Depicting groups using boxplots, Seeing data patterns using scatterplots, Creating Advanced Scatterplots, Depicting groups, Showing correlations, Plotting Time Series, Representing time on axes, Plotting trends over time, Plotting Geographical Data, Using an environment in Notebook, Getting the Basemap toolkit, Dealing with deprecated library issues, Using Basemap to plot geographic data, Visualizing Graphs, Developing undirected graphs, Developing directed graphs.	8	15

Course Outcome:

1. Understand Python programming fundamentals.
2. Apply Python libraries for data manipulation.
3. Perform data visualization using Python.
4. Utilize statistical methods for data interpretation
5. Work with real-world datasets

List of Textbooks:

1. McKinney, W., Python for Data Analysis, O'Reilly Media, 2022.
2. Géron, A., Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly Media, 2022.

List of Reference Books:

1. Mueller, J., Python for Data Science For Dummies, Wiley, 2015.
2. Downey, A. B., Think Python: How to Think Like a Computer Scientist, O'Reilly Media, 2015.
3. Grus, J., Data Science from Scratch: First Principles with Python, O'Reilly Media, 2019.
4. VanderPlas, J., Python Data Science Handbook, O'Reilly Media, 2016.
5. Bruce, P., Bruce, A., Gedeck, P., Practical Statistics for Data Scientists, O'Reilly Media, 2020.
6. Müller, A. C., Guido, S., Introduction to Machine Learning with Python, O'Reilly Media, 2016.

List of Suggested Experiments:

1. Write Python programs to demonstrate different data types, variables, operators, and control flow (if-else, loops).
2. Perform operations on lists, tuples, dictionaries, and sets. Write functions to manipulate these structures.
3. Import datasets (CSV/Excel), handle missing values, filter rows, and transform columns using Pandas.
4. Use group by, pivot tables, and aggregation functions to summarize and analyze data.
5. Create line plots, bar charts, histograms, scatter plots, and heat maps to visualize dataset features.
6. Perform a full EDA on a real-world dataset: summary statistics, data cleaning, visualizations, and correlation analysis.

7. Build and evaluate a classification model (e.g., decision tree or logistic regression) using scikit-learn.
8. Load and analyze a time series dataset (e.g., stock prices). Perform trend and seasonality analysis, plot moving averages, and visualize patterns.
9. Perform basic natural language processing (NLP) tasks such as tokenization, stopword removal, and frequency distribution using Python libraries like NLTK or spaCy.
10. Implement K-Means clustering on a dataset to group similar data points and visualize the clusters using scatter plots.

GANDHINAGAR INSTITUTE OF TECHNOLOGY
B.Tech Information Technology
Semester 6

Subject Code: 10060601	Subject Title: Cryptography and Network Security
Prerequisite: - Nil	

Course Objectives:

1. Analyze and design classical encryption techniques and block ciphers.
2. Understand and analyze data encryption standard.
3. Understand and analyze public-key cryptography, RSA and other public-key cryptosystems such as Diffie-Hellman Key Exchange, ElGamal Cryptosystem, etc.
4. Understand key management and distribution schemes and design User Authentication Analyze and MAC algorithms, and digital signatures.
5. Design network application security schemes, such as PGP, S/ MIME, IPSec, SSL, TLS,

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	5	70	30	30	20	150

Sr. No.	Content	Total HRS	% Weightage
1	Introduction – Security services, security services, security mechanisms Finite fields – group, ring, fields, modular arithmetic, The Euclidean algorithm. [TB-1 Cryptography And Network Security, Principles And Practice Sixth Edition, William Stallings CH-1]	5	15%
2	Symmetric Cipher Model, Cryptography, Cryptanalysis and Attacks; Substitution and Transposition techniques. [TB-1 Cryptography And Network Security, Principles And Practice Sixth Edition, William Stallings CH-3]	3	5%
3	Stream ciphers and 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 [TB-1 Cryptography And Network Security, Principles And Practice Sixth Edition, William Stallings CH-4 & 6]	5	10%
4	Multiple encryption and triple DES, Electronic Code Book, Cipher Block Chaining Mode, Cipher Feedback mode, Output Feedback mode, Counter mode. [TB-1 Cryptography And Network Security, Principles And Practice Sixth Edition, William Stallings CH-4 & 7]	4	5%

5	Public Key Cryptosystems with Applications, Requirements and Cryptanalysis, RSA algorithm, its computational aspects and security, Diffie-Hillman Key Exchange algorithm, Man-in-Middle Attack. [TB-1 Cryptography And Network Security, Principles And Practice Sixth Edition, William Stallings CH-9]	7	15%
6	Cryptographic Hash Functions, their applications, Simple hash functions, its requirements and security, Hash functions based on Cipher Block Chaining, Secure Hash Algorithm (SHA) .[TB-1 Cryptography And Network Security, Principles And Practice Sixth Edition, William Stallings CH-11]	4	10%
7	Message Authentication Codes, its requirements and security, MACs based on Hash Functions, Macs based on Block Ciphers [TB-1 Cryptography And Network Security, Principles And Practice Sixth Edition, William Stallings CH-12]	3	10%
8	Digital Signature, its properties, requirements and security, various digital signature schemes (Elgamal and Schnorr), NIST digital Signature algorithm. [TB-1 Cryptography And Network Security, Principles And Practice Sixth Edition, William Stallings CH-13]	4	8%
9	Key management and distribution, symmetric key distribution using symmetric and asymmetric encryptions, distribution of public keys, X.509 certificates, Public key infrastructure. [TB-1 Cryptography And Network Security, Principles And Practice Sixth Edition, William Stallings CH-14]	4	7%
10	Remote user authentication with symmetric and asymmetric encryption, Kerberos. [TB-1 Cryptography And Network Security, Principles And Practice Sixth Edition, William Stallings CH-15]	4	5%
11	Web Security threats and approaches, SSL architecture and protocol, Transport layer security, HTTPS and SSH. [TB-1 Cryptography And Network Security, Principles And Practice Sixth Edition, William Stallings CH-17]	5	10%

Course Outcome:

- CO-1 Define terms related to cryptography, hashing, message authentication code, digital signature.
- CO-2 Describe and discuss symmetric key cryptography algorithms, public key cryptography algorithms, hashing algorithms, Message authentication code generation algorithms, digital signature algorithms, key generation and key management, issues in web security and solution, issues in Transport layer security and solution.
- CO-3 Demonstrate the generation of keys and execution of symmetric and public key algorithms from given data.
- CO-4 Implement cryptography solution for given security problem by identifying strength and weaknesses of algorithms based on cryptanalytic and brute force attack.

List of Textbooks:

1. Cryptography And Network Security, Principles And Practice Sixth Edition, William Stallings, Pearson Seventh Edition 2021
2. Cryptography and Network Security Atul Kahate, TMH

List of Reference Books:

1. Information Security Principles and Practice 6th Edition By Mark Stamp, Wiley India Edition
2. Cryptography & Network Security, 2019 Forouzan, Mukhopadhyay, McGrawHill

Practical List

1. Write a C program to implement Caesar cipher encryption-decryption.
2. Write a C program to implement Monoalphabetic cipher encryption-decryption.
3. Write a C program to implement Playfair cipher encryption-decryption.
4. Write a C program to implement Polyalphabetic cipher encryption-decryption.
5. Write a C program to implement Hill cipher encryption-decryption.
6. Write a C program to implement simple DES.
7. Write a C program to implement Diffi-Hellmen Key exchange Method.
8. Write a C program to implement RSA encryption-decryption algorithm.
9. Write a C program to implement digital signature algorithm.
10. Perform various encryption-decryption techniques with cryptool.
11. Study and use the Wireshark for the various network protocols.

Gandhinagar Institute of Technology
B.Tech Information Technology
Semester 6

Subject Code: 10060602	Subject Title: Advanced Web Technology
Pre-requisite: Basic knowledge of Internet and Client Server system is required, Java Script, Dynamic Web Programming	

Course Objective:

1. To understand the concept of java script based framework for web programming.
2. To understand advanced web programming concepts related to Java script and CSS.
3. To understand advanced web programming concepts related to Angular JS.
4. To understand advanced web programming concepts related to Node JS.
5. To understand advanced web programming concepts related to MongoDB.

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

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)
1	Refreshing Java Script and CSS CSS syntax, benefits, Responsive design, Bootstrap introduction, Java script syntax, Java script inbuilt objects, Error handling and event handling, DOM, Asynchronous Programming. [Open e-Resource link CSS,JS]	06	10%
2	Introduction to Angular JS Basics and Syntax of Angular JS, Features, Advantages, Application Structure, Basics of routes and navigation, MVC with Angular JS, Services. [TB 1 Angularjs in Action - CH 1,2]	08	15%
3	Angular JS in Details Modules, Directives, Routes, Angular JS Forms and Validations, Data binding, Creating single page website using Angular JS. [TB 1 Angularjs in Action - CH 4,5,6,7]	10	20%
4	Introduction to Node JS Setup Node JS Environment, Package Manager, Features, Console Object, Concept of Callbacks . [TB 2 Node.js in Action - CH 1,2]	08	15%
5	Node JS in details Events and Event Loop, timers, Error Handling, Buffers, Streams, Work with File System, Networking with Node (TCP, UDP and HTTP clients and servers), Web Module, Debugging, Node JS REST API, Sessions and Cookies, Design patterns, caching, scalability. [TB 2 Node.js in Action - CH 3,4,5,6]	12	20%
6	Database Programming with Node JS and MongoDB Basics of MongoDB, Data types, Connect Node JS with MongoDB, Operations on data (Insert, Find, Query, Sort, Delete, Update) using Node JS. [RB 5 Beginning MERN Stack - CH 1,2,5]	10	20%

Course Outcome:

1. Learn the concepts of client side programming using CSS and Java Script
2. Understand the concepts of Angular JS to extend basic HTML features
3. Learn Node JS framework to build dynamic server side applications
4. Study the concept of database using Mongo DB and connect database with application
5. Design and implement full featured web application using the concepts of Angular JS and Node JS

List of Textbooks:

1. Angularjs in Action ISBN 9789351198383 Ruebbelke, Wiley Publication
2. Node.js in Action ISBN 9789386052049 Alex Young, Bradley Meck, Mike Cantelon, Tim Oxley, Marc Harter, T.J. Holowaychuk, Nathan Rajlich, Wiley Publication

List of Reference Books:

1. Node JS: Master the In-Demand JavaScript Platform from Basics to Practice (The Art of Coding) by Liam Peterson
2. Node.js in Practice ISBN 9789351197744 Alex Young, Marc Harter, Ben Noordhuis Wiley Publication
3. Node Cookbook: Discover solutions, techniques, and best practices for server-side web development with Node.js 14 by Bethany Griggs
4. Pro Angular 16 by Adam Freeman
5. Beginning MERN Stack: Build and Deploy a Full Stack MongoDB, Express, React, Node.js App by Greg Lim

Open e-Resource:**HTML:**

<https://developer.mozilla.org/en-US/docs/Web/HTML>

<https://www.w3schools.com/html/>

<https://www.tutorialspoint.com/html/index.htm>

CSS:

<https://developer.mozilla.org/en-US/docs/Web/CSS>

<https://www.manning.com/books/css-in-depth>

<https://www.w3schools.com/css/>

<https://www.tutorialspoint.com/css/index.htm>

Java Script:

<https://javascript.info/>

<https://github.com/getify/You-Dont-Know-JS>

<https://www.w3schools.com/js/>

<https://www.tutorialspoint.com/javascript/index.htm>

PHP:

<https://www.w3schools.com/php/>

<https://www.tutorialspoint.com/php/index.htm>

List of Suggested Experiments:

1. Study of basic implementation with Cascading Style Sheet.
2. Understand basics of Java script syntax.
3. Study of JavaScript's event, cookies, page redirect.
4. Study of JavaScript Object.
5. Study of Bootstrap
6. To understand Basics of AngularJS.
7. To study AngularJS's forms, AJAX, Views.
8. To study AngularJS Services, Dependency Injection
9. To understand Basics of NodeJs.
10. Implement database connection between mongodb and nodejs.

Gandhinagar Institute of Technology
B.Tech Information Technology
Semester 6

Subject Code: 10060603	Subject Title: Software Engineering
Pre-requisite: Object Oriented Programming fundamental, UML	

Course Objective:

1. To study Software Development Life Cycle, Development models and Agile Software development.
2. To study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods.
3. To discuss various software testing issues and solutions in software unit test; integration, regression, and system testing.
4. To learn the process of improving the quality of software work products.
5. To gain the techniques and skills on how to use modern software testing tools to support software testing projects
6. To expose Software Process Improvement and Reengineering.

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	Introduction to Software and Software Engineering The Evolving Role of Software, Software: A Crisis on the Horizon and Software Myths, Software Engineering: A Layered Technology, <u>Software Process Models</u> , The Linear Sequential Model, <u>The Prototyping Model</u> , The RAD Model, Evolutionary Process Models, Agile Process Model, Component-Based Development, Process, Product and Process. [R.B Roger S.Pressman, Software Engineering- A practitioner's Approach CH-1]	3	10	
2	Agile Development: <u>Agility and Agile Process model</u> , Extreme Programming, Other process models of Agile Development and Tools. [R.B Roger S.Pressman, Software Engineering- A practitioner's Approach CH-2]	4	7	
3	Managing Software Project: Software Metrics (Process, Product and Project Metrics), <u>Software Project Estimations</u> , Software Project Planning (MS Project Tool), Project Scheduling & Tracking, <u>Risk Analysis & Management</u> (Risk Identification, Risk Projection, Risk Refinement , Risk Mitigation). [R.B Roger S.Pressman, Software Engineering- A practitioner's Approach CH-2,28]	4	7	

4	Requirement Analysis and Specification: Understanding the Requirement, Requirement Modeling, <u>Requirement Specification (SRS)</u> , Requirement Analysis and Requirement Elicitation, Requirement Engineering [R.B Roger S.Pressman, Software Engineering- A practitioner's Approach CH-5]	4	9
5	Software Design: <u>Design Concepts</u> and <u>Design Principal</u> , <u>Architectural Design</u> , Component Level Design (Function Oriented Design, Object Oriented Design), <u>User Interface Design</u> , Web Application Design. [R.B Roger S.Pressman, Software Engineering- A practitioner's Approach CH-8,9]	5	12
6	Software Coding & Testing: Coding Standard and coding Guidelines, <u>Code Review</u> , Software Documentation, Testing Strategies, Testing Techniques and Test Case, Test Suites Design, Testing Conventional Applications, Testing Object Oriented Applications, Testing Web and Mobile Applications, Testing Tools (Win runner, Load runner). [R.B Roger S.Pressman, Software Engineering- A practitioner's Approach CH-17]	7	15
7	Quality Assurance and Management: <u>Quality Concepts</u> and <u>Software Quality Assurance</u> , Software Reviews (Formal Technical Reviews), Software Reliability, The Quality Standards: ISO 9000, CMM, Six Sigma for SE, SQA Plan [R.B Roger S.Pressman, Software Engineering- A practitioner's Approach CH-14,16]	5	15
8	Software Maintenance and Configuration Management: <u>Types of Software Maintenance</u> , <u>Re-Engineering</u> , <u>Reverse Engineering</u> , <u>Forward Engineering</u> , <u>The SCM Process</u> , Identification of Objects in the Software Configuration, Version Control and Change Control [R.B Roger S.Pressman, Software Engineering- A practitioner's Approach CH-22,29]	4	8
9	DevOps: Overview, Problem Case Definition, Benefits of Fixing Application Development Challenges, DevOps Adoption Approach through Assessment, Solution Dimensions, What is DevOps?, DevOps Importance and Benefits, DevOps Principles and Practices, 7 C's of DevOps Lifecycle for Business Agility, DevOps and Continuous Testing, How to Choose Right DevOps Tools, Challenges with DevOps Implementation, Must Do Things for DevOps, Mapping My App to DevOps - Assessment, Definition, Implementation, Measure and Feedback [R.B Roger S.Pressman, Software Engineering- A practitioner's Approach CH-29]	3	8
10	Advanced Topics in Software Engineering: Component-Based Software Engineering, Client/Server Software Engineering, Web Engineering, Reengineering, Computer-Aided Software Engineering, Software Process Improvement, Emerging Trends in software Engineering. [R.B Roger S.Pressman, Software Engineering- A practitioner's Approach CH-31]	3	9

Course Outcome:

1. Prepare SRS (Software Requirement Specification) document and SPMP (Software Project Management Plan) document.
2. Apply the concept of Functional Oriented and Object Oriented Approach for Software Design.
3. Recognize how to ensure the quality of software product, different quality standards and software review techniques.
4. Apply various testing techniques and test plan in.
5. Able to understand modern Agile Development

List of Reference Books:

1. Roger S.Pressman, Software Engineering- A practitioner's Approach, McGraw-Hill International Editions
2. Ian Sommerville, Software engineering, Pearson education Asia
3. Pankaj Jalote, Software Engineering – A Precise Approach Wiley
4. Behhforoz & Frederick Hudson, Software Engineering Fundamentals, OXFORD
5. Rajib Mall, Fundamentals of software Engineering, Prentice Hall of India.
6. Deepak Gaikwad, Viral Thakkar, DevOps Tools from Practitioner's ViewPoint, Wiley
7. Merlin Dorfman (Editor), Richard H. Thayer (Editor) ,Software Engineering
8. Robert C. "Uncle Bob" Martin , Clean Architecture: A Craftsman's Guide to Software Structure and Design

Open e-Resource:

1. <https://www.javatpoint.com/software/engineering>
2. <https://www.geeksforgeeks.org/software/engineering/introduction/to/software/engineering/>

List of Suggested Experiments:

There should be minimum 10 programs/shell scripts.

1. Select any application for which software development process can be defined and find out which processmodel will be more suitable for application. Justify the selection of model.
2. Create a SRS document for selected application.
3. Draw E/R diagram and class diagram for your selected application.
4. Write the scenario and draw Use case Diagram for selected application.
5. Draw Activity diagram for selected application.
6. Draw Sequence diagram for selected application.
7. Draw Data Flow Diagrams for selected application.
8. Apply FP oriented estimation model for selected application.
9. Prepare Test Cases for your application.

Gandhinagar Institute of Technology
B.Tech Information Technology
Semester 6

Subject Code: 10060608	Subject Title: UX Design Foundation
Pre-requisite: Design Fundamentals	

Course Objective:

1. To introduce the fundamentals of User Experience (UX) design and its importance in digital products.
2. To understand user-centered design principles and design thinking process.
3. To develop skills for user research, requirement analysis, and persona creation.
4. To learn information architecture, interaction design, and usability principles.
5. To familiarize students with UX evaluation methods and modern UX trends.

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 UX Design: Definition and scope of UX design, UX vs UI design, Importance of UX in product development, Elements of User Experience, Overview of UX design process	8	15	
2	User-Centered Design & Design Thinking: User-centered design principles, Design thinking process, Empathy, define, ideate, prototype, test, Understanding user needs and goals, Problem definition techniques	10	25	
3	User Research & Analysis: Types of user research, Qualitative and quantitative research, User interviews and surveys, Personas and user scenarios, User journey mapping	10	25	
4	Information Architecture & Interaction Design: Information architecture concepts, Card sorting techniques, Navigation design, Interaction design principles, Wireframes and low-fidelity prototypes	8	20	
5	Usability, Evaluation & Emerging Trends: Usability principles and heuristics, Usability testing methods, UX metrics and evaluation, Accessibility basics, Emerging trends in UX design	8	15	

Course Outcome:

- CO1: Explain basic concepts, principles, and scope of UX design.
CO2: Apply user-centered design and design thinking methodologies.
CO3: Conduct basic user research and create personas and user journeys.
CO4: Design effective information architecture and interaction flows.
CO5: Evaluate user interfaces using usability and UX evaluation techniques.

List of Textbooks:

1. Jesse James Garrett, The Elements of User Experience: User-Centered Design for the Web and Beyond, New Riders.

List of Reference Books:

1. Don Norman, The Design of Everyday Things
2. Jesse James Garrett, The Elements of User Experience
3. Steve Krug, Don't Make Me Think

Open e-Resource:

1. UX Design Fundamentals – Interaction Design Foundation: <https://www.interaction-design.org/>
2. Google UX Design Guide: <https://www.thinkwithgoogle.com/intl/en-154/consumer-insights/ux-design/>
3. Nielsen Norman Group – UX Research & Usability: <https://www.nngroup.com/articles/>

(Professional Elective-II)
Gandhinagar Institute of Technology
B.Tech Information Technology
Semester 6

Subject Code: 10050603	Subject Title: Advance Computer Networks
Pre-requisite: Fundamental of basic computer topologies, types of networks, basic networking protocols	

Course Objective:

1. Identify the computer network topologies and its features.
2. Understand routing algorithms and routing techniques.

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	Basic Overview of network fundamentals Optical Networking: Introduction to Optical Networking, (DQDB) Distributed Queue Dual bus, SONET / (SDH) Synchronous Digital hierarchy Standard. [RB -3: Computer network, Andrew S. Tanenbaum, CH-2]	6	13	
2	ATM: The WAN Protocol: Introducing ATM Technology, Faces of ATM Explaining the basic concepts of ATM Networking, B-ISDN reference model Explaining the Physical Layer, ATM Layer, ATM Adaptation Layer, ATM Physical interface, Choosing an Appropriate ATM Public Service [RB -4: Introduction to Data communication and Networking, CH-18]	8	17	
3	Packet Switching Protocols: Introduction to Packet Switching, Virtual Circuit Packet Switching, X.25, switched multimegabit data service [RB -3: Computer network, Andrew S. Tanenbaum, CH-2,5] [RB-4: Introduction to Data communication and Networking CH-18]	5	11	
4	Protocols and Interfaces in Upper Layers of TCP/IP: Introducing TCP/IP suite, Explaining Network Layer Protocols, Transport Layer Protocol, Application Layer Protocol [RB-4: Introduction to Data communication and Networking CH-2]	4	8	
5	Routing in the Internet: Introduction to Intra-domain and inter-domain routings, Unicast Routing Protocols, Multicast Routing Protocols Routing Techniques: IP over ATM, Multiprotocol Label Switching [RB-4: Introduction to Data communication and Networking CH-22]	5	10	
6	Network Management and Services Remote monitoring Techniques: Polling, Traps, Performance management, Security management, Firewalls, VLANs, Proxy Servers [RB-4: Introduction to Data communication and Networking CH-12,32,15]	4	8	
7	Traffic Engineering Basics: Traffic Engineering, Requirement Definition for Traffic Engineering, Traffic Sizing, Traffic Characteristics, Protocols, Time and Delay Consideration [RB-4: Introduction to Data communication and Networking CH-24]	5	10	
8	Introduction to the Cisco Router: The Cisco Router User Interface, Command Line Interface (CLI), Router and Switch Administrative Functions,	4	8	

	Router Interfaces, Viewing, Saving, and Erasing Configurations. [RB-6: Cisco IP Routing CH-1]		
9	IP Routing: Routing Basics, The IP Routing Process Configuration IP Routing in Our Network [RB-6: Cisco IP Routing CH-2]	6	13
10	Dynamic Routing Protocols: Routing Protocol Basics, Routing Information Protocol (RIP), Interior Gateway Routing Protocol (IGRP), Verifying Your Configurations [RB 6: Cisco IP Routing, CH-8]	3	6

Course Outcome:

1. Understand the state-of-the-art in network protocols, architectures and applications
2. Understand how networking research is done.
3. Investigate novel ideas in the area
4. Understand the gravity and concepts of computer networks
5. Identify basic protocols and design issues for layered model.
6. Explain various topological and routing strategies for IP based networks.
7. Knowledge of data packet trafficking and its solutions

List of Reference Books:

1. High Speed Networks and internets, Performance and Quality of Service, William Stallings, Pearson.
2. Advance Computer Network, Dayand Ambawadw, Dr. Deven Shah, Prof Mahendra Mehra, Wiley India.
3. Computer network, Andrew S. Tanenbaum, Pearson.
4. Introduction to Data communication and Networking, Behrouz Forouzan, TMH Publication.
5. TCP/IP Protocol suit ,Behrouz Forouzan , TMH Publication
6. Cisco IP Routing: Packet Forwarding and Intra-domain Routing Protocols

Open e-Resource:

1. <https://www.netacad.com/about-networking-academy/packet-tracer/>
2. <http://www.networkworld.com/blogs>
3. <https://www.tutorialspoint.com/ipv6/>

List of Suggested Experiments:

1. Introduction to Cisco packet tracer with Implementing any network
2. Create a network with static routing configuration
3. Perform Dynamic routing with protocol
4. To study SONET network configuration and network elements
5. Configuration of ATM Switching
6. Perform VLAN on switches by packet tracer
7. Implement DSL connection with packet tracer
8. Create virtual circuit network frame relay and ATM

(Professional Elective – II)
Gandhinagar Institute of Technology
B.Tech Computer Engineering/Information Technology
Semester 6

Subject Code: 10050604	Subject Title: Distributed Computing
Pre-requisite: A strong foundation in data structures, algorithms, computer networks, and programming is essential for studying distributed computing.	

Course Objective:

1. Understand the fundamental concepts and challenges of distributed computing.
2. Gain practical experience in designing and implementing distributed systems.
3. Analyze and evaluate different distributed algorithms and architectures.
4. Develop skills in designing fault-tolerant and scalable distributed applications.

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	Introduction to Distributed Systems: Definition and characteristics of distributed systems, Motivation and challenges of distributed computing, Types of distributed systems, Examples of distributed systems in real-world applications. [T.B-1:Distributed Systems: Principles and Paradigms- CH-1,2]	3	10	
2	Distributed System Models: Client-server architecture, Peer-to-peer architecture, Middleware-based architectures, Comparison of different distributed system models. [T.B-1:Distributed Systems: Principles and Paradigms- CH-4]	4	10	
3	Communication in Distributed Systems: Remote Procedure Call (RPC), SUN RPC operation, example - SUN RPC LRPC, Example: DCE RPC Remote object invocation ,The General Architecture, Steps for Developing an RMI system, Remote Interfaces and Classes, example, Message passing, Synchronous vs. asynchronous communication. [T.B-1:Distributed Systems: Principles and Paradigms- CH-6]	4	15	
4	Concurrency Control: Mutual exclusion and synchronization, Distributed mutual exclusion algorithms, Deadlock detection and prevention [T.B-1:Distributed Systems: Principles and Paradigms- CH-8]	4	12	
5	Distributed Algorithms: Leader election, Distributed consensus algorithms (e.g., Paxos, Raft), Distributed termination detection, Distributed graph algorithms [T.B-2:Distributed Algorithms- CH-1,2]	5	12	
6	Fault Tolerance: Types of faults in distributed systems, Replication and consistency models, Fault tolerance techniques (e.g., replication, check pointing, recovery)	7	15	

	[T.B-1:Distributed Systems: Principles and Paradigms- CH-9]		
7	Scalability and Performance: Scalability metrics, Techniques for achieving scalability (e.g., load balancing, caching), Performance modeling and analysis Case studies of scalable distributed systems [T.B-1:Distributed Systems: Principles and Paradigms- CH-11]	5	15
8	Case Studies and Applications: Case studies of distributed systems (e.g., Google File System, Amazon Dynamo DB) Applications of distributed computing (e.g., cloud computing, Iot) [T.B-4:Distributed Systems: Principles and Paradigms- CH-13]	4	11

Course Outcome:

1. To gain experience in the design and development of distributed systems and distributed systems applications.
2. To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.
3. To analyze the current popular distributed systems such as peer-to-peer (P2P) systems will also be analyzed.
4. Understand distributed system techniques and methodologies.

List of Textbooks:

1. Distributed Systems: Principles and Paradigms" by Andrew S. Tanenbaum and Maarten Van Steen.
2. Distributed Algorithms" by Nancy A. Lynch.
3. Tributed Computing: Principles, Algorithms, and Systems" by Ajay D. Kshemkalyani and Mukesh Singhal.
4. Principles of Distributed Database Systems" by M. Tamer Özsu and Patrick Valduriez.

List of Reference Books:

1. Building Microservices" by Sam Newman - While primarily focusing on microservices architecture, this book discusses the principles and challenges of building distributed systems, including communication patterns, service discovery, resilience, and deployment strategies.
2. Cloud Computing: Principles and Paradigms" edited by Rajkumar Buyya, James Broberg, and Andrzej Goscinski - This book provides comprehensive coverage of cloud computing concepts, architectures, deployment models, and technologies, which are essential for understanding modern distributed computing infrastructures.
3. Distributed Systems for Fun and Profit" by Mikito Takada - This online book provides practical insights into designing and implementing distributed systems, covering topics such as network protocols, concurrency models, fault tolerance, and scalability techniques.

Open e-Resource:

1. <https://ieeexplore.ieee.org/search/distributedcomputing>
2. <https://nptel.ac.in/courses/106106168>
3. <https://github.com/topics/distributed-systems>
4. <https://www.coursera.org/courses/distributedsystems>

List of Suggested Experiments:

1. Set up a simple client-server architecture using sockets or a higher-level framework like Apache Thrift. Experiment with different communication protocols and message formats.
2. Implement a basic distributed file system where files are stored across multiple servers.
3. Experiment with file replication, fault tolerance, and consistency models.
4. Implement a distributed key-value store like Dynamo or Cassandra.

5. Experiment with data partitioning, replication strategies, and consistency levels.
6. Implement a distributed task execution framework like Apache Spark or Hadoop.
7. Experiment with task scheduling, data partitioning, and fault tolerance.
8. 8-Program to implement termination detection
9. 8-Program to implement termination detection
10. 8-Program to implement termination detection
11. Implement concurrent echo client-server application.
12. Implement concurrent day-time client-server application.
13. Configure following options on server socket and tests them: SO_KEEPALIVE, SO_LINGER, SO_SNDBUF, SO_RCVBUF, and TCP_NODELAY.
14. Incrementing a counter in shared memory.
15. Create CORBA based server-client application.

(Professional Elective – II)
Gandhinagar Institute of Technology
B.Tech Information Technology
Semester 6

Subject Code: 10060606	Subject Title: Cloud Infrastructure and Services
Pre-requisite: Fundamentals of Distributed Computing	

Course Objective:

This course aims students to understand the hardware, software concepts and architecture of cloud computing. Students realize the importance of Cloud Virtualization, Abstractions and Enabling Technologies.

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	Introduction: Cloud Computing, Layers and Types of Clouds, Cloud Infrastructure Management, Challenges and Applications. Virtualization: Virtualization of Computing, Storage and Resources. Cloud Services: Introduction to Cloud Services IaaS, PaaS and SaaS [T.B-1: “The Basics of Cloud Computing” - CH-1]	4	10	
2	Software as a Service (SaaS): Evolution of SaaS, Challenges of SaaS Paradigm, SaaS Integration Services, SaaS Integration of Products and Platforms. Infrastructure As a Services (IaaS): Introduction, Background & Related Work, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, VM Provisioning and Migration in Action. Platform As a service (PaaS): Integration of Private and Public Cloud, Technologies and Tools for Cloud Computing, Resource Provisioning services [T.B-1: “The Basics of Cloud Computing” - CH-2]	8	20	
3	Abstraction and Virtualization: Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hyper visors, Understanding Machine Imaging, Porting Applications, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context, Virtualization of CPU, Memory, I/O Devices, Virtual Clusters and Resource management, Virtualization for Data Center Automation [T.B-2: “Cloud Computing: Methodology, Systems, and Applications” - CH-4]	8	20	
4	Cloud Infrastructure and Cloud Resource Management: Architectural Design of Compute and Storage Clouds, Layered Cloud Architecture Development, Design Challenges, Inter Cloud Resource Management, Resource Provisioning and Platform Deployment, Global	8	20	

	Exchange of Cloud Resources. Administrating the Clouds, Cloud Management Products, Emerging Cloud Management Standards [R.B-3: “Cloud Application Architectures” - CH-2]		
5	Security: Security Overview, Cloud Security Challenges and Risks, Software-as-a Service Security, Cloud computing security architecture: Architectural Considerations, General Issues Securing the Cloud, Securing Data, Data Security, Application Security, Virtual Machine Security, Identity and Presence, Identity Management and Access Control, Autonomic Security Establishing Trusted Cloud computing, Secure Execution Environments and Communications, , Identity Management and Access control Identity management, Access control, Autonomic Security Storage Area Networks, Disaster Recovery in Clouds. [T.B-3: “Cloud Computing: Concepts, Technology & Architecture” - CH-5]	7	14
6	Cloud Middleware: OpenStack, Eucalyptus, Windows Azure, CloudSim, EyeOs, Aneka, Google App Engine [T.B-3: “Cloud Computing: Concepts, Technology & Architecture” - CH-6]	5	8
7	Cloud Based Case-Studies: Overview of Cloud services, Designing Solutions for the Cloud, Implement & Integrate Solutions, Emerging Markets and the Cloud, Tools for Building Private Cloud: IaaS using Eucalyptus, PaaS on IaaS - AppScale	5	8

Course Outcome:

1. Compare the strengths and limitations of cloud computing
2. Identify the architecture, infrastructure and delivery models of cloud computing
3. Apply suitable virtualization concept.
4. Choose the appropriate cloud player, Programming models and approach
5. Address the core issues of cloud computing such as security, privacy and interoperability

List of Text Books:

1. The Basics of Cloud Computing: Understanding the Fundamentals of Cloud Computing in Theory and Practice.
2. Cloud Computing: Methodology, Systems, and Applications
3. Cloud Computing: Concepts, Technology & Architecture

List of Reference Books:

1. Rajkumar Buyya, James Broberg, Andrzej M Goscinski, Cloud Computing: Principles and Paradigms, Wiley publication.
2. Toby Velte, Anthony Velte, Cloud Computing: A Practical Approach, McGraw-Hill Osborne Media.
3. George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, O'Reilly Publication
4. John Rhoton, Cloud Computing Explained: Implementation Handbook for Enterprises, Recursive Press.

List of Experiments:

1. BASICS OF CLOUD COMPUTING
2. STUDY OF CLOUD COMPUTING ARCHITECTURE AND SERVICE MODEL
3. STUDY VIRTUALIZATION OF CLOUD THROUGH ANY HYPERVISON
4. STUDY OF GOOGLE APP ENGINE (GAE)
5. STUDY OF AMAZON WEB SERVICES (AWS)

6. STUDY OF APACHE HADOOP
7. STUDY OF MICROSOFT AZURE
8. STUDY ABOUT CLOUD COMPUTING SECURITY ISSUE

Open e-Resource:

1. technolamp.blogspot.com
2. <http://www.intelligentedu.com/>
3. NITTR Instructional Resources Videos

(Professional Elective – II)
Gandhinagar Institute of Technology
B.Tech. Information Technology
Semester 6

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)				
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	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, submitting operations, yank, put, delete commands, reading & writing files, exrc file for setting parameters, advance editing techniques, vim (improved vi).	9	18
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, Builtin , 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.

Gandhinagar Institute of Technology
B. Tech Information Technology
Semester 7

Subject Code: 10060701	Subject Title: Project/Internship
Prerequisite: -	

Course Objective:

1. Industrial Training or Project work is required to enhance employability skills of the students.
2. It provides practical experience in a field of CE/IT and helps to reinforce theoretical knowledge gained in different courses to solve real life challenges.
3. The students are given exposure to explore new developments and techniques.
4. Student's can lead them to self-employment or even employment generation through extension of the work done in the project.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture	Tutorial	Practical	Credit	Theory		Practical		Total
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
-	-	6	3	0	0	80	20	100

Course Outcomes (COs)

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

1. CO1: Finalize the Capstone Project problem which is of the level of representative of the Undergraduate work.
2. CO2: Evaluate the proposal keeping in view the different stakeholders including potential customers and market analysis.
3. CO3: Assess the idea from feasibility, scope, timeline and delivery point of view.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3		3	3								3		
CO2	3	3		3	3								3	3	3
CO3			3		3								3	3	3

1=weakly related 2= moderately related 3=strongly related

Student Work:

The purpose of the semester project/Internship is to enable the students to further explore and learn about the application of the theoretical concepts studied in the previous semesters and develop the understanding related to the implementation, design and theoretical aspects of the computer science and its application to the practical problems. Students will extend and deepen their knowledge of CE/IT while working. Students will be learning what it's like to be part of a workforce: how to deal with fellow workers, including your bosses;

how to take suggestions, (including criticism);how to contribute to the team, and so on. Immersed in this absorbing and exciting world, it's easy to lose sight of the academic world, but remember that the project semester is really part of your university education. The developed projects/Internship would be assessed based on the following points: The relevance and novelty of the problem statement. The design of the proposed solution. Use of latest tools/technology for implementing the designed solution. Ability to collaborate, coordinate and work in a team. Presentation and technical reporting of the solution designed for the real-world problem. Ethical and legal standards followed for developing the solution.

General Guidelines for Internship/Project:

Step 1: Students, after joining the Training at the concerned Industry / Organization, has to submit the Joining Report/ Letters / Email.

Step 2: Students are undergoing Internship at the concerned Industry / Organization. In between Faculty Member(s) has to evaluate(s) the performance of students once by visiting the Industry/Organization and Evaluation Report of the students needs to be submit in department office with the consent of Industry persons/ Trainers

Step 3: Students will submit a training report after completion of internship

Step 4: Training Certificate to be obtained from industry.

Step 5: List of students who have completed their internship successfully will be issued/maintained by Training and Placement Cell of the Institute

Gandhinagar Institute of Technology
B.Tech Computer Engineering/Information Technology
Semester 7

Subject Code: 10060702	Subject Title: Artificial Intelligence
Pre-requisite: Data Structures, Mathematics	

Course Objective:

1. To learn Logic, problem-solving
2. To understand how Knowledge representation is implemented in the system
3. To understand how to utilize planning to achieve the desired goal
4. To learn how facts and predicate logic is used and implemented in the basic AI system
5. To understand game theory and its algorithms

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: The AI Problems, The Underlying Assumption, AI techniques, The Level of The Model, Criteria For Success	2	5	
2	Problems, State Space Search & Heuristic Search Techniques: Defining The Problems As A State Space Search, Production Systems, Production Characteristics, Production System Characteristics and Issues in the Design of Search Programs, Generate-And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.	6	20	
3	Knowledge Representation: Representations And Mappings, Approaches To Knowledge Representation, Representation Simple Facts In Logic, Representing Instance And Isa Relationships, Computable Functions and Predicates, Resolution, Procedural versus Declarative Knowledge, Logic Programming, Forward versus Backward Reasoning	6	20	
4	Symbolic Reasoning Under Uncertainty: Introduction To Nonmonotonic Reasoning, Logics For Non-monotonic Reasoning.	4	10	
5	Probabilistic Reasoning: Probability And Bays' Theorem, Certainty Factors And RuleBase Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic	4	10	
6	Game Playing: Overview, MiniMax Search Procedure, Alpha-Beta Cut-offs, Refinements, Iterative deepening.	5	12	
7	Planning: The Blocks World, Components Of a Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems	4	10	
8	Statistical Learning Methods – Statistical Learning, Learning with Complete Data, Learning with Hidden Variables: EM Algorithm.	3	8	
9	Introduction to Prolog: Syntax and Numeric Function, Basic List Manipulation Functions In Prolog.	2	5	

Course Outcome:

1. Understand the search technique procedures applied to real world problems
2. Understand and use various types of logic and knowledge representation schemes.
3. Understand various Game Playing techniques and apply them in programs.
4. Gain knowledge in AI Applications and advances in Artificial Intelligence.
5. Use Prolog Programming language using predicate logic.

List of Textbooks:

1. “Artificial Intelligence” -By Elaine Rich And Kevin Knight Tata Mcgraw-Hil

List of Reference Books:

1. Artificial Intelligence: A Modern Approach, Stuart Russel, Peter Norvig, PHI
2. Nils J Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann Publications
3. “PROLOG Programming For Artificial Intelligence” -By Ivan Bratko(Addison-Wesley.
4. “Programming with PROLOG” –By Klocksinn and Mellish

Open e-Resource:

1. <https://www.technologyreview.com/s/534871/our-fear-of-artificial-intelligence>
2. <http://www.sanfoundry.com/artificial-intelligence-mcqs-inductive-logic-unification-lifting-1/>
3. <https://nptel.ac.in/courses/106102220>
4. <https://nptel.ac.in/courses/106105077>
5. <https://nptel.ac.in/courses/106106126>

List of Suggested Experiments:

There should be a minimum 10 programs.

1. To study the turbo prolog editor and implement basic facts.
2. To study about family relationship tree in Prolog.
3. To study the rules implemented in prolog.
4. To study how to implement recursion in Prolog.
5. To study the use of GCD in Prolog.
6. To study the use of list in Prolog.
7. To study how to implement water jug problem in Prolog using BFS.
8. To study how to implement N-Queens problem in Prolog.
9. To study how to implement 8 puzzle problem in Prolog.
10. To study how to implement travelling salesman problem using Prolog.

Gandhinagar Institute of Technology
B.Tech Information Technology
Semester 7

Subject Code: 10060703	Subject Title: SOFTWARE PROJECT MANAGEMENT
Pre-requisite: Fundamentals of Software Engineering	

Course Objective:

1. To understand key aspects of software project.
2. To understand the fundamental principles of software project management.
3. To have a good knowledge of the responsibilities of a project manager.
4. To understand the purpose, methods, and benefits of process management.
5. To be familiar with the different methods and techniques used for project management.

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	Introduction to Software Project Management (SPM): Rationale, Software Projects Vs other types of Projects, Contract Management and Technical Project Management, Activities Covered by SPM, Plans, Methods and Methodologies, Categorizing Software Projects, Project Charter, Stakeholders, Setting Objectives, Project Success, and Failure. NPTEL CH-1 RB-1	4	10%	
2	Project Planning: Tasks in Project Planning; Work Breakdown Structures (WBS), Planning Methods, Selecting Project Approach, SDLC, Software Processes and Process Models, Choice of Process Models, A Generic Project Model, Software Cost Estimation; NPTEL CH-3 RB-1	6	14%	
3	Project Scheduling, Monitoring & Control: Scheduling Techniques, Program Evaluation and Review Technique (PERT), Gantt Chart, Critical Path Method (CPM), Automated Tools. Project Status Reporting; Project Metrics; Earned Value Analysis (EVA); Project Communication Plan & Techniques; Steps for Process Improvement. CH-2 & CH-4 RB-1	7	17%	
4	Risk Management: Concepts of Risks and Risk Management; Risk Management Activities; Effective Risk Management; Risk Categories; Aids for Risk Identification; Potential Risk Treatments; Risk Components and Drivers; Risk Prioritization. NPTEL CH-7 RB-1	6	14%	
5	Configuration Management: Software Configuration Management (SCM) – Baselines, Software Configuration Items (SCI), SCM Process, Identification of Objects in the Software Configuration, Version Control, Change Control, Configuration Audit, Status Reporting, Goals of SCM. CH-9 RB-1	4	10%	

6	Quality Assurance: Software Quality Assurance Activities, Software Qualities, Software Quality Standards – ISO Standards for Software Organization, Capability Maturity Model (CMM), Comparison between ISO 9001 & SEI CMM, Other Standards. NPTEL CH-13 RB-1	6	14%
7	Software Re-engineering: Software Maintenance Problems, Redevelopment vs. Reengineering, Business Process Reengineering, Software Reengineering Process Model, Technical Problems of Reengineering. CH-10 RB-1	6	14%
8	Project closure: Project Closure Analysis, Case Study of Software Company's Project Closure Analysis Report. NPTEL CH-14 RB-1	3	7%

Course Outcome (COs):

1. Describe and determine the purpose and importance of a software project and project management practices.
2. Compare project approaches for given software project and identify risk factors.
3. Estimate and evaluate project cost and schedules and determine risk management approaches.
4. Define and evaluate quality assurance measures.
5. Implement a project to manage project schedule, expenses and resources with the application of suitable project management tools.

List of Reference Books:

1. Bob Hughes and Mike Cotterell, "Software Project Management ", Tata McGraw Hill, 6th edition,
2. S. A. Kelkar, "Software Project Management", PHI Publication, 15th edition
3. Roger S. Pressman , "Software Engineering – A Practitioner's approach", Tata McGraw Hill 15th edition
4. Shailesh Mehta, "Project Management and Tools & Technologies – An overview", SPD, 2021

Open e-Resource:

1. www.rspa.com/spi
2. www.sei.cmu.edu

List of Suggested Experiments:

Case Study:

Stage 1:

Selection of case study topics and formation of small working groups of 3-5 students per group. Students engage with the cases, read through background material provided in the session and work through an initial set of questions to deepen the understanding of the case. Sample Project closure analysis report is given to the students to study.

Stage 2:

The groups are expected to perform closure analysis reports for their own semester project.

Stage 3:

Each group prepares a short 2 – 5 pages report on their results and a 10 min oral presentation of their project closure analysis.

Apart from case student students will perform at the following exercises:

1. Prepare SRS for given software project.
2. Compare SDLC models for the given project.
3. Estimate project cost and prepare project schedule.
4. Evaluate risk management approaches suitable for the project.
5. Design test suite to ensure software quality.

(Professional Elective – III)
Gandhinagar Institute of Technology
B.Tech Information Technology
Semester 7

Subject Code: 10050703	Subject Title: Image Processing
Pre-requisite: Physics and fundamentals of signal processing	

Course Objective:

1. To become familiar with digital image fundamentals
2. To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
3. To learn image restoration, interpolation, and filtering operations.
4. To learn various image processing operations like edge detection, segmentation; color-based processing, region and boundary detection, morphological operations.
5. To become familiar with image compression and recognition methods
6. To get exposure to digital image processing in detail with enhanced knowledge in various application areas.

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	Digital image fundamentals: Light and Electromagnetic spectrum, Components of Image processing system, Image formation and digitization concepts, Neighbors of pixel adjacency connectivity, regions and boundaries, Distance measures, Applications. NPTEL, CH.1,2: R1	05	20
2	Image Enhancements: In spatial domain: Basic gray level transformations, Histogram processing, Using arithmetic/Logic operations, smoothing spatial filters, Sharpening spatial filters. In Frequency domain: Introduction to the Fourier transform and frequency domain concepts, smoothing frequency-domain filters, Sharpening frequency domain filters. NPTEL, CH.2: R1	15	30
3	Image Restoration: Various noise models, image restoration using spatial domain filtering, image restoration using frequency domain filtering, Estimating the degradation function, Inverse filtering. NPTEL, CH.5: R1	5	20
4	Colour Image processing: Colour fundamentals, Colour models, Colour transformation, Smoothing and Sharpening, Colour segmentation. NPTEL, CH.6: R1	3	5

5	Wavelet and Multi-resolution processing: Image pyramids, Multi-resolution expansion, wavelet transform. NPTEL, CH.7: R1	3	10
6	Image compression: Introduction, Image compression model, Error-free compression, Lossy compression. NPTEL, CH.8: R1	3	5
7	Image segmentation: Detection of discontinuities, Edge linking and boundary detection, thresholding. NPTEL, CH.10: R1	3	10

Course Outcome:

1. Understand the basic image enhancement techniques in spatial & frequency domains
2. Apply various tools and techniques for digital image quality enhancement in spatial/frequency domain
3. Analyse image to evaluate quality of the digital image
4. Design real time application using digital image processing concepts

List of References:

1. Digital Image Processing, by Rafael C. Gonzalez and Richard E. Woods, Pearson Education, latest edition.
2. Digital Image Processing by Bhabatosh Chanda and Dwijesh Majumder, PHI
3. Fundamentals of Digital Image Processing by Anil K Jain, PHI
4. Digital Image Processing Using Matlab, Rafael C. Gonzalez and Richard E. Woods, Pearson Education

Open e-Resource:

1. MATLAB with image processing toolbox.
2. Scilab (SIP)

List of Suggested Experiments:

1. MATLAB program to extract different Attributes of an Image.
2. MATLAB program for Image Negation.
3. MATLAB program for Power Law Transformation.
4. MATLAB program for Histogram Mapping and Equalization.
5. MATLAB program for Image Smoothing and Sharpening.
6. MATLAB program for Edge Detection using Sobel, Prewitt and Roberts Operators.
7. MATLAB program for Morphological Operations on Binary Images.
8. MATLAB program for Pseudo Coloring.
9. MATLAB program for Chain Coding.
10. MATLAB program for DCT/IDCT Computation.

(Professional Elective – III)
Gandhinagar Institute of Technology
B. Tech Computer Engineering/Information Technology
Semester 7

Subject Code: 10270706	Subject Title: Advance Machine Learning
Pre-requisite: Machine Learning, Probability theory	

Course Objective:

1. To strengthen foundational understanding of advanced machine learning principles.
2. To explore kernel-based methods and probabilistic classifiers such as Support Vector Machines, Kernel PCA, LDA, QDA, and Naive Bayes for modeling nonlinear and probabilistic data distributions.
3. To introduce advanced clustering techniques for unsupervised data analysis.
4. To provide practical insights into ensemble learning approaches like bagging, boosting, and stacking to improve model accuracy and robustness.
5. Students should be able to understand deep learning concepts.
6. To expose students to real-world applications of advanced machine learning and deep learning in 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	Key Concepts of Machine Learning: Supervised/Unsupervised learning, Loss functions and Generalization, Probability theory, Model tuning and evaluation, Overfitting and Underfitting.	4	10
2	Nonlinear data kernel Methods: Feature Engineering, nonlinear data, Support Vector Machine, Kernel Principal Component Analysis, Kernel Ridge Regression.	6	18
3	Probabilistic Classifiers: Basics of Probability, Classifiers, LDA, QDA, Generative classifiers: Naive Bayes classification, Conditional classifier: Logistic	6	18
4	Clustering: Mixture model and Expectation maximization, K-Means Clustering, Distance based clustering, Density based clustering techniques.	5	14
5	Ensemble Learning: Bagging, Boosting, Stacking, Gradient Boosting, XGBoost, AdaBoost.	5	10
6	Deep Learning: Convolutional neural network (CNN), Recurrent Neural Network (RNN), LSTM	7	20
7	Applications: Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing, Other Applications.	4	10

Course Outcome:

1. Key concepts, tools and approaches of machine learning concepts on complex data sets
2. Kernel methods for handling high dimensional and non-linear patterns.
3. State-of-the-art algorithms such as Clustering and Bayesian networks
4. Demonstrate a comprehensive understanding of ensemble learning and deep learning fundamentals and their applications.
5. Modeling real world problems using machine learning techniques.

List of Textbooks:

1. Machine Learning. T. Mitchell. McGraw-Hill, 1997.
2. Pattern recognition and machine learning by Christopher Bishop, Springer Verlag, 2006.

List of Reference Books:

1. Machine Learning Yearning – Andrew Ng
2. Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David. Cambridge University Press. 2017.
3. Fundamentals of Deep Learning – Nikhil Budhama

Open e-Resource:

1. <https://nptel.ac.in/>
2. Hands-on Deep Learning Algorithms with Python – Sudarshan Ravichandra
3. <https://www.analyticsvidhya.com/all-free-courses/#>

List of Suggested Experiments:

There should be minimum 10 programs.

1. Implement machine learning concepts and analyze loss functions.
2. Apply Support Vector Machine with different kernels (linear, RBF, polynomial) on a classification dataset.
3. Perform Kernel PCA for dimensionality reduction and visualize transformed features.
4. Implement Naive Bayes Classifier on text or categorical data.
5. Compare LDA, QDA, Logistic Regression, and Naive Bayes on the same dataset.
6. Apply K-Means Clustering and visualize clusters.
7. Write Implement Bagging (Random Forest) and Boosting (AdaBoost, Gradient Boosting).
8. Build and train a Convolutional CNN for image classification (e.g., MNIST or CIFAR-10).
9. Implement RNN or LSTM for time-series forecasting or text sequence modeling.
10. Perform sentiment analysis on text data.

(Professional Elective – III)
Gandhinagar Institute of Technology
B.Tech Information Technology
Semester 7

Subject Code: 10060704	Subject Title: Mobile Computing and Wireless Communication
Pre-requisite: Computer Network	

Course Objective:

1. To understand Wireless communication fundamental i.e. mobility, flexibility, convenience
2. To understand the use of Wireless communication devices
3. To understand the use of Wireless communication in research
4. To understand different approaches of mobile computing
5. Students should be able to use Local area network and Bluetooth network

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	Introduction: Signals for Conveying Information, Analog and Digital Data Transmission, Channel Capacity, Transmission Media, Multiplexing, Communication Networks: LANs, MANs and WANs, Switching Techniques, Circuit Switching, Packet Switching	7	15	
2	Cellular Wireless Networks: Principles of Cellular Networks, First-Generation Analog Second-Generation TDMA Second-Generation CDMA, Third-Generation Systems Antennas and Propagation: Antennas, Propagation Modes, Line-of-Sight Transmission, Fading in the Mobile Environment Spread Spectrum- The Concept of Spread Spectrum, Frequency Hopping Spread Spectrum, Direct Sequence Spread Spectrum Coding and Error Control: Error Detection, Block Error Correction Codes, Convolutional Codes, Automatic Repeat Request	13	30	
3	Multiple access in Wireless System: Multiple access scheme, frequency division multiple access, Time division multiple access, code division multiple access, space division multiple access, packet radio access, multiple access with collision avoidance. Global system for mobile communication: Global system for mobile communication, GSM architecture, GSM entities, call routing in GSM, PLMN interface, GSM addresses and identifiers, network aspects in GSM, GSM frequency allocation, authentication, and security. General packet radio service (GPRS): GPRS and packet data network, GPRS network architecture, GPRS network operation, data services in GPRS, Applications of GPRS, Billing and charging in GPRS. Wireless System Operations and Standards: Cordless Systems, Wireless Local Loop, WiMAX and IEEE 802.16 Broadband Wireless Access Standards	15	33	

	Mobile IP and Wireless Application, Protocol		
4	Wi-Fi and the IEEE 802.11 Wireless LAN Standard: IEEE 802.11 architecture and services, IEEE 802.11 Medium access control, IEEE 802.11 physical layer, Wi-Fi protected access.	5	11
5	Bluetooth: Radio specification, baseband specification, link manager specification, logical link control and adaption protocol.	5	11

Course Outcome:

1. Understand the mobile and wireless network systems such as 2G/3G/4G/5G.
2. Understand GSM and GPRS.
3. Implement various error coding techniques.
4. Differentiate between multiple access schemes and various Spread Spectrum techniques.
5. Understand the working with local area network, Bluetooth and Android APIs environment.

List of Reference Books:

1. Wireless Communications & Networks, Second Edition, William Stallings by Pearson.
2. Mobile Computing Technology, Applications, and service creation by Asoke K Telukder, Roopa R. Yavagal, TMH.
3. Wireless Communications, Principles and Practices by T. S. Rappaport, Pearson Education India.
4. Android Application Development Black Book by Pradeep Kothari, Dreamtech Press.
5. Wireless and Mobile Networks by Dr. Sunilkumar S. Manvi, Dr. Mahabaleshwar S.Kakkasageri, WILEY.
6. Wireless Networks by P. Nicopolitidis, M.S. Obaidat, G. I. Papadimitriou, A.S.Pomportsis by Wiley
7. Mobile Computing by Raj Kamal, Oxford.
8. Mobile Computing Theory and Practice-Kumkum Garg-Pearson.
9. Lauren Darcey and Shane Conder, Android Wireless Application Development, Pearson Education, 2nd ed. (2011).

Open e-Resource:

1. <http://www.wirelessdevnet.com/>
2. <http://www.protocols.com/>
3. www.tutorialspoint.com/mobile_computing
4. <https://nptel.ac.in/courses/108/106/106106167>

List of Suggested Experiments:

1. Introduction to Mobile Web Development.
2. Study and demonstration of Bluetooth Network Simulation.
3. Study and demonstration of GSM Network Simulation.
4. Study and demonstration of GPRS Network Simulation.
5. Study and demonstration of Mobile IP Simulation.
6. To Study Setup & configuration of wireless access point.
7. To study wireless LAN infrastructure and Ad hoc models.

(Professional Elective – III)
Gandhinagar Institute of Technology
B. Tech Information Technology
Semester 7

Subject Code: 10060705	Subject Title: Software Testing and Analysis
Prerequisite: Basic Knowledge of SDLC, Operating System and Programming skills.	

Course Objective:

1. Understand Software Testing Fundamentals, Testing Techniques, Effective test cases.
2. Manage the Testing Process, Test Automation and performance, Security Testing.
3. Design Test Mobile Applications, Integrated Testing with Agile DevOps.
4. Understand how to Utilize Testing tools.
5. How to compile and design documents and Report Testing Activities.

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

Sr. No	Topic	Total Hours	Weight (%)
1	Introduction to Software Testing: Definition and objectives of software testing. Importance in the Software Development Life Cycle(SDLC). Roles and responsibilities of a software tester. Software Testing Life Cycle (STLC). Verification vs. Validation and Testing Terminology and Methodology.	3	10
2	Testing Techniques: Black-Box Testing: Equivalence Class Partitioning, Boundary Value Analysis, Decision Table Testing, Cause-Effect Graphing, Error Guessing. White-Box Testing: Basis Path Testing, Control Flow Testing Data Flow Testing, Mutation Testing, Static Testing Techniques	3	10
3	Types of Testing: Functional Testing: Unit Testing, Integration Testing, System Testing, Acceptance Testing. Non-Functional Testing: Performance Testing, Security Testing, Usability Testing, Compatibility Testing, Regression Testing, Smoke and Sanity Testing, Exploratory and Ad-hoc Testing.	4	10
4	Test Planning and Design: Test Planning, Test Strategy and Objective Definition, Test Estimation and Scheduling, Deliverables test and Documentation. Test Case Design: Test Case Development and Review, Test Data Preparation, Traceability Matrix	3	8
5	Test Automation Fundamentals: Introduction to Automation: Benefits and Challenges of Test Automation Automation Frameworks and Tools. Tools Covered: Selenium WebDriver, JUnit/TestNG, Maven	5	12

	Jenkins for Continuous Integration.		
6	Advanced Test Automation Engineering (ISTQB CTAL-TAE): Overview, Preparing for Test Automation, Test Automation Architecture, Implementing Test Automation, Test Automation Reporting and Metrics, Verifying the Test Automation Solution, Continuous Improvement.	7	20
7	Agile and DevOps Testing: Agile Methodology, Agile testing principles, Test-Driven Development (TDD), Behavior-Driven Development (BDD) DevOps Integration: Continuous testing in DevOps, Automation in Continuous Integration/Continuous Deployment (CI/CD).	5	15
8	Specialized Testing: Web Application Testing, Functional and non-functional testing, Security testing (e.g., SQL Injection, XSS). Mobile Application Testing: Platform-specific testing (Android/iOS), Performance and usability testing API Testing: RESTful and SOAP web services Tools: Postman, SoapUI. Database Testing: SQL queries and data validation Stored procedures and triggers.	4	10
9	Advanced Topics: Test Metrics and Reporting, Test coverage and effectiveness, Defect density and trends, Performance Testing Tools: LoadRunner, JMeter Security Testing Tools: OWASP ZAP, Burp Suite	2	5

Course Outcome:

1. Understanding of Software Testing Fundamental.
2. Proficiency in Test Planning and Management
3. Competence in Test Automation
4. Knowledge of Automation Frameworks
5. Critical Thinking and Problem-Solving Skills.

List of Textbooks:

1. Software Testing: A Craftsman's Approach" by Paul C. Jorgensen
2. The Art of Software Testing" by Glenford J. Myers
3. Software Engineering" by Rajib Mall.

List of Reference Books:

1. Software Testing: Principles and Practices "by Srinivasan Desikan and Gopalaswamy Ramesh
2. Automated Software Testing: Introduction, Management, and Performance by Elfriede Dustin, Thom Garrett, and Bernie Gau

Open e-Resource:

1. <https://www.udemy.com/topic/Software-Testing>.
2. <https://github.com/software-automation>
3. <https://www.selenium.dev/documentation/webdriver/>
4. HTTP://NPTEL/Software Testing

List of Suggested Experiments:

There should be a minimum of 10 programs/shell scripts.

1. Identifying test cases that are repetitive, time-consuming, or critical for regression testing.
2. Study automation tools based on your project requirements, technology stack, and budget.
3. Create a dedicated test environment that mirrors the production environment and evaluate different automation frameworks (e.g., Selenium, Appium, Cypress) based on project requirements.
4. Identify and create test data required for testing scenarios.
5. Develop test scripts using the selected automation tool and programming language.

6. Include assertions and verifications in test scripts to validate expected outcomes.
7. Implement error handling and exception handling mechanisms in test scripts.
8. Integrate automated tests with CI tools like Jenkins, Travis CI, or Azure DevOps.
9. Execute automated test suites on various environments and configurations.
10. Analyze test results to identify failures, errors, and defects.

(Professional Elective – IV)
Gandhinagar Institute of Technology
B.Tech Information Technology
Semester 7

Subject Code: 10050708	Subject Title: Data Compression
Pre-requisite: Basic Knowledge of Mathematical Foundation	

Course Objective:

- To introduce students to basic applications, concepts, and techniques of Data Compression.
- To develop skills for using recent data compression software to solve practical problems in a variety of disciplines.
- To gain experience doing independent study and research.

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	Introduction: Compression Techniques, Modeling and Coding Mathematical Preliminaries for Lossless Compression: Models – Physical Models, Probability Models, Markov Models Coding – Uniquely Decodable Codes, Prefix codes	3	8
2	Huffman coding: The Huffman Coding Algorithm – Minimum variance Huffman codes Adaptive Huffman coding – Update Procedure, Encoding Procedure, Decoding Procedure Golomb Codes Rice codes Tunstall Codes Applications of Huffman Coding – Lossless Image compression, Text compression, Audio Compression Arithmetic coding: Coding a sequence – Generating a Tag, Deciphering the Tag Generating Binary Code – Uniqueness and Efficiency of the Arithmetic code, Algorithm implementation, Integer Implementation Comparison of Huffman and Arithmetic coding Applications	12	35
3	Dictionary Techniques: Static Dictionary – Diagram Coding Adaptive Dictionary – The LZ77 approach, The LZ78 Approach	5	12
4	Context based Compression: Prediction with partial match(ppm) – The Basic Algorithm, The Escape symbol, Length of context, The Exclusion Principle The Burrows-Wheeler Transform – Move-to-Front Coding	5	12
5	Lossless Image Compression: The Old JPEG Standard, CALIC, JPEG-LS	4	8
6	Mathematical Preliminaries for Lossy Coding:	7	25

	Distortion criteria – The Human Visual System, Auditory Perception Models – Probability Models, Linear System Models, Physical Models Scalar Quantization: The Quantization, Problem Uniform Quantizer Adaptive Quantization – Forward Adaptive, Backward Adaptive Non uniform Quantization – pdf optimized Quantization, Companded Quantization Entropy Coded Quantization – Entropy coding of Lloyd – Max Quantizer Outputs Vector Quantization: Advantages of Vector Quantization over Scalar Quantization the Linde-Buzo-Gray Algorithm Tree structured Vector Quantization Structured Vector Quantization		
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Course Outcome:

1. Understand the Mathematical Preliminaries involved in compression techniques.
2. Use Lossless compression algorithm to compress Image, Text and Audio.
3. Use Lossy compression algorithm considering the Criteria.
4. Differentiate Lossless and Lossy algorithms and test appropriate algorithms for compression of given digital information.

List of Textbooks:

1. Introduction to Data Compression –By Khalid Sayood, publication Elsevier

List of Reference Books:

1. The Data Compression book, By Mark Nelson, Jean Loup Gailly
2. Data Compression: The Complete Reference”, By David Saloman, publication Springer
3. Data Compression Methods and Theory - by James A. Storer

Open e-Resource:

1. <https://ics.uci.edu/~dhirschb/pubs/DataCompression.html>
2. <https://www.tutorialspoint.com/difference-between-lossy-compression-and-lossless-compression>

List of Suggested Experiments:

1. Given the code as sequence of characters and given the probability of characters, write a program to calculate the average length of each code.
2. Write a program to generate Huffman code.
3. Write a program to generate binary code for the sequence abacabb, Given the frequency count of a – 37, b-38, c-25.
4. Write a program to implement diagram coding for given text file.
5. Write a program to Implement LZ77 algorithm.
6. Write a program to Implement LZ78 algorithm.
7. Write a program to Implement LZW algorithm.
8. Given the sequence of characters, write a program to find unique characters, and write a program to implement ppma algorithm.
9. Write a program to apply speech compression.
10. Write a program to apply jpeg compression.

(Professional Elective – IV)
Gandhinagar Institute of Technology
B. Tech Information Technology
Semester 7

Subject Code: 10060706	Subject Title: Computer Vision
Pre-requisite: Calculus, Linear algebra, Probability, Programming knowledge	

Course Objective:

1. Understand the principles of image formation, processing, and analysis.
2. Apply core computer vision techniques such as filtering, edge detection, feature extraction, and image segmentation.
3. Implement and evaluate object detection, recognition, and tracking algorithms.
4. Explore and utilize machine learning and deep learning methods for visual perception tasks.
5. Work with real-world datasets and tools (e.g., OpenCV, TensorFlow, PyTorch) to solve practical computer vision problems.
6. Develop critical thinking for designing and evaluating vision-based systems across various domains such as robotics, medical imaging, and autonomous vehicles.

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	Overview of computer vision and its applications: Image Formation and Representation: Imaging geometry, radiometry, digitization, cameras, and Projections, rigid and affine transformation.	6	16
2	Image Processing: Pixel transforms, color transforms, histogram processing, histogram equalization, filtering, convolution, Fourier transformation and its applications in sharpening, blurring and noise removal	7	19
3	Feature detection: edge detection, corner detection, line and curve detection, active contours, SIFT and HOG descriptors, shape context descriptors, Morphological operations	6	16
4	Segmentation: Active contours, split & merge, watershed, region splitting, region merging, graph-based segmentation, mean shift and model finding, Normalized cut	5	14
5	Camera calibration: camera models; intrinsic and extrinsic parameters; radial lens distortion; direct parameter calibration; camera parameters from projection matrices; orthographic, weak perspective, affine, and perspective camera models.	4	13
6	Motion representation: the motion field of rigid objects; motion parallax; optical flow, the image brightness constancy equation, affine flow; differential techniques; feature-based techniques; regularization and robust	3	9

	estimation		
7	Motion tracking: statistical filtering; iterated estimation; observability and linear systems; the Kalman filter	3	8
8	Object recognition and shape representation: alignment, appearance-based methods, invariants, image eigenspaces	2	5

Course Outcome:

1. Learn the fundamentals of computer vision and its applications
2. Understand the basic image processing operations to enhance, segment the images.
3. Understand the analyzing and extraction of relevant features of the concerned domain problem.
4. Understand and apply the motion concepts and its relevance in real time applications
5. Apply the knowledge in solving high level vision problems like object recognition, image classification etc.

List of Textbooks:

1. Computer Vision: Algorithms and Applications, R. Szeliski, Springer, 2011

List of Reference Books:

1. Computer Vision: Algorithms and Applications, R. Szeliski, Springer, 2011
2. Introductory techniques for 3D computer vision, E. Trucco and A. Verri, Prentice Hall, 1998.

Open e-Resource:

1. <https://nptel.ac.in/courses/106105216>
2. <https://www.tutorialspoint.com/computer-vision/index.htm>

List of Suggested Experiments:

There should be minimum 10 programs/shell scripts.

1. Implementing various basic image processing operations in python/matlab/open-CV: Reading image, writing image, conversion of images, and complement of an image
2. Implement contrast adjustment of an image. Implement Histogram processing and equalization.
3. Implement the various low pass and high pass filtering mechanisms.
4. Use of Fourier transform for filtering the image.
5. Utilization of SIFT and HOG features for image analysis.
6. Performing/Implementing image segmentation
7. Implement optical flow computation algorithm
8. Demonstrate the use of optical flow in any image processing application
9. Object detection and Recognition on available online image datasets
10. Character or digit or face classification project.

(Professional Elective – IV)
Gandhinagar Institute of Technology
B.Tech Computer Engineering/Information Technology
Semester 7

Subject Code: 10060707	Subject Title: Blockchain
Pre-requisite: Cryptography	

Course Objective:

1. To understand what Blockchain is and why it is used
2. To be able to explain the different components involved in Blockchain
3. To know when and why you may want to use Blockchain within your environment
4. To master at a high level what cryptocurrency is

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	Fundamentals of Blockchain: Introduction, Origin of Blockchain, Blockchain solution, Components of Blockchain, Block in Blockchain, The TechnologyBlockchain Types and Consensus Mechanism: Introduction, Decentralization and Distribution, Types of Blockchain, Consensus Protocol Cryptocurrency – Bitcoin, Altcoin, Token:Introduction, Bitcoin and the cryptocurrency, Cryptocurrency Basics, Types of Cryptocurrency, Cryptocurrency usage	8	25
2	Public Blockchain System: Introduction, Public Blockchain, Popular public Blockchain, The Bitcoin Blockchain, Ethereum Blockchain Smart Contracts: Introduction, Smart Contract, Characteristics of a Smart Contract, Types of Smart contracts, Types of Oracles, Smart Contracts in Ethereum, Smart Contracts in Industry	8	25
3	Private Blockchain System: Introduction, Key characteristics of Private Blockchain, Private Blockchain Examples, Smart Contract in Private Environment, State Machine, Different Algorithms of Permissioned Blockchain, Byzantine Fault	8	20
4	Consortium Blockchain: Introduction, Key characteristics of Consortium Blockchain, Hyperledger platform, Overview of Ripple, Overview of Corda	6	10
5	Applications of Blockchain: Introduction, Blockchain in Education, Blockchain in Healthcare	3	10
6	Limitations and Challenges of Blockchain: Blockchain Implementation – Limitation, Challenges	3	10

Course Outcome:

1. Explain different types of Blockchain
2. Describe Consensus algorithms for decentralized network architecture
3. Explain the support of Blockchain technology in a cryptocurrency or Digital currency.
4. Use the Blockchain technology for a given application.

List of Textbooks:

1. Blockchain Technology By Chandramouli Subramanian, Asha George, Abhilash K A and Meena Karthikeyan Universities Press Publication 2021
2. Blockchain Blueprint for a New Economy, By Melanie Swan, O'Reilly Publication
3. Blockchain For Dummies By Tiana Laurence, Wiley Publication

List of Suggested Experiments:**1. Ethereum – With respect to Ethereum, carry out following :**

- Install Geth Client & Configure Ethereum Nodes
- Manage Accounts and Account states.
- Enable Mining and checking balance in Ether\
 - Setting up Metamask and Testing Fund Transfer – work with Ethereum Ecosystem
- Add Parameters to Cryptocurrency
- Check Balance Before Transfer
- Adding Transfer Event for Logging

2. Hyperledger - With respect to Hyperledger, carry out following :

- Installing Hyperledger Fabric(latest version)
- Build Network with Network configuration
- Hyperledger Fabric Demo

3. Corda - With respect to Corda, carry out following :

- Corda – Setting up the Environment
 - Building the Corda Network

Gandhinagar Institute of Technology
B. Tech Information Technology
Semester 8

Subject Code: 10060801	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 /managerial skills required at the job.
3. To work on a problem assigned by a mentor at industry, prepare action plan and complete within time limit
4. 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).
5. To explore possibilities of patent or research paper publications.
6. Expose students to the engineer's responsibilities and ethics.

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

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

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 20 IT Companies	Survey Period April 2026	Region Gujarat (Ahmedabad, Gandhinagar, GIFT City and surrounding IT hubs)
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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 Executive Officers (CEOs)
 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.
