GANDHINAGAR UNIVERSITY

Gandhinagar Institute of Technology

Academic Regulation & Curriculum

For

B. Tech

in

Electronics and Communication Engineering (ECE) Department

w.e.f. 2026-27

Preamble

The Department of Electronics and Communication Engineering is dedicated to quality education, innovation, and practical learning in the field of electronics and communication. The B. Tech. Curriculum for the academic session 2026–2027 has been developed as per UGC, AICTE, NCrF, NEP 2020, and IEEE blended learning syllabus guidelines with an Outcome-Based Curriculum (OBC) and Choice-Based Credit System (CBCS).

The curriculum includes emerging technologies such as Artificial Intelligence, Machine Learning, IoT, 5G Communication, and Design Thinking, with special focus on Semiconductor Technology through VLSI Design, Chip Design Fundamentals, and Semiconductor Manufacturing to meet the growing demands of the semiconductor and electronics industry.

The department continuously updates the syllabus through stakeholder feedback to ensure industry relevance, practical exposure, and future readiness, helping students become skilled engineers and innovators.

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1. Institutional Vision & Mission

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.

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

1. To provide quality education in electronics, communication engineering, and related technologies.
2. To develop strong theoretical knowledge and practical skills required for designing, analyzing, and implementing engineering solutions.
3. To equip students with the ability to use modern engineering tools and techniques for solving real-world problems.
4. To encourage innovation, creativity, and research in emerging areas such as Artificial Intelligence, Internet of Things, Semiconductor Technology, Embedded Systems, and Wireless Communication.
5. To provide hands-on learning through laboratories, projects, internships, and industry interaction.
6. To develop effective communication, teamwork, leadership, and problem-solving skills among students.
7. To promote professional ethics, social responsibility, environmental awareness, and lifelong learning.
8. To prepare students for successful careers in industry, higher education, entrepreneurship, and research.

3. Program Educational Objectives (PEOs)

PEO1

“To enable graduates to grasp the fundamental concepts of Electronics and Communication Engineering effectively and develop the ability to continuously update themselves with emerging technologies.”

PEO2

“To prepare competent professionals for industry and academia with the capability to solve interdisciplinary and complex real-time engineering problems.”

PEO3

“To prepare graduates with the knowledge and skills required to meet the challenges of upcoming technologies in the fields of semiconductor technology, IoT, wireless communication, image processing, communication networks, and consumer electronics.”

PEO4

“To prepare graduates with effective communication skills, professional ethics, leadership qualities, and an aptitude for contributing to societal and national needs.”

4. Program Details

4.1 Program Structure & Duration

- Duration & Intake : 4 Years & 60 Seats
- Semesters: 8
- Mode: Full Time
- Credit Structure: As per NCrF, NEP / University norms
- Medium of Instruction: English

4.2 Eligibility Criteria for Admission

Candidates who have obtained a bachelor's degree in any discipline from a recognized University/Institution approved by UGC, with minimum 50% aggregate marks (45% for reserved category candidates as per applicable norms), shall be eligible for admission to the program.

4.3 Admission Procedure

Admission to the B. Tech in Electronics and Communication and M Tech in V L S I program may be granted on the basis of merit obtained in the ACPC Allotment and in the qualifying examination and or performance in the Entrance Test and or Personal Interview or evaluation of Statement of Purpose, as prescribed by the University from time to time.

The University reserves the right to revise admission procedures.

4.4 Credit distribution as per NEP-2020 for B Tech Course in ECE

Course Type	ECE Credit
Humanities and Social Sciences including Management Courses	05%
Basic Science Courses	15%
Engineering Science Courses including Workshop, Drawing, Basics of Electrical / Mechanical / Computer, etc.	10%
Program Core Courses	50%
Multidisciplinary	05%
Project / Training	10%
Skills (AEC, VAC, SEC), IKS	05%
Total	100%

Definition of Credit (as per UGC / AICTE):

- 1 Hour Lecture (L) per Week = 1 Credit 1 Hour Tutorial (T) per Week = 1 Credit
- 1 Hour Practical (P) per Week = 0.5 Credits 2 Hours Practical (Lab) per Week = 1 Credit

5. Curriculum Structure

Gandhinagar Institute of Technology - 01

Program Name: Bachelor of Technology (01)			Branch Name (Code): EC (004) Batch – III & IV, V-2024-25, 2025-26 & 2026-27					
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 (Basic Science)	ICT Fundamental & Workshop	4	4	0	0	4
	SEC001	SEC-I	Animation & Graphics Design	2	2	0	0	2
	VAC003	VAC-I	Awareness of Cybercrime and Ethical Hacking	2	2	0	0	2
	AEC016	AEC-I (Humanities)	Practical English	2	2	0	0	2
				24	20	2	4	26

Program Name: Bachelor of Technology (01)			Branch Name (Code): EC (004) Batch – III & IV, V-2024-25, 2025-26 & 2026-27					
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 (Basic Science)	Social Media Management	2	2	0	0	2
	VAC021	VAC-II (Humanities)	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
				25	19	2	6	26

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Program Name: Bachelor of Technology (01)			Branch Name (Code): EC (004) Batch – III & IV, V-2024-25, 2025-26 & 2026-27					
Semester / Year: 03 / 02								
NCrF LEVEL	Subject Code	Course Type	Subject Name	Credit	Hours per week			
					L	T	P	Total
NCR – 5.0	10040301	Professional Core	Electronic Devices and Circuits (SC Physics)	4	3	0	2	5
	10040302	Eng. Science (Minor Sub)	Digital System Design	4	3	0	2	5
	10040303	Professional Core	Network Theory	4	3	0	2	5
	10040304	Professional Core	Signal and Systems	3	3	0	0	3
	10000304	Basic Science	Numerical Methods	3	2		2	4
	VAC023	VAC (Humanities)	UHV	2	2	0	0	2
	10040305	Professional Core	Simulation and Design Tools	1	0	0	2	2
			Total	21	16			26

Program Name: Bachelor of Technology (01)			Branch Name (Code): EC (004) Batch – III & IV, V-2024-25, 2025-26 & 2026-27					
Semester / Year: 04 /02								
NCrF LEVEL	Subject Code	Course Type	Subject Name	Credit	Hours per week			
					L	T	P	Total
NCR – 5.0	10040401	Eng. Science (Minor Sub)	Analog Circuit design	5	4	0	2	6
	10040402	Professional Core	Control System Engineering	4	3	0	2	5
	10040403	Eng. Science (Minor Sub)	Microprocessor & Microcontroller	5	4	0	2	6
	10040404	Professional Core	Analog and Digital Communication	4	3	0	2	5
	100000401	IKS	IKS – Vedic Math’s	2	2	0	0	2
	SEC014	SEC (Professional Core)	Introduction of Cyber Security	2	2	0	2	2
			Total	22	18			26

Program Name: Bachelor of Technology (01)			Branch Name (Code): EC (004) Batch – III & IV, V-2024-25, 2025-26 & 2026-27					
Semester / Year: 05 / 03								
NCrF LEVEL	Subject Code	Course Type	Subject Name	Credit	Hours per week			
					L	T	P	Total
NCR – 5.5	10040502	Professional Core	VLSI Design	4	3	0	2	5
	10040503	Professional Core	Electromagnetic Theory	3	3	0	0	3
	10040507	Professional Core	Power Electronics	4	3	0	2	5
	10040505	Professional Core	Internet of Things	3	3	0	0	3
	10040509	Professional Core	Artificial Intelligence and Machine Learning	4	3	0	2	5
	10050504	Multi-Disciplinary	Computer Networks	4	3	0	2	5
		Professional Core	Open Elective - I	3	3	0	0	3
				25				29
		Eng. Science (Minor Sub)	Open Elective – I					
	10040504	Robotics and Automation		EC				
	10040508	Sensors and Transducers		EC				
	10040506	Semiconductor Device and Modelling		SC				

Program Name: Bachelor of Technology (01)			Branch Name (Code): EC (004) Batch – III & IV, V-2024-25, 2025-26 & 2026-27					
Semester / Year: 06 / 03								
NCrF LEVEL	Subject Code	Course Type	Subject Name	Credit	Hours per week			
					L	T	P	Total
NCR – 5.5	10040601	Professional Core	Antenna & Wave Propagation	4	3	0	2	5
	10040602	Professional Core	Digital Signal Processing	4	3	0	2	5
	10040603	Professional Core	Wireless Communication	3	3	0	0	3
	10040609	Professional Core	Optic Communication	4	3	0	2	5
		Professional Elective	Elective-I	3	3	0	0	3
		Professional Elective	Elective II	4	3	0	2	5
		IKS	Minor Project on IKS	2	0	0	4	4
				24				30
		Elective-I						
	10040607	Elective	Mobile Application Development	ECE				
	10040605	Elective	Wireless Sensor Network(IEEE)	CSE				
		Elective-II						
	10040608	Elective	Satellite Communication	ECE				
	10040606	Elective	Introduction to Web Technology	CSE				

Program Name: Bachelor of Technology (01)			Branch Name (Code): EC (004) Batch – III & IV, V-2024-25, 2025-26 & 2026-27					
Semester / Year: 07/04								
NCrF LEVEL	Subject Code	Course Type	Subject Name	Credit	Hours per week			
					L	T	P	Total
NCF – 6.0	100000707	IKS	IKS - P10 (Ancient India and World)	2	2	0	0	
	100407012	Professional Core	Microwave Engineering and Applications	4	3	0	2	
	10040702	Professional Core	Digital Image Processing	4	3	0	2	
		Professional Elective	Elective-III	4	3	0	0	
		Multi-Disciplinary	Elective-IV	3	3	0	2	
	10040703	Internship	Summer Internship	4	0	0	8	
				21	14		14	
	Elective-III							
	10040705	Radar and Navigational Aids		ECE				
		Probability Theory and Stochastic Processes		B S				
	10040709	Semiconductor Process Technology		ECE				
	Elective-IV							
	10040707	Embedded System Design		ECE				
		Deep Learning		CS				
	100540710	Advanced Mobile Communications		ECE				

Program Name: Bachelor of Technology (01)			Branch Name (Code): EC (004) Batch – III & IV, V-2024-25, 2025-26 & 2026-27					
Semester / Year : 08/04								
NCrF LEVEL	Subject Code	Course Type	Subject Name	Credit	Hours per week			
					L	T	P	Total
NCF – 6.0	10040803	Major Project	Major Project / Internship	12	0	0	24	24
	10040804	Technical Seminar	Technical Seminar	4	0	0	8	8
				16			32	32

Overall Credit Summary

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credit	24	25	21	22	25	24	21	16	178

6. Teaching, Learning & Evaluation

6.1 Teaching Methodology

The program shall adopt:

- Classroom Teaching
- Case Studies
- Industry Interaction
- Site Visits
- Workshops
- GIS/Software Training
- Field Surveys
- Research Projects
- Internships
- AI-based Learning Tools
- Blended and Digital Learning

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 practical's, internships, and field work.

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
- Presentations
- Field work
- Class Test
- AI Quiz & Viva Voce
- Dissertation
- Project work

6.4 Suggested Weightage

- Continuous Internal Evaluation: 40%
- End Semester Examination: 50%

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

Evaluation Scheme:

- Grading Scheme: A student is awarded a grade on the basis of his/her performance in examination assignments, practical exam etc. These grades are described by the letters AA, AB, BB, BC, CC, CD, DD FF and their numerical equivalent called "grade point" are as below.

UG	Range of Marks (%)	≥80	≥73 <80	≥66 <73	≥60 <66	≥55 <60	≥50 <55	≥45 <50	<45
	Letter Grade	AA	AB	BB	BC	CC	CD	DD	FF
	Grade Point	**10**	**09**	**08**	**07**	**06**	**05**	**04**	**00**
UG B.Pharm.	Range of Marks (%)	≥90	≥80 <90	≥70 <80	≥60 <70	≥50 <60	<50	-	-
	Letter Grade	AA	AB	BB	BC	CC	FF	-	-
	Grade Point	**10**	**09**	**08**	**07**	**06**	**00**	-	-
PG	Range of Marks (%)	≥80	≥75 <80	≥70 <75	≥65 <70	≥60 <65	≥55 <60	≥50 <55	<50
	Letter Grade	AA	AB	BB	BC	CC	CD	DD	FF
	Grade Point	**10**	**09**	**08**	**07**	**06**	**05**	**04**	**00**
Diploma in Engg.	Range of Marks (%)	≥90	≥80 <90	≥70 <80	≥62 <70	≥53 <62	≥44 <53	≥35 <44	<35
	Letter Grade	AA	AB	BB	BC	CC	CD	DD	FF
	Grade Point	**10**	**09**	**08**	**07**	**06**	**05**	**04**	**00**
Diploma in Pharmacy	Range of Marks (%)	≥85	≥75 <85	≥65 <75	≥55 <65	≥45 <55	≥40 <45	<40	-
	Letter Grade	AA	AB	BB	BC	CC	CD	FF	-
	Grade Point	**10**	**09**	**08**	**07**	**06**	**05**	**00**	-

6.7 Dissertation / Project Work

Students shall undertake Research Project OR Industry-Based Dissertation. Requirements may include:

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

The dissertation 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 / field training in:

- Semiconductor Industries
- Software Industries
- Core EC Industries
- Research Area – DRDO, Defense Lab, ISRO
- Medical Equipment Companies
- Smart Sensor Companies

7.3.2 Students must submit:

- Internship Report
- Work Diary / Logbook
- Completion Certificate
- Presentation

7.4 Discipline Rules

Students shall maintain discipline, professional ethics, and proper conduct within the institution, during field 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 behavior 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:

- Various Software and AI Tools
- Data Analytics Tools
- AI-based Learning Platforms
- AS per Subject Use various Software
- Digital Tools

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

8. Student Support

8.1 Industry Collaboration

The department shall actively promote collaboration with real estate companies, infrastructure firms, valuation agencies, urban planning organizations, government departments, financial institutions, municipal bodies, smart city projects, and professional organizations to enhance practical exposure and industry relevance of the program. Such collaborations may include internships, field training, live projects, expert lectures, workshops, industrial visits, consultancy assignments, joint research activities, skill development programs, and placement support. The institution may also establish Memoranda of Understanding (MoUs) with industry partners and professional bodies for academic enrichment, technology support, certification programs, and collaborative initiatives aimed at improving employability, entrepreneurship, innovation, and professional competency among students.

8.2 Research and Consultancy

The department shall encourage faculty members and students to actively engage in research, consultancy, innovation, and applied studies related to real estate, valuation, urban development, infrastructure planning, sustainability, smart cities, GIS, and emerging technologies. Students may undertake research projects, market surveys, valuation studies, policy analysis, urban development assessments, and data-driven studies as part of their academic and professional training. The institution may also undertake consultancy assignments for government agencies, local authorities, industries, financial institutions, developers, and other organizations in areas such as property valuation, feasibility analysis, urban planning, infrastructure assessment, GIS mapping, and real estate market studies. Participation in seminars, conferences, workshops, publications, funded projects, and collaborative research activities shall be encouraged to promote academic excellence, innovation, and industry- oriented learning.

8.3 Library and Laboratory Facilities

Adequate library, laboratory, and digital learning facilities shall be made available to support effective teaching, practical training, research, and skill development under the ECE in Core, Semiconductor, and Software program. The department shall facilitate access to relevant books, journals, research publications, e-resources, valuation manuals, urban planning documents, GIS databases, and digital learning platforms related to real estate, infrastructure,

urban development, sustainability, and emerging technologies. Necessary computing facilities, GIS and mapping software, data analytics tools, internet access, and other technical resources required for practical and project-based learning shall also be provided to enhance industry-oriented education, research capability, and professional competency among students.

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 ECE program. The department shall facilitate academic counselling, mentoring, career guidance, research support, and skill development activities to assist students in their academic progression and professional growth. Students may also be provided opportunities for interaction with industry experts, participation in workshops, seminars, field visits, training programs, and extracurricular activities aimed at enhancing employability, leadership qualities, communication skills, and overall personality development. Necessary support mechanisms for addressing academic and personal concerns shall also be made available as per institutional policies.

8.5 Placement and Career Development

The department shall promote placement assistance and career development activities for students through industry interaction, professional networking, training programs, internships, and campus engagement initiatives. Efforts shall be made to establish linkages with real estate companies, infrastructure organizations, valuation firms, financial institutions, urban development agencies, and related industries to facilitate internships, live projects, industrial exposure, and employment opportunities for students. Career development activities such as aptitude training, resume preparation, soft skill development, entrepreneurship guidance, certification programs, expert sessions, and placement-oriented workshops may also be organized to enhance professional competency and employability of students.

9. Program Credibility

9.1 Executive Summary

The Department of Electronics and Communication Engineering focuses on developing technically skilled, innovative, and industry-ready graduates with strong fundamentals in electronics, communication systems, semiconductor technology, embedded systems, IoT, wireless communication, and automation.

The program prepares students for placement opportunities in semiconductor industries, telecommunications, electronics manufacturing, IT and software companies, automation industries, networking sectors, consumer electronics, and research organizations. Through practical learning, industry interaction, internships, and project-based training, students gain the knowledge and professional skills required to adapt to emerging technologies and succeed in diverse technical careers."

9.2 Scope and Career Opportunities

Graduates of the Electronics and Communication Engineering (ECE) program may work in:

- Electronics Manufacturing Companies
- Telecommunication Companies
- Semiconductor Industries
- Embedded Systems and IoT Companies
- Consumer Electronics Industries
- Information Technology Companies
- Defense and Aerospace Organizations
- Power and Energy Sector Companies
- Automation and Industrial Control Industries
- Research and Development Organizations
- Government Departments and Public Sector Undertakings (PSUs)
- Artificial Intelligence and Machine Learning Based Technology Companies

9.3 Potential Job Roles

- Electronics Engineer
- Communication Engineer
- Design Engineer
- Embedded Systems Engineer
- VLSI Engineer

- Semiconductor Engineer
- Network Engineer
- RF (Radio Frequency) Engineer
- IoT Engineer
- Automation Engineer
- Testing and Validation Engineer
- Technical Support Engineer
- Project Engineer
- Research and Development Engineer
- AI and Machine Learning Engineer (with relevant specialization)

9.4 Higher Study & Professional Opportunities

Students may pursue:

- M. Tech. in Electronics and Communication Engineering
- M. Tech. in VLSI Design and Semiconductor Technology
- M. Tech. in Communication Systems
- M. Tech. in Embedded Systems and IoT
- M. Tech. in Artificial Intelligence and Machine Learning
- MBA in Technology Management or Operations Management
- Ph.D. in Electronics, Communication, AI, Semiconductor, or related disciplines
- GATE Qualification for Higher Studies and PSU Opportunities
- Industry Certifications in Embedded Systems, IoT, Networking, AI, and Semiconductor Technologies
- International Certifications in Electronics and Communication Technologies
- Research and Innovation Projects in Emerging Technologies

10. Collaborative Field Work / Experimental Work

The B. Tech Electronics and Communication Engineering programme shall emphasize practical learning, industry exposure, and application-oriented engineering education through collaborative field work, laboratory practice, workshops, industrial training, and experimental learning activities.

Students may participate in:

1. Industrial visits, field training, and manufacturing plant exposure
2. MAT/VLSI/Embedded modelling, simulation, and design-based exercises
3. Product development, fabrication, and prototype-building activities
4. Robotics, automation, thermal, and energy-related experimental projects
5. Research projects, innovation challenges, technical competitions, and interdisciplinary engineering activities
6. Internship programs, industry-oriented mini projects, and major project work in collaboration with industries and research organizations

The programme shall encourage experiential learning, problem-solving ability, teamwork, innovation, technical communication, and practical engineering competency aligned with modern industrial and technological requirements.

11. Market Survey Review

11.1 Executive Summary

Electronics and Communication Engineering – Future Scope & Industry Demand

The demand for Electronics and Communication engineers is expected to grow continuously from 2024 onwards due to rapid development in semiconductors and digital technologies.

Growth in semiconductor industries, 5G/6G communication, IoT, embedded systems, automation, AI-based electronics, robotics, and smart devices is creating large career opportunities for ECE graduates.

Students completing B. Tech. in Electronics and Communication Engineering can work in semiconductor industries, telecom sectors, electronics manufacturing, IT industries, networking companies, automation industries, consumer electronics, and research organizations.

Industries are seeking graduates with practical knowledge, technical skills, innovation ability, and adaptability to modern technologies.

The program offers opportunities in core technical roles, software-related electronics applications, research, higher studies, government sectors, and entrepreneurship.

The future market trend indicates that Electronics and Communication Engineering will remain one of the most demanding and career-oriented engineering branches in the coming years."

11.2 Market Demand & Industry Trends

The Electronics and Communication Engineering (ECE) sector plays a vital role in technological advancement, digital transformation, communication networks, and semiconductor development. The demand for skilled ECE professionals continues to grow across various industries. Major growth areas include:

1. Semiconductor Design and Manufacturing
2. Embedded Systems and Internet of Things (IoT)
3. Artificial Intelligence and Machine Learning Applications
4. 5G/6G Communication Technologies
5. Wireless and Mobile Communication Systems
6. VLSI Design and Chip Development
7. Consumer Electronics and Smart Devices
8. Robotics and Automation Systems
9. Aerospace, Defense, and Satellite Communication

10. Industrial Electronics and Control Systems
11. Smart Cities and Digital Infrastructure
12. Cyber-Physical Systems and Industry 4.0 Technologies

Industries are increasingly looking for engineers with strong technical knowledge, practical skills, digital competency, innovation capability, and the ability to work with emerging technologies in a rapidly changing environment.

11.3 Skill Gap Identified by Industry

Industry feedback and market analysis have identified several skill gaps commonly observed among engineering graduates, including:

1. Limited practical and hands-on experience with electronic systems and equipment
2. Insufficient industrial exposure and application-based learning
3. Lack of proficiency in industry-standard software and simulation tools
4. Limited knowledge of semiconductor, VLSI, embedded systems, and IoT technologies
5. Insufficient exposure to communication systems, networking, and wireless technologies
6. Limited understanding of AI, machine learning, and data-driven electronic applications
7. Weak problem-solving, communication, teamwork, and project management skills
8. Insufficient industry interaction and real-world project experience

The industry has emphasized the need for graduates who are technically competent, innovative, adaptable, and capable of contributing effectively to electronics, communication, semiconductor, automation, and digital technology sectors.

11.4 Employment Opportunities & Industry Support

Graduates of the programme shall have employment opportunities in electronics industries, telecommunication companies, semiconductor industries, embedded systems companies, IoT organizations, consumer electronics industries, automation companies, aerospace and defense sectors, information technology companies, research organizations, startups, and public sector organizations.

Industries have also expressed willingness to support the programme through:

1. Internships and Industrial Training
2. Industrial Visits and Expert Lectures
3. Industry-Sponsored Projects
4. Collaborative Research and Development Activities
5. Workshops, Seminars, and Skill Development Programs
6. Innovation and Entrepreneurship Support
7. Placement and Career Development Activities

The programme is therefore expected to contribute significantly towards developing industry-ready Electronics and Communication Engineers equipped with modern technical knowledge, practical skills, innovation capability, digital competency, and professional ethics required by the global technology ecosystem.

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 : Detailed Syllabus

Gandhinagar institute of Technology
B.Tech Electronics and Communication Engineering Department
Semester 3

Subject Code: 10000302	**Subject Title: Economics & 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)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	0	0	3	70	30	0	0	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	Introduction to Economics; Definitions, Nature, Scope, Difference between Microeconomics & Macroeconomics Theory of Demand & Supply; law of demand, law of supply, equilibrium between demand & supply Elasticity; elasticity of demand, price elasticity, income elasticity, cross elasticity	05	12
2.	Theory of production; production function, meaning, factors of production (meaning & characteristics of Land, Labour, capital & entrepreneur), Law of variable proportions & law of returns to scale Cost; meaning, short run & long run cost, fixed cost, variable cost, total cost, average cost, marginal cost, opportunity cost. Break even analysis; meaning, explanation, numerical	04	12
3.	Markets; meaning, types of markets & their characteristics (Perfect Competition, Monopoly, Monopolistic Completion, Oligopoly) National	04	12

	Income; meaning, stock and flow concept, NI at current price, NI at constant price, GNP, GDP, NNP,NDP, Personal income, disposal income.		
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 Principles; 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 decentralisation	06	12
8.	Organisational 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: After completion of this course, student will be able to

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 Electronics and Communication Engineering
Semester 3

Subject Code: 10000304	**Subject Title: Numerical Methods**
Pre-requisite: Engineering Mathematics	

Course Objective: Main Objective of the course is to familiarize students with the way of solving complicated mathematical problems numerically and help them to familiarize with mathematical tool MATLAB.

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

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Interpolation and Numerical Integration:** Interpolation by polynomials, error of the interpolating polynomial, piecewise linear and cubic spline interpolation, Numerical integration, Simpson rule, composite rules, error formulae, Gauss quadrature.	8	19
2	**Solution of a System of Linear Equations:** Solution of a system of linear equations, implementation of Gaussian elimination and Gauss-Seidel methods, partial pivoting, row echelon form, LU factorization, Cholesky's method, ill-conditioning, norms.	10	24
3	**Solution of a Non-Linear Equations**: Bisection and Secant methods, Newton-Raphson method, Rate of Convergence, Solution of a system of nonlinear equations.	8	19
4	**Numerical Solution of Ordinary Differential Equations:** Euler and Runge-Kutta methods, Multistep methods, Predictor-Corrector methods, Order of convergence, Finite Difference methods, Numerical solutions of Elliptic, Parabolic, and Hyperbolic partial differential equations.	10	24

5	**Eigenvalue problem**: Power method, QR method, Gershgorin's theorem	6	14

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

1. Understand different numerical integration techniques, and numerically solve differential equations.
2. Identify various matrix computations and solve simultaneous linear equations.
3. Analyze roots of a transcendental equation using different methods.
4. Classify different interpolation schemes.

List of Textbooks:

1. R. Singh and M. Bhatt, Numerical and Statistical methods for Civil Engineering, Tata McGraw Hill.
2. R. Singh and M. Bhatt, Complex Variables and Numerical methods, Tata McGraw Hill.

List of Reference Books:

1. E. Kreyszig, Advanced Engineering Mathematics (8th Edition), John Wiley (1999)
2. S. D. Conte and Carl de Boor, Elementary Numerical Analysis-An Algorithmic Approach (3rd Edition), McGraw-Hill, 1980.
3. C.E. Froberg, Introduction to Numerical Analysis (2nd Edition), Addison-Wesley,1981
4. Gerald C. F. and Wheatley,P.O., Applied Numerical Analysis (Fifth Edition), Addison-Wesley, Singapore, 1998.
5. Chapra S.C, Canale, R P, Numerical Methods for Engineers, Tata McGraw Hill, 2003.

Open e-Resource:

- https://nptel.ac.in/courses/106108054
- https://nptel.ac.in/courses/111106050

List of Suggested Experiments:

1. Introduction to MATLAB
2. Introduction to Functions and Plot
3. Introduction to Vectors, Matrices and Conditions
4. Program on Interpolation methods
5. Program on Numerical Integration methods
6. Program on Solution of a system of linear equations methods
7. Program on Solution of a nonlinear equation methods
8. Program on solution of ordinary differential equations methods
9. Program on solution of Partial differential equations methods
10. Program on Eigen Value and Eigen Vectors methods

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Gandhinagar Institute of Technology

B.Tech Mechanical Engineering

Semester 3

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

Course Objective:

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

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

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education:** Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels	9	20
2.	**Understanding Harmony in the Human Being - Harmony in Myself!:** Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer),	8	17

	Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya - Practice Exercises and Case Studies will be taken up in Practice Sessions.		
3.	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship:** Understanding Harmony in the family – the basic unit of human interaction, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family! - Practice Exercises and Case Studies will be taken up in Practice Sessions.	11	25
4.	**Understanding Harmony in the Nature and Existence - Whole existence as Co-existence:** Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence - Practice Exercises and Case Studies will be taken up in Practice Sessions.	7	15
5.	**Implications of the above Holistic Understanding of Harmony on Professional Ethics:** Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: (a) Ability to utilize the professional competence for augmenting universal human order, (b) Ability to identify the scope and characteristics of people-friendly and ecofriendly production systems, (c) Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: (a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, (b) At the level of society: as mutually enriching institutions and organizations	10	23

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

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

List of References:

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

Open e-Resource:

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

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List of Suggested Tutorial:

1. Introduce yourself in detail. What are the goals in your life? How do you set your goals in your life? How do you differentiate between right and wrong? What have been your achievements and shortcomings in your life? Observe and analyze them.
2. Now-a-days, there is a lot of voice about many techno-genic maladies such as energy and natural resource depletion, environmental pollution, global warming, ozone depletion, deforestation, soil degradation, etc. – all these seem to be man-made problems threatening the survival of life on Earth – What is the root cause of these maladies & what is the way out in your opinion? On the other hand, there is rapidly growing danger because of nuclear proliferation, arms race, terrorism, criminalization of politics, large scale corruption, scams, breakdown of relationships, generation gap, depression & suicidal attempts, etc. – what do you think, is the root cause of these threats to human happiness and peace – what could be the way out in your opinion?
3. Observe that each one of us has Natural Acceptance, based on which one can verify right or not right for him. Verify this in case of What is Naturally Acceptable to you in a relationship- Feeling of respect or disrespect? What is Naturally Acceptable to you – to nurture or to exploit others? Is your living the same as your natural acceptance or different? Out of the three basic requirements for fulfillment of your aspirations- right understanding, relationship and physical facilities, observe how the problems in your family are related to each. Also observe how much time & effort you devote to each in your daily routine.
4. List down all your desires. Observe whether the desire is related to Self (I) or Body. If it appears to be related to both, see which part of it is related to Self (I) and which part is related to Body.
5. Observe that any physical facility you use follows the given sequence with time: Necessary & tasteful→ unnecessary & tasteful → unnecessary & tasteless → intolerable. In contrast, observe that any feeling in you is either naturally acceptable or not acceptable at all. If naturally acceptable, you want it continuously and if not acceptable, you do not want it any moment! List down all your activities. Observe whether the activity is of 'I' or of Body or with the participation of both 'I' and Body. Observe the activities within 'I'. Identify the object of your attention for different moments (over a period of say 5 to 10 minutes) and draw a line diagram connecting these points. Try to observe the link between any two nodes.
6. Chalk out programs to ensure that you are responsible to your body- for the nurturing, protection and right utilization of the body. Find out the plants and shrubs growing in and around your campus. Find out their use for curing different diseases. Observe on how many occasions you are respecting your related ones (by doing the right evaluation) and on how many occasions you are disrespecting by way of under evaluation, over-evaluation or otherwise evaluation. Also observe whether your feeling of respect is based on treating the other as yourself or on differentiations based on body, physical facilities or beliefs.
7. Write a note in the form of story, poem, skit, essay, narration, dialogue to educate a child. Evaluate it in a group. Develop three chapters to introduce 'social science- its need, scope and content' in the primary education of children. List down units (things) around you. Classify them in four orders. Observe and explain the mutual fulfillment of each unit with other orders.
8. Make a chart for the whole existence. List down different courses of studies and relate them to different units or levels in existence. Choose any one subject being taught today. Evaluate it and suggest suitable modifications to make it appropriate and holistic.
9. Choose any two current problems of different kind in society and suggest how they can be solved on the basis of natural acceptance of human values. Suggest steps you will take in present conditions. Suggest ways in which you can use your knowledge of Technology/Engineering/ Management for universal human order, from your family to the world family. Suggest one format of humanistic constitution at the level of nation from your side.

10. The course is going to be over now. Evaluate your state before and after the course in terms of thought, behavior, work and realization. Do you have any plans to participate in the transition of society after graduating from the institute? Write a brief note on it.

Gandhinagar Institute of Technology
B.Tech Electronics and Communication Engineering
Semester 3

Subject Code: 10040301	**Subject Title:** Electronic Devices and Circuits
Pre-requisite: Basic knowledge of semiconductor electronics, electronic components, and laws such as KCL, KVL, voltage divider, current divider etc.	

Course Objective:

(1) To introduce the electrical characteristics of ideal and practical diodes under forward and reverse bias to analyze and design diode application circuits such as rectifiers and voltage regulators.
(2) To learn the analysis of bipolar junction transistors and field effect transistors.
(3) To learn about the importance of biasing.
(4) To learn about Power Amplifiers.

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

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**PN Junction Diode and applications:** Theory of PN diode, energy band diagram of PN diode, PN junction as a diode, Operation and V-I characteristics, static and dynamic resistances, diode equivalent circuits, diffusion and transition capacitance, diode current equation, temperature dependence of V-I characteristics, Zener diode characteristics, break down mechanisms in semiconductor diodes, Zener diode as a voltage regulator. principles of operation and characteristics of silicon controlled rectifier, tunnel diode, varactor diode, photodiode; Half wave rectifier, full wave rectifier, bridge rectifier, RC and LC filters, Design of un-regulated DC power supply, Clipping circuit, Clamping circuit, voltage multiplier circuit, Reading datasheet of semiconductor diode.	8	20
2	**Bipolar Junction Transistor**: The Junction transistor, Transistor current components, Transistor as an amplifier, Transistor construction, Input and Output characteristics of transistor in Common Base, Common Emitter, and Common collector configurations. α and β Parameters and the relation between them, BJT Specifications. BJT Hybrid Model, h-parameter representation of a transistor, Analysis of single stage transistor amplifier using h-parameters:	10	25

	voltage gain, current gain, Input impedance and Output impedance. Comparison of transistor configurations in terms of Ai, Ri ,Av,and Ro,		
3	**Transistor Biasing and Stabilization:** Operating point, the D.C and A.C Load lines, Need for biasing, criteria for fixing, operating point, B.J.T biasing, Fixed bias, Collector to base bias, Self-bias techniques for stabilization, Stabilization factors, Bias Compensation using diode and transistor, (Compensation against variation in VBE, ICO,) Thermal run away, Condition for Thermal stability.	10	25
4	**Field Effect Transistor:** JFET Construction, JFET principal of Operation and Volt –Ampere characteristics, Pinch- off voltage, FET as Voltage variable resistor, Comparison of BJT and FET, MOSFET Construction, principal of Operation and symbol of MOSFET, MOSFET characteristics in Enhancement and Depletion modes.	9	20
5	**Power Amplifiers:** Amplifier Terms, Two Load Lines, Class-A Operation, Class-B Operation, Class-B Push Pull Emitter Follower, Biasing Class B/AB Amplifiers, Class B/AB Driver, Class-C Operation.	5	10

Course Outcome:

CO1: Examine the structure and working of the diodes.

CO2: Design, analyze and compare BJT and FET.

CO3: Analyze the DC bias circuitry of a Transistor.

CO4: Understand power amplifiers.

List of Textbooks:

1. Integrated Electronics Analog Digital Circuits, Jacob Millman and D. Halkias, McGraw Hill.
2. Electronic Devices and Circuits Theory, Boylsted, Prentice Hall Publications.
3. Electronics Principles by Albert Malvino [seventh Edition].
4. Electronics Device and circuits by S Salivahanan and N Suresh Kumar, McGraw Hill Publication [Second Edition or Higher Edition].

List of Reference Books:

1. Electronic Devices and Circuits,K.Lal Kishore B.S Publications.
2. Electronic Devices and Circuits K.S. Srinivasan Anurdha Agencies.
3. Electronic Devices and Circuits, G.S.N. Raju, I.K. International Publications, New Delhi, 2006.
4. Basic Electronics devices and Circuits by Mahesh B Patil, PHI Learning PVT. Ltd.

Open e-Resource:

Courses available through NPTEL.
- website : nptel.ac.in
- Ng-spice/Multisim/ Partsim

List of Suggested Experiments:

1. To study and perform the VI characteristics of P-N junction diode.
2. To study and perform the VI characteristics of Zener diode.
3. To study and perform about the half wave Rectifier.
4. To study and perform about the Bridge Rectifier Circuit.
5. To study and perform clipping circuits.
6. To study and perform clamping circuits.
7. To study and perform CE characteristics.
8. To study and perform CB characteristics.
9. To study and perform CC characteristics.
10. To design clipper, clamper and rectifier circuits using Multisim/ Partsim.

Gandhinagar Institute of Technology
B.Tech Electronics and Communication Engineering
Semester 3

Subject Code: 10040302	**Subject Title:** Digital System Design
Pre-requisite: Basic knowledge of electronics and Number system.	

Course Objective:

(1) To learn basic concepts of number system and Boolean algebra.
(2) To learn combinational and sequential circuits.
(3) To learn the concept of finite state machines.
(4) To learn about Programmable Logic Devices.
(5) To Understand the Analog to Digital conversion and Digital to Analog conversion process.

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

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Number System:** Introduction, number conversion system, binary arithmetic, representation of signed binary numbers, 1's and 2's complement, Codes: straight binary code, BCD Code Excess3 Code, Grey Code ASCII, Integer and floating-point representation.	6	12
2	**Boolean Algebra**: Boolean theorems and identities, logic gates AND, OR, NOT, NAND, NOR, EX-OR. Boolean expression SOP & POS form. Minimization using Boolean rules. Minimization of logic expression using K-maps. Use of Don't care conditions. Minimization using prime implicit table, Logic Family Terminology.	7	12
3	**Combinational logic Circuit Design:** Design of HA, HS, FA, FS, carry look ahead adder; 4-bit 8-bit adder, 8421 Adder/Sub. Ex-3Adder/Sub design of multiplexers, demultiplexers, Decoders, Encoders, digital comparator, parity checker/generator, code converters, priority encoder.	4	12
4	**Sequential Logic circuits Design:** SR, D, JK, T, and master-slave FF, registers, shift registers, universal shift register, asynchronous and synchronous counters, ring counter, Johnson counter.	8	20
5	**Introduction to Finite State Machines (FSM):** The need for state machines, The state machine, basic concepts in state machine analysis.	2	10

6	**Synchronous state machine design:** Sequential counters, state changes referenced to clock, number of state flip-flops, input forming logic, output forming logic, generation of a state diagram from a timing chart, redundant states, general state machine architecture. Concept of asynchronous state machine and comparison to synchronous state machine.	5	10
7	**Programmable Logic Devices:** Introduction to Programmable Logic Devices, Read-Only Memory, Programmable Logic Arrays (PLA), Programmable Array Logic (PAL), Combinational PLD-Based State Machines, State Machines on a Chip.	5	12
8	**A/D and D/A Converters:** Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter ICs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs	5	12

Course Outcome:

CO1: Apply the concepts of various number systems and Boolean algebra.

CO2: Design combinational and sequential circuits.

CO3: Apply the concept of finite state machines.

CO4: Analyze the Programmable Logic Devices.

CO5: Understand the Analog to Digital conversion and Digital to Analog conversion process.

List of Text Books:

1. Digital Logic and Computer Design by M Morris Mano, PHI.
2. Fundamentals of Digital Circuits by A. Anand Kumar, PHI.
3. Thomas A. Demassa and Zack Ciccone, Digital Integrated Circuits, Wiley Publications.
4. Principle of digital Electronics By Malvino & Leach.
5. Digital Logic & State Machine Design By David J. Comer, Third Indian Edition, Oxford University Press.

List of Reference Books:

1. Modern Digital Electronics By R.P.Jain, Fourth Edition, Tata McGraw-Hill Education.
2. Digital Electronics: Principles and Integrated Circuits By A.K. Maini, Wiley India Publications.

Open e-Resource:

Courses available through NPTEL.
- website : nptel.ac.in

List of Suggested Experiments:

1. To study about different logic gates using IC.
2. To configure diodes and transistor as logic gates and verify truth table.
3. To configure NAND and NOR logic gates as universal gates.
4. To implement Boolean logic functions using logic gates and combinational circuits.
5. To study and configure adder and subtractor circuits.
6. To study and configure encoder, decoder and code convertor.
7. To study and configure multiplexer and demultiplexer circuits.
8. To study and configure various Flip-Flops.
9. To study and configure shift register.
10. To study and configure about Counter.

Gandhinagar Institute of Technology
B.Tech Electronics & Communication Engineering
Semester 3

Subject Code: 10040303	**Subject Title:** Network Theory
Pre-requisite: Basic knowledge of electric circuit sources and elements, basic mathematics.	

Course Objective:

(1) To impart the knowledge of Network theorems with their application.
(2) To provide the knowledge transient analysis of electrical circuits.
(3) To Introduce transient analysis using Laplace transform.
(4) To Understand the concept of two port networks.

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

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Network Theorems:** Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources. Node and Mesh Analysis. Concept of duality and dual networks.	10	30
2	**Transient analysis using time domain approach** Solution of first & second order differential equations for Series & parallel R-L, R-C, RL-C circuits, initial & final conditions in network elements, forced and free response, time constants, steady state and transient state response for AC & DC excitation	12	20
3	**Transient analysis using Laplace transform approach:** Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, Inverse Laplace transform, transformed network with initial conditions, Transfer function representation, Concept of Poles &Zeroes representation	8	25
4	**Two Port Networks And Network Functions:** Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interdependence & relationship, interconnections of two port networks. Network functions: Concepts of Complex Frequency,	10	25

	Transform Impedance, Network Functions of 1&2 Port Networks, Concept of Poles &Zeroes, Properties of Driving Point & Transfer Functions, Time Response Stability from Pole-Zero Plot.		

Course Outcome:

CO1: Apply the knowledge of basic circuital law for analysing an electrical Circuit
CO2: Obtain the Transient analysis of different order system
CO3: Apply Laplace transform to get transient response of electrical network
CO4: Analyse the two port network and understand the network functions

List of Text Books:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
2. A. A. Nimje and D. P. Kothari, "Electrical Circuit Analysis and synthesis", New Age International Publications, 2017

List of Reference Books:

1. K.S.Suresh Kumar, "Electric Circuit Analysis", Pearson Publications, 2013Millman and Halkias, Textbook of Integrated Electronics, Mc Graw Hill.
2. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998.
3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
4. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
5. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.

Open e-Resource:

Courses available through NPTEL.
- website : nptel.ac.in

List of Suggested Experiments:

1. To verify the Superposition theorem.
2. To verify the Thevenin and Norton's theorems.
3. To verify the maximum power transfer theorem.
4. To verify the reciprocity theorem.
5. To measure and verify the steady-state and transient time-response of R-L circuit.
6. To measure and verify the steady-state and transient time-response of R-C circuit.
7. To measure and verify the steady-state and transient time-response of R-L-C circuit.
8. To verify the current and voltage phasors in complex AC circuits by measurement and theoretical analysis.
9. To obtain the solution of first order and second order linear differential equations with Laplace transform.

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10. To obtain the solution of R-L-C networks with impedance functions.
11. To verify the impedance parameters for a two port network.
12. To verify the admittance parameters for a two port network.
13. To verify the hybrid parameters for a two port network.
14. To verify the transmission parameters for a two port network.

Gandhinagar Institute of Technology
B.Tech Electronics and Communication Engineering
Semester 3

Subject Code: 10040304	**Subject Title:** Signal and Systems
Pre-requisite: Differential equations and difference equations, Laplace Transform, Electrical circuits and networks	

Course Objective:

(1) Introduce mathematical tools for analysis of continuous time signals and LTI systems.
(2) Understand basic principles of communication systems.
(3) Create foundation for digital signal processing.

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

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction to Signals & Systems:** Basic definitions of signals and systems, Basic elementary signals, Classification of signals and systems. Signal operations and properties. Basic continuous time signals, Basic system properties, Case study of different signals.	4	15
2	**Continuous and Discrete Time LTI Systems**: Impulse response characterization and convolution for CT- LTI and DT-LTI systems, Properties of LTI systems,LTI systems characterized by Differential and difference equations.	12	25
3	**Fourier Series and Fourier Transform:** Fourier Series Representation of periodic Signals, Fourier series, Waveform Symmetries, Calculation of Fourier Coefficients, Frequency spectrum of aperiodic signals, Fourier Transform, Relation between Laplace Transform and Fourier Transform. Properties of Continuous Time Fourier transform. System Analysis using Fourier Transform. Introduction to DTFT and DFT.	12	25
4	**Z Transform:** The z-Transform, Convergence of z-Transform, , Properties of z-Transform, Inverse z-Transform , LTI System analysis from Linear Constant Coefficient Difference Equations using z-Transform.	10	25
5	**Sampling & Reconstruction:** Representation of digital signals, The Sampling Theorem, Sampling with a zero order hold, Reconstruction of a signal from its samples using interpolation, Aliasing and its effects.	4	10

Course Outcome:

CO1: Remember properties of signals, systems, and principles of various modulation and demodulation methods.
CO2: Understand mathematical representation of signals, systems, modulated signals and detection techniques.
CO3: Apply mathematical concepts to model behaviour of LTI systems, modulation and demodulation of signals.
CO4: Analyze signals and systems in time and frequency domain to obtain various parameters.

List of Text Books:

1. Linear Systems and Signals by B.P.Lathi, Oxford University Press.
2. Signal and Systems by Anand Kumar, 3rd Edition, PHI.

List of Reference Books:

1. Signals and Systems by Simon Haykin and Bary Van Veen, Wiley- India Publications.
2. Signals and Systems by K. Gopalan, Cengage Learning (India Edition).
3. Signal, Systems and Transforms by Charles L. Philips, J. M. Parr and E. A. Riskin, Pearson Education.

Open e-Resource:

Courses available through NPTEL.
- website : nptel.ac.in.

Gandhinagar Institute of Technology
B.Tech Electronics and Communication Engineering
Semester 4

Subject Code: 10040401	**Subject Title:** Analog Circuit Design
Pre-requisite: Basic knowledge of electronic active and passive components and low frequency circuit analysis techniques etc.	

Course Objective:

(1) To understand the high frequency analysis of BJT circuits.
(2) To learn about the feedback amplifiers and oscillator principles.
(3) To understand the op-amp parameters and their importance.
(4) To learn the use of linear and non-linear applications of Op-amp.
(5) To introduce the special purpose of ICs.
(6) To understand the Op-amp based Filter Circuits.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
4	0	2	5	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Transistor at High Frequencies:** Hybrid –pi CE Transistor Model, Hybrid –pi Conductance, Hybrid –pi Capacitances, Validity of Hybrid –pi Model, Variation of Hybrid –pi Parameters, CE Short-Circuit Current Gain, Current Gain with Resistive Load, Single-Stage CE Transistor Amplifier Response, Gain-Bandwidth Product, Emitter Follower at High Frequencies.	8	14
2	**Feedback Amplifiers and Oscillators:** Advantages of negative feedback – Voltage / Current, Series, Shunt feedback Amplifiers, positive feedback–Condition for oscillations, Sinusoidal oscillators, Phase-shift oscillator, Resonant circuit oscillators, A general form of oscillator circuit, Wien bridge oscillator, Crystal oscillators, Frequency stability.	7	12
3	**Introduction to Operational Amplifiers:** Block Diagram representation of a typical op-amp, the differential amplifier, the emitter coupled differential amplifier, Transfer characteristics of a differential amplifier, types of ICs, Manufacturers' designations and package types for ICs, Power supplies for ICs, Interpreting datasheet, Ideal op-amp, Equivalent circuit of an op-amp, Ideal	6	10

	voltage transfer curve, Open-loop op-amp configurations, op-amp with Negative Feedback.		
4	**Op-amp Offset Voltage**: Introduction, Input offset voltage, Input bias current, Input offset current, Total output offset voltage, Thermal Drift, Effect of variation in power supply voltages on offset voltage, Change in input offset voltage and input offset current with time, other temperature and supply voltage sensitive parameters, Noise.	4	8
5	**Linear Applications of Op-amp:** DC and AC Amplifiers, Inverting and Non-Inverting Amplifier, AC amplifiers with single supply voltage, Peaking amplifier, Summing, Scaling and Averaging Amplifier, Instrumentation Amplifier – its block diagram along with applications, Differential input and differential output amplifier, Voltage-to-current converter with floating load, Current-to-voltage converter, Integrator, Differentiator, Voltage Follower.	7	16
6	**Non-Linear Applications of Op-amp:** Comparator, Zero Crossing Detector, Schmitt Trigger, Voltage Limiters, Clipper and Clampers, Absolute Value output circuit, Peak Detector, Sample and Hold Circuit, Precision Rectifier – Half/Full Wave, Square, Triangular and Saw tooth wave generator, Common mode configuration and common mode rejection ratio, Slew rate and its equations, Effect of slew rate in applications.	7	15
7	**Specialized ICs and its Applications:** a. 555 Timer and its applications: Block diagram, Monostable and Astable multivibrator, Applications as Frequency divider, Square wave generator b. Phase Locked Loops and its Applications: Block diagram and operation, Applications as Frequency Multiplier, Frequency Shift Keying c. Design of Power Supply: Simple op-amp voltage regulator, Three terminal voltage regulators, Fixed and adjustable voltage regulators (78XX, LM317), Heat sink, Dual power supply (LM320, LM317), Basic switching regulator and its characteristics	5	10
8	**Analog-to-digital converters (ADC) and Digital-to-analog converters (DAC):** Weighted resistor, R-2R ladder, resistor string etc. Analog-to-digital converters (ADC): Single slope, dual slope, successive approximation, flash etc. Switched capacitor circuits: Basic concept, practical configurations, application in amplifier, integrator, ADC etc.	8	15

Course Outcome:

CO1: Examine the high frequency analysis of BJT circuits.

CO2: Analyze the feedback amplifiers and oscillator principles.

CO3: Explain op-amp parameters and their importance.

CO4: Make use of linear and non-linear applications of Op-amp.

CO5: Design and Construct various circuits using special ICs

CO6: Design and Analyze ADC and DAC.

List of Textbooks:

1. Electronics Device and Circuits by Jacob Milman, Christos C. Halkias, Chetan D. Parikh, Tata Macgraw Hill Publication [Second Edition]
2. Op-amp and Linear Integrated Circuits by Ramakant A. Gayakwad, Prentice Hall India.
3. Analog filter design by Van Valkenburg, Oxford Publication.
4. Electronics Principles by Albert Malvino [seventh Edition]

List of Reference Books:

1. Introduction to Operational Amplifier theory and applications by J.V. Wait, L.P. Huelsman and GA Korn, McGraw Hill.
2. Application and design with analog Ics by J. Michael Jacob, Prentice Hall India.

Open e-Resource:

Courses available through NPTEL.
- website : nptel.ac.in
- Ng-spice/Multisim

List of Suggested Experiments:

1. To study about the Hartley Oscillator.
2. To study about Colpitt's Oscillator.
3. To configure op-amp in inverting and non-inverting amplifier mode and measure their gain.
4. To configure the op-amp in voltage follower mode.
5. To measure PSRR and CMRR of a given op-amp.
6. To study Wien bridge Oscillator.
7. To design Schmitt trigger circuit using op-amp and take measurements.
8. To study OP-amp as an Integrator.
9. To study OP-amp as a Differentiator.
10. To design Monostable and Astable multi vibrators using 555 timer IC and verify their operations using measurements.

Gandhinagar Institute of Technology
B.Tech Electronics and Communication Engineering
Semester 4

Subject Code: 10040402	**Subject Title:** Control System Engineering
Pre-requisite: Knowledge of Linear differential equations, Differential equations and its solution, and Laplace transform.	

Course Objective:

(1) Understanding and predicting behavior of the system.
(2) Differentiate between the open loop and closed loop systems.
(3) Design and analysis of closed loop control systems.
(4) Analyze the condition for system stability.

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

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction to Control Systems:** Introduction, Brief History of Automatic Control, Examples of Control Systems, Engineering Design, Mechatronic Systems, The Future Evolution of Control Systems.	3	8
2	**Mathematical Models of Systems:** Differential Equations of Physical Systems, Linear Approximations of Physical Systems, The Laplace Transform, The Transfer Function of Linear Systems, Block Diagram Models, Signal-Flow Graph Models.	6	14
3	**State Variable Models:** The State Variables of a Dynamic System, The State Differential Equation, Signal-Flow Graph and Block Diagram Models, Alternative Signal-Flow Graph and Block Diagram Models, The Transfer	8	18

	Function from the State Equation , The Time Response and the State Transition Matrix.		
4	**Feedback Control System Characteristics:** Error Signal Analysis, Sensitivity of Control Systems to Parameter Variations ,Disturbance Signals in a Feedback Control System, Control of the Transient Response, Steady-State Error, The Cost of Feedback. Test Input Signals, Performance of Second-Order Systems, Effects of a Third Pole and a Zero on the Second-Order System Response,	6	16
5	**The Stability of Linear Feedback Systems:** The Routh-Hurwitz Stability Criterion, The Relative Stability of Feedback Control Systems, The Stability of State Variable Systems. The Root Locus Concept. The Root Locus Procedure, Parameter Design by the Root Locus Method, Sensitivity and the Root Locus, Three-Term (PID) Controllers	7	18
6	**Frequency Response Methods:** Frequency Response Plots, Frequency Response Measurements, Performance Specifications in the Frequency Domain, Log Magnitude and Phase Diagrams. Mapping Contours in the s-Plane, The Nyquist Criterion, Relative Stability and the Nyquist Criterion, Time-Domain Performance Criteria in the Frequency Domain, System Bandwidth, The Stability of Control Systems with Time Delays	6	14
7	**The Design of Feedback Control Systems:** Approaches to System Design, Cascade Compensation Networks, Phase-Lead Design Using the Bode Diagram, Phase-Lead Design Using the Root Locus, System Design Using Integration Networks, Phase-Lag Design Using the Root Locus, Phase-Lag Design Using the Bode Diagram, Design on the Bode Diagram Using Analytical Methods.	5	12

Course Outcome:

CO1: Apply systems theory in order to obtain models that are expressed using differential equations and transfer functions.
CO2: Predict system behavior based on the mathematical model of that system in time or frequency Domain.
CO3: Analyze the behavior of closed loop systems using tools such as root locus, Routh Hurwitz, Bode and Nyquist.
CO4: Devise a safe and effective method of investigating a system identification problem in the lab

List of Text Books:

1. Control Systems Engineering by Nagrath and Gopal New Age Publication
2. Feedback and Control Systems by Joseph J Distefano 2nd Edition TMH

List of Reference Books:

1. Modern Control System by Richarc C. Drof and Robert H. Bishop,11th Edition Person Int.
2. Modern Control Engineering by Katsuhiko Ogata, 4th Edition, Prentice Hall of India.

3. Automatic Control Systems by Benjamin C.Kuo, 8th Edition, Farid Golnaraghi, John Wiley & Sons.

Open e-Resource:

Courses available through NPTEL.
- website : nptel.ac.in

List of Suggested Experiments:

1. Simulation of DC motor working
2. Simulation of synchros
3. Generating standard test signals i.e. step, ramp, unit impulse on a simulator
4. Analysis of time response of second order system
5. Effect of P, PD, PI, PID Controller on a second order systems.
6. Plotting root locus of a given transfer function using a simulator
7. Temperature control using PID
8. Plotting phase magnitude plot of a given transfer function with a simulator.
9. Obtaining frequency response of a common emitter amplifier and plotting on a Bode plot.
10. Simulation of a given transfer function using OPAMPs
11. Stability Analysis (Root locus, Bode, Nyquist) of Linear Time Invariant System.
12. Study of a PLL as a closed loop control system on a simulator..

Gandhinagar Institute of Technology
B.Tech Electronics & Communication Engineering
Semester 4

Subject Code: 10040403	**Subject Title:** Microprocessor & Microcontroller
Pre-requisite: Basic knowledge of Digital System Design.	

Course Objective:

(1) To impart the basic concepts of microprocessor
(2) To be familiar with writing assembly language programs
(3) To understand and implement concepts about interfacing.
(4) To apply the concepts for interfacing different peripherals like keyboard, display, etc.
(5) Compare different advanced processors.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
4	0	2	5	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction** Introduction to Microprocessor, Components of a Microprocessor, Registers, ALU, Control & Timing Unit, System Bus	10	20
2	8086 Architecture, Segments, Flags, Pin Functions, Memory Bank, Minimum and Maximum Mode,	10	30
3	8086 Instruction Set (Arithmetic, Logical, Data Transfer, Branch, Loop), Assembly Language Programming using Assembler, Interrupts, Interrupt Service Routine, Debugging	20	30
4	**Advanced Microprocessors** 80286/386/486 Architecture, Registers, Privilege levels, Descriptors, Memory Access in GDT & LDT, Multitasking, Addressing Modes, Flag Register, MMU, Virtual Memory, Paging, Segmentation, Task Switching, Interrupts	20	20

Course Outcome:

CO1: Describe the various features of microprocessor.
CO2: Explain various elements of 8086 microprocessor architecture.
CO3: Select required instructions by considering the addressing modes.
CO4: Analyse different concepts of programmable interfacing with microprocessors.
CO5: Compare different features of advance microprocessors.

List of Text Books:

1. Ramesh S. Gaonkar Pub: Microprocessor Architecture, Programming, and Applications with the 8085, Penram International.
2. Douglas Hall, Microprocessor & Interfacing, TMH

List of Reference Books:

1. N. Senthil Kumar, M. Saravanan, S. Jeevanathan, S. K. Shah, Microprocessors and Interfacing, Oxford
2. Daniel Tabak, Advanced Microprocessors, McGrawHill
3. K.R.Venugopal, Microprocessor x86 programming, BPB

Open e-Resource:

Courses available through NPTEL: nptel.ac.in

List of Suggested Experiments:

1. Introduction to 8086 microprocessor and internal architecture.
2. To study and implement data transfer instructions.
3. Implement and use arithmetic & logical operations.
4. Implement and use branch operations.
5. Make a simple calculator with user inputs in 8086.
6. Write a program to find 1's and 2's complements of user inputs.
7. Write a program to sort 8 bit numbers in ascending and descending order.
8. Write a program to perform multiplication and division operations.
9. Write a program to convert a user input number from one base to another.
10. Design and implement a basic Calculator using assembly language.

Gandhinagar Institute of Technology
B.Tech Electronics and Communication Engineering
Semester 4

Subject Code: 10040404	**Subject Title:** Analog and Digital Communication
Pre-requisite: Analog Electronics, Digital Electronics, Fourier Series, Fourier Transform.	

Course Objective:

(1) Understand basic theories for the signals.
(2) Understand basic concepts of the analog communication systems with design and analysis of various basic modulation systems.
(3) Understand about the analog to digital conversion process.
(4) Understand about the digital communication and modulation schemes.

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

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction to Communication System:** Review of signals and systems, Frequency domain of signals, Analog and Digital Messages, Channel Effect, Signal-to Noise ration and capacity, Modulation and Detection, History of Communications.	6	15
2	**Modulation and Demodulation:** 1. Amplitude modulation And Demodulations: Single and Double sideband Amplitude modulation, Amplitude modulation, Bandwidth-efficient Amplitude modulation, VSB, Local Carrier synchronization, FDM, PLL. 2. Angle Modulation and demodulation: Nonlinear Modulation, Bandwidth of Angle-modulated Waves, Generating FM waves, Demodulation of FM signals, Nonlinear distortion and interference, Superheterodyne Receivers, FM broadcasting System.	12	25
3	**Analog to digital Conversion:** Sampling theorem, Sampling and signal reconstruction, Aliasing, Types of sampling, Quantization, PCM, Companding, DPCM, ADPCM, Delta modulation, Adaptive delta modulation, T1 carrier system	12	25
4	**Digital Data Transmission:** Components of digital communication system, line coding, pulse shaping, Scrambling, Regenerative Repeater, Eye Diagram,	6	10

	Timing Extraction, Detection Error Probability, M-ary communication, Digital Carrier Systems		
5	**Digital Modulation schemes:** Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying, BPSK, QPSK, GMSK	10	25

Course Outcome:

CO1: Remember the basic theories for the signals.
CO2: Analyze the Basics of Analog and Digital Communication Systems and Modulation as well as Transmission Techniques.
CO3: Implement the Analog and Digital Communication Systems.

List of Text Books:

1. Digital and analog communication system by B.P.Lathi .Zhi Ding 4th edition.

List of Reference Books:

1. Communication Systems by Simon Haykins.
2. Electronic Communications Systems by Wayne Tomasi.
3. Digital Communications, Tata McGraw Hill by J. Proakis,

Open e-Resource:

Courses available through NPTEL.
- website : nptel.ac.in.

List of Suggested Experiments:

1. To understand and the concept of Pulse Code Modulation and To observe the Performance of PCM system.
2. To understand and the role of signal compression/Expansion on S/N ratio.
3. To understand the concept of Delta Modulation and to achieve the Delta Modulation / De-Modulation.
4. To study the performance of An-adaptive Delta modulator/De-modulator circuits.
5. To Study and observe the performance of Digital carrier system—ASK.
6. To Study and observe the performance of Digital carrier system—FSK.
7. To Study and observe the performance of Digital carrier system—PSK.
8. To Study and observe the performance of Return to Zero (RZ) types of line codes.
9. To Study and observe the performance of Non- Return to Zero (NRZ) types of line Codes.
10. To establish a PCM based transmission-reception link.
11. To Study and observe the effect of signal Distortion using EYE-Diagram.
12. To Study and Perform sampling theorem and reconstruction.
13. To Study and perform Error Detection and Correction codes.
14. To perform TDM-PCM Transmission and Reception.

15. To study and perform Data Conditioning carrier modulation.
16. To study and perform Data Re-Conditioning carrier De-modulation.
17. To study and perform TDM pulse amplitude modulation/demodulation.
18. To study and perform PAM, PWM, PPM.
19. Few simulation exercises on digital communication techniques / basic systems.

Gandhinagar Institute of Technology
Bachelor of Technology Electronics and Communication Engineering
Semester 5

Subject Code: 10000501	**Subject Title: Probability Theory and Stochastic Processes**
Pre-requisite: Engineering Mathematics	

Course Objective: The purpose of the course is to teach basic theory and applications of probability theory and stochastic processes.

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

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	Sets and set operations; Probability space; Conditional probability and Bayes theorem; Combinatorial probability and sampling models.	8	19
2	Discrete random variables, probability mass function, probability distribution function, example random variables and distributions; Continuous random variables, probability density function, probability distribution function, example distributions.	10	24
3	Joint distributions, functions of one and two random variables, moments of random variables; Conditional distribution, densities and moments; Characteristic functions of a random variable; Markov, Chebyshev and Chernoff bounds.	8	19
4	Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems; Strong and weak laws of large numbers, central limit theorem.	10	24
5	Random process. Stationary processes. Mean and covariance functions. Ergodicity. Transmission of random process through LTI. Power spectral density.	6	14

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

1. Develop understanding of basics of probability theory.
2. Identify different distribution functions and their relevance.
3. Apply the concepts of probability theory to different problems.
4. Extract parameters of a stochastic process and use them for process characterization.

List of Textbooks:

1. H. Stark and J. Woods, “Probability and Random Processes with Applications to Signal Processing," Third Edition, Pearson Education.
2. A.Papoulis and S. Unnikrishnan Pillai, “Probability, Random Variables and Stochastic Processes," Fourth Edition, McGraw Hill.

List of Reference Books:

1 K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers,
3. S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press.

Open e-Resource:

- https://nptel.ac.in/courses/111102111

GANDHINAGA INSTITUTE OF TECHNOLOGY
B. TECH ELECTRONICS AND COMMUNICATION ENGINEERING
Semester–V

Subject Code: 10040501	**Subject Title: Advance Microcontroller**
Pre-requisite: Microprocessor & Microcontroller	

Course Objective:

1. This course will provide an opportunity to the students to learn ARM architecture, instruction set and programming.
2. ARM is very popular for portable applications because of its high performance withlow power consumption. Students will learn architecture, assembly language and C programming for ARMmicrocontrollerin thiscourse.

Teaching Scheme:

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

Content:

Sr. No.	**Content**	**Tota lHrs**	**% Weight age**
1	**ARM Introduction** Types of computer Architectures, ISA's and ARM, Difference between RISC and CISC, RISC Design philosophy, ARM Design Philosophy, History of ARM microprocessor, ARM processor family, Embedded System Software and Hardware	6	10%
2	**ARM Architecture and pipeline structure** The Acorn RISC Machine, ARM Core data flow model, Architectural inheritance,The ARM7TDMI programmer's model: General purpose registers, CPSR, SPSR, ARM memory map, data format, load and store architecture, ARM 3stage Pipeline, ARM 5 stage Pipeline, Pipeline Hazards, Data forwarding - a hardware solution, Stack implementation in ARM, Endianness, condition codes. Processor core Vs CPU core, ARM7TD MI Interface signals	6	20%

3	**ARM 7TDMI assembly language instructions and programming** Different Types of Instructions, ARM Instruction set, data processing instructions. Shift Operations, shift Operations using RS lower byte, Immediate value encoding. Data processing Instructions. Addressing modes with examples. Instruction Timing, Swap Instructions, Swap Registerre lated Instructions, Loading Constants. Program Control Flow, Control Flow Instructions, B & B L instructions, B X instruction. Interrupts and Exceptions, Exception Handlers, Reset	10	25%
	Handling. Aborts, software Interrupt Instruction, undefined instruction exception. Interrupt Latency, Multiply Instructions, Thumb state, Thumb Programmers model, Thumb Implementation, Thumb Applications. Thumb Instructions, Interrupt processing. Interrupt Handling schemes, Examples of Interrupt Handlers, Co-processorinstructions		
4	**Embedded C Programming for ARM:** ARMD development Environment Embedded Software, Overview of C compiler and optimization, Basic C datatypes, C Looping structures, Register allocations, function calls, pointer aliasing, structure arrangement, bit-fields, unaligned data and Endianness, Division, floating point, Inline functions and inline assembly, Portability issues. C programs for General purpose I/O, general purpose timer, PWM Modulator, UART, I2C Interface, SPI Interface, ADC, DAC	10	20%
5	**Cache and Memory Management and Protection** Memory Technologies, Need for memory Hierarchy, Hierarchical Memory Organization, Virtual Memory. Cache Memory, Mapping Functions. Cache Design, Unified or split cache, multiple level of caches, ARM cache features, co processor 15 for system control. Processes, Memory Map, Protected Systems,ARM systems with MPU, memory Protection Unit (MPU). Physical Vs VirtualMemory, Paging, Segmentation. MMU Advantage, virtual memory translation, Multi tasking with MMU, MMU organization, Tightly coupled Memory (TCM).	6	15%
6	**ARM Peripherals and versions** AMBA Overview, Typical AMBA Based Micro controller, AHB bus features, AHB Bus transfers, APB bus transfers, APB bridge. Overview of ARM Versions: ARMv5, ARMv6, ARM v7 (Cortex family R: Real time A: Application and M : Microcontroller), ARM big. LITTLE® Technology, ARMv8.	5	10%

ReferenceBooks:

[1] ARM Assembly Language Programming & Architecture By. Muhammad Ali Mazidi, Kindleedition

[2] ArmAssembly Language, Fundamentals and Techniques, 2nd edition, William Hohl, Christppher Hinds, CRC Press.

[3] Arm System Developer's Guide, Designing and Optimizing Software, Andrew N. Sloss, Dominic Symes, Chris Wwight, Elsevier

[4] Arm System-on-chip Architecture, 2nd Edition, Steve Furber, Pearson publication

[5] Embedded Systems By. Lyla Das, Pearson publication

[6] Manualsand Technical Documents from the ARM Inc, web site.

CourseOutcomes:

Sr. No.	COstatement	Marks %weightage
CO-1	Explain architecture and programming model of ARM 7 TDMI	20
CO-2	Learn and analyze assembly language programs for ARM microcontroller	25
CO-3	Develop Embedded Clan guage program for interfacing I/O devices with ARM microcontroller and use it	25
CO-4	Exemplify memory management system of ARM and different versions of ARM	15
CO-5	Design ARM based system to solve real life challenges	15

SuggestedListofExperiments:

1. To write and simulate ARM assembly language programs for data transfer, arithmetic and logical operations.
2. To write and simulate C Programs for ARM microprocessor in KEIL
3. To interface LED with ARM microprocessor and write program to blink LED at the interval of 1 second
4. To interface switch with ARM microprocessor and write program in C language to read status of The switch
5. To interface LCD with ARM microprocessor. Write and execute programs in C language for Displaying text messages and numbers on LCD.
6. To interface DC motor with ARM microprocessor. Write program to rotate DC motor in clock wise and anti clock wise direction with different speed
7. To interface Stepper motor with ARM microprocessor. Write program to rotate motor in half step and full step mode

8. Programming Node MCU with Arduino IDE or Micro python. Write and execute programs for device control using Android App and Node MCU
9. Write program to control devices using web page and Node MCU.
10. Write program to read analog value from sensors (light, temperature, humidity etc.) using Node MCU and upload data on cloud.
11. Student mini project based on ARM microprocessor /Node MCU

ListofOpenSourceSoftware/learningwebsite:

- NPTELVideolectureonhttps://nptel.ac.in/courses/117106111/
- EnergiaSoftwareforTexasTivaBoard
- Micropython

Gandhinagar Institute of Technology
B. Tech Electronics and Communication Engineering
Semester 5

Subject Code: 10040502	**Subject Title:** VLSI Design
Pre-requisite: Knowledge of Basic and Digital Electronics	

Course Objective:

1. This course will provide an opportunity to the students to learn about various topics of VLSI such as MOSFET fabrication, its physics, and analysis as well as design of digital circuits using MOS FET device.
2. In laboratory part of this course, students will be given exposure to hardware description language such as VHDL / Verilog for automated design of digital circuits.
3. This subject is very important for the students who would like to pursue their career in VLSI domain.

Teaching Scheme:

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

Content:

Sr. No.	**Content**	**Total Hrs**	**% Weightage**
1	**Introduction:** Overview of VLSI design methodology, VLSI design flow, Design hierarchy, Concept of regularity, Modularity, and Locality, VLSI design style, Design quality, package technology, introduction to FPGA and CPLD, computer aided design technology.	**2**	**8**
2	**Fabrication of MOSFET:** Introduction, Fabrication Process flow: Basic steps, C-MOS n-Well Process, Lay out Design rules, full custom mask lay out design.	**4**	**8**
3	**MOS Transistor:** The Metal Oxide Semiconductor (MOS) structure, The MOS System under external bias, Structure and Operation of MOS transistor, MOS FET Current –Voltage characteristics, MOS FET scaling and small-geometry effects, MOS FET capacitances	**6**	**16**
4	**MOS Inverters - Static Characteristics:** Introduction, Resistive load Inverter, Inverter with n-type MOS FET load (Enhancement and Depletion type MOS FET load), CMOS Inverter	**6**	**13**

5	**MOS Inverters Switching characteristics and Inter connect Effects:** Introduction, Delay- time definitions, Calculation of Delay times, Inverter design with delay constraints, Estimation of Interconnect Parasitic, Calculation of inter connect delay, Switching Power Dissipation of CMOS Inverters	**7**	**16**
6	**Combinational MOS Logic Circuits:** Introduction, MOS logic circuits with Depletion n MOS Loads, CMOS logic circuits, Complex logic circuits, CMOS Transmission Gates (TGs)	**4**	**7**
7	**Sequential MOS Logic Circuits:** Introduction, Behavior of Bi stable elements, The SR latch circuit, Clocked latch and Flip-flop circuit, CMOSD – latch and Edge-triggered flip-flop	**4**	**6**
8	**Dynamic Logic Circuits:** Introduction, Basic Principles of pass transistor circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, CMOS Dynamic Circuit Techniques, High-performance Dynamic CMOS circuits	**4**	**10**
9	**Chip I/P and O/P Circuits:** On chip Clock Generation and Distribution, Latch – Up and its Prevention	**2**	**4**
10	**Design for testability:** Introduction, Fault types and models, Control liability and observability, Ad Hoc Testable design techniques, Scan – based techniques, built-in Self Test (BIST) techniques, current monitoring IDDQ test	**3**	**6**
11	**Fin FET Device:** Introduction (Need of Fin FET device), structure, Comparison between Fin FET and Planar MOSFET (gm, gds, leakage current, DIBL, Sub threshold Slope)	**3**	**6**
Total		**45**	**100**

Reference Books:

1. CMOS Digital Integrated circuits – Analysis and Design by Sung–MoKang, Yusuf Leblebici, TATA McGraw – Hill Pub. Company Ltd.
2. Basic VLSI Design By Pucknell and Eshraghian, PHI, 3rd ed.
3. Introduction to VLSI Systems by Mead C and Conway, Addison Wesley
4. Introduction to VLSI Circuits & Systems – John P.Uyemura
5. Fundamentals of Digital Logic Design with VHDL, Brown and Vranesic
6. Fin FETs and Other Multi gate Transistors .J .P. Colinge, Springer Publications

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

1. Describe working of MOSFET and develop its mathematical model
2. Analyze, design, and simulate various static CMOS circuits
3. Analyze and simulate various dynamic CMOS circuits
4. Prepare layout of MOSFET based circuits
5. Understand CMOS latch-up, clocking strategy, and testing principles
6. Write programs in VHDL / Veri log for digital circuits and realize the m on FPGA/CPLD

ListofExperiments:

1. Minimum 9 practical's Based on VHDL/Verilog
2. Minimum 3 Practical's Based on Pspice / spice of MOS FET Characteristics
3. Minimum 2 Practical's on Layout Tools

VLSI design methodologies should be covered during Laboratory sessions.

Suggested List of Experiments

1. Introduction to programmable devices (FPGA, CPLD), Hardware Description Language (VHDL), and the use programming tool.
2. Implementation of basic logic gate sand its testing.
3. Implementation of adder circuits and its testing.
4. Implementation 4 to1 multiplexer and its testing.
5. Implementation of 3to 8 decoder and its testing.
6. Implementation of 8 to3 priority encoder and its testing.
7. Implementation of J-K and D Flip Flops and its testing.
8. Implementation of sequential adder and its testing.
9. Implementation of BCD counter and its testing.
10. Implementation of two 8- bit multiplier circuit and its testing.
11. Simulation of CMOS Inverter using SPICE for transfer characteristic.
12. Simulation and verification of two input CMOS NOR gate using SPICE.
13. Implementation and simulation of given logic function using dynamic logic.
14. To generate layout for CMOS Inverter circuit and simulate it for verification.
15. To prepare layout for given logic function and verify it with simulations.
16. To measure I_{DS}–V_{GS} and I_{DS}–V_{DS} characteristic so f given n-channel and p-channel MOSFETs.
17. To measure propagation delay of a given CMOS Inverter circuit.

Major Equipment /software:

Circuit simulator, FPGA / CPLD programming tool, Multi-meter, Power supply, function generator, oscilloscope

List of Open Source Software / learning website: NPTEL, NG spice circuit simulator

Gandhinagar Institute of Technology
B.Tech Electrnics & Communication Engineering
Semester V

Subject Code: 10040503	**Subject Title: Electromagnetic Theory**
Pre-requisite:	

Course Objective:

(1) Study of electromagnetic fields is basically concerned with study of charges at rest and in motion.
(2) Electromagnetic principles serve as basic fundamentals for detailed and in-depth study of electrical engineering and are indispensable for analysis of various electrical, electro-mechanical and electronic systems.
(3) This subject would cover the behavior of static and dynamic, electric and magnetic fields.

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

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Review of Vector Analysis:** Introduction, scalars and vectors, unit vector, vector addition and subtraction, position and distance vectors, dot product, cross product, scalar triple product, vector triple product, components of a vector, Cartesian co-ordinate system, Circular cylindrical co-ordinate system, Spherical co-ordinate system, transformation from one co-ordinate to other coordinate systems	3	10
2	**Static Electric Fields:** Coulomb's law, Electric field intensity, Electric field due to point and line charges, Line surface and volume charge distributions, Gauss' law and its applications, Divergence theorem, Absolute Electric potential, Potential difference, Potential gradient, Calculation of potential difference for	6	20

	different configurations, Electric dipole, Electrostatic energy and energy density		
3	**Time varying fields and Maxwell's equations:** Faraday's law, Transformer and motional electromotive forces, Displacement current, Maxwell's equations in integral and point form, Time varying potentials	4	20
4	**Uniform Plane Wave (6Hours)** Wave Propagation in Free Space, Wave Propagation in Die-Electric, The Poynting Vector and Power Considerations, Propagation in Good Conductors: Skin Effect, Wave Polarization.	12	20
5	**Plane Waves at Boundaries and in Dispersive Media** Reflection of Uniform Plane Wave at Normal Incidence, Standing Wave Ratio, Wave Reflection from Multiple Interfaces, Plane Wave Propagation in General Directions, Plane Wave Reflection at Oblique Incidence Angle.	**10**	15
6	**Transmission Lines** Transmission lines parameters, Equations of Voltage and Current on TX line, Propagation Constant and Characteristic Impedance, Input Impedance, and Reflection Co-efficient and VSWR, Power Transfer, Loss less and Distortion less Transmission Lines, Smith Chart, Applications of Transmission Lines, Impedance	**10**	**15**

Course Outcome:

CO1: Apply vector calculus to electric and potential fields due to various charge distributions.
CO2: Compute potential, Electric fields, Electric flux density, Capacitance using Poisson's and Laplace's equations.
CO3: Derive forces and torques in magnetic fields, forces due to current carrying conductors and their inter-relationship with magnetic field.
CO4: Analyze Maxwell's equations in different forms (point & integral) and apply them to diverse engineering problems.

List of Text Books:

1. W. H. Hayt, J. A. Buck, "Engineering Electromagnetics", McGraw Hill Education
2. A. Pramanik, "Electromagnetism-Problems with Solutions, PHI, 2012

List of Reference Books:

3. M.N.O. Sadiku, S.V. Kulkarni, “Principles of Electromagnetics”, 6 th edition, Oxford University Press
4. A Pramanik, “Electromagnetism- Theory and Applications” PHI Learning Pvt. Ltd. ,New Delhi, 2009.
5. S.P. Seth, “Elements of Electromagnetic fields”, Dhanpat Rai & Co, 2013

Open e-Resource:

1. https://nptel.ac.in/downloads/108104087/ by Prof. Pradeep Kumar, IIT, Kanpur
2. https://nptel.ac.in/downloads/115101005/ by Prof. D.K. Ghosh, IIT , Bombay
3. https://nptel.ac.in/downloads/115104088/ by Prof. Manoj K. Harbola, IIT, Kanpur
4. Transcripts and video lectures of Prof. Harishankar Ramachandran, IIT, Madras https://nptel.ac.in/courses/108106073/
5. MATLAB experiments manual by Dr. M. H. Bakr http://www.ece.mcmaster.ca/faculty/talia/EM_2FH3_downloads/assignments/Matlab_Manual_2FH3_Bakr.pdf

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Gandhinagar Institute of Technology
B.Tech ECE
Semester V

Subject Code: 10040505	**Subject Title: Internet of Things**
Prerequisite: C Programming, Microprocessor, Networking	

Course Objective:

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

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

	Subject Contents			
Sr. No.	**Topic**	**IEEE Blended**	**Total Hours**	**Weight (%)**
1	**Introduction to Internet of Things:** Application areas of IoT, Characteristics of IoT, Things in IoT, IoT stack, Enabling, technologies, IoT challenges, IoT levels, IoT and cyber physical system, IoT and WSN, Industrial IOT and Consumer IOT, IOT Functional Blocks. CH.1 : TB.1	**IEEE**	5	15
2	**Sensors, Microcontrollers, and Their Interfacing:** Sensor interfacing,Types of sensors, Controlling sensors, Microcontrollers, ARM, Thing Architecture. NPTEL : week 4	**IEEE**	5	15
3	**Protocols for IoT :** Messaging protocols, Transport protocols, IPv4, IPv6,URI (Layer), Information Sensing Actuation. NPTEL : week 3	**IEEE**	8	10

4	**Cloud for IoT:** IoT and cloud, Fog computing, Security in cloud, Case study, Nano Technology & Industry 4.0, (Technology that support IOT growth – cloud). NPTEL : week 9	**IEEE**	6	10
5	**Application Building with IoT:** Various application of IoT : Food,Healthcare, Lavatory maintenance, Water quality, Warehouse, Retail, Driver Assistance, Collision impact, M2M & IOT. CH.6 & 7 : TB.1	**IEEE**	6	20
6	**Arduino and Raspberry Pi:** Arduino : Architecture, Programming and Application Raspberry Pi : Architecture, Programming and Application NPTEL : week 5	**IEEE**	8	15
7	**IoT Security:** Various security issues and need, architecture, requirement, challenges andalgorithms, Standards: National and International Scenario. CH.8 : TB.1	**IEEE**	4	15

Course Outcome:

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

List of Textbooks:

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

List of Reference Books:

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

Open e-Resource:

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

List of Suggested Experiments:

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

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Gandhinagar Institute of Technology
B.Tech Computer Engineering
Semester 5

Subject Code: 10050503	**Subject Title: Python Programming**
Prerequisite: Problem Solving and Python Programming / – Fundamentals of Data Structures using Python	

Course Objective:

1. Understand data types and basic commands of Python programming.
2. Understand data structures and indexing, and use them in your work.
3. Understand about functions and modules.
4. Demonstrate File Operations.
5. Understand the concept of Micro Python.

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

	Subject Contents			
Sr. No	**Topic**	**IEEE**	**Total Hours**	**Weight (%)**
1	**Introduction, Data Types and Operators:** Installation and working with Python, Variables and data types in python, Perform computations and create logical statements using Python's operators: Arithmetic, Assignment, Comparison, Logical, Membership, Identity, Bitwise operators, list, tuple and string operations [T.B-1:Learn Python Programming Fundamentals:A Beginner's Guide CH-1,2] [R.B-2:Core Python Programming - CH:1,2,3]	IEEE	4	10%
2	**Python Decision making and Loops:** Write conditional statements using If statement, if ...else statement, elif statement and Boolean expressions, While loop, For loop, Nested Loop, Infinite loop, Break statement, Continue statement, Pass statement, Use for and while loops along with useful built-in functions to iterate over and manipulate lists, sets, and dictionaries. Plotting data, Programs using decision making and loops. [T.B-1:Learn Python Programming Fundamentals: A Beginner's Guide. CH-4,5] [R.B-2:Core Python Programming - CH-2,3,4]		10	25%

3	**Python Functions and Modules:** Defining custom functions, Organizing Python codes using functions, Create and reference variables using the appropriate scope, Basic skills for working with lists, tuples, work with dates and times, get started with dictionaries, Importing own module as well as external modules, Programming using functions, modules and external packages [T.B-3:Fundamentals of Python : First Programs with MindTap-CH:2,3,4]	IEEE	10	25%
4	**Python File Operations:** An introduction to file I/O, use text files, use CSV files, use binary files, Handle a single exception, handle multiple exceptions, Illustrative programs, Exercises. [T.B-2:Introduction to Computation and Programming Using Python CH-5,6,7]		8	20%
5	**MicroPython:** Introduction, main difference between MicroPython and Python, Installation of MicroPython on Hardware, MicroPython libraries, GPIO programming on MicroPython Hardware, Sensor Programming using MicroPython [T.B-2:Introduction to Computation and Programming Using Python CH-8,9] [RB-1:Advanced Python Programming by Dr. Gabriele Lanro]	IEEE	8	20%

Course Outcome:

1. To test and debug code written in pythonLearning the basic R-Language Constructs
2. To create applications using Python Programming
3. To perform file operations to read and write data in fileTo develop applications and Performing T-Testing
4. To write programs for general purpose I/O devices using MicroPython

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.

Reference Book:

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.

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 Experiments:

1.Write Python programs to understand control structures

2.Write Python programs to understand list and tuples

3. Use conditional statements and loops in Python programs

4.Write python programs to create functions and use functions in the program

5.Import module and use it in Python programs

6.Write python program to plot data using PyPlot

7. To become familiar with MicroPython and NodeMCU. Configure NodeMCU for MicroPython.

8.Write program in MicroPython to send digital data on GPIO pins of NodeMCU and glow LED connected with NodeMCU or any other MicroPython supported board.

9. Connect Digital/Analog I/O module with NodeMCU and write program to display temperature in MicroPython.

10. Connect NodeMCU with with WiFi Access Point and transmit data from NodeMCU to Cloud. Connect Digital/Analog I/O module with NodeMCU and send temperature and light data on cloud (Thingspeak, Firebase or any other cloud service)

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Gandhinagar Institute of Technology
B.Tech Computer Engineering
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)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	-	2	4	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction to computer networks and Internet:** Understanding of network and Internet, The network edge, The network core, Understanding of Delay, Loss and Throughput in the packet-switching network, protocols layers and their service model, History of the computer network [R.B-5: Data Communications and Networking- CH-3] NPTEL	8	15

2	**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	9	17
3	**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	12	25
4	**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	13	25
5	**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	10	18

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 about Network Layer– IPv4 Addressing Scheme and perform an Exercise.
2. Write a C program to implement the data link layer farming methods.
3. To simulate the SHORTEST PATH FIRST routing protocol using C.
4. Introduction of Packet Tracer.
5. Configuration of Static Routing.
6. Configure a network with subnetting along with DNS Server.
7. Protocol Visualization with Packet Tracer.
8. Configure RIP using packet tracer.
9. Configuration of Frame Relay.

Gandhinagar Institute of Technology
B.Tech Electronics and Communication Engineering
Semester 6

Subject Code: 10040601	**Subject Title:** Antennas and Wave Propagation
Pre-requisite: Higher Engineering Mathematics, Fundamental knowledge of Engineering Electromagnetics	

Course Objective:

(1) They are expected to be able to design different antennas for specific given frequency and application.
(2) They should be acquainted with concept of arrays and antenna measurement methods.
(3) They will be practiced in study of antenna radiation patterns and in measurement of different antenna parameters.
(4) They will be able to design and analyze some basic antennas in hardware and application specific antenna in HFSS or CST.

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

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Basic antenna concepts:** Definition and functions of an antenna, comparison between an antenna & transmission line, radio communication link with transmitting antenna and a receiving antenna, radiation patterns of antennas-field and power patterns, all antenna types.	3	5
2	**Radiation of Electric dipole:** Potential functions and the electromagnetic field, oscillating electric dipole-derivations for E and H field components in spherical coordinate systems, Power Radiatedby a current element, Application to antennas, Radiation from quarter wave monopole and half wave dipoles, Derivation for radiation resistance, application of reciprocity theorem to antennas, equality of directional patterns and effective lengths of transmitting and receiving antennas, directional properties of dipole antennas, antenna feeding methods.	3	10
3	**Antenna parameters and definitions:** beam area, beam width- Half-Power Beam width (HPBW)and First Null Beamwidth (FNBW) ,Polarization, Radiation Intensity ,Beam Efficiency,	3	10

	Directivity and directive gain, radiation resistance, radiation efficiency, resolution, Antenna aperture- physical and effective apertures, effective height, transmission formula, antenna field zones, Transmission loss as a function of frequency. Antenna temperature and signal to noise ratio.		
4	**Arrays of point sources:** Expression for electric fields from two, three and N element arrays- linear arrays: Broad- side array and End-Fire array- Method of pattern multiplication- Binomial array- Horizontal and Vertical Antennas above the ground plane, Effect of ground on ungrounded antenna, Schelkunoff theorems for linear arrays, Dolph-Tchebysheff distribution for linear arrays.	3	10
5	**Loop Antenna:** Small loop short magnetic dipole, comparison of far field of small loop and shortdipole loop antennas, field pattern of circular loop antenna & radiation resistance of loop antenna, directivity of circular loop antennas with uniform current.	3	10
6	**Helical antenna:** Helical geometry, transmission radiation modes, practical design considerations, wideband characteristics of helical antenna.	3	10
7	**Arrays of dipoles & apertures**: 3 element dipole Array with parasitic elements, Yagi-Uda array-function and its design,Phased arrays, frequency scanning arrays, smart antennas, long wire antennas, location methods of feeding antennas, folded dipole antennas, matching arrangements.	3	10
8	**Reflector antennas**: Parabolic reflector, paraboloidal reflector, aperture Pattern of large circular apertures withuniform illumination, off axis operation of paraboloidal reflectors, Cassegrain feed system.	3	5
9	**Slot patch & Horn antennas**: Slot antenna, its pattern, Babinet's principle and complementary antennas, impedance of slot antennas, and horn antenna-function and types.	3	5
10	**Microstrip (patch) antennas:** Rectangular and circular types-function, features analysis, design considerations and applications	4	5
11	**Lens antennas**: Non-metallic Dielectric lens and artificial dielectric lens antennas, reflector lensantennas.	2	4
12	**Broadband & Freq. Independent antennas**: Broadband antenna, Frequency independent antenna, log periodic antennas.	2	4
13	**Antennas for special applications:** Antennas design consideration for satellite communication, antenna for terrestrial mobilecommunication systems, GPR, Embedded antennas, UWB, Plasma antenna.	2	4
14	**Antennas measurements**: Experimental set ups for measurement of radiation patterns, gain, phase polarization, terminal impedance.	2	4

15	**Radio wave propagation** : Modes of propagation, Ground Wave Propagation, Structure of troposphere and ionosphere, Characteristic of Ionospheric layers, Sky wave propagation, Definitions for Virtual height, MUF and Skip distance, OWF, Fading, ionospheric absorptions, Multi- hop propagation, Space wave propagation and Super refraction.	5	4

Course Outcome:

CO1: Understand the radiation phenomenon and identify different types of antennas

CO2: Create strong foundation of basic antenna parameters.

CO3: Design and analyze different antennas, antenna arrays and matching / feeding networks for antennas

CO4: Demonstrate the antenna measurement techniques.

CO5: Understand the fundamentals of radio-wave propagation

List of Textbooks:

1. Antennas for all applications", J.D. Krauss 3RD Edition (TMH

List of Reference Books:

1. "Electromagnetic wave & radiating systems", Jordan & Balmain PHI Publication
2. "Antenna & Wave Propagation", K.D. Prasad Satyaprakash Publications
3. "Antenna Theory: Analysis and design", C. Balanis Wiley India

Open e-Resource:

1. https://onlinecourses.nptel.ac.in/noc20_ee20

List of Suggested Experiments:

1. To study the variation of radiated field with distance from transmitting antenna.
2. To demonstrate the reciprocity theorem for transmitting and receiving radiation patterns of an antenna.
3. To plot the radiation pattern of an Omni directional antenna.
4. To plot radiation pattern of directional antenna.
5. To study Phenomena of Circular, Linear and Elliptical Polarization of antennas.
6. To study and plot the radiation pattern of the dipole/Folded dipole antennas in Azimuth & Elevation planes.
7. To study and plot the radiation pattern of the helical antenna.
8. To study and plot the radiation pattern of the parabolic reflector.
9. To study and plot the radiation pattern of the Log-Periodic antenna.
10. To study and plot the radiation pattern of the Broadside antennas and Measure its Gain,Bandwidth and Beam width.
11. To plot radiation pattern of $3\lambda/2$ dipole antenna and compare with $\lambda/2$ dipole antenna.
12. To plot the radiation pattern of a Slot antenna.
13. Design and simulate micro strip patch antenna in HFSS simulator.

Gandhinagar Institute of Technology
B.Tech Electronics and Communication Engineering
Semester 6

Subject Code: 10040602	**Subject Title:** Digital Signal Processing
Pre-requisite: Signal and System and Mathematics	

Course Objective:

(1) An understanding and working knowledge of design, implementation and analysis DSP systems.
(2) An ability to design filters
(3) An ability to understand Digital Processors

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

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction:** Signals, systems and signal processing, classification of signals, elements of digital signal processing system, concept of frequency in continuous and discrete time signals, Periodic Sampling, Frequency domain representation of sampling, Reconstructions of band limited signals from its samples, general applications of DSP.	3	5
2	**Discrete-Time Signals and Systems:** Discrete-Time Signals, Discrete-Time Systems, LTI Systems, Properties of LTI Systems, linear convolution and its properties, Linear Constant Co-efficient Difference equations, Frequency domain representation of Discrete-Time Signals & Systems, Representation of sequences by discrete time Fourier Transform, (DTFT), Properties of discrete time Fourier Transform, and correlation of signals, Fourier Transform Theorems.	5	10
3	**The Z- Transform and Analysis Linear Time-of Invariant System:** Z-Transform, Properties of ROC for Z-transform, the inverse Z-transform methods, Z- transforms properties, Analysis of LTI systems in time domain and stability considerations. Frequency response of LTI system, System functions for systems with linear constant-coefficient Difference equations, Freq. response of rational system functions relationship between magnitude & phase, All pass systems, inverse systems, Minimum/Maximum phase systems, systems with linear phase.	10	20

4	**Structures for Discrete Time Systems:** Block Diagram and signal flow diagram representations of Linear Constant-Coefficient Difference equations, Basic Structures of IIR Systems, Transposed forms, Direct and cascade form Structures for FIR Systems, Effects of Co-efficient quantization.	6	15
5	**Filter Design Techniques:** Design of Discrete-Time IIR filters from Continuous-Time filters-Approximation by derivatives, Impulse invariance and Bilinear Transformation methods; Design of FIR filters by windowing techniques, Illustrative design examples of IIR and filters.	6	15
6	**Discrete-Fourier Transform:** Representation of Periodic sequences: The discrete Fourier Series and its Properties Fourier Transform of Periodic Signals, Sampling the Fourier Transform, The Discrete-Fourier Transform, Properties of DFT, Linear Convolution using DFT.	6	15
7	**Fast Fourier Transform:** FFT-Efficient Computation of DFT, Goertzel Algorithm, radix2 and radix 4 Decimation-in-Time and Decimation-in-Frequency FFT Algorithms.	6	15
8	**Architecture of DSP Processors- :** Harward architecture, pipelining, Multiplier-accumulator (MAC) hardware, architectures of fixed and floating point (TMSC6000) DSP processors.	3	5

Course Outcome:

CO1: Express engineering problems in terms of DSP tasks.

CO2: Interpret and analyze discrete time signals.

CO3: Analyze digital and analog signals and systems.

CO4: Analyze discrete time signals in frequency domain.

CO5: Ability to design & analyze DSP systems like FIR and IIR Filter etc..

CO6: Apply signal processing algorithms for real time applications.

CO7: Describe and explain working of DSP Processors.

List of Textbooks:

1. Digital Signal Processing: Principles, Algorithm & Application,4th edition,Proakis, Manolakis, Proakis, Manolakis, Pearson.
2. Discrete Time Signal Processing, Oppeheim, Schafer, Buck Pearson education publication, 2nd Edition, 2003.

List of Reference Books:

1. Digital Signal Processing fundamentals and applications, Li Tan, Elsevier.
2. Fundamentals of digital Signal Processing –Lonnie c.Ludeman, Wiley.
3. Digital Signal processing-A Practical Approach, second edition, Emmanuel Ifeacher, and Barrie W..Jervis, Pearson Education.
4. Digital Signal Processing, S.Salivahanan, A.Vallavaraj, C.Gnapriya TMH.
5. Digital Signal Processors, Architecture, programming and applications by B. Venkatramani, M Bhaskar, Mc-Graw Hill.

Open e-Resource:

www.nptel.in
http://ocw.mit.edu,
https://cnx.org/content

List of Suggested Experiments:

1. Introduction to MATLAB.
2. Write a MATLAB code to generate different discrete time signals.
3. Write a MATLAB code to simulate basic operations on discrete time signals.
4. Write a MATLAB code to implement Sampling Theorem for different values of sampling frequencies.
5. Write a MATLAB code to implement Convolution of discrete time signals.
6. Write a MATLAB code to implement Correlation of discrete time signals.
7. Write a MATLAB code to perform Z-transform of a given sequence.
8. Write a MATLAB code to perform Discrete Fourier Transform (DFT) of a given sequence.
9. Write a MATLAB code to design a Finite Impulse Response (FIR) filter.
10. Write a MATLAB code to design a Low pass and High pass Butterworth filter.

Gandhinagar Institute of Technology
B.Tech Electronics and Communication Engineering
Semester 6

Subject Code: 10040603	**Subject Title:** Wireless Communication
Pre-requisite: Digital and analog Communication, Signals & Systems, Electromagnetic Theory, Probability & Random Processes.	

Course Objective:

(1) Students will be able to Understand the evolution and architecture of wireless communication systems including mobile radio systems, cellular generations (2G, 3G), WLANs, WLL, Bluetooth, and PAN technologies.

(2) Students will be able to Apply cellular system design concepts such as frequency reuse, channel assignment strategies, handoff techniques, and methods to improve coverage and capacity-like cell splitting, sectorization, and repeaters.

(3) Students will be able to Analyze mobile radio propagation models and small-scale fading mechanisms by evaluating path loss, multipath effects, fading types, and diversity techniques using empirical and statistical models.

(4) Students will be able to Compare and evaluate multiple access techniques including TDMA, CDMA, FDMA, OFDM, and CSMA, focusing on their advantages, limitations, and suitability for different wireless systems

(5) Students will be able to Examine the architecture and functioning of advanced wireless systems like GSM, CDMA, GPRS, and emerging technologies such as Wi-Fi, WiMAX, ZigBee, SDR, and UWB, including their protocols, interfaces, and security challenges

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

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction to Wireless Communication System:** Evolution of mobile communications, Mobile Radio System around the world, Types of Wireless communication System, Comparison of Common wireless system, Trend in Cellular radio and personal communication. Second generation Cellular Networks, Third Generation (3G) Wireless Networks, Wireless Local Loop(WLL), Wireless Local Area network (WLAN), Bluetooth and Personal Area Networks	3	5
2	**The Cellular Concept- System Design Fundamentals:**	10	10

	Cellular system, Hexagonal geometry cell and concept of frequency reuse, Channel Assignment Strategies Distance to frequency reuse ratio, Channel & co-channel interference reduction factor, S/I ratio consideration and calculation for Minimum Co-channel and adjacent interference, Handoff Strategies, Umbrella Cell Concept, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular System-cell splitting, Cell sectorization , Repeaters, Micro cell zone concept, Channel antenna system design considerations.		
3	**Mobile Radio Propagation Model, Small Scale Fading and diversity:** Large scale path loss:-Free Space Propagation loss equation, Path-loss of NLOS and LOS systems, Reflection, Ray ground reflection model, Diffraction, Scattering, Link budget design, Max. Distance Coverage formula, Empirical formula for path loss, Indoor and outdoor propagation models, Small scale multipath propagation, Impulse model for multipath channel, Delay spread, Feher's delay spread, upper bound Small scale, Multipath Measurement parameters of multipath channels, Types of small-scale Fading, Rayleigh and rician distribution, Statistical for models multipath fading channels and diversity techniques in brief.	15	30
4	**Multiple Access Techniques:** Introduction, Comparisons of multiple Access Strategies TDMA, CDMA, FDMA, OFDM, CSMA Protocols	7	25
5	**Wireless Systems:** GSM system architecture, Radio interface, Protocols, Localization and calling, Handover, Authentication and security in GSM, GSM speech coding, Concept of spread spectrum, Architecture of IS-95 CDMA system, Air interface, CDMA forward channels, CDMA reverse channels, soft handoff, CDMA features, Power control in CDMA, Performance of CDMA System, RAKE Receiver, CDMA2000 cellular technology, GPRS system architecture.	8	25
6	**Recent trends:** Introduction to Wi-Fi, WiMAX, ZigBee Networks, Software Defined Radio, UWB Radio, Wireless Ad hoc Network and Mobile Portability, Security issues and challenges in a Wireless network.	2	5

Course Outcome:

CO1: Students are able to Understand the evolution and architecture of wireless communication systems including mobile radio systems, cellular generations (2G, 3G), WLANs, WLL, Bluetooth, and PAN technologies.

CO2: Students are able to Apply cellular system design concepts such as frequency reuse, channel assignment strategies, handoff techniques, and methods to improve coverage and capacity like cell splitting, sectorization, and repeaters.

CO3: Students are able to Analyze mobile radio propagation models and small-scale fading mechanisms by evaluating path loss, multipath effects, fading types, and diversity techniques using empirical and statistical models

CO4: Students are able to Compare and evaluate multiple access techniques including TDMA, CDMA, FDMA, OFDM, and CSMA, focusing on their advantages, limitations, and suitability for different wireless systems.

CO5: Students are able to Examine the architecture and functioning of advanced wireless systems like GSM, CDMA, GPRS, and emerging technologies such as Wi-Fi, WiMAX, ZigBee, SDR, and UWB, including their protocols, interfaces, and security challenges.

List of Textbooks:

1. Wireless Communication", Theodore S. Rappaport, Prentice Hall

List of Reference Books:

1. Wireless Communications and Networking ", Vijay Garg, Elsevier
2. Mobile Communications Engineering", William C. Y. Lee, Mc Graw Hill Publications

Open e-Resource:

1. https://archive.nptel.ac.in/courses/108/106/106106167/

Gandhinagar Institute of Technology
B.Tech Electronics and Communication Engineering
Semester 6

Subject Code: 10040604	**Subject Title:** Microwave Engineering
Pre-requisite: Knowledge of Basic Electronics, Electromagnetics	

Course Objective:

(1) An understanding of microwave waveguides, passive & active devices, tubes and network analysis.
(2) An ability to design microwave matching networks.
(3) An ability to perform microwave measurements.
(4) An understanding of RADARs and its applications.

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

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction to microwaves:** Microwave frequencies, advantages of microwaves, general and Industrial applications of microwaves.	1	10
2	**Microwave transmission lines and waveguides:** Transmission line equations & solutions, reflection and transmission coefficient, standing wave and standing wave ratio, line impedance and admittance, impedance matching, using stub line, application of smith chart in solving transmission line problems Introduction to strip lines**,** Microstrip lines, parallel strip lines, coplanar strip lines, shielded strip lines, rectangular waveguides-theory and analysis, principle of circular waveguide.	15	20
3	**Microwave components & their s-parameters:** Wave-guide tees, magic tees, wave-guide corners, bends, twists, directional couples, circulators and isolators. S Matrix and its applications in analyzing microwave components.	5	20
4	**Microwave tubes and circuits:** Limitations of conventional tubes at UHF & Microwave, Klystrons, velocity modulation, multicavity klystron, reflex klystron, traveling wave tube, Magnetron. (Without derivations).	8	20
5	**Semiconductor microwave devices and circuits:**	8	15

	Microwave transistors and integrated circuits, varactor diodes, step- recovery diodes, parametric amplifiers, tunnel diode and its applications, Gunn diode and its applications IMPATT diode, TRAPATT diode, PIN diode, schottky barrier diodes.		
6	**Radar systems:** Basic principle, radar range equation: powers and frequencies used in radar, basic pulsed radar system, Factors Influencing maximum range, Effect of noise, Display Methods, Search and Tracking radar systems, Moving target indicator (MTI), CW Doppler Radar, Frequency Modulated CW radar.	8	15

Course Outcome:

CO1: Describe the use and advantages of microwave transmission

CO2: Analyze typical microwave networks using impedance, admittance, transmission and scattering matrix representations.

CO3: Identify different types of waveguides and their respective modes of propagation.

CO4: Explain working of microwave passive circuits such as isolator, circulator, Directional couplers, attenuators etc

CO5: Describe and explain working of microwave tubes and solid state devices.

CO6: Analyze the operation of RADAR systems and recite their applications.

List of Textbooks:

1. Microwave Engineering, David M. Pozar, Wiley India 3rd Edition.
2. Microwave Devices and Circuits, Samuel Liao, PHI.
3. Microwave Engineering, Annapurna Das, Sisirk. Das, TMH 2nd Edition.
4. Microwave Engineering, Manojit Mitra, Dhanpat rai & Co.
5. Microwave and Radar Engineering, M Kulkarni, Umesh Publishers.
6. Microwave Engineering, Sanjeev Gupta Khanna Pub.

List of Reference Books:

1. R.E. Collins, Microwave Circuits, McGraw Hill.
2. G. Kennedy - Electronic Communication Systems, McGraw-Hill Book Company
3. Dennis Roddy - Microwave Technology, PHI

Open e-Resource:

Courses available through NPTEL.
- website : nptel.ac.in

List of Suggested Experiments:

1. To study microwave bench.
2. To study V-I characteristic of Gunn Diode.
3. To study V-I characteristic of Reflex klystron.
4. To determine the frequency and wavelength in rectangular waveguide.
5. To determine the standing wave Ration and Reflection Coefficient.
6. To study the function of E -plane Tee.
7. To study the function of H -plane Tee.
8. To study the function of Magic or Hybrid Tee.
9. To study the function of Circulator.
10. To study the function of Attenuator.

Gandhinagar Institute of Technology
B.Tech Electronics and Communication Engineering
Semester 6

Subject Code: 10040605	**Subject Title:** Wireless Sensor Networks
Pre-requisite: Knowledge of Computer Networks, Basic computer languages, Microprocessor, Algorithms & Communication Basics	

Course Objective:

- Understand standards and communication protocols for wireless sensor networks.
- Functionality of the node architecture and use of sensors for various applications.
- Get familiar with architectures, functions and performance of wireless sensor networks systems and platforms

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory		Practical		
Lecture	Tutorial	Practical	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total
3	0	0	3	60	40	-	-	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction** – challenges and constraints, Applications. NPTEL CH-1 RB-1	1	5
2	**Single Node Architecture** – Hardware components, Energy consumption of sensor nodes, Operating systems and execution environments, examples of sensor nodes **Network Architecture** – Sensor network scenarios, optimization goals, design principles, service interfaces, gateway concepts. CH-2 RB-2	7	20
3	**Physical layer** – Introduction, wireless channel and communication fundamentals, physical layer and transceiver design considerations in WSNs. CH-4 RB-1	4	10
4	**MAC protocols** – Fundamentals of MAC protocols, Low duty cycle protocols and wakeup concepts, contention-based protocols, schedule-based protocols, The IEEE 802.15.4 MAC protocol **Link Layer Protocol** – Tasks and requirements, Framing, Link Management. NPTEL CH-5&6 RB-1	8	20
5	**Naming and addressing** – Fundamentals, address and name management, Assignment of MAC address, Distributed assignment of locally unique addresses, content based and geographic addressing. CH-7 RB-1	2	10
6	**Time Synchronization, Localization and positioning** - Time synchronization problem, protocols, properties of localization and positioning procedures, single hop localization, Positioning in multi hop environments. CH-8&9 RB-1	4	15

7	**Routing protocols** – Forwarding and routing, MANET protocols, gossiping and agent based unicast forwarding, Energy-efficient unicast, Broadcast and multicast, geographic routing, Mobile nodes. NPTEL CH-11 RB-1	6	15
8	**IoT** – What is IoT, WSN and IoT, Applications, Architecture and reference, routing, Data aggregation, data centric storage. NPTEL CH-14 RB-2	4	10

Course Outcomes (COs):

After completion of course, students would be able to:

- Describe and explain radio standards and communication protocols for wireless sensor networks.
- Explain the function of the node architecture and use of sensors for various applications.
- Be familiar with architectures, functions and performance of wireless sensor networks systems and platforms.

List of References:

1) Holger Karl and Andreas Willig, "Protocols and Architectures for wireless sensor networks, WILEY
2) W. Dargie and C. Poellabauer, "Fundamentals of Wireless Sensor Networks –Theory and Practice", Wiley
3) KazemSohraby, Daniel Minoli and Taieb Znati, "wireless sensor networks -Technology, Protocols, andApplications", Wiley Inter science

Open e-Resource:

1) NPTEL: https://nptel.ac.in/courses/106105160
2) UDEMY: https://www.udemy.com/course/wireless-sensor-networks-electronics-telecommunication-f/

Gandhinagar Institute of Technology
B.Tech Electronics and Communication Engineering
Semester 6

Subject Code: 10040606	**Subject Title: Introduction to Web Technology**
Pre-requisite : Programming, TCP/IP protocols and client-server development	

Course Objective:

1. To comprehend the basics of the internet and web terminologies
2. To introduce scripting language concepts for developing client-side applications.
3. To practice server-side programming features – PHP, JSP.
4. To know the usefulness of web services.

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

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction to WEB** Basics of WWW, HTTP protocol, Client Server architecture, Introduction to web server installation and configuration. CH-1 RB-1	4	7
2	**Web Design** 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	8
3	**Basics of HTML and CSS** Structure of HTML page, HTML tags for data formatting, tables, links, images, meta tags, frames, html form tags, media, APIs, HTML5 tags and validation. Need for CSS, Syntax and structure, CSS rules for Backgrounds, Colors and properties, manipulating texts, Fonts, borders and boxes, Margins, Padding Lists, CSS Positioning. Animations, Tooltips, Style images, Variables, Media Queries, Wildcard Selectors (*, ^ and $) in CSS, Working with Gradients, Pseudo Class, Pseudo elements, basic of frameworks like Bootstrap. CH-2,3&4 RB-1	8	15
4	**Client-Side Scripting using JavaScript** Syntax of JavaScript, Execution of JavaScript, Internal, Embedded and External Java script, Java Script: variables, arrays, functions, conditions, loops, Pop up boxes, JavaScript objects and DOM, JavaScript inbuilt functions, JavaScript validations and Regular expressions, Event handling with	10	20

	JavaScript, Callbacks in Java script, Function as arguments in JavaScript, Introduction to JSON. CH-5,6&7 RB-1		
5	**Server-Side Programming with PHP** Difference between Client side and Server side scripting, Structure of PHP page, PHP Syntax: variables, decision and looping with examples, PHP and HTML, Arrays and Functions, String, Form processing, File uploads, Dates and time zone, Working with Regular Expressions, Exception Handling, Basic concepts of Session and State, State management using query string, hidden form controls, Cookies, Session variables. CH-12,13&14 RB-1	10	25
6	**Database programming with PHP and MySQL** Basic MySQL commands, PHP functions for database connectivity, Implementation of CRUD operations using PHP, Prepared Statement and stored procedure execution in PHP. CH-16 RB-1	4	10
7	**Advanced Web Programming concepts** Asynchronous Web Programming, Difference between synchronous and asynchronous web programming, AJAX, and J Query, Web service and API development using PHP	8	15

Course Outcome (COs):

1. Use the various HTML tags with appropriate styles to display the various types of contents effectively.
2. Develop the dynamic web pages using HTML, CSS and JavaScript applying web design principles to make pages effective.
3. Develop the server side PHP scripts using various features for creating customized web services.
4. Write the server side scripts for designing web based services with database connectivity.
5. Develop a web application using advanced web programming features including AJAX and JQuery using concepts of Web API.

List of Reference Books:

1. Web Technology, Moseley and Savaliya, Wiley India
2. HTML 5 Black Book 2Ed, Kogent Learning Solutions Inc, dreamtech
3. Web Design, Joel Sklar, Cengage Learning
4. Learning PHP, MySQL, JavaScript, CSS & HTML5, 3rd Edition, Robin Nixon, O'Reilly
5. A Step-by-Step Guide to Creating Dynamic Websites By Robin Nixon Publisher: O'Reilly Media
6. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel, Pearson
7. JavaScript for impatient programmers, Dr. Axel Rauschmayer
8. PHP: The Complete Reference By Steven Holzner, McGrawhill

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
4. **PHP:**
    a. https://www.w3schools.com/php/
    b. https://www.tutorialspoint.com/php/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 Cascading Style Sheets (CSS).
5. To study about Basic Javascript.
6. Install XAMPP in Ubuntu or Windows
7. Introduction and basic syntax of PHP.
8. To study about PHP Form Processing, Files, Cookies and Sessions.
9. To study about PHP and MySQL Basic commands and data base operation (Update and Delete)
10. To study advanced concepts of AJAX and jQuery in PHP.

Gandhinagar Institute of Technology
B.Tech Electronics and Communication Engineering
Semester 6

Subject Code: 10040607	**Subject Title:** Mobile Application Development
Pre-requisite: Basic knowledge of Java Programming	

Course Objective:

(1) There is a growing number of people who uses smart phones and tablets, and hence mobile app development has ability to access a large segment.
(2) An ability to design filters
(3) This course will enable the students to develop mobile application using Android.

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

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	Overview of Android Introducing Android, The Android Application Components, the manifest file, Downloading and Installing Android, Exploring the Development Environment, Developing and Executing the first Android Application.	3	5
2	Using Activities, Fragments and Intents in Android Working with activities, Using Intents, Fragments, Using the Intent Object to Invoke Built –in Application	5	10
3	Working with the User Interface Using Vies and View Groups Working with View Groups, building data with the Adapter View Class, Designing Auto Text Complete View, Implementing Screen Orientation, Designing the views programmatically, Handling UI events, Creating Menus	10	20
4	Storing the Data Persistently Introducing the Data Storage Options, Using the internal storage, Using the external storage, Using the SQ Lite Database, Working with content Provider	6	15
5	Working with Location Services and Maps Working with Google Maps, Working with Geocoding and Reverse Geocoding.	6	15
6	Working with Graphics and Animation Working with Graphics, Using the Drawable Object, Using the Shape Drawable object, Hardware Acceleration, Working with Animation	6	15
7	Audio, Video and Camera Use Media Player, Recording and Playing sound, creating a sound pool, Using Camera, Recording Video	6	15

8	Publishing and Distributing Android Application Signing the Android Application, Versioning the Android Application, Publishing the Android Application	3	5

Course Outcome:

CO1: Understand Android architecture, activities and their life cycle.

CO2: Use View Groups comprising layouts and Views in application.

CO3: Manage data binding, user interface events, maps

CO4: Work with graphics, animation, still images and video.

CO5: Publish and distribute Android Application

List of Textbooks:

1. Android Application Development Black Book by Pradeep Kothari, DreamTech
2. Beginning Android Application Development by Wei Meng Lee, Wrox

List of Reference Books:

1. Android Wireless Application Development By Lauren Darcey, Shane Conder, Pearson List of Open Source Software/learning website

Open e-Resource:

https://developer.android.com/

Gandhinagar Institute of Technology
B.Tech Electronics and Communication Engineering
Semester 6

Subject Code: 10040608	**Subject Title:** Satellite Communication
Pre-requisite: Analog and Digital Communication, Microwave Engineering	

Course Objective:

(1) To understand the basics of satellite communications.
(2) To understand different satellite communication orbits.
(3) To understand the satellite segment and earth segment.
(4) Provide an in-depth treatment of satellite communication systems operation and planning.
(5) To analyze the various methods of satellite access.
(6) Link budgets & planning.
(7) Review the state of the art in new research areas such as speech and video coding, satellite networking and satellite personal communications.
(8) To learn Digital audio/video broadcasting using satellites.
(9) To understand various applications of satellite communications.

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

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction to Satellite Communication:** Historical background, Basic concepts of Satellite Communications, Communication Networks and Services, Comparison of Network Transmission technologies, Orbital and Spacecraft problems, Growth of Satellite communications.	2	5
2	**Orbits and Launching Methods:** Introduction, Kepler's First Law, Kepler's Second Law, Kepler's Third Law, Definitions of Terms for Earth-Orbiting Satellites, Orbital Elements, Apogee and Perigee Heights, Orbit Per turbations, Effects of a non-spherical earth, Atmospheric drag.	6	15
3	**The Geostationary Orbit:**	6	15

	Introduction, Antenna Look Angles, The Polar Mount Antenna, Limits of Visibility, Near Geostationary Orbits, Earth Eclipse of Satellite, Sun Transit Outage, Launching Orbits		
4	**Radio Wave Propagation:** Introduction, Atmospheric Losses, Ionospheric Effects, Rain Attenuation, Other Propagation Impairments	4	10
5	**Polarization:** Introduction, Antenna Polarization, Polarization of Satellite Signals, Cross Polarization, Discrimination, Ionospheric Depolarization, Rain Depolarization, Ice Depolarization	4	10
6	**The Space Segment:** Introduction, The Power Supply, Attitude Control, spinning satellite stabilization, Momentum wheel stabilization, Station Keeping, Thermal Control, TT&C Subsystem, Transponders, The wideband receiver, The input demultiplexer, The power amplifier, The Antenna Subsystem	6	15
7	**The Earth Segment:** Introduction, Receive-Only Home TV Systems, The outdoor unit, The indoor unit for analog (FM) TV, Master Antenna TV System,Community Antenna TV System, Transmit-Receive Earth Stations	6	10
8	**The Space Link:** Introduction, Equivalent Isotropic Radiated Power, Transmission Losses, Free-space transmission, Feeder losses, Antenna misalignment losses, Fixed atmospheric and ionospheric losses, The Link-Power Budget Equation, System Noise, Carrier-to-Noise Ratio, The Uplink, Saturation flux density, Input backoff, Downlink, Output back-off, Combined Uplink and Downlink C/N Ratio	6	10
9	**Satellite Access:** Introduction, Single Access, Preassigned FDMA, Demand- Assigned FDMA, Spade System, TDMA, Preassigned TDMA, Demand-assigned TDMA, Satellite-Switched TDMA, Code-Division Multiple Access	5	10

Course Outcome:

CO1: Understand principle, working and operation of various sub systems of satellite as well asthe earth station.

CO2: Apply various communication techniques for satellite applications.

CO3: Analyze and design satellite communication link.

CO4: Learn advanced techniques and regulatory aspects of satellite communication.

CO5: Understand role of satellite in various applications.

List of Textbooks:

1. Satellite Communications, by Dennis Roddy (Fourth edition), McGraw Hill.
2. Satellite Communication Systems Engineering, by Wilbur L. Pritchard, Henri G. Suyderhoud, Robert A. Nelson (Second Edition), Pearson.

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List of Reference Books:

1. Timothy Pratt, Charles W.Bostian, Jeremy E Allnutt: Satellite Communications: Wiley India.
2. Satellite Technology, Principles and Applications, by Anil K. Maini, Varsha Agarwal (Second Edition), Wiley

Open e-Resource:

www.nptel.in

List of Suggested Experiments:

1. Understanding Basic concepts of Satellite communication. Theoretical concept only.
2. To establish a direct communication link between Uplink Transmitter and Downlink Receiver using tone signal.
3. To setup an Active satellite link and demonstrate Link Fail operations.
4. To establish an AUDIO-VIDEO satellite link between Transmitter and Receiver..
5. To communicate VOICE signal through satellite link.
6. To change different combinations of uplink and downlink frequencies and to check the communication link.
7. To transmit and receive three separate signals (Audio, Video, Tone) simultaneously through satellite link.
8. To transmit and receive function generator waveforms through satellite link.
9. To transmit and receive PC data through satellite link.
10. To study the basic of MATLAB

Gandhinagar Institute of Technology
B.Tech Electronics and Communication Engineering
Semester 7

Subject Code: 10040701	**Subject Title:** Fiber Optic Communication
Pre-requisite: Semiconductor Physics, Electromagnetic, Mode theory of waveguide, Analog Communication.	

Course Objective:

(1) To learn the principles and operation of fiber optic communication system.
(2) To study the use of various optical components constituting optical fiber links and to calculate different kind of losses and signal distortion.
(3) To learn about design of fiber optic link with encapsulation of different system components.
(4) To learn adout measurement techniques for performance parameters of optical.

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

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Overview of Optical fiber Communications :** Electromagnetic spectrum, Optical Spectral bands, Evolution of fiber optic system, Multiplexing Techniques, Elements of an optical fiber transmission link with the functional description of each block, WDM concepts, transmission widows, advantages of optical fiber link over conventional copper systems, applications of fiber optic transmission systems**.**	2	6
2	**Optical fibers :** Structures, Wave guiding and Fabrication : Optical laws and definitions, optical fiber modes and configurations, Mode theory, Step Index and Graded Index (GI) fibers ,single mode and graded index fibers, Derivation for numerical aperture, V number and modes supported by step index fiber, mode field ,Numerical aperture and modes supported by GI fibers, fiber materials, linearly Polarized modes fiber fabrication techniques, and mechanical properties of fibers, fiber optic cables.	6	15
3	**Signal Degradation in Optical Fibers :** Attenuation, signal distortion in optical waveguides, pulse broadening in graded index fiber, Characteristics of Single Mode Fibers, mode coupling, International Standards for optical transmission fibers.	5	10

4	Optical Sources : Semiconductor Physics background, Light emitting diode (LEDs)- structures, materials, Figure of merits, characteristics & Modulation. Laser Diodes -Modes & threshold conditions, Diode Rate equations, resonant frequencies, structures, characteristics and figure of merits, single mode lasers, Modulation of laser diodes, Spectral width , temperature effects, and Light source linearity.	4	8
5	Power Launching and Coupling : Source to fiber power launching, Lensing schemes, fiber-to-fiber joints, LED coupling to single mode fibers, fiber splicing, Optical fiber connectors.	4	10
6	Photodetectors : Principles of operation, types, characteristics, figure of merits of detectors photodiode materials, photodetector noise, detector response time,temperature effects on gain, comparison of photodetectors.	4	8
7	Optical Receiver Operation : Receiver operation, Preamplifier types, receiver performance and sensitivity, Eye diagrams, Coherent detection, Specification of receivers.	4	10
8	Transmission Systems : Point –to-point link –system considerations, Link power budget and rise time budget methods for design of optical link, BER calculation	3	6
9	Optical Amplifiers : Semiconductor optical Amplifier, EDFA, Raman Amplifier, Wideband Optical Amplifiers	4	5
10	Advances in Optical Fiber Systems : Principles of WDM, DWDM, Telecommunications & broadband application, SONET/SDH, MUX, Analog & Digital broadband, optical switching.	3	10
11	Overview of Optical Components : Optical couplers, Tunable sources and Filters ,optical MUX/DEMUX, Arrayed waveguide grating, optical add drop multiplexer (OADM), optical cirulators, attenuators, optical cross connects, wavelength converter, Mach-Zender Interferometer	3	6
12	Fiber Optical Measurements : Test Equipments, OTDR , Set ups for Measurement of Attenuation, Dispersion, NA and EYE pattern .	3	6

Course Outcome:

CO1: To understand the principles and operation of fiber optic communication system.

CO2: To be familiar with use of various optical components constituting optical fiber links and to calculate different kind of losses and signal distortion.

CO3: To design an optical fiber link with encapsulation of different system components.

CO4: To understand the measurement techniques for performance parameters of optical fiber.

List of Text Books:

1. Optical Fiber Communications by Gerd Keiser, 4th Edition (Mc Graw Hill).
2. Optical Fiber Communication by John M. Senior (PHI/Pearson).

List of Reference Books:

1. Fiber optical communication Technology by Djafar Mymbaev & Lowell L, Scheiner. (Pearson).
2. Fiber optic Communication Systems by G. Agrawal (John Wiley and sons)

Open e-Resource:

- http://www.cdeep.iitb.ac.in/nptel/Electrical%20&%20Comm%20Engg/Optical%20Communication /Course%20Objective.htm
- OptiSystem Version 14.0 Software
- NPTEL Videos.
- AICTE SWYAM Portal**.**

List of Suggested Experiments:

1. To study of a 650nm fiber optic analog link.
2. To study of a 650 nm fiber optic digital link.
3. To study of Frequency modulation in fiber optic system.
4. To study of pulse width modulation in fiber optic system.
5. To study of Propagation Loss in Optical Fiber.
6. To study of Bending Loss in Optical Fiber.
7. To measure the Numerical Aperture.
8. To set up Fiber Optics voice link using Frequency Modulation.
9. To study of Switched Fault in Intensity Mode.
10. Computer to Computer communication using RS232 interface via Fiber Optic Link.

Gandhinagar Institute of Technology
B.Tech Electronics and Communication Engineering
Semester 7

Subject Code: 10040702	**Subject Title:** Digital Image Processing
Pre-requisite: Engineering Mathematics, Algorithms.	

Course Objective:

(1) To study the image fundamentals and mathematical transforms necessary for image processing.
(2) To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
(3) To learn concepts of restoration and reconstruction techniques.
(4) To have an understanding of colour models, type of image representations and related statistics.
(5) To study the image enhancement techniques.
(6) To study image compression procedures.
(7) To study image segmentation and representation techniques.
(8) To aware about Morphological Image Processing.

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

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Digital Image Fundamentals:** Human visual system, Image as a 2D data, Image representation – Gray scale and Color images, image sampling and quantization.	3	10
2	**Image enhancement in Spatial domain:** Basic gray level Transformations, Histogram Processing, Spatial Filtering.	6	15
3	**Filtering in the Frequency Domain:** Preliminary Concepts, Extension to functions of two variables, Image Smoothing, Image Sharpening, Homomorphic filtering, 2D- DFT, 2D- FFT, 2D- DCT, Fundamentals of 2D-wavelet transform, Image pyramids, sub-band coding.	6	15
4	**Image Restoration and Reconstruction:** Noise Models, Noise Reduction, Inverse Filtering, MMSE (Wiener) Filtering	6	15
5	**Color Image Processing:** Color Fundamentals, Color Models, Pseudocolor image processing.	6	15
6	**Image Compression:** Fundamentals of redundancies, Basic Compression Methods: Huffman coding, Arithmetic coding, LZW coding, JPEG Compression standard.	6	10

7	**Image Segmentation:** Edge based segmentation, Region based segmentation, Region split and merge techniques, Region growing by pixel aggregation, optimal thresholding.	6	10
8	**Morphological Image Processing:** Erosion, dilation, opening, closing, Basic Morphological Algorithms: hole filling, connected components, thinning, skeletons.	6	10

Course Outcome:

CO1: Able to understand about image fundamentals and mathematical transforms necessary for image processing.
CO2: Able to learn about image enhancement techniques in Spatial and Frequency domain.
CO3: Able to understand about concepts of restoration and reconstruction techniques.
CO4: Able to study about colour models, type of image representations and related statistics.
CO5: Able to learn about the image enhancement techniques.
CO6: Able to understand about image compression procedures.
CO7: Able to understand about image segmentation and representation techniques.
CO8: Familiar with morphological image processing

List of Text Books:

1. Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods, Third Edition, Pearson Education.

List of Reference Books:

1. Digital Image Processing, S Jayaraman, S Esakkirajan, T Veerakumar, Tata McGraw Hill Publication.
2. Digital Image Processing, S Sridhar, Oxford University Press.
3. Digital Image Processing Using MATLAB, Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins, Second Edition, Tata McGraw Hill Publication.

Open e-Resource:

- NPTEL Videos.
- AICTE SWYAM Portal**.**

List of Suggested Experiments:

1. To study and introduce MATLAB using Image Processing Toolbox.
2. Write a MATLAB code to draw the National Flag of India.
3. Write MATLAB code to find out single color from a given color image.
4. Write a MATLAB code to observe Spatial Resolution of an Image.
5. Write a MATLAB code to observe Gray Level Resolution of an Image.
6. Write a MATLAB code to observe Digital Negative of an Image.
7. Write a MATLAB code to observe Contrast Stretching of an Image.

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8. Write a MATLAB code to observe Contrast Thresholding of an Image.
9. Write a MATLAB code to observe Gray Level Slicing of an Image without back ground.
10. Write a MATLAB code to observe Gray Level Slicing of an Image with back ground.

GANDHINAGAR INSTITUTE OF TECHNOLOGY
B.Tech Electronics and Communication Engineering
Semester 7

Subject Code: 10040703	**Subject Title:** Summer Internship
Pre-requisite: --	

Course Objective:

1. To provide students with exposure to industry practices and enhance practical knowledge.
2. To develop real-time technical and managerial skills through practical assignments.
3. To cultivate experience in project/report writing, technical presentations, and industry ethics.
4. To understand the impact of engineering solutions within societal and economic contexts.

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

Types of Internships:

1. **Offline Internship in Industry**:
   Students will be assigned to industry sectors where they will complete tasks under the guidance of an industry mentor. The completion of this internship requires submission of a joining and relieving letter from the respective organization.
2. **Online Internship**:
   Students may participate in approved online internship programs, facilitated through platforms like Internshala or other AICTE-recognized bodies.
3. **Mini-Project**:
   A hands-on mini-project related to the student's branch of study. This can be a fabrication, experimental analysis, simulation, or design/analysis of systems, and must be carried out individually by the student.

Internship Report and Evaluation:

- **Report Submission**:

A detailed report on the internship must be prepared and submitted by the student. The report will be evaluated by both the internal mentor (faculty) and an external industry mentor.

- **Continuous Evaluation – 50 Marks**

The evaluation will be based on continuous assessment throughout the internship. Both the internal mentor and external industry mentor will evaluate the student's performance on a continuous basis.

1. Internship Regularity & Task Performance (20 marks):

This includes the student's attendance, regularity, task completion, and proactive engagement in the assigned tasks. The internal mentor tracks the student's consistency, work ethics, and ability to carry out the tasks effectively.

2. Adequacy & Quality of Work (15 marks):

Evaluation of the quality, depth, and relevance of the tasks completed during the internship. This includes the execution of assigned tasks and how well the objectives of the internship were met.

3. Tools & Techniques Used (5 marks):

Assessment of the methods, tools, and techniques the student employed during the internship. The student will be evaluated on how effectively they used these tools to complete the work assigned by the industry mentor.

4. Report Quality & Presentation (10 marks):

The clarity, technical depth, and overall quality of the internship report. The presentation includes the student's ability to clearly and effectively communicate their work and findings.

Report Submission and Documentation:

- Internship report signed by both the internal and external mentors.
- Softcopy of the internship presentation approved by both mentors.
- A CD containing scanned copies of the report and presentation for departmental record.

Steps for Internship Completion:

- **Joining Report Submission**:

Upon joining the internship, students must submit a joining report to the institute.

- **Continuous Assessment**:

Students will be continuously assessed throughout the internship on their regularity, task performance, and the quality of their work and report.

- **Midterm Evaluation**:

The internal mentor will evaluate the student's progress midway through the internship.

- **Final Report Submission**:

After completing the internship, students will submit the final report for evaluation.

- **Training Certificate:**

Students must obtain a completion certificate from the industry, verifying their participation and successful completion of the internship.

Course Outcome:

Upon successful completion, students will have gained exposure to real-world industrial practices and developed technical skills to apply in future career opportunities.

GANDHINAGAR INSTITUTE OF TECHNOLOGY

B.Tech Electronics and Communication Engineering

Semester 7

Subject Code: 10040704	**Subject Title:** Mini Project
Pre-requisite: --	

Course Objective:

- To introduce students to the process of identifying and defining research or design-based engineering problems relevant to industry or society.
- To develop the students' ability to conduct literature reviews, formulate objectives, and propose appropriate methodologies under faculty guidance.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
0	0	12	06	0	0	80	20	100

Selection of project topic:

- The project topic must be selected in consultation with a faculty mentor and finalized only upon their approval.
- Topics should reflect the student's area of interest and align with departmental research areas or industrial challenges.
- Projects may involve:
  - Literature surveys
  - Conceptual designs
  - Feasibility studies
  - Initial computational models
  - Simulation frameworks
  - Field surveys or data collection

Evaluation:

Criteria	Weightage
Regularity and Timely Submission (Continuous Assessment)	20 Marks
Problem Identification and Literature Review	15 Marks
Methodology Framing and Technical Content	25 Marks
Quality of Report (Structure, Referencing, etc.)	20 Marks
Oral Presentation and Communication Skills	20 Marks

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Course Outcomes:

- Identify and define an engineering problem relevant to industry or societal needs.
- Conduct a comprehensive literature review using credible academic sources.
- Formulate clear objectives and propose feasible methodologies.
- Initiate technical work through conceptual design, analysis, or modeling.
- Communicate ideas effectively through presentations and technical reports.
- Work independently and collaboratively with ethical responsibility.

Gandhinagar Institute of Technology
B.Tech Electronics and Communication Engineering
Semester 7

Subject Code: 10040705	**Subject Title:** Radar and Navigational Aids
Pre-requisite: Analog and Digital Communication, Signals and Systems, Microwave Theory and Techniques, Antennas and Propagation	

Course Objective:

(1) To study about the basics of Radar, significance of Radar parameters and its applications.
(2) To learn about the working of pulsed and CW Radar transmitters and receivers.
(3) To get exposed to Radar signal detection techniques and different types of radars.
(4) To learn principles of navigation and modern navigational techniques with their applications.

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

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction:** Block diagram and operation of Radar, ,Radar frequencies, Millimeter and submillimeter waves, Applications of Radar.	3	5
2	**Radar Equation:** The simple form of Radar equation Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Signal to Noise Ratio, Matched filter impulse response, Integration of radar Pulses, Radar Cross Section of Targets, Cross section Fluctuations, Radar Clutter-surface clutter, sea clutter and Land clutter , weather clutter, Transmitter Power, Pulse Repetition Frequency and Range ambiguities, Antenna Parameters, System losses, Propagation effects, other considerations.	6	15
3	**CW and FM CW Radar:** Doppler effect, CW Radar, FMCW Radar, Applications Multiple frequency CW Radar.	3	10
4	**MTI And Pulse Doppler Radar:** Introduction, Delay line Cancellers, Multiple or staggered Pulse Repetition Frequencies, Range gated Doppler Filters, Block Diagram of Digital Signal Processor, Example of MTI radar Processor, Pulse Doppler Radar, Non coherent MTI ,MTI from moving platform, Other types of MTI and Airborne radar.	6	15
5	**Tracking Radar:** Tracking with Radar ,Monopulse tracking, Conical scan and Sequential lobing, Tracking in range, Automatic tracking with Surveillance Radars and Doppler, Acquisition.	3	10

6	**Radar Transmitters, Antennas and Receivers:** Hard tube and pulse modulators, Types of Radar antennas, Duplexers, Displays.	5	15
7	**Electronic Scanning Radar:** Principle of phased array for electronic scanning, Advantages and capabilities of electronic scanning, block diagram of an electronic scanning system and its operation.	4	10
8	**Navigational:** Aids Introduction, Four Methods of Navigation , Radio Direction Findings, Radio Ranges, Hyperbolic Systems of Navigation-LORAN and DECCA, Aids to approach and Landing.	8	10
9	**Modern Navigation :** Doppler navigation-Doppler Effect, New configuration, Doppler frequency equations, Track stabilization, Doppler navigation system, GPS-Principle of operation, Position location determination, principle of GPS receiver, Global Navigation Satellite System, GAGAN,IRNSS-NAVIC Receiver and applications. Mention of Navigation Satellites of different countries such as Galileo, Glonass and Compass.	7	10

Course Outcome:

CO1: Familiar with the basics of Radar, significance of Radar parameters and its applications.
CO2: able to understand the working of pulsed and CW Radar transmitters and receivers.
CO3: able to know about Radar signal detection techniques and different types of radars.
CO4: able to understand principles of navigation and modern navigational techniques with their applications.

List of Text Books:

1. Introduction to Radar System M.I. Skolnik , Publisher: McGraw Hill.
2. N S Nagaraja, “Elements of Electronic Navigation”, TMH.

List of Reference Books:

1. Electronic and Radio Engg. F.E. Terman, Publisher: McGraw Hill.
2. Radar Engineering Hand Book, M.I. Skolnik, Publisher: McGraw Hill.
3. Bernhard Hofmann-Wellenhof et al,GNSS – Global Navigation Satellite Systems: Springer Wien New York.

Open e-Resource:

- NPTEL Videos.
- AICTE SWYAM Portal**.**

List of Suggested Experiments:

1. To study NV2001 Radar Trainer Kit.
2. To study the working of Doppler Radar.

3. Determination of the velocity of the object moving in the Radar range.
4. Understanding the principle of Doppler Radar of Time and Frequency measurement with the help of moving pendulum.
5. To study alarm system by using Radar.
6. To study object counting with the help of Radar.
7. To study detection of vibration of different Tuning forks.
8. Determination of the rotation per minute (RPM) of a moving object.
9. To study the effect of different types of materials on Radar receiving or detection.
10. Tutorial.