GUJARAT TECHNOLOGICAL UNIVERSITY

SUBJECT CODE: 3110003

PROGRAMMING FOR PROBLEM SOLVING

1ST YEAR

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Topics	Teaching Hours	Module Weightage
1	**Introduction to computer and programming:** Introduction, Basic block diagram and functions of various components of computer, Concepts of Hardware and software, Types of software, Compiler and interpreter, Concepts of Machine level, Assembly level and high level programming, Flowcharts andAlgorithms	5	11
2	**Fundamentals of C:** Features of C language, structure of C Program, comments, header files, data types, constants and variables, operators, expressions, evaluation of expressions, type conversion, precedence and associativity, I/O functions	4	9
3	**Control structure in C:** Simple statements, Decision making statements, Looping statements, Nesting of control structures, break and continue, goto statement	5	11
4	**Array & String:** Concepts of array, one and two dimensional arrays, declaration and initialization of arrays, string, string storage, Built-in-string functions	6	13
5	**Functions:** Concepts of user defined functions, prototypes, definition of function, parameters, parameter passing, calling a function, recursive function, Macros, Pre-processing	5	11
6	**Recursion:** Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.	4	9
7	**Pointers:** Basics of pointers, pointer to pointer, pointer and array, pointer to array, array to pointer, function returning pointer	4	9
8	**Structure:** Basics of structure, structure members, accessing structure members, nested structures, array of structures, structure and functions, structures and pointers	4	9
9	**Dynamic memory allocation:** Introduction to Dynamic memory allocation, malloc, calloc	4	9
10	**File management:** Introduction to file management and its functions	4	9

GUJARAT TECHNOLOGICAL UNIVERSITY
Subject Code: 3110016
BASIC ELECTRONICS(2nd sem)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Sr. No.	Content	Total Hrs	% Weightage
1	**Diode theory and applications** Basic idea about forward bias, reverse bias and VI characteristics, ideal diode, second and third approximation, surface mount diodes, Zener diode, Testing of diode with multi-meter, 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.	**10**	20%
2	**Bipolar junction transistors and its biasing** BJT operation, BJT voltages and currents, CE, CB and CC characteristics, DC load line and bias point, base bias, emitter feedback bias, collector feedback bias, voltage divider bias, Thermal stability, biasing BJT switching circuits, transistor power dissipation and switching time, Testing of bipolar junction transistor with multi-meter, Reading datasheet of BJT.	**10**	20%
3	**Special purpose diodes and transistors** Light emitting diode (LED). Zener diode Zener diode circuit for voltage regulation, Photo diode, Solar cell, PIN diode, Varactor, Schottky diode, Varistors, Tunnel diode, Seven Segment display, Sixteen segment display, Identify segments on pin using multi-meter, Dot-matrix LED display, Photo transistor, Opto-coupler, Reading datasheet of opto-electronics devices	**4**	10%

4	**AC Analysis of BJT circuits and small signal amplifier** Coupling and bypass capacitors, AC load lines, Transistor models and parameters, Common emitter circuit analysis, common base circuit analysis, common collector circuit analysis, Comparison of CE, CB and CC circuits, Transistor as a switch	**10**	20%
5	**Field effect transistors (FET) and its biasing** Junction field effect transistors(JFET), Comparison of BJT and FET, JFET characteristics, FET, Biasing in ohmic region and active region, Trans-conductance, amplification and switching, MOSFETs (D-type and E-type MOSFET), CMOS introduction, E-MOSFET amplifier. MOSFET testing, Reading datasheet for FET and MOSFET.	**10**	20%
6	**Digital Circuits** Basic gates AND, OR,NOT, NAND, NOR, EX-OR, EX-NOR, Building AND, OR Gate with diodes, Digital logic families RTL, DTL, TTL, CMOS, Comparison of logic families	**4**	10%

Reference Books:

[1] David A. Bell, "Electronic Devices and Circuits", Oxford University Press, Fifth edition
[2] Albert Malvino & David, "Electronic Principles", Tata McGraw-Hill, Seventh edition
[3] R. L. Boylestad and L. Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education
[4] Jaccob Millman, Chritos Halkias, Chetan D Parikh, "Integrated Electronics", Tata McGraw-Hill, Second edition
[5] Albert Malvino & David, "Problems and Solutions in Basic Electronics, McGraw Hill Education

Course Outcomes:

Sr. No.	CO statement
CO-1	Analyze the general – and special-Purpose diode circuits
CO-2	Design biasing circuits for BJT
CO-3	Analyze BJT Circuits in small-signal domain
CO-4	Analyze basic FET Circuits
CO-5	Verify the functionalities of basic digital gates and logic families

Mapping & Justification

	PO 1	PO 2	PO3	PO4	PO 5	PO6	PO7	PO8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO .1	**2**	--	--	--	--	--	--	--	--	--	--	--	**2**		--
CO .2	**2**	--	**1**	--	--	--	--	--	--	--	--	--	**2**	**1**	--
CO .3	**2**	**1**	--	--	--	--	--	--	--	--	--	--	**2**	**1**	--
CO .4	**2**	**1**	--	--	--	--	--	--	--	--	--	--	**2**	**1**	--
CO .5	**2**	--	--	--	--	--	--	--	--	--	--	--	**2**	--	--

Mapping	**Level**	**Justification**
CO1-PO1	2	Engineering knowledge about different types of Diode can be get.
CO2-PO1	2	By applying basic engineering knowledge students will have knowledge of Design biasing circuits like fixed bias ,emitter to base bias etc for BJT
CO3-PO1	2	Students will have basic knowledge about Analyze BJT Circuits in small-signal domain using h-parameter.
CO4-PO1	2	Basic Engineering knowledge about analysis of different FET circuits will be gain by students
CO5-PO1	2	Students will understand the need of different types of logic gates and logic families.
CO2-PO3	1	By using different equations design BJTcircuits .
CO3-PO2	1	Problem analysis BJT circuits will be done by students.
CO4-PO2	1	Problem analysis FET circuits will be done by students.
CO1 to 5-PSO1	2	Sound knowledge of active and passive electronic devices like diodes, BJT,FET, various basic and advanced laws governing electronic circuits and systems will be get by students.
CO2,CO3,CO4- PSO2	1	Analyze and design BJT and FET circuits will be done by students..

GUJARAT TECHNOLOGICAL UNIVERSITY
Subject: Control Systems(3rd sem)

Programme: E.C	Degree: B.E.
Course Code: 3131101	Semester: 3
Credits: 4	Contact hours: 3 (Theory) + 2 (Laboratory)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks			
				Theory Marks		Practical Marks	
L	T	P	C	ESE (E)	PA (M)	ESE Viva (V)	PA (I)
3	0	2	4	70	30	30	20

Sr. No.	Topics	Teaching Hrs.
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.	**2**
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.	**5**
3	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.	**3**
4	The Performance of Feedback Control Systems: Test Input Signals, Performance of Second-Order Systems, Effects of a Third Pole and a Zero on the Second-Order System Response, Transient Response, The Steady-State Error of Feedback Control Systems, Performance Indices, The Simplification of Linear Systems.	**5**
5	The Stability of Linear Feedback Systems: The Concept of Stability, relative stability analysis, Routh-Hurwitz criteria.	**2**

6	The Root Locus Method: The Root Locus Concept. The Root Locus Procedure, Parameter Design by the Root Locus Method, Sensitivity and the Root Locus, Three-Term (PID) Controllers.	**5**
7	Frequency Response Methods: Frequency Response Plots, Frequency Response Measurements, Performance Specifications in the Frequency Domain, Log Magnitude and Phase Diagrams.	**3**
8	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.	**6**
9	Stability in the Frequency Domain: 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.	**5**
10	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 Function from the State Equation , The Time Response and the State Transition Matrix.	**6**
	Total	**42**

Reference Books:

[1] Control Systems Engineering by Nagrath and Gopal New Age Publication
[2] Modern Control Engineering by Katsuhiko Ogata, 4th Edition, Prentice Hall of India.
[3] Modern Control System by Richarc C. Drof and Robert H. Bishop,11th Edition Person Int.
[4] Automatic Control Systems by Benjamin C.Kuo, 8th Edition, Farid Golnaraghi, John Wiley & Sons.
[5] Feedback and Control Systems by Joseph J Distefano 2nd Edition TMH

Course Outcomes:

After learning the course the students should be able to:

CO	**CO statement**
1	Understand fundamental concepts of different types of control system and Derive mathematical modelling of the system with differential equations.
2	Realizations Of system transfer function using Block diagram reduction, signal flow graph method.
3	Analyze and apply all the stability techniques for closed loop system performance parameters.
4	Determine time and frequency response of first order and second order control system.
5	Comprehend the need of different types of controllers and compensators to obtain the required dynamic response of the system and Synthesis system equations for state space models of linear systems

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO .1	**2**	--	--	--	--	--	--	--	--	--	--	--
CO .2	**2**	**1**	--	--	--	--	--	--	--	--	--	--
CO .3	**2**	**1**	--	--	--	--	--	--	--	--	--	--
CO .4	**2**	--	--	--	--	--	--	--	--	--	--	--
CO .5	**2**	--	--	--	--	--	--	--	--	--	--	--

Mapping & Justification

Mapping	**Level**	**Justification**
CO1-PO1	2	Engineering knowledge about different types of control system and mathematical modelling of the system using F-V and F-I analogy.
CO2-PO1	2	By applying basic engineering knowledge students will have knowledge of block diagram reduction and signal flow graph for find transfer function of system.
CO3-PO1	2	Students will have basic knowledge about different methods like Rouths Hurwits criteria, root locus ,Bode plot for find system stability and different parameters.
CO4-PO1	2	Basic Engineering knowledge about time and frequency response of different basic signal (step, impulse ,ramp)of first order and second order control system will be gain by students
CO5-PO1	2	Students will understand the need of different types of controllers and compensators to obtain the required dynamic response of the system.
CO-PO2	1	Find Transfer Function using Block diagram representation and Signal Flow Graph .
CO3-PO2	1	Problem analysis of system for find stability and different parameters will be done by students.

SEMESTER:III

Digital system design(3rd sem)

Type of course: Design and Analysis of Digital Circuits

Prerequisite: Basic Electronics and Number Systems.

Rationale: The students need to learn basic concepts of digital circuits and system which leads to design of complex digital system such as microprocessors. The students need to know combinational and sequential circuits using digital logic fundamentals. The students will learn the design of combinational and sequential circuit. This is the first course by which students get exposure to digital electronics world.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE Viva (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Sr. No.	Content	Total hours	% Weightage
1	Review of number systems, logic gates, Boolean algebra - postulates and theorems, SOP & POS forms, canonical forms, logic minimization using Karnaugh Map and tabulation methods up to 6 variables, Realizing logic functions using gates.	7	15
2	Combinational logic circuit design: half adder full adder, BCD adder, code converters, magnitude comparator, multiplexers and decoders, MSI digital circuit design problems.	8	15
3	Sequential logic circuit design: Flip Flops-SR, JK, T, D and master-slave FF, ripple and synchronous counters, shift registers.	7	15
4	Introduction to Finite State Machines (FSM): The need for state machines, The state machine, basic concepts in state machine analysis.	5	10
5	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.	9	15
6	Logic families: Specifications, noise margin, propagation delay, fan-in, fan-out, Transistor-Transistor Logic (TTL), Emitter-Coupled Logic (ECL), CMOS Logic, TTL and CMOS Gates,Introduction to basics of FINFET	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	10
8	VLSI Design flow: Design entry: Schematic, FSM & HDL, different modeling styles in Verilog: Behavioral and Structural Modeling, Data types and objects, Synthesis and Simulation Verilog constructs and codes for combinational and sequential circuits.	5	5
9	A to D Converter and D to A Converter: Introduction, Digital to Analog	**5**	**5**
	Conversion : Weighted Resistor D/A Converter, R-2R Ladder D/A Converter, Specifications for D/A Converters,An Example of D/A Converter IC: Digital Input Codes, Analog output, Calibration, Sample and Hold, Analog to Digital Converters: Quntization and Encoding, Parallel Comparator A/D Converter, Counting A/D Converter, Dual Slope A/D Converter, A/D Converter Using Voltage to frequency conversation, A/D Converter Using Voltage to time conversation, Specification of A/D ConvertersAnExampleofA/DConverterIC:Operation,DigitalOutput, Analog Input, Calibration		
	Total	**56**	**100**

Reference Books:

1. Digital Logic & State Machine Design By David J. Comer, Third Indian Edition, Oxford UniversityPress
2. Digital Logic and Computer Design By M Morris Mano, Fourth Edition, Prentice HallPublication
3. Digital Principles and Applications By Malvino& Leach, Seventh Edition, McGraw-HillEducation
4. Modern Digital Electronics ByR.P.Jain, Fourth Edition, Tata McGraw-HillEducation.
5. Digital Electronics: Principles and Integrated Circuits By A.K. Maini, Wiley IndiaPublications
6. Digital Design M. Morris Mano and Michael D. Ciletti, PearsonEducation
7. A Verilog HDL Primer by J. Bhaskar, Third Edition, BSPublication
8. Fundamentals of Digital Logic with Verilog Design by Brown and Vrenesic, Second Edition, McGrawHill publication.

Course Outcomes:

After learning the course the students should be able to

CO-1	Apply the knowledge of digital number systems, Boolean algebra, and logic gates for logic function minimization.
CO-2	Design and analysis combinational and sequential circuits
CO-3	Design synchronous and asynchronous circuits FSM.
CO-4	Comprehend the digital logic families and PLDs
CO-5	Implement digital circuits using Verilog based VLSI design flow

Mapping of CO-PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											
CO2	1		2									
CO3	1		2									
CO4		2										
CO5	2											

	LEVEL	Justification
CO-1 – PO1	2	Knowledge of digital number systems, Boolean algebra, and logic gates increase engineering knowledge of the students
CO-2-PO3	2	Students can design combinational and sequential circuits, which improve their designing skill
CO2-PO1	1	Design of sequential and combination circuits also increasing engineering knowledge
CO-3-PO3	2	Students can design synchronous and asynchronous circuits with FSM design which improve their designing skill
CO-3-PO1	1	Design of synchronous and asynchronous circuits also increasing engineering knowledge
CO-4-PO2	2	Students can Identify, formulate and analyze different logic IC behavior.
CO-5-PO1	2	Digital circuits using Verilog based VLSI design increase engineering knowledge of the student

Mapping of CO-PSO

	PSO1	PSO2	PSO3
CO1	2	1	
CO2		2	1
CO3		2	1
CO4			2
CO5			2

	LEVEL	Justification
CO-1 – PSO1	2	Knowledge of digital number systems, Boolean algebra, and logic gates improves different governing laws of electronic circuits and systems.
CO-1-PSO2	1	Design and analysis of adder, multiplexer ,demultiplexer encoder ,decoder which improves designing skill of the students
CO2-PSO2	2	Design and analysis full adder, multiplexer ,demultiplexer encoder ,decoder ,parallel adder, look ahead adder which improves designing skill of the students
CO-2-PSO3	1	Knowledge of adder, multiplexer ,demultiplexer encoder ,decoder ,parallel adder, look ahead adder improves testing and simulation skill of the students.
CO-3-PSO2	2	Design and analysis combination circuits which improves designing skill of the students.
CO-3-PSO3	1	Knowledge of flipflops,counters improves testing and simulation skill of the students.
CO-4-PSO3	2	Knowledge of combinational and sequential circuits improves testing and simulation skill of the students.
CO-5-PSO3	2	Knowledge of combinational and sequential circuits improves testing and simulation skill of the students.

Bachelor of Engineering Subject Code: 3131103

Subject Name: NETWORK THEORY
Semester III

Type of course: Passive circuit analysis and synthesis

Prerequisite: Fundamental knowledge of electric circuit sources and elements, basic mathematics (integration, differentiation, etc.)

Rationale: tudents of EC Engineering need to possess good understanding of concepts and principles of passive circuit analysis and synthesis by applying various circuit laws and theorems. This is one of the foundation course which is required to understand the concepts of advanced courses and develop skills that are needed in Electronics field.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE(E)	PA	ESE (V)	PA(I)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	**Total Hrs**	**% Weightage**
1	Circuit Variables and Circuit Elements and Sources: E.M.F, Potential and Potential Difference, Current and Current Density, Ideal and Practical Voltage and Current Sources. Conversion from one source into other. Internal Impedance of voltage and current source relative to load. Two-terminal Capacitance – Two- terminal Inductance- Independent and Dependent Electrical Sources –Power and Energy Relations for Two-terminal Elements – Classification ofTwo-terminal Elements – Multi-terminal Circuit Elements, Dot Convention.	3	6
2	Nodal Analysis and Mesh Analysis of resistive Circuits: Nodal Analysis of Circuits Containing Resistors and Independent and Dependent Sources – Source Transformation Theorem for circuits with independent sources – Source Transformation Theorem for circuits with Dependent sources –Nodal Analysis of Circuits Containing Dependent Sources - Mesh Analysis of Circuits with Resistors containing Independent Voltage Sources - Mesh Analysis of Circuits Containing Dependent Sources.	5	10
3	Circuit Theorems and Their Applications in Electric Networks: Linearity of a Circuit and Superposition Theorem-Substitution Theorem- Compensation Theorem - Thevenin's Theorem and Norton's Theorem - Determination of Equivalents for Circuits with Dependent Sources -Reciprocity Theorem - Maximum Power	6	12

	Transfer Theorem - Millman's Theorem-Duality Theorem-Duality between Electricity and Magnetism.		
4	Time domain response of First order RL and RC circuits: Mathematical preliminaries – Source free response –DC response of first order circuits – Superposition and linearity – Response Classifications – First order RC Op Amp Circuits.	4	8
5	Time domain response of Second order linear circuits: Discharging of a Capacitor through an inductor – Source free second order linear networks – second order linear networks with constant inputs.	4	8
6	Initial conditions: Initial conditions in elements, procedure for evaluating initial conditions, Solution of circuit equations by using Initial Conditions.	4	8
7	Laplace Transform Analysis and Circuit Applications: Notions of Impedance and Admittance – Manipulation of Impedance and Admittance- Notions of Transfer Function- Equivalent circuits for inductors and capacitors – Nodal and Loop analysis in the s-domain – Switching in RLC circuits- Switched capacitor circuits and conservation of charge.	6	10
8	Laplace Transform Analysis and Transfer Function Applications: Poles, Zeros and the s-plane- Classification of Responses – Computation of sinusoidal steady state response for stable networks and systems.	5	8
9	Two –Port Networks :One port networks – Two port admittance Parameters (y parameters)– Admittance parameters analysis of terminated two- Port networks - Two port impedance parameters (z-parameters) –Impedance and Gain calculations of terminated two-Port networks modeled by z-parameters – Hybrid parameters (h para)– Inverse Hybrid Parameters (g-para)- Transmission parameters (ABCD parameters)- Scattering parameters(S parameters)-Scattering Transfer parameters(T parameters)–reciprocity-Various Combinations of Two-Port network.	8	12
10	Introduction to Network Topology: Linear Oriented Graphs (Connected Graph, Subgraphs and Some Special Subgraphs) - The Incidence Matrix of a Linear Oriented Graph -Kirchhoff's Laws in Incidence Matrix Formulation - Nodal Analysis of Networks – The Circuit Matrix of a Linear Oriented Graph- Kirchhoff's Laws in Fundamental Circuit Matrix Formulation - Loop Analysis of Electrical Networks – (Loop Analysis of Networks Containing Ideal Dependent Sources- Planar Graphs and MeshA n a l y s i s –Duality)- The Cut-set Matrix of a Linear Oriented Graph (Cut-sets - The All cut- set matrix Qa- Orthogonality relation between Cut-set matrix and Circuit matrix - The Fundamental Cut-set Matrix of - Relation between of , A and Bf) -Kirchhoff's Laws in Fundamental Cut-set formulation - Tie set -Tie set Matrix (F-loop matrix)- Tie setschedule.	7	12
11	Introduction to Passive Network Synthesis: Introduction of Hurwitz Polynomial, Positive Real Function (PRF), Elementary Synthesis Procedure.	4	6
	Total	56	100

Reference Books:

1. Network Analysis & Synthesis By Franklin S. KUO, WileyPublication
2. Network Analysis :- By M.E Van Valkenburg PHIPublication
3. Electric Circuits and Networks :- By K. S. Suresh Kumar – PearsonEducation
4. Linear Circuits Analysis 2nd edition :-By DeCarlo/ Lin – Oxford University Press(Indianedition)
5. Engineering Circuit Analysis : - By W H Hayt, J E Kemmerly, S M Durbin 6th Edition TMH Publication
6. Graphs: Theory and Algorithms By K. Thulasiraman, m.n.s Swamy, WileyPublication.
7. Electric Circuit Analysis By S N Sivanandam, Vikas PublishingHouse
8. Introductory Circuit Analysis by Robert Boylestad,Pearson

Course Outcomes:

1. Student will be able to analyse passive circuits using various networks theorems.
2. Student will be able to a and evaluate the transfer functions using classical and transform methods.
3. Student will be able to evaluate two port parameters for the given two port network configurations.
4. Student will be able to comprehend the basics of network topologies,graph theory and network synthesis.
5. Student will be able to synthesis the knowledge of Circuit theory to electrical and electronic circuits

Co-PO-Pso mapping

	PO1	PO2	PSO-1	PSO-2
CO-1	2	--	2	
CO-2	2	1	1	1
CO-3	2	--	1	
CO-4	1	--	1	
CO-5	3	2	2	

CO-PO Justification

Mapping	Level	Justification
CO-1 PO-1	2	Student will be able to write mathematical equations for given network and find out the solution for it.
CO-2 PO-1	2	By getting transfer function student can alnalyze the network.
CO-3 PO-1	2	Student can find diffrent parameters for given network.
CO-4 PO-1	1	For complex network solution can be achived with graph theory.
CO-5 PO-1	3	Knowledge of circuit theory helps understanding of behaviour of diffrent electonic components.
CO-2 PO-2	1	Transfer function helps to analyse the problem and system behaviour.
CO-5 PO-2	2	Complete network synthesis helps to conclude network behaviour from basic mathematical principles.

CO-PSO Justification

Mapping	Level	Justification
CO-1 PSO-1 CO-2 PSO-1	2	Student will be able to understand passive and active components.Student will also be able to understand and apply basic laws/theorems.
CO-3 PSO-1	1	Student will be able to find transfer fuction from basic knowledge.
CO-4 PSO-1	1	Student will be able to find basic parameters for given network.
CO-5 PSO-1	1	Student will be able to create graph ,tree for given network
	2	Student will be able to syntesize basic circuits.

ELECTRONICS (10), ELECTRONICS & COMMUNICATION (11), SIGNALS AND SYSTEMS
SUBJECT CODE: 2141005
B.E. 4th SEMESTER

Type of Course: Foundation of signals and systems for electrical, electronics and electronics and communication engineering

Prerequisite: Inclination to learn mathematics, basic knowledge of differential equations and difference equations, electrical circuits and networks.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	Basic definitions, Classification of signals and systems. Signal operations and properties. Basic continuous time signals, signal sampling and quantization, discretization of continuous time signals, discrete time signals. Basic system properties, Representation of digital signals. Case study of different signals form communication and biomedical field	**7**	**15**
2	Impulse response characterization and convolution integral for CT-LTI system, signal responses to CT-LTI system, properties of convolution, LTI system response properties from impulse response. (***Review of Laplace transform with reference to CT signals and systems.)**	**7**	**15**
3	Impulse response characterization and convolution sum, Causal signal response to DT-LTI systems. Properties of convolution summation, Impulse response of DT-LTI system. DT-LTI system properties from Impulse response. System analysis from difference equation model	**9**	**30**
4	Representation of periodic functions, Fourier series, Frequency spectrum of aperiodic signals, Fourier Transform, Relation between Laplace Transform and Fourier Transform and its properties. **Introduction to DTFT and DFT**	**8**	**25**
5	The z-Transform, Convergence of z-Transform, Basic z-Transform, Properties of z-Transform, Inverse z-Transform and Solving difference equation using z-Transform	**7**	**15**

Reference Books:

1. Signals and Systems by Alan V. Oppenheim, Alan S. Wilsky and Nawab, Prentice Hall
2. Signals and Systems by K. Gopalan, Cengage Learning (India Edition)
3. Signals and Systems by Michal J. Roberts and Govind Sharma, Tata Mc-Graw Hill Publications
4. Signals and Systems by Simon Haykin and Bary Van Veen, Wiley- India Publications
5. Linear Systems and Signals by B.P.Lathi, Oxford University Press
6. Signal, Systems and Transforms by Charles L. Philips, J. M. Parr and E. A. Riskin, Pearson Education
7. Digital Signal Processing Fundamentals and Applications by Li Tan, Elsevier, Academic Press
8. Signal and Systems By Anand Kumar, 3rd Edition, PHI

Course Outcomes:

After learning the course the students should be able to:

1. To understand,classify and analyze various types of signals.
2. To understand,classify and analyze various types of systems.
3. To understand concept of convolution and its properties.
4. To study different types of transforms.
5. To analyse different signals and system by use of transforms
6. To study and verify different properties of transforms.

	PO1	PO2	PO3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1	2		3										3		
CO-2	1		1										2		
CO-3			2										1		
CO-4	3		1		2								2		
CO-5	3	2	2										2	2	
CO-6	3	3													

CO-PO Justification

Mapping	Level	Justification
		Students will be able to
CO1-PO1 CO2 -PO1 CO6-PO1	2 1 3	Use the knowledge of various signals & systems and various properties of transforms.
CO1-PO3 CO2-PO3 CO3-PO3 CO4-PO3 CO5-PO3	3 1 2 1 2	Use the knowledge of mathematical concept, students can design and develop solutions for engineering problems.
CO4-PO5	2	Understand various concept of signals with the use of transforms.
CO4-PO1 CO5-PO1	3 3	Solve problems based on signals and systems using various continuous and discrete transforms.
CO4-PO2 CO5-PO2	3 2	Understand and analyze engineering problems with the help of transforms.

CO-PSO Justification

Mapping	Level	Justification
		Students will be able to
CO1-PSO1 CO2-PSO1 CO3-PSO1 CO4-PSO1 CO5-PSO1	1 2 1 2 2	Apply knowledge of various basic and advanced signals and systems and their transforms to solve the engineering problems.
CO5-PSO2	2	Analyze and understand various transforms of signals and systems.

GUJARAT TECHNOLOGICAL UNIVERSITY
ELECTRONICS AND COMMUNICATION
MICROCONTROLLER AND INTERFACING (EC)
SUBJECT CODE: 2151001
B.E. 5th SEMESTER

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
L	T	P	C		PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Introduction To 8-bit Microcontroller:** Microcontrollers and Embedded processors, Overview of AVR family, AVR Microcontroller architecture, Register, AVR status register, ROM space and other hardware modules, ATmega32 pin configuration & function of each pin.	**8**	**15**
2	**AVR Assembly Language Programming:** Addressing modes of AVR, Data transfer, Arithmetic, Logic and Compare, Rotate and Shift, Branch and Call instructions. AVR data types and assembler directives, AVR assembly language programs, AVR I/O Port Programming, Time delay loop, BCD, ASCII conversion Program, Look-up table, Bit addressability, MACROs.	**15**	**25**
3	**AVR Programming in C:** Data types, I/O programming, logic operations, Intel HEX file, Timer programming in assembly and C, Interrupt programming in assembly and C, Serial Port programming in assembly and C	**15**	**30**
4	**Peripheral Interfacing:** LCD and Keyboard Interfacing, ADC, DAC and sensor interfacing, Relay, Opto-isolator and Stepper Motor Interfacing, Input capture and Wave Generator, PWM programming and DC motor control, SPI protocol and Display interfacing, I2C Protocol and RTC interfacing.	**18**	**30**

Reference Books:

1. The AVR Microcontroller and Embedded Systems Using Assembly and C, By Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi, Pearson Education.

2. Programming and Customizing the AVR Microcontroller, By Dhananjay Gadre, McGraw Hill Education

Course Outcome:

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

1. Students will able to understand the architecture of AVR 8-bit Microcontroller.
2. Students will Study instruction set and able to Write, Debug and Simulate assembly language programs.
3. Students will able to Write, debug and simulate C language programs.
4. Students will able to Design circuits based on timer operations, interrupts and serial interface operations.
5. Students will able to Interface I/O peripheral devices with microcontroller.

CO-PO Mapping:

	PO1	PO2	PO3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1	1														
CO-2		1	2		2								3	3	3
CO-3		1	2		2								3	3	3
CO-4		2	2		2								3	3	3
CO-5		2	2		2								3	3	3

CO-PSO Justifications:

Mapping	Level	Justification
		Students will be able to
CO1-PO1	1	Use knowledge of the architecture of AVR 8-bit Microcontroller to make use of it for various engineering problem and find its optimum solution.
CO2-PO2 CO3-PO2 CO4-PO2 CO5-PO2	1 1 2 2	Understand the problem and able to do analysis of it.
CO2-PO3 CO3-PO3 CO4-PO3 CO5-PO3	2 2 2 2	Design the solutions of complex engineering problem with knowledge of programming and hardware components.
CO2-PO5 CO3-PO5 CO4-PO5 CO5-PO5	2 2 2 2	Use latest tools for doing the simulations of solutions of complex engineering problems.

GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS AND COMMUNICATION
(11) ENGINEERING ELECTROMAGNETICS
SUBJECT CODE: 2151102

B.E. 5th SEMESTER

Type of course: Electromagnetics Theory and Wave Propagation

Prerequisite: Basic knowledge of vector calculus, Electric and Magnetic fields and its laws.

Rationale: This course provides strong foundation for understanding the fundamental principles and laws of electromagnetism to understand transmission, radiation and propagation theory. Students can understand the physical interpretation and application of various laws and theorems of electric and magnetic fields. The students can also understand the transmission lines, antennas and waveguides theory.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage

1	**Vector Analysis:** Scalars and Vectors, Vector Algebra, The Rectangular Coordinate System, Vector Components and Unit Vectors, The Vector Field, The Dot Product, The Cross Product, Other Coordinate Systems: Circular, Cylindrical Coordinates & The Spherical Coordinate System.	**04**	**05**
2	**Coulomb's Law and Electric Field Intensity:** The Experimental Law of Coulomb, Electric Field Intensity, Field Arising from a Continuous Volume Charge Distribution, Field of a Line Charge, Field of a Sheet of Charge, Streamlines and Sketches of Fields	**05**	**10**
3	**Electric Flux Density, Gauss's Law and Divergence:** Electric Flux Density, Gauss's Law and Application of Gauss's Law: Some Symmetrical Charge Distributions and Differential Volume Element, Divergence and Maxwell's First Equation, The Vector Operator ∇ and the Divergence Theorem.	**05**	**15**
4	**Energy and Potential:** Energy Expended in Moving a Point Charge in an Electric Field, The Line Integral, Definition of Potential Difference and Potential, The Potential Field of a Point Charge, The Potential Field of a System of Charges: Conservative Property, Potential Gradient, The Electric Dipole, Energy Density in the Electrostatic Field.	**06**	**10**
5	**Conductors and Dielectrics:** Current and Current Density, Continuity of Current, Metallic Conductors, Conductor Properties and Boundary Conditions, The Method of Images, Semiconductors, The Nature of Dielectric Materials, Boundary Conditions for Perfect Dielectric Materials.	**06**	**05**
6	**Capacitance:** Capacitance, Parallel-Plate Capacitor, Several Capacitance Examples, Capacitance of a Two-Wire Line, Using Field Sketches to Estimate Capacitance in Two-Dimensional Problems, Poisson's and Laplace's Equations, Examples of the Solution of Laplace's Equation, Example of the Solution of Poisson's Equation: the *p-n* Junction Capacitance	**06**	**05**
7	**The Steady Magnetic Field:** Bio-Savart Law, Ampere's Circuital Law, Curl, Stokes' Theorem, Magnetic Flux and Magnetic Flux Density, The Scalar and Vector Magnetic Potentials, Derivation of the Steady-Magnetic-Field Laws.	**06**	**15**
8	**Magnetic Forces, Materials and Inductance:** Force on a Moving Charge, Force on a Differential Current Element, Hall Effect, Force between Differential Current Elements, Force and Torque on a Closed Circuit, The Nature of Magnetic Materials, Magnetization and Permeability, Magnetic Boundary Conditions, The Magnetic Circuit, Potential Energy and Forces on Magnetic Materials	**06**	**10**
9	**Time-Varying Fields and Maxwell's Equations:** Faraday's Law, Displacement Current, Maxwell's Equations in Point Form, Maxwell's Equations in Integral Form, The Retarded Potentials	**06**	**10**
10	**Electromagnetic Wave Propagation:** Wave Propagation in Free Space, Lossy and Lossless Dielectrics and in Good Conductors. Reflection of Plane Wave, Poynting Vector, Wave Power, Skin Effect, Wave Polarization and Standing Wave Ratio	**06**	**15**

Reference Books:

1. Engineering Electromagnetics, William H Hayt And John A Buck - Tata McGraw-Hill Publishing Company Limited, Seventh Edition
2. Principles of Electromagnetics, Matthew N. O. Sadiku - Oxford university press, 2007 - fourth edition
3. Electromagnetics with applications by J.D.Krauss and Daniel Fleisch fifth edition, Mcgraw Hill.
4. Fundamentals of Electromagnetics with MATLAB, Karl Erik Lonngren, Sava Vasilev Savov, SCITECH Publishing Inc.

Course Outcome:

After learning the course the students should be able to:

7. Explain the physical interpretation of coulomb's law, Gauss's law, Biot Savart law and Amperes Circuital law
8. Explain the physical interpretation and application of divergence, curl and gradient.
9. Analyze the electromagnetic waves using divergence theorem and stock theorem.
10. Analyze the electromagnetic waves using Maxwell's equations, Poisson's and Laplace equations.
11. Determine skin effect, Hall Effect, pointing vector, and standing wave ratio of electromagnetic waves.

	PO1	PO2	PO3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1	2		3										3		
CO-2	1		1										2		
CO-3			2										1		
CO-4	3	3	1		1								2		
CO-5	3	2	2										2	2	

CO-PO Justification

Mapping	Level	Justification
		Students will be able to
CO1-PO1 CO2 -PO1	2 1	Use the knowledge of various Electromagnetics laws. Use the concept of vector calculus
CO1-PO3 CO2-PO3 CO3-PO3 CO4-PO3 CO5-PO3	3 1 2 1 2	Use the knowledge of mathematical concept, students can design and develop solutions for engineering problems.
CO4-PO5	2	Understand various concept of electromagnetic waves.
CO4-PO1 CO5-PO1	3 3	Solve problems based on various boundary conditions using engineering equations.
CO4-PO2 CO5-PO2	3 2	Understand fundamental concepts of Electromagnetic Equations which will help in solving engineering problems.

CO-PSO Justification

Mapping	Level	Justification
		Students will be able to
CO1-PSO1 CO2-PSO1 CO3-PSO1 CO4-PSO1 CO5-PSO1	1 2 1 2 2	Apply knowledge of various basic and advanced electromagnetic laws to solve the engineering problems.
CO5-PSO2	2	Analyze and understand various electromagnetic parameters.

GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS AND COMMUNICATION (11) ELECTRONICS & COMMUNICATION
SUBJECT CODE: 2151004 B.E. 5th SEMESTER

Type of course: Mathematical analysis, designing, building and testing analog communications systems with applications to telecommunication systems.

Prerequisite: Fourier series, Fourier Transforms, Circuit Theory

Rationale: This course explores the fundamentals of electronic communication systems. The course has two primary focuses:

(1) Understanding electronic communications systems in analog form from deterministic approach

(2) Design and analysis of analog communications systems.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	%Wei
1	**Introduction to communication systems:** Communication system, Analog and digital Messages, Channel effect, Modulation and detection, Bandwidth of different information signals, Historical review of telecommunication, Applications	3	2
2	**Analysis and transmission of signals:** Aperiodic (non-periodic) signal representation by Fourier integral, Fourier transforms of some useful functions, signal transmission through a linear system, signal distortion over a communication channel, Signal energy and energy spectral density, signalpower and power spectral density.	6	12
3	**Passive Circuits:** Introduction, Series tuned circuits, Parallel tuned circuits, self-capacitance of a coil, Skin effect.	3	5
4	**Amplitude modulation(AM)/Demodulation:** Concept of modulation, Mathematical representation of sinusoidal Amplitude modulated signals in time and frequency domain- Double sideband Full carrier (DSBFC) , Double sideband suppressed carrier(DSBSC) and single sideband suppressed carrier modulations(SSBSC), Vestigial Sideband (VSB)	10	18

	modulation and Quadrature amplitude modulation(QAM), power and bandwidth calculations for DSBFC, DSBSC, SSBSC, VSB and QAM modulations, Non sinusoidal AM – effective modulation index, Effective voltage and current for sinusoidal and non-sinusoidal AM, AM generation: FET balanced modulator and IC balanced modulator circuits, Diode ring modulator, SSB generation: balanced modulator-filter method, phasing method and the third method, AM detection: peak (envelope detector), synchronous detectors, square law detectors.		
5	Angle modulation/demodulation: Conceptof instantaneous frequency and angle modulation, sinusoidal FM and its time domain representation, spectral components of angle modulated signals, power in sinusoidal FM and modulation index, Carson's rule, equivalence between Frequency modulation(FM) and Phase modulation(PM), Angle modulator circuits, Fm transmitters, Armstrong method of FM generation, Fm stereo broadcast, FM detection: Basic slope detector, Foster-Seeley discriminator, ratio detector, PLL detector and Quadrature detector, Concept of Amplitude limiter, Pre-emphasis and de-emphasis circuits, Interference in angle modulated systems.	**12**	24
6	Radio receivers: Functions of radio receivers, working of super heterodyne radio receivers, tuning ranges, tracking, sensitivity and gain, image rejection, spurious responses, Adjacent channel selectivity, Automatic gain control, Electronically tuned, receivers, IC receivers, AM receivers, FM receivers	**8**	16
7	Noise: Introduction, thermal noise, Shot noise, Partition Noise, Low frequency noise, Burst noise, a noise, High frequency noise, BJT and FET noises, Equivalent input noise generators, Signal to noise ratio (SNR), SNR of Tandem connection, Noise factor and noise Amplifier input noise in terms of	**8**	16

	figure, noise figure, Noise factor in cascaded amplifiers, Noise factor and equivalent input noise generators, noise factor of a lossy network, Noise temperature, Measurement of noise temperature and noise factor, narrow-band band pass noise.Behavior of Analog systems in presence of Noise		
8	Introduction of amateur radio technology What is Ham radio? How to become radio amateur? Importance of Ham radio during natural calamities, Technology used in amateur radio	**2**	6

Reference Books:

1. Electronic Communications by Dennis Roddy & John Coolen IV Edition PHI.
2. Digital and analog communication system by B.P.Lathi .Zhi Ding (international 4th Edition), OXFORD university press.
3. Electronic Communications by Kennedy McGraw Hill Publication.
4. Electronic Communications Systems by Wayne Tomasi. Pearson education India.
5. Electronic Communication Systems by Roy Blake By Cengage learning.
6. Communication Systems By Simon Haykins By Wiley India.
7. Theory and Problem Of Electronic Communication By Lloyd Temes and Mitchel E.Schulz(Second edition), McGraw Hill Publication.

Course Outcome:

After learning the course the students should be able to:

[1] To understand the basic concept of communication system.

[2] To analyze Fourier transforms of different signals and systems and observe frequency content of signal using spectrum analyzer and study different types of noise in communication systems, their effect on communication systems and parameters to analyze noise in the system.

[3] To understand basic blocks and operations of different stages of super-heterodyne receiver and become aware of amateur radio technology

[4] To study the need of modulation, types of modulation and different techniques for amplitude modulation and demodulation

[5] To analyze different type of passive circuits/Tuned circuits and understand the different techniques for frequency modulation and demodulation.

Mapping

	PO1	PO2	PO3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1	1	1	--	--	--	--	--	--	--	--	--	3	--	--	--
CO-2	2	1	--	--	--	--	--	--	--	--	--	1	--	--	--
CO-3	-	1	-	--	--	--	--	--	--	--	--	--	--		---
CO-4	-	-	1	--	1	--	--	--	--	--	--	1	1	-	-
CO-5	-	-	1	--	1	--	--	--	--	--	--	1	1	-	-

CO- PO Justification

Mapping	Level	Justification
		Students will be able to
CO1-PO1 Co2 – PO1	1 2	Know the concept of Communication system, their classification and how it is applied to recent communication system
CO2-PO1 CO2-PO2	2 1	Use knowledge of Fourier series and Fourier integral Laplace transform in various engineering problem and find its optimum solution.Effect of noise in different communication system
CO4-PO3 CO5-PO3	3 3	Know the modulation process and its need in communication and different techniques of modulation
CO1-PO12 CO2-PO12 CO4-PO12 CO5-PO12	3 1 1 1	Know fundamental concepts of communication and signals analysis which will help in solving communication engineering problem

Co- PSO Justification

Mapping	Level	Justification
		Students will be able to
CO4-PSO1 CO5-PSO1	1 1	Apply knowledge of communication in real life problems using engineering principles and find its solution.

GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS AND COMMUNICATION
AUDIO VIDEO SYSTEMS
SUBJECT CODE: 2151101
B.E. 5th SEMESTER

Type of course: Undergraduate

Prerequisite: Basic Electronics, Digital electronics

Rationale: The state of the art in Audio and Video system will enable the students to comprehend concept, working principle and its application in various types of modern electronic system. The knowledge acquired by students will help them to become familiar with designing concepts and troubleshooting of audio and video systems.

The low cost video systems, cameras have brought video revolution in the field of home entertainment, education, training, advertising and electronic newsgathering. Dramatic developments in flat panel display, reduction in the cost of image scanning system, LCD display and integrated subsystems has affected our communication capabilities and life-style in broad sense. It is taken care to include these latest developments in the present syllabus.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Characteristics of Sound: Nature of Sound, Pressure and Intensity of sound waves, Sensitivity of human ear for sound, Frequency of sound waves, Overtones and timbre, Intervals octaves and harmonics, Pitch, Resonance effect in sound systems, Helmholtz resonator, Reflection and diffraction of sound waves.	**2**	**5**
2	Audio devices and their applications: Microphones : Introduction, Characteristics of a Microphone, Requisites of a Good		

	Microphone, Moving Coil Microphone, Ribbon Microphone, Crystal Microphone, Capacitor(or Condensor) Microphone, Electret Microphone, Carbon Microphone, Comparisons of Various Types of Microphones, Special Microphones, Precautions while Using Microphones Loudspeaker s: Characteristics of Loudspeakers, Moving-Coil Cone Type Loudspeaker, Electrodynamic Loudspeaker, Horn-type or Indirect Radiating Type Loudspeaker, Comparison between Cone-type and Horn-type speakers,	**7**	**15**

	Loudspeaker column or line source speakers, Baffles and Enclosures, Multi-way Speaker System(Woofers and Tweeters), Crossover networks, Consequence of Mismatch between Amplifier Output and Loudspeaker Impedance Optical recording: Types of Optical Recording of sound, Methods of Optical Recording of Sound on Film, Reproduction of Sound from Films, Modern method of recording of sound for movie films, Compact Disc, Optical recording on Disc, Playback process, Comparison of Compact Discs and Conventional(Gramaphone) Discs. Introduction to Blue ray technology, Introduction to High Fidelity(Hi-fi) systems, Introduction to Public Address Systems(PA-Systems), Introduction to Audio Amplifiers, Introduction to Acoustic Reverberation, Introduction to AM/FM tuners, Introduction to USB Mp3 players.		
3	Digital Audio Fundamentals: Audio as Data, What is an Audio Signal, Why Binary, Why Digital, Some Digital Audio Processes Outlined, Time Compression and Expansion, Error Correction and Concealment, Channel Coding, Audio Compression, Disk-Based Recording, Rotary Head Digital Recorders, Digital Audio Broadcasting, Networks.	**2**	**5**
4	Television Fundamentals: Elements of TV communication system, Scanning, Synchronization, Aspect ratio, Pixels, Resolution, Bandwidth, Composite video signal, Modulation of video and audio signals, Monochrome and color cameras, Compatibility, Luminance and Chrominance signal, Picture tubes, Solid state picture transducers, TV broadcasting systems, Video monitors.	**6**	**15**
5	Digital video, compression techniques and standards: Digital Video, The RGB and YUV Representation of Video Signals, The Need for Compression, How compression works, Compression formats for video - MPEG-x format, H.26x format	**3**	**5**
6	Digital Television-Transmission and Reception: Digital system hardware, Signal quantizing and encoding, digital satellite		

	television, Direct-To-Home(DTH) satellite television, Digital TV receiver, Merits of digital TV receivers, Digital Terrestrial Television(DTT), Introduction to Video on demand, Introduction to CCTV, Introduction to CATV	**4**	**10**
7.	Stereophonic sound, Flat panel TV receivers, 3-Dimensional TV, EDTV, HDTV and Digital Studio equipments: Stereo sound systems, Projection television, Flat panel display TV receivers, Three Dimensional (3-D) television, Advances in 3D TV technology, Present status of new 3D receivers, Extended Definition Television(EDTV), Digital equipment for television studios, Electronic control of studio lights, Digital audio recorders and editing, Colour receivers of new generation	**6**	**15**
8.	Liquid Crystal and Plasma Screen Televisions: LCD technology, LCD matrix types and operation, LCD screens for television, Plasma and conduction of charge, Plasma television screens, Signal processing in Plasma TV receivers, A Plasma colour receiver, LCD colour receivers, Single LCD receivers, 3-LCD colour receivers, Plasma or LCD-which is the best choice, Performance comparison of Plasma and LCD televisions, Introduction to LED TV, RGB dynamic LEDs, Edge-LEDs, Differences between LED-backlit and Backlit LCD displays, Comparison of Plasma TV and LED TV, Introduction to OLED	**6**	**20**

	TVs		
9.	Projection Display Systems and Television Home Theaters: Direct View and rear projection systems, front projection TV system, Transmittive type projection systems, Reflective projection systems, Digital Light Processing(DLP) projection system, Projection television for home theatres, Choice of projection TV system, Essential features of front projectors, Comparison and choice of rear projection receivers, Satellite Off-Air tuners and Digital Video Recorders, Surround sound stereo receiver, Top of the line Home Theatre	**5**	**5**
10.	Troubleshooting in Audio and Video Equipment: Introduction, Modern Electronic Equipment, Maintenance Policy, Maintenance Aids for Fault Diagnosis, Procedure of Servicing and Maintenance, Shielding and Grounding, Fault location, Identifying the faulty component in the Faulty stage, Some common Faults in Components, Intermittent Faults, Troubleshooting in a power supply unit, Troubleshooting in a Public Address system, Troubleshooting in Stereo Amplifier, Troubleshooting in DVD Players.	**4**	**5**

Reference Books:

(3) Modern Television Practice(Fourth revised edition) - R.R.Gulati , New Age International Publishers.
(4) Audio and Video Systems(Second Edition) - R.G.Gupta, McGraw Hill Education Limited.
(5) Television & Video Engineering(Second edition) - A.M.Dhake, McGraw Hill Education Limited.
(6) Video Demystified – Keith Jack, LLH Technology Publishing.
(7) Audio Engineering, Know it all series, Newnes Press
(8) Essential Guide to Digital Video - John Watkinson, Snell & Wilcox Inc. Publication.
(9) Guide To Compression - John Watkinson, Snell & Wilcox Inc Publication
(10) Audio Video Systems Principles Practices and Troubleshooting - Bali & Bali, Khanna Publishing Company.
(11) Consumer Electronics - S.P.Bali, Pearson Education.

Course Outcome:

After learning the course the students should be able to:

1. Describe the basic idea and fault finding in audio and video transmitter, and receiver sections.
2. Explain importance of Digital Audio and Video systems including importance of compression.
3. Distinguish between Stereo & Hi-fi Amplifier.
4. Understand CD/DVD player mechanism and fault finding in CD player, AM/FM tuners, MP3 players and Blue-Ray Technology.

5. Explore advanced Digital color Television systems (LCD, LED, Plasma) and fault finding and exposure of the HDTV, 3D TV and OLED TV

co-po mapping

	PO1	PO2	PO3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO-1	2		3										1			
CO-2	1		1	2									2			
CO-3	1	1	2	1									1			
CO-4	3		1		2								2			
CO-5	3	2	2	2									2	2		

Co- Po Justification

Mapping	Level	Justification
		Students will be able to
CO1-PO1 Co2 –PO1	2 1	Describe the basics about fault finding in audio and video equipments. Able to troubleshoot the faults
CO1-PO3 CO2-PO3	3 1	Use the knowledge of various types of microphones, various types of loudspeakers , audio amplifiers, video amplifiers and tuner circuits for communication.
CO5-PO3	2	Understand the design of various woofer, tweeter circuits
CO4-PO	3	Know various analysis approach involves solving audio and video circuits problems.
CO4-PO1	3	Know fundamental concepts of various television concepts like HDTV, LCD tv LED tv.

Co- Pso Justification

Mapping	Level	Justification
		Students will be able to
CO1-PSO1 CO2-PSO1 CO3-PSO1 CO4-PSO1 CO5-PSO1	1 2 1 2 2	Sound knowledge of color signals, various basic and advanced laws governing audio and video systems Sound knowledge of loudspeakers, microphones, Sound knowledge of stereo amplifiers as well as audio amplifiers. Practical knowledge and troubleshooting techniques about TV tuners and CD/DVD players. Practical knowledge and troubleshooting techniques about HD TV and OLED TVs.
CO5-PSO2	2	Analyze and design various audio and video electronic circuits and systems; suggest and develop electronic systems/solutions for field problems.

GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS AND COMMUNICATION (11)

DIGITAL COMMUNICATION

SUBJECT CODE: 2161001

B.E. 3rd YEAR (6th Semester)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	2	2	6	70	20	10	20	10	20	150

Content:

Sr.No	Topic	Teaching Hrs	Module Weightage (%)
1	Base Band Modulation Base band system, sampling theorem, Sampling and signal reconstruction, Aliasing, Types of sampling, Quantization, PCM, Companding, DPCM, ADPCM, Delta modulation, Adaptive delta modulation, T1 carrier system	10	19
2	Digital Data Transmission Components of digital communication system, line coding, pulse shaping, Scrambling, Regenerative Repeater, Eye Diagram, Timing Extraction, Detection Error Probability, M-ary communication, Digital Carrier Systems	06	12
3	Digital Modulation Techniques: Modulation techniques for ASK, QASK, FSK, M-ary FSK, BPSK, DPSK, DEPSK, QPSK, M-ary PSK, QAM, MSK, GMSK	08	15
4	Digital Carrier Demodulation Techniques Coherent and non coherent detection of ASK, QASK, FSK, PSK, QPSK, M-ary PSK, DPSK, Noise temperature, Noise bandwidth, Noise figure	06	12
5	Probability Theory and Random Variable Concept of probability, Conditional probability and independent event, random variable, types of random variable, CDF, PDF, Statistical Averages, Chebyshev's inequality, Central limit theorem, Concept of correlation, 8 15	08	15
6	Information Theory Measure of information, Entropy, Source encoding, Error free communication over noisy channel, channel capacity of discrete memory less channel, Channel capacity of continuous channel, Practical communication system in lights of Shannon theorem	6	12
7	Error Correcting Codes Introduction, Linear Block Code, Cyclic Code, Burst error detecting and correcting codes, Interlace codes for burst and random error correction, Convolution Code, Comparison of coded and un coded system	8	15

Reference Books:

1. Modern Digital and Analog Communication Systems, B. P. Lathi, (3rd Edition), Oxford Publication
2. Principles of Communication Systems, Taub & Schilling, (2nd Edition), Tata McGraw Hill Publication
3. S.Haykin, Communication systems, John Wiley 2001
4. Bhattacharya Amitabh, "Digital Communication", Tata McGraw-Hill, 1st Ed., 2006.

Course Outcomes:

After learning the course the students should be able to:

1. Convert analog signal into digital signal using different techniques like PCM, DM and ADM.
2. To study Line codes with PSD and Understand the concept of ISI and reduction of ISI through Nyquist criteria
3. Compare various digital modulation-demodulation techniques and understand its behavior in presence of noise.
4. To study fundamentals of probability, random variable and various statistical analysis methods.
5. Derive channel capacity for discrete memory less channel and continuous channel.
6. To study & apply various error detection and correction codes.

	CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	**PSO-1**	**PSO-2**	**PSO-3**
DC (2161001)	1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
	2	3	2	1	-	-	-	-	-	-	-	-	2	2	3	-
	3	3	2	2	-	-	-	-	-	-	-	-	2	3	2	-
	4	3	-	3	-	-	1	-	-	-	-	-	1	2	3	-
	5	3	2	2	-	-	1	-	-	-	-	-	2	2	2	3
	6	2	3	3	-	2	2	-	-	-	-	-	2	2	2	3

CO- PO Justification

Mapping	Level	Justification
		Students will be able to
CO1-PO1	3	Apply the knowledge of mathematics, engineering fundamentals to study different digital modulation techniques
CO2-PO1 CO2-PO2 CO2-PO3 CO2-PO12	3 2 1 2	Apply the knowledge of mathematics, engineering fundamentals, and Do analysis of Line codes with PSD and compare them . Understanding and reducing ISI using Nyquist Criterions useful for all communications.
CO3-PO1 CO3-PO2 CO3-PO3 CO3-PO12	3 2 2 2	Analysis of all digital modulation and demodulation techniques with mathematical equations. Transmitter and Receiver Design, Comparison of the techniques using constellation diagram

CO4-PO1 CO4-PO3 CO4-PO6 CO4-PO12	3 3 1 1	Applying Statistical mathematics in the field of communication.
CO5-PO1 CO5-PO2 CO5-PO3 CO5-PO6 CO5-PO12	3 2 2 1 2	Channel Capacity estimation in wired and wireless domain
CO6-PO1 CO6-PO2 CO6-PO3 CO6-PO5 CO6-PO6 CO6-PO12	2 3 3 2 2 2	Applying error Detection and correction codes for communication systems.

C0- PSO Justification

Mapping	Level	Justification
		Students will be able to
CO1-PSO1 CO2-PSO1 CO3-PSO1 CO4-PSO1 CO5-PSO1 CO6-PSO1	3 2 3 2 2 2	Sound knowledge of various basic and advanced laws governing digital communication systems.
CO2-PSO2 CO3-PSO2 CO4-PSO2 CO5-PSO2 CO6-PSO2	3 2 3 2 2	Analyze and design digital communication systems

CO5-PSO3 CO6-PSO3	3 3	Make use of latest simulation tools like MATLAB and develop programs for various error detection and correction codes.

GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS (10) &
ELECTRONICS AND COMMUNICATION ENGINEERING (11)
ANTENNA & WAVE PROPAGATION
SUBJECT CODE: 2161003
B.E. 6th SEMESTER

Type of course: Compulsory

Prerequisite: Higher Engineering Mathematics, Fundamental knowledge of Engineering Electromagnetics (Maxwell's equations, three basic coordinate systems and polarization).

Rationale:

UG Students of EC Engineering need to possess good understanding of the fundamentals and applications of Antenna and wave propagation, including radiation from point sources as applied to antenna, antenna types and their radiation patterns. They are expected to be able to design different antennas for specific given frequency and application. They should be acquainted with concept of arrays and antenna measurement methods. They will be practiced in study of antenna radiation patterns and in measurement of different antenna parameters. They will be able to design and analyze some basic antennas in hardware and application specific antenna in HFSS or CST.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
				ESE	PA (M)		ESE (V)		PA	
L	T	P	C	(E)	PA	ALA	ESE	OEP	(I)	
4	0	2	6	70	20	10	20	10	20	100

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Basic antenna concepts**: Definitio functions of an antenna, comparison between an antenna n and & transmission line, radio communication link with transmitting antenna and a receiving antenna, radiation patterns of antennas-field and power patterns, all antenna types.	3	9%
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 by a current element, Application to antennas, Radiation from Radiated quarter wave monopole and half wave dipoles, Derivation for radiation resistance, application of reciprocity theorem to antennas, equality of directional patterns and effective lengths transmitting antennas directiona of and receiving , l properties of dipole antennas, antenna feeding methods.	5	10%
3	**Antenna parameters and definitions:** beam area, beam width- Half-Power Beam width (HPBW)and First Null Beam width(FNBW) ,Polarisation, Radiation Intensity ,Beam Efficiency, Directivity	5	10%

	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.	**6**	11%
5	**Loop Antenna:** Small loop short magnetic dipole, comparison of far field of small loop and short dipole loop antennas, field pattern of circular loop antenna & radiation resistance of loop antenna, directivity of circular loop antennas with uniform current.	**2**	3%
6	**Helical antenna:** Helical geometry, transmission radiation modes, practical design considerations, wide band characteristics of helical antenna.	**2**	3%
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.	**4**	7%
8.	**Reflector antennas**: Parabolic reflector, paraboloidal reflector, aperture Pattern of large circular apertures with uniform illumination, off axis operation of paraboloidal reflectors, Cassegrain feed system.	4	7%
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	9%
10.	**Microstrip (patch) antennas :** Rectangular and circular types-function, features analysis ,design considerations and applications	4	7%

11.	**Lens antennas**: Non-metallic Dielectric lens and artificial dielectric lens antennas, reflector lens antennas.	2	3%
12.	**Broadband & Freq. Independent antennas**: Broadband antenna, Frequency independent antenna, log periodic antennas.	2	3%
13.	**Antennas for special applications:** Antennas design consideration for satellite communication, antenna for terrestrial mobile communication systems, GPR, Embedded antennas, UWB, Plasma antenna.	2	3%
14.	**Antennas measurements**: Experimental set ups for measurement of radiation patterns, gain, phase polarization, terminal impedance.	2	3%
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.	6	11%

uggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30 %	**20 %**	**20 %**	**10 %**	**10 %**	**10 %**

Reference Books:

(12) "Antennas for all applications", J.D. Krauss 3RD Edition (TMH)
(13) "Electromagnetic wave & radiating systems", Jordan & Balmain PHI Publication
(14) "Antenna & Wave Propagation", K.D. Prasad Satyaprakash Publications
(15) "Antenna Theory: Analysis and design", C. Balanis Wiley India

Course Outcome:

After learning the course the students should be able to:

Course Outcome:

After learning the course the students should be able to:

1. Understand the concepts of antenna and electromagnetic radiation through antennaand
2. Identify and measure the antenna parameters
3. Analyze and design various types of wire and aperture antenna using different tools.

4. Design and analyze the linear and nonlinear antenna arrays,special antennas and measure the different parameters and feeding methods of antenna
5. Understand and identify the atmospheric and terrestrial effects on radio wave propogation

Mapping

	PO1	PO2	PO3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1	2	-	-	-	-	-	-	-	-	-	-	-	--	--	--
CO-2	2	-	-	-	-	-	-	-	-	-	-	-	--	--	--
CO-3	1	2	-	-	2	-	-	-	1	-	-	-	--	1	--
CO-4	1	2	-	1	-	-	-	-	-	-	-	-	--	-	--
CO-5	-	2	-	1	-	-	-	-	1	-	-	-	--	1	--

CO- PO Justification

Mapping	Level	Justification
		Students will be able to
CO1-PO1 Co2 –PO1 CO3-PO1 CO4-PO1	2 2 1 1	Know the concept of Antenna and how it radiates and different types of antenna
CO3-PO2 CO4-PO2 Co4-PO2	2 2 2	Identify the different types of arrays
CO4-PO4 CO5-PO4	1 1	Design and analyze the linear and nonlinear antenna arrays,special antennas and measure the different parameters and feeding methods of antenna
CO3-PO8	1	Analyze and design various types of wire and aperture antenna using different tools.
CO3-PO9 CO5-PO9	1 1	Understand and identify the atmospheric and terrestrial effects on radio wave propogation

Co- PSO Justification

Mapping	Level	Justification
		Students will be able to
CO3-PSO2 CO5-PSO2	1 1	Apply knowledge of Antenna and Wave Propagation in real life problems using engineering principles and find its solution.

GUJARAT TECHNOLOGICAL UNIVERSITY
ELECTRONICS (10) &
ELECTRONICS AND COMMUNICATION ENGINEERING (11)
OPTICAL COMMUNICATION
SUBJECT CODE: 2161005
B.E. 6th SEMESTER

Type of course: NA
Prerequisite: Semiconductor Physics, Electromagnetic, Mode theory of waveguide
Rationale: To introduce the students to various optical fiber modes, configurations and various signal degradation factors associated with optical fiber and to study about various optical sources and optical detectors and their use in the optical communication system, optical amplifiers, fiber network elements, basic optical components, and techniques of fiber optic measurement.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE(E)	PA(M)		ESE (V)		PA(I)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr.no.	Name of the topic	Number of hours	% Weightage
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.	3	6
2	**Optical fibers : Structures, Waveguiding 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	7	13

	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.		
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 figureof merits, single mode lasers, Modulation of laser diodes, Spectral width , temperature effects, and Light source linearity.	6	12
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	8
6	**Photodetectors :** Principles of operation, types, characteristics, figure of merits of detectors photodiode materials, photodetector noise, detectorresponse 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.	5	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	3	6
10	**Advances in Optical Fiber Systems :** Principles of WDM, DWDM, Telecommunications & broadband application, SONET/SDH, MUX, Analog & Digital broadband, optical switching.	5	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
	TOTAL	51	100

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks

R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**10**	**15**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Optical Fiber Communications by Gerd Keiser, 4th Edition (Mc Graw Hill)
2. Optical Fiber Communication by John M. Senior (PHI/Pearson)
3. Fiber optical communication Technology by Djafar Mymbaev & Lowell L, Scheiner. (Pearson)
4. Fiber optic Communication Systems by G. Agrawal (John Wiley and sons)

CO(Course Outcomes)	
CO-1	To comprehend the basic elements of Optical link, optical fiber structures, waveguiding and fabrication
CO-2	To visualize significance of different losses and distortion of signal in optical waveguide
CO-3	To study and analyze various optical sources.
CO-4	To analyze fiber optic receiver operation and optical network
CO-5	To design optical link with different system components.
CO-6	To understand various optical components and measuring instruments.

CO-PO Mapping

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO-1	2	1	--	--	--	--	--	--	--	--	--	2
CO-2	1	2	--	--	--	--	--	--	--	--	--	2

CO-3	2	2	--		--	--	--	--	--	--	--	2
CO-4	2	1	2	---	1	--	--	--	--	--	--	2
CO-5	1	--	3	--	--	--	--	--	--	--	--	2
CO-6	2	--	2	--	--	--	--	--	--	--	--	2

CO-PO Justification

Mapping	Level	Justification
CO-1 PO-1	2	Student will be able to write mathematical equations for optical communication and fundamental engineering is associated.
CO-2 PO-1	1	Mathematical model for different losses is analysed.
CO-3 PO-1	2	Different sources can be compared and best possible for particular application can be chosen.
CO-4 PO-1	2	It gives basic mathematics and engineering required to design a link.
CO-5 PO-1	1	Basic knowledge required to design a link.
CO-6 PO-1	2	Basic engineering knowledge of Optical components is involved.
CO-1 PO-2	1	Will be able to review literature based on basic optical communication
CO-2 PO-2	2	Student can formulate the problem related to optical communication by mathematical equations.
CO-3 PO-2	2	Engineering science is involved in study of optical sources.
CO-4 PO-2	1	Student can identify and analyse the problem in optical communication.
CO-4 PO-3	2	Student will be able to choose different component of link based on given parameters.
CO-5 PO-3	3	Student can design a basic link as per given specification.
CO-4 PO-5	1	Students are designing bsic optical link using MATLAB or Optisim software.
CO-1 PO-12	2	Life long learning for the optical communication is involved.
CO-2 PO-12	2	To design optical link knowledge of basic losses is must so it involves life long learning.
CO-3 PO-12	2	It's a life long learning.
CO-4 PO-12	2	Life long learning for designing a optical link is involved.
CO-5 PO-12	2	Life long learning
CO-6 PO-12	2	Life long learning

CO-PSO MAPPING

	PSO-1	**PSO-2**	**PSO-3**
CO-1	2	**1**	**--**
CO-2	**--**	1	**--**
CO-3	**3**	2	**--**
CO-4	**2**	1	1
CO-5	**2**	2	2
CO-6	2	1	3

Co-PSO justification

Mapping	Level	Justification
CO-1 PSO-1	2	Students will be able to understand basic components of optical link.
CO-3 PSO-1	3	Students will be able to understand how optical sources work.
CO-4 PSO-1	2	Student will be able to understand components and equipments of optical receiver .
CO-5 PSO-1	2	Student will be able to design optical link by understanding basic component working.
CO-6 PSO-1	2	Optical components is explained so student can undestand its characteristics.
CO-1 PSO-2	1	Students will be able to understand basic components of optical link and thus can use the proper components in link design.
CO-2 PSO-2	1	Students will be able to understand different losses and thus can design link.
CO-3 PSO-2	2	Student will be able to choose proper source for link design.
CO-4 PSO-2	1	Student will be able to design optical link by understanding reveiver operation.
CO-5 PSO-2	2	Student will be able to design optical link from given specifications.
CO-6 PSO-2	1	Optical components is explained so student can undestand its characteristics and can use proper components in link design.
CO-4 PSO-3	1	Student will be able to analyse different component characteristics by testing equipment
CO-5 PSO-3	2	Student will be able to use different measuring equipment at different stage of link to analyse link performance.
CO-6 PSO-3	3	Diffrent optical components are discussed and student will be able to use them in simulation tool.

GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS AND COMMUNICATION ENGINEERING (11)
VLSI TECHNOLOGY & DESIGN
SUBJECT CODE: 2161101
B.E. 6th SEMESTER

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	30	0	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.	4	8
2	**Fabrication of MOSFET :** Introduction, Fabrication Process flow: Basic steps, C-MOS n-Well Process, Layout Design rules, full custom mask layout design.	4	8
3	**MOS Transistor:** The Metal Oxide Semiconductor (MOS) structure, The MOS System under external bias, Structure and Operation of MOS transistor, MOSFET Current-Voltage characteristics, MOSFET scaling and small-geometry effects, MOSFET capacitances	8	16
4	**OS Inverters:** Static Characteristics: Introduction, Resistive load Inverter, Inverter with n-type MOSFET load (Enhancement and Depletion type MOSFET load), CMOS Inverter	7	13
5	**MOS Inverters Switching characteristics and Interconnect Effects :** Introduction, Delay-time definitions, Calculation of Delay times, Inverter design with delay constraints, Estimation of Interconnect Parasitic, Calculation of interconnect delay, Switching Power Dissipation of CMOS Inverters	8	16
6	**Combinational MOS Logic Circuits:** Introduction, MOS logic circuits with Depletion nMOS Loads, CMOS logic circuits, Complex logic circuits, CMOS Transmission Gates (TGs)	5	9
7	**Sequential MOS Logic Circuits :** Introduction, Behavior of Bistable elements, The SR latch circuit, Clocked latch and Flip-flop circuit, CMOS D-latch and Edge-	4	8

	triggered flip-flop		
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	7	12
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, Controllability and observability, Ad Hoc Testable design techniques, Scan –based techniques, built-in Self Test (BIST) techniques, current monitoring IDDQ test	3	6

Reference Books:

1. CMOS Digital Integrated circuits – Analysis and Design by Sung – Mo Kang, 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

Course Outcomes:

1. To understand fabrication and operation of MOSFET device.
2. To obtain mathematical model of MOSFET device.
3. Analyze and design Static and Dynamic CMOS Circuits.
4. To understand techniques of DFT.
5. To write programs in VHDL for combinational and sequential circuits and realize them on FPGA.

CO-PO and CO-PSO mapping:

	PO1	PO2	PO3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1	2												2		
CO-2	1	3	1										2		
CO-3	2	2	3											3	
CO-4	2												1		
CO-5				1	3				2						3

CO- PO Justification :

Mapping	Level	Justification
		Students will be able to
CO1-PO1	2	Use knowledge of MOSFET structure and working of it.
CO2-PO1 CO2-PO2 CO2-PO3	1 3 1	Derive and analyze mathematical equation of MOSFET model. Solve the problems based on model equations. Design model for MOS based devices.

CO3-PO1 CO3-PO2 CO3-PO3	2 2 3	Use the knowledge of mathematical concept, students can design and develop solutions Static and dynamic circuit using MOSFET. Design the MOSFET based digital circuits for different applications.
CO4-PO1	2	Know various techniques of Design for Testability of VLSI circuits.
CO5-PO4 CO5-PO5 CO5-PO9	1 3 2	Know fundamental concepts of HDL programming and synthesis. Simulate various digital circuits on simulator like Xilinx and download their design on FPGA.

CO- PSO Justification:

Mapping	Level	Justification
		Students will be able to
CO1-PSO1	2	Understand the fabrication process of MOSFET based VLSI circuits.
CO2-PSO1	2	Derive the various equations for MOS model and solve problems of devices based on these equations.
CO3-PSO2	3	Design the circuits of digital applications using MOSFET.
CO4-PSO1	1	Learn the various techniques of DFT.
CO5-PSO3	3	Simulate and design application circuits using HDL programming with the help of Xilinx software and download their design on hardware.

GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS AND COMMUNICATION ENGINEERING
POWER ELECTRONICS DEVICES AND CIRCUITS
SUBJECT CODE: 2161006
B.E. 6th SEMESTER

Type of course: Discipline Core course.

Prerequisite: Semiconductor physics, Analog electronics, Electronic devices and circuits, Electrical machines, Microprocessors.

Rationale: This course provides strong foundation for understanding and designing of domestic and industrial power electronics circuits. Students can understand the conversion of power from AC to variable DC, Fixed DC to Variable DC, DC to variable AC and Fixed AC to variable AC using power electronics circuits. This subject also helps to understand the speed control of DC and AC drives and design of UPS and SMPS.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr.	Topics	Teaching Hours	Module Weightage
1	**INTRODUCTION TO THYRISTER FAMILY:** Construction, operation and characteristics of SCR, Diac, Triac, SUS, SBS, RCT, LASCR, SITS, SITH, GTOs, IGBT , MCT etc. Two transistor analogy of SCR. Turn On and Commutation methods of SCR. Triggering circuits of SCR. UJT relaxation oscillator and PUT. Series and parallel operation of Thyristor. Thyristor protection.	7	15 %
2	**PHASE CONTROLLED RECTIFIERS:** Single phase, half wave, Full wave, half controlled bridge and Full controlled bridge rectifiers with resistive and inductive loads. Effect of freewheeling diodes. Three phase controlled rectifiers.	6	15 %
3	**INVERTERS:** Thyristor inverter classification, Voltage and current source inverters, Series, Parallel and Bridge Inverters. The McMurray and McMurrayBedford inverters. PWM inverters, Three phase inverters.	6	15 %
4	**CHOPPER:** Principle of chopper operation, control strategies, Step-Up, Stepdown and Step-Up/Down chopper. Type-A, Type-B, Type-C, Type-D and Type-E	6	15 %

Sr.	Topics	Teaching Hours	Module Weightage
	chopper. Voltage and current commutated chopper. Jones, Morgan and AC choppers.		
5	**CYCLOCONVERTERS:** Basic principle of operation. Single phase to single phase, Three phase to single phase Cycloconverter. Three phase to three phase Cycloconverter.	4	10 %
6	**CONTROL OF DC DRIVES:** Introduction, Basic machine equations. Braking modes. Single phase separately excited drives. Single phase series DC motor drives. DC chopper drives. Closed loop control of DC drives. PLL control of DC drives. Microcomputer control of DC drives.	5	10 %
7	**CONTROL OF AC DRIVES:** Basic principle of operation. Torque-speed characteristic of induction motor. Speed control of induction motor. Stator voltage control. Variable frequency control. Rotor resistance control. Slip power recovery scheme	5	10 %
8	**APPLICATION OF THYRISTOR:** Over voltage protection, Zero voltage switch. SMPS, Online and Off line UPS, Induction heating, Dielectric heating, Switchmode welding, Battery charger, Static circuit breakers	6	10 %

Reference Books:

1. Power Electronics by M D Singh and K B Khanchandani (TMH)
2. Power Electronics Circuits Devices and Application by Muhammad Rashid (PHI)
3. Power Electronics and Controls by Samir K Datta (PHI)
4. Industrial and Power Electronics by Harish C Rai
5. Power Electronics byElbs R. Ramshaw
6. Thyristor and Their Applications byRamamourthy
7. Power Electronics by Dr. P S Bimbhra (Khanna Publisher)

Course Outcome:

After learning the course the students should be able to:

1. Understand the power semiconductor devices
2. Design and analyze various SCR firing and commutation methods.
3. Explain the operation of phase controlled rectification.
4. Understand the design and operation of various industrial based power electronics circuits like inverters, choppers and cycloconverters.
5. Designing and repairing of SMPS, UPS , battery charger and circuit breakers.

	PO1	PO2	PO3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO-1	3		3										1			

CO-2	3	2	1										2			
CO-3	3	2	2										1			
CO-4	3		1										2			
CO-5	2	3	2										2	2		

Co- Po Justification

Mapping	Level	Justification
		Students will be able to
CO1-PO1 Co2 – PO1	2 1	Describe the basics about power semiconductor devices. Able to troubleshoot and analyze the SCR based firing and commutation circuits.
CO1-PO3 CO2-PO3	3 1	Use the practical knowledge of various types of rectifiers, ac-ac converters, dc-dc converters and dc-ac converters.
CO5-PO3	2	Understand the design of various thyristor based converter circuits.
CO4-PO3	3	Know various analysis approach involves solving online and offline UPS, SMPS
CO4-PO1	3	Design and repair of battery charger and circuit breakers.

Co- Pso Justification

Mapping	Level	Justification
		Students will be able to
CO1-PSO1 CO2-PSO1 CO3-PSO1 CO4-PSO1 CO5-PSO1	1 2 1 2 2	Sound knowledge of thyristor family , various basic and advanced laws governing power semiconductor devices Sound knowledge of SCR , power MOSFET, IGBT, UJT, Sound knowledge of converter circuits. Practical knowledge and troubleshooting techniques about rectifiers, choppers. Practical knowledge and troubleshooting techniques about cycloconverters and inverters.
CO5-PSO2	2	Analyze and design various power electronic circuits and systems; suggest and develop electronic systems/solutions for field problems like UPS,SMPS,battery charger.

GUJARAT TECHNOLOGICAL UNIVERSITY

Electronics and communication **ADVANCED MICROPROCESSOR**

SUBJECT CODE: 2161102 **B.E. 6th SEMESTER**

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	2	0	5	70	20	10	30	0	20	150

Content:

No.	Content	Total Hrs	% Weightage
1	**Introduction:** Need of advance microprocessors, Difference between RISC and CISC, RISC Design philosophy,	3	10
2	ARM Design Philosophy, History of ARM microprocessor, ARM processor family, Development of ARM architecture	3	
3	**The ARM Architecture and Programmers Model :** The Acorn RISC Machine, ARM Core data flow model, Architectural inheritance	3	20
4	The ARM7TDMI programmer's model: General purpose registers, CPSR, SPSR, ARM memory map, data format, load and store architecture, Core extensions, Architecture revisions, ARM development tools	7	20
5	**ARM Instruction set:** Data processing instructions**,** Arithmetic and logical instructions**,** Rotate and barrel shifter**,** Branch instructions, Load and store instructions, Software interrupt instructions, Program status register instructions, Conditional execution, Multiple register load and store instructions, Stack instructions, Thumb instruction set, advantage of thumb instructions, Assembler rules and directives	7	20
6	Assembly language programs for shifting of data, factorial calculation, swapping register contents, moving values between integer and floating point registers	3	15
7	**C Programming for ARM:** Overview of C compiler and optimization, Basic C data types, 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.	6	15

Reference Books:

[1] ARM Assembly Language Programming & Architecture By. Muhammad Ali Mazidi, Kindle edition
[2] Arm Assembly 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

Course outcomes:

CO 2171008.1: To compare and analyze RISC and CISC processor Architecture.
CO 2171008.2: To understand architecture and operation of ARM.
CO 2171008.3: To study ARM instructions Set and its related examples
CO 2171008.4: To write, debug and simulate various programs for ARM processor using assembly language
CO 2171008.5: To write, debug and simulate various programs for ARM processor using C language
CO 2171008.6: To interface peripheral devices with ARM processor

CO-PO mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 2171008.1	1	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO 2171008.2	1	-	2	-	-	-	-	-	-	-	-	-	2	-	-
CO 2171008.3	2	-		-	-	-	-	-	-	-	-	-	2	-	-
CO 2171008.4	-	1	2	2	2	2	-	-	-	-	-	-	-	2	2
CO 2171008.5	-	1	2	2	2	2	-	-	-	-	-	-	-	2	2
CO 2171008.6	-	2	3	-	-	2	-	-	-	-	-	-	-	2	2

Mapping & Justification:

Mapping	Level	Justification
CO 2171008.1-PO1 CO2171008.2-PO1 CO 2171008.5 PO1	2 1 2	Students will completely understand Basics of computer networking and its application will be understood by the students using high level language program and tools
CO2171008.1-PO2 CO2171008.2- PO2 CO2171008.3-PO2 CO2171008.4-PO2 CO2171008.5- PO2	1 2 2 2 1	Working of various protocols of networking will be understood by the students.
CO2171008.2- PO3 CO2171008.3-PO3 CO2171008.4-PO3 CO2171008.5- PO3	1	For the implementation of laboratory practicals, students will be trained in their own implementation.
CO2171008.2- PO12 CO2171008.3-PO12 CO2171008.4-PO12 CO2171008.5- PO12	1 2 2 2	Students use various networking tools and programming software for performing of their laboratory experiements.

Co- Pso Justification

Mapping	Level	Justification
		Students will be able to
CO 2171008.1-PSO1	2	Understanding of the protocols and programs will be useful in development of new system.
CO 2171008.3-PSO2	3	New software tools will be learnt by the students

GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: Electronics Engineering / Electronics & Communication Engineering /Electronics & Telecommunication Engineering

SUBJECT NAME: Microwave Engineering

SUBJECT CODE: 2171001

B.E. 7th SEMESTER

Type of course: Core Course.

Prerequisite: Electromagnetic theory, Wave propagation, Antennas and Semiconductor physics

Rationale: This course provides basic knowledge of designing of transmission lines and wave guides. The various modes of propagations through transmission line and wave guides are included. Students will become familiar with the usage of active and passive components of microwave systems. Measurements of various parameters of microwave systems are also part of the subject.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
04	00	02	06	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightag
1	**Introduction to Microwaves**. History of Microwaves, Microwave Frequency bands, General Applications of Microwaves, Advantages of Microwaves	2	5
2	**Mathematical model of Microwave Transmission** Concept of Mode, Characteristics of TEM, TE and TM Modes, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission	4	5
3	**Analysis of 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**,** Micro strip lines, parallel strip lines, coplanar strip lines, shielded strip lines , Rectangular and circular waveguides-theory and analysis.	13	20
4	**Microwave Network Analysis** Equivalent Voltages and currents for non-TEM lines, Network	5	10

	parameters for microwave Circuits, Scattering Parameters.		
5	**Passive and Active microwave Devices** Microwave Passive components: Directional Coupler, Power Divider, Magic Tee, Wave-guide Corners, Bends, Twists, Attenuator, Circulator, Isolator and Resonator. Microwave Active components: Tunnel diode, Varactor diodes, Step recovery diodes, Schottky Barrier diodes, PIN diodes, Gunn Diodes, IMPATT and TRAPATT diodes, Parametric Amplifiers, Microwave Transistors, Microwave oscillators and Mixers. Microwave tubes: Klystron, TWT, Magnetron.	**12**	20
6	**Microwave Measurements** Power, Frequency and impedance measurement at microwave frequency, Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal, Noise at microwave frequency and measurement of noise figure, Measurement of Microwave antenna parameters.	**6**	15
7	**Modern Trends in Microwaves Engineering** Effect of Microwaves on human body, Medical and Civil applications of microwaves, Electromagnetic interference / Electromagnetic Compatibility (EMI / EMC), Monolithic Microwave IC fabrication , RF MEMS for microwave components, Microwave Imaging	**5**	15
8	**Microwave Systems** Wireless Communications system, Radar Systems, Radiometer Systems, Satellite Communication, Remote sensing, Microwave Propagation, Microwave Antennas.	**5**	10
Total		**52**	

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
05	**20**	**10**	**20**	**10**	**05**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. Samuel Liao - Microwave devices and circuits, PHI
2. Dennis Roddy - Microwave Technology, PHI
3. G. Kennedy - Electronic Communication systems, McGraw-Hill Book Company
4. Annapurna Das, Sisir K.Das- Microwave engineering, (TMG)
5. Siteshkumar Roy & Manojit Mitra - Microwave semiconductor devices, PHI
6. A. K. Gautam - Microwave engineering, (S. K. Kataria pub)

7. Sanjeev Gupta, Microwave Engineering, Khanna Pub.

CO(Course Outcomes)	
CO-1	Understand basic concepts and applications of microwave systems.
CO-2	Analyze different waveguide structures
CO-3	Understand S-parameters and using them to analyze passive and active microwave components.
CO-4	Analyze different microwave sources
CO-5	Understand microwave measurement
CO-6	Understand microwave communication.

CO-PO Mapping

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO-1	3	2	2	2	0	0	0	0	0	0	0	2
CO-2	3	2	2	2	0	0	0	0	0	0	0	2
CO-3	3	2	2	2	0	0	0	0	0	0	0	2
CO-4	3	2	2	2	0	0	0	0	0	0	0	2
CO-5	3	2	2	2	0	0	0	0	0	0	0	2
CO-6	3	2	2	2	0	0	0	0	0	0	0	2

GUJARAT TECHNOLOGICAL UNIVERSITY
Electronics and Communication
Satellite Communication (Dept Elec-II) (2171007)
SUBJECT CODE: 2171007
B.E. 7th SEMESTER

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	2	0	5	70	20	10	20	10	20	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
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.	02	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	05	10
3	**The Geostationary Orbit:** Introduction, Antenna Look Angles, The Polar Mount Antenna, Limits of Visibility, Near Geostationary Orbits, Earth Eclipse of Satellite, Sun Transit Outage, Launching Orbits	04	10

4	**Radio Wave Propagation:** Introduction, Atmospheric Losses, Ionospheric Effects, Rain Attenuation, Other Propagation Impairments	02	5
5	**Polarization:** Introduction, Antenna Polarization, Polarization of Satellite Signals, Cross Polarization, Discrimination, Ionospheric Depolarizaon, Rain Depolarization, Ice Depolarization	02	5
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	04	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	04	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 back off, Downlink, Output back-off, Combined Uplink and Downlink C/N Ratio	05	15
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	04	10
10	**Direct Broadcast Satellite Television and Radio:** C-Band and Ku-Band Home Satellite TV, Digital DBS TV, DBSTV System Design, DBS-TV Link Budget, Error Control in Digital DBS-TV, Master Control Station and Uplink, Installation of DBSTV Antennas, Satellite Radio Broadcasting, Digital Video Broadcast (DVB) Standards, Digital Video Broadcast – Terrestrial (DVB-T)	04	10
11	**Satellite Mobile and Specialized Services:** Introduction, Satellite Mobile Services, VSATs, Radarsat, Global Positioning Satellite System (GPS), Orbcomm, Iridium	03	05
	Total	**39**	

Reference Books:

(16) Satellite Communications, by Dennis Roddy (Fourth edition), McGraw Hill.
(17) Satellite Communication Systems Engineering, by Wilbur L. Pritchard, Henri G.

(18) Satellite Communication, by Timothy Pratt, Charles Bostian, Jeremy Allnutt (Second
Edition), John Wiley & Sons.
(19) Satellite Technology, Principles and Applications, by Anil K. Maini, Varsha Agarwal
(Second Edition), Wiley.)

Course Outcomes:

After successful completion of the course, the students will be able to:

1. Understand principle, working and operation of various sub systems of satellite as well as
the earth stations.
2. Apply various communication techniques for satellite applications
3. Analyze and design satellite communication link
4. Learn advanced techniques and regulatory aspects of satellite communication
5. Understand role of satellite in various applications

	PO1	PO2	PO3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1	3	2	2	-	-	-	1	1	1	-	-	-	2	1	-
CO-2	2	3	2	-	2	-	-	-	-	-	-	1	2	2	1
CO-3	3	3	3	1	1	-	-	-	-	-	-	-	1	1	1
CO-4	2	3	2	1	2	-	-	-	-	-	-	1	2	2	2
CO-5	2	2	1	-	-	-	-	-	-	-	-	2	1	3	3

Co- Po Justification

Mapping	Level	Justification
		Students will be able to
CO1-PO1 Co2 – PO1	3 3	Understand principle, working and operation of various sub systems of satellite as well as the earth station engineering knowledge.
CO1-PO3 CO2-PO3 CO3-PO3	2 2 3	Use the knowledge of satellite communication for design of various satellite system components.

CO4-PO3 CO5-PO3	2 1	
CO5-PO3	1	Understand different satellite applications and its designing and analysis.
CO4-PO1 CO5-PO1	2 2	Know various regulatory aspects of satellite and satellite designs.
CO4-PO1 CO5-PO2	2 2	Know advanced topics of satellite communication and its different regulatory aspects and apply its knowledge and analyze problems related to satellite communication.

Co- Pso Justification

Mapping	Level	Justification
		Students will be able to
CO1-PSO1 CO2-PSO1 CO3-PSO1 CO4-PSO1 CO5-PSO1	2 2 1 2 1	Apply knowledge of active and passive electronic devices, circuits used in Satellite Communication.
CO5-PSO2	3	Analyze and understand the designing of different satellite systems and find it solution.
CO5-PSO3	3	Simulate different satellite systems for different applications

GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: Electronics & Communication Engineering

SUBJECT NAME: Wireless Communication

SUBJECT CODE: 2171004

B.E. 7th SEMESTER

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
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	10
2	**The Cellular Concept- System Design Fundamentals:** 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.	12	20

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.	**09**	20
4	**Multiple Access Techniques:** Introduction, Comparisons of multiple Access Strategies TDMA,CDMA, FDMA, OFDM , CSMA Protocols.	**07**	15
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.	**12**	20
6	**Recent Trends:** Introduction to Wi-Fi, WiMAX, ZigBee Networks, Software Defined Radio, UWB Radio, Wireless Adhoc Network and Mobile Portability, Security issues and challenges in a Wireless network.	**09**	15
Total		**52**	

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**10**	**15**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

Text Book:
1 Wireless Communication, Theodore S. Rappaport, Prentice hall
2 Wireless Communications and Networking,Vijay Garg, Elsevier

3 Wireless digital communication, Kamilo Feher, PHI
4 Mobile Communications Engineering, William C. Y. Lee, Mc Graw Hill Publications
5 Mobile and personal Communication system and services by Rajpandya, IEEE press (PHI).
6 Wireless Communications-T.L.Singh-TMH
7 Adhoc Mobile Wireless network, C.K.Toh Pearson.

Course Outcome:

After learning the course the students should be able to:

1 Understand the basics of propagation of radio signals
2 Understand the basic concepts of basic Cellular System and the design requirements
3 Have an understanding of the basic principles behind radio resource management techniques such as power control, channel allocation and handoffs.
4 Gain insights into various mobile radio propagation models and how the diversity can be exploited to improve performance
5 Gain knowledge and awareness of the technologies for how to effectively share spectrum through multiple access techniques i.e. TDMA, CDMA, FDMA etc.
6 Have in-depth understanding of the design consideration and architecture for different Wireless Systems like GSM, CDMA, GPRS etc
7 Understanding of the emerging trends in Wireless communication like WiFi, WiMAX, Software Defined Radio (SDR) and related issues and challenges.

	PO1	PO2	PO3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1	2												1		
CO-2	1		2										1		
CO-3		2	3												2
CO-4			2										2	2	
CO-5	2			2										2	
CO-6			3	2										2	
CO-7	2											1	2		

Co- Po Justification

Mapping	Level	Justification
		Students will be able to

CO1-PO1 CO2-PO1 CO5-PO1 CO7-PO1	2 1 2 2	Propagation of radio signals,Basic Cellular systems, Access Techniques and Emerging technologies
CO3-PO2	2	Radio Resource management and different analysis related to it
CO2-PO3 CO3-PO3 CO4-PO3 CO6-PO3	2 3 2 3	Students can design and develop solutions for Cellular system problems.
CO5-PO4 CO6-PO4	2 2	Students can learn how to implement different technologies for the different solutions.
CO7-PO12	1	Students can understands how technologies are growing continuously and what are the latest trends

Co- Pso Justification

Mapping	Level	Justification
		Students will be able to
CO1-PSO1 CO2-PSO1 CO4-PSO1 CO7-PSO1	1 1 2 2	Students can have sound knowledge about Radio signal propagation and cellular systems.
CO4-PSO2 CO5-PSO2 CO6-PSO2	2 2 2	Students can analyze Radio channels and different technologies over the different conditions.
CO3-PSO3	2	Students can simulate and use software for the designing of cell sights.

GUJARAT TECHNOLOGICAL UNIVERSITY

Electronics and communication

Data Communication and Networking

SUBJECT CODE: **2171008 B.E. 7th SEMESTER**

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	2	0	5	70	20	10	30	0	20	150

Content:

No.	Content	Total Hrs	% Weightage
1	**Introduction to Data Communication and Networking:** Uses of Computer Networks, Network Hardware, Network Software Internet Reference Models (OSI and TCP/IP)	02	05
2	**Physical Layer:** Basis for Data Communication, Guided Transmission Media , Wireless Transmission Medium, Circuit Switching and Telephone Network, High Speed Digital Access	02	05
3	**Data Link Layer:** Data Link Layer Design Issues, Error Detection and Correction, Data Link Control and Protocols, Example Data Link Protocol	04	15
4	**Medium Access Layer:** Channel Allocation Problem, Multiple Access, CSMA, CSMA/CD, CSMA/CA	05	15
5	**Local Area Network:** Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LAN, Blue tooth, Connecting devices:- Repeaters, Hub, Bridges, Switch, Router, Gateways, Virtual LAN, Example Networks: X.25, Frame Relay, ATM, ISDN	04	10
6	**Network Layer:** Network Layer Design Issues, Routing Algorithms (Optimality principle, Static Routing Algorithms, Shortest Path, Flooding, Dynamic routing Algorithms, Distance Vector, Link State routing.), Congestion control Algorithms (Principles, Policies, Algorithms),Quality of Service (Requirements, Techniques, Integrated Services & Differentiated Services), Network Layer Protocols (IP Addressing , CIDR & NAT, IP layer protocols (ICMP, ARP, RARP, DHCP, BOOTP), IPv6)	10	15
7	**Transport layer:** Transport Layer Service, Elements of Transport protocols, Internet protocols (UDP and TCP)	4	10
8	**Application Layer:** DNS- Domain Name System, Electronic Mail, World Wide Web, Multimedia (Audio Compression, Streaming Audio, Voice over IP, Video Compression, Video on Demand)	4	15
9	**Network Security:** Cryptography, Symmetric key Algorithms (DES, AES), Public key Algorithms-RSA, Digital Signatures,	4	10

	IPSec ,Firewall		

Reference Books:

1. Computer Networks by Andrew S. Tanenbaum (Fifth Edition), Pearson Education
2. Data Communication and Networking by Behrouz A. Forouzan (Fourth Edition), Tata McGraw Hill

Course outcomes:

CO 2171008.1: To understand the terminology and concepts of the OSI reference model and the TCP-IP reference model
CO 2171008.2: To analyze the functions of each layer and gain knowledge in different applications that use computer networks.
CO 2171008.3: To inspect the networking programs of protocols and IP addressing in the C/C++ (or other programming language)
CO 2171008.4: To examine the network interfaces and components , design / performance issues in local area networks and wide area networks
CO 2171008.5: To implement and understand the behaviors of various networking protocols on networking tools.

CO-PO mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 2171008.1	2	1	-	-	-	-	-	-	-	-	-	-	2	-	-
CO 2171008.2	1	2	1	-	-	-	-	-	-	-	-	1	-	-	-
CO 2171008.3	-	2	1	-	-	-	-	-	-	-	-	2	-	-	3
CO 2171008.4	-	2	1	-	-	-	-	-	-	-	-	2	-	-	-
CO 2171008.5	2	1	1	-	-	-	-	-	-	-	-	2	-	-	-

Mapping & Justification:

Mapping	Level	Justification
CO 2171008.1-PO1 CO2171008.2-PO1 CO 2171008.5 PO1	2 1 2	Students will completely understand Basics of computer networking and its application will be understood by the students using high level language program and tools
CO2171008.1-PO2 CO2171008.2- PO2 CO2171008.3-PO2 CO2171008.4-PO2 CO2171008.5- PO2	1 2 2 2 1	Working of various protocols of networking will be understood by the students.
CO2171008.2- PO3 CO2171008.3-PO3 CO2171008.4-PO3 CO2171008.5- PO3	1	For the implementation of laboratory practicals, students will be trained in their own implementation.

CO2171008.2- PO12 CO2171008.3-PO12 CO2171008.4-PO12 CO2171008.5- PO12	1 2 2 2	Students use various networking tools and programming software for performing of their laboratory experiements.

Co- Pso Justification

Mapping	Level	Justification
		Students will be able to
CO 2171008.1-PSO1	2	Understanding of the protocols and programs will be useful in development of new system.
CO 2171008.3-PSO2	3	New software tools will be learnt by the students

GUJARAT TECHNOLOGICAL UNIVERSITY
Electronics & Communication Engineering
Embedded Systems
SUBJECT CODE: 2171005
B.E. 7th SEMESTER

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
				ESE	PA (M)		PA (V)		PA	
L	T	P	C	(E)	PA	ALA	ESE	OEP	(I)	
3	0	2	5	70	20	10	30	0	20	150

Content:

Sr No.	Course content	No. of Hrs.
1	Introduction to Embedded Systems Embedded Systems, Processor Embedded into a System, Embedded Hardware Units and Devices In a System, Embedded Software in a system, Examples of Embedded Systems, Embedded System-on-chip (SOC) and Use of VLSI Circuit Design Technology, Complex Systems Design and Processors, Design Process in Embedded System, Formulization of System Design, Design Process and Design Examples, Classification of Embedded Systems, Skills Required for an Embedded System Designer	3
2	Device and Communication Bus for Devices Network IO Types and examples, Serial communication devices, Parallel Device ports, Sophisticated Interfacing Feature in Devices Ports, Wireless Devices, Timer and Counting Devices, Watch dog timer, Real time clock, Network Embedded Systems, Serial Bus Communication Protocols, parallel Bus Devices protocol-Parallel communication Network using ISA, PCI, PCI-X and advanced buses, Internet Enabled Systems- Network protocols, Wireless and mobile system protocol.	6
3	Device Drivers and Interrupt Services Mechanism Programmed-I/O Busy-wait Approach without Interrupt Services Mechanism, ISR Concept, Interrupt Sources, Interrupt Servicing(Handling) Mechanism, Multiple Interrupts, Context and the Periods for Context Switching, Interrupt Latency and Deadline, Classification of Processor Interrupt Service Mechanism from Context-Saving Angle, Direct Memory Access, Device Driver Programming	5
4	Interprocess Communication and Synchronization of processes, Threads and Tasks: Multiple process in an application, Multiple Threads in an application,Task and	8

	Task state, Task and Data, Clear-cut Distinction between Functions, ISRS and Tasks by their Characteristics, Concept of Semaphores, Shared Data, Inter process Communication, Signal Function, Semaphore Functions, Message Queue Functions, Mailbox Functions, Pipe Functions, Socket Functions, RPC Functions	
5	Real Time Operating System: Operating system service, Process management, Timer function, Event function, Memory management, Device , File and I/O subsystem management, Interrupt routine in RTOS environment and handling of interrupt Sources calls, Real Time Operating Systems, Basic Design Using an RTOS, RTOS Task Scheduling Models, Interrupt Latency and Response of the Tasks as Performance Metrics, OS Security Issues	11
6	Case Study: Case Study : Motivation for MSP 430 Microcontrollers: MSP430 RISC CPU architecture, Compiler-friendly features, Instruction set, Clock system, Memory subsystem. Understanding of different MSP430 families. Introduction to Code Composer Studio (CCS) and use CCS for Embedded C. Digital I/O – I/O ports programming using C, Understanding the muxing scheme of the MSP430 pins, interrupt programming On-chip peripherals - Watchdog Timer, Basic Timer, Real Time Clock (RTC), ADC, Universal Serial Communication Interface (USCI). Interfacing LED, LCD, Seven segment LED modules interfacing. Example – Real-time clock, Low-power features of MSP430.	9

Reference Books:

1. Embedded System: Architecture, Programming and Design by Rajkamal,2nd edition,2010, Tata McGraw Hill
2. MSP430 Microcontroller Basics by John H. Davies Elsevier; First edition (2010)
3. Computer as Components: Principles of Embedded Computing System Design, Wayne Wolf,2nd edition,2008, Morgan Kaufmann Publication

Course Outcomes:

1. Understand the concepts of Embedded Systems
2. Understand interfacing of IO devices and other peripherals.
3. Device driver programming & interrupt service mechanisms
4. Understand Inter-process Communication and Synchronization of processes, Threads and Tasks
5. Learn OS functions and Real Time Operating System
6. Able to use MSP430 along with analog and digital peripherals.

	PO1	PO2	PO3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1		2	2		2							2	3		
CO-2		1	1		2									3	2
CO-3			3											2	3
CO-4	3													3	2
CO-5		2	3											3	3
CO-6		2	2											2	2

Co- Po Justification

Mapping	Level	Justification
		Students will be able to
CO4-PO1	3	apply the knowledge of engineering fundamentals and synchronization of process to the solution of complex engineering problems.
CO1-PO2 CO2-PO2 CO5-PO2 CO6-PO2	2 1 2 2	Find out the limitation of existing technology and can develop the advance protocols to overcome it.
CO1-PO3 CO2-PO3 CO3-PO3 CO5-PO3 CO6-PO3	2 1 3 3 2	use the knowledge of peripheral devices and programming to design the system.
CO1-PO5 CO2-PO5	2 2	Work on modern open source software and operating systems.
CO4-PO12	2	Understand the evaluation in the field of embedded systems.

Co- Pso Justification

Mapping	Level	Justification
		Students will be able to
CO1-PSO1	3	Know the practical application of electronic component and systems.

CO2-PSO2 CO3-PSO2 CO4-PSO2 CO5-PSO2 CO6-PSO2	3 2 3 3 2	Understand the real life problem and design the solution for the same.
CO2-PSO3 CO3-PSO3 CO4-PSO3 CO5-PSO3 CO6-PSO3	2 3 2 3 2	Use the simulator and hardware for the application development.

GUJARAT TECHNOLOGICAL UNIVERSITY
Electronics & Communication Engineering
Fundamental of Image Processing
SUBJECT CODE: 2181102
B.E. 8th SEMESTER

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
				ESE	PA (M)		PA (V)		PA	
L	T	P	C	(E)	PA	ALA	ESE	OEP	(I)	
4	0	2	6	70	20	10	30	0	20	150

Content:

Sr. No	Topic	No of Lecture
1	Introduction To 8-bit Microprocessor : History of Microprocessor, 8085 Microprocessor architecture, buses, register, flags. 8085 pin configuration & function of each pin. Fetch, Decode and execute operations. Op-code Fetch, execute cycle, T state, Machine cycle. Memory and I/O read and write cycles WAIT state, interrupt timing diagram.	7
2	Intel 8085 Microprocessor Instruction Set and Programming: Addressing modes of 8085. Data transfer, Arithmetic, Logical, Rotate, Branch and machine control instructions. Development of 8085 assembly language programs, time delays. Concept of stack and Instruction related to stack. 8085 interrupts, RST, RIM, SIM instructions. Subroutines and conditional call instruction	15
3	Interfacing of Memory Chips & Input / Output Chips : Memory mapped I/o and I/O mapped I/O. Address decoding, interfacing of memory chips with 8085. Interfacing of input/output chips with 8085	5
4	Peripherals IC and Applications : Block diagram, Pin description and Interfacing of 8255(PPI) with 8085 Microprocessor. Interfacing of keyboard, display, ADC and DAC to 8255. Block diagram, Pin description and Interfacing of 8253(PIT) with 8085 Microprocessor. Brief description and application of 8259 PIC, 8251 USART and 8237 DMA Controller	10
5	Introduction advance Microprocessor : Intel 8086 Microprocessor architecture, Addressing Modes, 8086 pin configuration & function of each pin. Introduction and advance features of 8088, 80186, 80286, 80386 and 80486microprocessor	8

Reference Books:

4. Microprocessor 8085 and its Interfacing, By Sunil Mathur, Second Edition, PHI Learning Pvt. Ltd.
5. Microprocessor Architecture, Programming, and Applications with the 8085 – Ramesh S. Gaonkar
6. 8085 Microprocessor And its Applications, By A. Nagoor Kani, Third Edition,TMH Education Pvt. Ltd.

Course Outcomes:

1. Understand different types of Imaging system, Grey scale and color image processing
2. Apply different types of image enhancement techniques in spatial domain
3. Represent image in frequency domain and apply frequency domain filtering
4. Apply image restoration technique to improve image quality
5. To study and apply image compression techniques
6. To study and apply image segmentation & different morphological technique

	PO1	PO2	PO3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1	1		1												1
CO-2		2	1												2
CO-3		2	1												1
CO-4		2	1												1
CO-5	1		1												1
CO-6	1	1	1												1

Co- Po Justification

Mapping	Level	Justification
		Students will be able to
CO1-PO1 CO5-PO1 CO6-PO1	1 1 1	Understand the different operation for image enhancement
CO2-PO2 CO3-PO2 CO4-PO2	2 1 2	Understand the use of spatial and frequency domain for particular operation and their techniques.

CO6-PO2	2	
CO1-PO3 CO2-PO3 CO3-PO3 CO4-PO3 CO5-PO3 CO6-PO3	2 2 3 1 2	use the knowledge of image processing for real time application.

Co- Pso Justification

Mapping	Level	Justification
		Students will be able to
CO1-PSO3 CO2-PSO3 CO3-PSO3 CO4-PSO3 CO5-PSO3 CO6-PSO3	1 2 1 1 1 1	Use the simulator and hardware for the image processing application development.

GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS & COMMUNICATION ENGINEERING (11)

RADAR & NAVIGATIONAL AIDS

SUBJECT CODE: 2181103

B.E. 8th SEMESTER

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Contents:

Sr No	Content	Total Hrs	% Weightage
1	**Introduction** The s i m p l e f o r m of R a d a r Equation, Radar Block diagram and Operation, Types of transmitters, duplexer and displays. Radar Frequencies, millimeter and submilimeter waves, Applications of Radar.	4	07
2	**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.	7	14
3	**CW and FM CW Radar** Doppler effect. CW radar. FM CW radar. Airborne Doppler Navigation, Multiple CW radar	3	06
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, Airborne radar.	5	11
5.	**Tracking and Imaging Radar** Tracking with Radar ,Monopulse tracking,Conical scan and Sequential lobing, Low angle tracking ,Air surveillance radar, Introduction to Synthetic aperture radar(SAR).tracking in range and Doppler, Acquisition.	4	7

6.	**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**	**7**
7.	**Navigation:** Introduction, Four Methods of Navigation.	**2**	**04**
8.	**Radio Direction Findings:** Loop Antenna, Loop input circuits, aural null direction finder, Goniometer, Errors in Direction Finding, Adcock Direction Finder, Its advantages over loop antenna, .	**4**	**07**
9.	**Radio Ranges:** LF/MF Four course Radio Range, VHF Omni Directional Range, and VOR receiving Equipment	**3**	**06**
10.	**Hyperbolic Systems of Navigation**: LORAN, DECCA navigation systems	**4**	**07**
11.	**Aids to approach and Landing:** Instrument Landing System, Ground controlled Approach System, Microwave landing system , Distance Measuring Equipment, TACAN Doppler navigation-Doppler Effect, New configuration, Doppler frequency equations, Track stabilization, Doppler	**5**	**10**
12.	**Recent trends in Satellite Navigation :** GPS principle of operation, Position location determination, principle of GPS receiver and applications, **Brief note on :**Global Satellite Navigation system, Martitime Satellite ,Satellite Constellations ,Navigation Satellites of different countries such as Glonas and Compass, GAGAN,IRNSS, NAVIC Receiver and applications	**7**	**14**

Reference Books:

1. Introduction to Radar System M.I. Skolnik ,McGraw Hill
2. Elements of Electronic Navigation Systems", Tata McGraw-Hill,
3. Radar Systems and Radio Aids to Navigation, Sen & Bhattacharya, Khanna publishers
4. Radar Principles", Peyton Z. Peebles ,JohnWiley, 2004
5. J.C Toomay, " Principles of Radar", 2nd Edition –PHI,2004
6. Radar Systems Analysis and Design Using MATLAB, Bassem R. Mahafza, Ph.D. CHAPMAN & HALL/CRC
7. Radar Engg. Hand Book M.I. Skolnik, Publisher: McGraw Hill
8. Roger J Suullivan, “Radar Foundations for Imaging and Advanced Topics”.
9. Global Navigation Satellite Systems Insights into GPS, GLONASS, Galileo, Compass, and others B. Bhatta BSP Books
10. Global Navigation Satellite Systems Rao,TMH
11. Global Navigation Satellite Systems R, Acharya ,Academic Press
12. Radar and ARPA Manual Alan Bole, Bill Dineley, Alan Wall, Elsevier

Course outcomes:

C2181103.1	Understand the fundamental concepts of RADAR
C2181103.2	Understand various types of navigational system
C2181103.3	Understand different types of RADAR used in various application.
C2181103.4	Understand and calculate range using radar range equation
C2181103.5	Understand various instrument landing system
C2181103.6	Understand antenna systems for radar and navigation

CO-PO mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO **2181103**.1	2	1	--	--	--	--	--	--	--	--	--	2	--	--	1
CO **2181103**.2	2	1	--	--	--	--	--	--	--	--	--	2	--	2	--
CO **2181103**.3	1	--	--	--	--	--	--	--	--	--	--	1	--	2	--
CO **2181103**.4	2	1	--	--	--	--	--	--	--	--	--	--	--	1	--
CO **2181103**.5	1	1	--	--	--	--	--	--	--	--	--	--	--	1	--
CO **2181103**.6	2	1	--	--	--	--	--	--	--	--	--	--	--	1	--

Mapping & Justification:

Mapping	Level	Justification
CO **2181103**.1-PO1 CO**2181103**.2-PO1 CO **2181103**.3 PO1 CO **2181103**.4 PO1 CO **2181103**.5 PO1 CO **2181103**.6 PO1	2 2 1 2 1 2	Understand the concept of Radar and Navigation System
CO **2181103**.1-PO2 CO**2181103**.2-PO2 CO **2181103**.4 PO2 CO **2181103**.5 PO2 CO **2181103**.6 PO2	1 1 1 1 1	Students should develop skills to solve problems in Radar and Navigational engineering using mathematical equation and scientific knowledge.
CO **2181103**.1-PO12 CO**2181103**.2-PO12 CO **2181103**.3 PO12	2 2 1	Lifelong learning for designing radar and navigational system

Co- PSO Justification

Mapping	Level	Justification
CO**2181103**.2-PSO2 CO **2181103**.3 PSO2 CO **2181103**.4 PSO2 CO **2181103**.5 PSO2 CO **2181103**.6 PSO2	2 2 1 1 1	Analysis of radar system by conducting suitable experiments
CO **2181103**.1-PSO3	1	Implement social relevant projects using basic concepts of radar