GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 1

Communication Engineering

Subject Name Statistical Signal Analysis

Sr.No	Course content
1	Review of probability, Sample space, Algebra and random variable, Distribution and densities, Characteristics functions and moment generating functions, Transformation (function) of random variables; Conditional expectation; Sequences of random variables: convergence of sequences of random variables.
2	Statistical Independence, Uncorrelation of Random Variables, Joint and Marginal Densities Function of random variables, Stochastic processes: wide sense stationary processes, orthogonal increment processes, Wiener process, Ergodicity.
3	Mean square continuity, Stochastic Calculus: mean square derivative and mean square integral of stochastic processes.
4	Stochastic systems: response of linear dynamic systems to stochastic inputs correlation function; power spectral density function; introduction to linear least square estimation.
5	Least square and mean square error.

Reference Books:

1. Alberto leon Gracia, Probability and Random Processes for Electrical Engineer, 2nd Ed PE India
2. A.Papoulis, Probability Random Variables and stochastic Processes, 2nd Ed Mc Graw Hill
3. A. Larson and B.O. Schubert, Stochastic Processes, Vol.I and II, Holden-Day
4. W.Gardener, Stochastic Processes, McGraw Hill.
5. S. Haykin, Adaptive filter theory, prentice Hall.
6. B.P.Lathi, Modern Analogue and Digital communication, Oxford uni. Press.

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 1

Communication Engineering

Subject Name Information Theory and Coding

Sr.No	Course content
1	Basic concept of coding, Unique decodable codes and instantaneous decodable codes (IDC) Construction of IDC, Krafts inequality and MC Millan's theorem. Huffman and Shannon-fano code.
2	Entropy, Entropy of sources and their extension. Loss less image compression.
3	Arithmetic Coding
4	Basic of channel coding and Hamming distances, channel capacity and shannon's fundamental theorem
5	Linear block codes ; Systematic linear codes and optimum decoding for the binary symmetric channel; Generator and parity Check Matrices Syndrome decoding on symmetric channels; Hamming codes, cyclic code, Burst errors, BCH Code, Reed-solomon Codes.
6	Convolution codes; Wozencraft's sequential decoding algorithm, Fann's algorithm and other sequential decoding algorithms Viterbi decoding algorithm, BCH code.
7	Cryptography

Reference Books:

1. Jiri Adamek, Foundation of coding, John Wiley and sons.
2. A.J. Viterbi and J.K.Ormura, Principal of Digital Communication and Coding, McGraw Hill
3. Bernard Sklar, Digital communication fundamental and Application, PE India.
4. N. Abramson, Information and Coding, McGraw Hill
5. M Mansurpur, Introduction to Information Theory, McGraw Hill
6. R.B.Ash, Information Theory, Prentice Hall
7. Shu Lin and S.J.Costello Jr., Error Control Coding, Prentice Hall

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 1

Communication Engineering

Subject Name ASIC Design

Sr.No	Course content
1	ASIC Design flow, Design Methodotogies, Introduction to Hardware Description Language (VHDL): Stuctural, Behavioral, Data flow modeling, Concurrent and sequential VHDL, RAM and ROM, Test Benches, Finite State Machines, RTL Synthesis Test Methodology
2	Programmable Logic Design, Basics of Programmable logic devices, CPLD Architecture and its building blocks, FPGA Architectures and its building blocks, Technology mapping for FPGAs
3	Design implementation using CPLD and FPGA, Floor planning and Placement

Reference Books:

1. D.Perry, BHDL,2nd Ed., McGraw Hill International.
2. J. Bhasker, BHDL, Primer, Pearson Education Asia, Low Price Edition
3. Charles H Roth, Jr., Digital Systems Design Using VHDL, Brooks/Cole Thompson Learning
4. Z. Navabi, VHDL: Analysis and Modeling of Digital Systems, McGraw Hill International Editions
5. Michael John Sebastian Smith, Application Specific Integrated Circuits, Pearson Education Asia.
6. Xilinx and Altera Application Notes on the architecture of FPGAs and CPLDs.

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 2

Communication (Specialization)

Subject Name Telecom Switching System, Networks and Network Management.

Sr.No	Course content
1	Introduction to communication networks and services, Basics of telephony-Store Program control, centralized and distributed control.
2	Space Division switching Basic time division switching, Time multiplexed switches, Combination Switching, Fundamental of traffic engineering,; Lee and Jacobeus blocking analysis.
3	ISO-OSI reference model, TCP-IP protocol suit, ATM networks, LANs and MAC protocols, Packet Switching Networks.
4	Introduction to network management, SNMPv1, SNMPv2, SNMPv3.
5	Network monitoring tools and systems, Network monitoring applications.
6	Remote Monitoring (RMON), ATM network management, web-based management.

Reference Books:

1. T Viswanathan , Telecommunication switching systems and networks. PHI
2. Johan C. Bellamy ,Digital Telephony , 3rd edition, John Wiley and Sons
3. Mani Subramanian, Network Management: Principal and Practice Addison-wesley.
4. Stalling, W. SNMP, SNMPv2, SNMPv3, and RMON 1 and 2 Reading MA: Addison-Wesley.

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 2

Communication Engineering

Subject Name Advanced Digital Communication

Sr.No	Course content
1	Review of probability and Stochastic Processes.
2	Characterization of Communication Signal and System. Geometric Representation of Signals and its use in communication.
3	Optimum receiver for Additive White Gaussian Noise, BER calculation.
4	Carrier and symbol synchronization, signal design for Band Limited Channels.
5	Communication through Band limited Channel, concept of parallel transmission, Multi channel and multi carrier CDMA system, fading multi-path channel, OFDM, Future trends.

Reference Books:

1. Proakis J.J.,D Wozencraft J.M. and Jacobs I.M., Principles of Communication Engineering, John Wiley.
2. Carison A., Communication System, 3rd ., McGraw Hill.
3. Van Trees H.L., Detection Estimation and Modulation Theory, Vol. 1., Wiley.
4. Blahut R.F., Digital transmission of Information, Addison Wesley.
5. Benedetto S., Biglieri E. and Castellari V., Digital Transmission Theory, Prentice Hall.

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **Fiber Optic Communication**

Sr.No	Course content
1	Introduction, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model. Different types of optical fibers, Modal Analysis of a step index fiber.
2	Optical channel Modeling – Signal degradation on optical fiber due to dispersion and attenuation. Fabrication of fibers measurement techniques like OTDR
3	Optical sources – LEDs and Lasers, Photo-detectors – Pin-detectors, detector responsively noise, Optical link design – BER calculation, quantum limit, power panelities.
4	Optical switches – coupled mode analysis of directional couplers, electro-optic switches.
5	Nonlinear effect in fiber optic links. Concept of self-phase modulation, group velocity dispersion and soliton based communication. Optical amplifiers – EDFA, Raman amplifier and WDM systems.

Reference Books:

1. J. Keiser, Fiber Optic Communication, McGraw-Hill
2. J. Gower, Optical Communication systems, Prentice Hall, India.
3. G. Agrawal, Nonlinear fiber optics, Academic Press.
4. G. Agrawal, Fiber optic Communication systems, John Wiley and sons.
5. J. Senior, Optical Fiber Communication.

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **Image Processing**

Sr.No	Course content
1	Introduction – Image as a 2D data, Image representation – Gray scale and Color images, image sampling and quantization.
2	Frequency domain processing – Two dimensional orthogonal transforms: DFT, FFT, WHT. Haar transform, KLT, DCT.
3	Image enhancement – filters in spatial and frequency domains, histogram-based processing, Homomorphic filtering.
4	Edge detection – non parametric and model based approaches, LOG filers, localization problem
5	Image restoration – PSF, circulant and block circulant matrices, deconvolution, restoration using inverse filtering. Wiener filtering and maximum entropy- based methods.
6	Mathematical morphology – binary morphology, dilation, erosion, opening and closing duality relations, gray scale morphology, application such as hit-and-miss transform thinning and shape decomposition.
7	Image communication – JPED, JPEG 2000, MPEGs and H.26x standards packet video, error concealment.
8	Image texture analysis co-occurrence matrix, measures of textures, statistical models for textures, principal component analysis.
9	Misc. topic such as – Hough Transform, boundary detection, chain coding, and segmentation, thresholding methods.

Reference Books:

1. R. Gonzalez and E. Woods, Digital Image Processing, PHI
2. A. K. Jain, Fundamentals of digital image processing, Prentice Hall of India.
3. W. K. Pratt, Digital image processing, Prentice Hall
4. Rosenfold and A. C. Kak, Digital imag processing, Vol 1 & 2, Prentice Hall.

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **Speech Processing**

Sr.No	Course content
1	Introduction – Speech production and acoustic phonetics, speech perception.
2	Speech analysis: time and frequency domain techniques for pitch and formant estimation, cepstral and LPC analysis.
3	Speech Enhancement: Microform Codes, Source coders, and Hybrid coders.
4	Speech Enhancement; Microphone Array processing, Noice Suppression, and Echo Canceller.
5	Speech Recognition: Basic pattern recognition, preprocessing, Parametic representation, Evaluating the similarity of speech patter, Accommodating both spectral and temporal variability, Network for speech recognition, Language model, Artificial neural networks. Summary of current speech recognition design.
6	Speech synthesis: articulatory, formant, and LPC synthesis, voice response and text-to-speech systems.
7	Applications: data compression, vocoders, speech enhancement, speech recognition speaker recognition, aids for the speech and hearing impairments.

Reference Books:

1. D O'shaughnessy, Speech Communication: Human and Machine, Addison Wesley.
2. L R Rabiner and R W Schaferm, Digital Processing of Speech Signals, Prentice Hall
3. J Flanagan, Speech Analysis, Synthesis, and Perception, Springer Verlag.
4. W. Rappaport, Wireless Communication.

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **Biomedical Signal Processing**

Sr.No	Course content
1	Introduction to Human physiological system, Types of Biomedical signals: ECG, EEG, EMG, EOG, ERG etc.
2	Introduction to short term Fourier transform (STFT), Design of filters using Hanning window, Hamming window, Kaiser window, Haar window
3	Introduction to Electrocardiograph and ECG signals, Types of interferences in ECG signals, ECG signal analysis and noise removal, Detection of ECG abnormalities, ANN-based ECG analysis system
4	Introduction to Electroencephalograph and EEG signals, EEG signal analysis, Kurtosis coefficients, Independent component analysis (ICA), Principle component analysis (PCA)
5	Autoregressive (AR) Model, Fast Fourier Transform (FFT) and Inverse Fast Fourier Transform (IFFT), Data Compression methods: Arithmetic coding, Huffman coding, LZW coding, Bit-plane coding
6	Introduction to Medical image compression: Discrete cosine transform (DCT), Walsh-Hadamard Transform (WHT), Wavelet transform (WT), JPEG, JPEG 2000, SPIHT coding

Reference Books:

1. Willis Tompkins, Biomedical Signal Processing, PHI
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall
3. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principle, Algorithms and Applications, Prentice Hall

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **Computer Vision**

Sr.No	Course content
1	Imaging model and geometry: scene radiance and image irradiance, reflectance model of a surface, Lambertian and specular reflectance, photometric stereo.
2	III-posedness of vision problems: regularization theory.
3	Shape from shading, structured light and texture. Optical flow, structure from motion and recursive motion analysis. Stereo vision and correspondence problem.
4	Depth analysis using real-aperture camera; depth from defocused images.
5	MRF approach to early vision problems: (shape from shading, matching, stereo and motion) image texture analysis.
6	Introduction to image understanding. Integrated vision, sensor fusion.

Reference Books:

1. B. K. P. Horn, Robot Vision, MIT Press.
2. D. Marr, Vision, Freeman and Co., San Francisco
3. S. Chaudhuri and A. N. Rajagopalan, Depth from Defocused images, Springer Verlag, NY 1999. Selected Papers.

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **Embedded System Design**

Sr.No	Course content
1	Embedded Micro controller Cores, Embedded Memories, SRAM, DRAM Controllers.
2	Embedded System Design Aspects:
3	Interfacing between analog and digital sections, signal conditioning, Interfacing with external systems, User interfacing.
4	Software aspects of Embedded Systems:
5	Real time programming languages & operating systems for Embedded Systems, Embedded programming in C/C++, Scheduler, Multitasking, Threading concepts and implementation,
6	Serial Communication Interface: UART, SCI applications, Modern Serial Interface Standards, Modems, SPI, I2C, USB, Introduction to JTAG Port
7	Case study of Embedded Applications .

Reference Books:

1. J. W. Valvo, Embedded Micro computer system, Brooks/Cole.
2. K. J. Ayala, The 8051 Microcontroller, Pernam Intl.
3. Jack Ganssle. The art of designing Embedded Systems.
4. sDaniel W. Lewis, Fundamentals of Embedded Software

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **Introduction to Artificial Intelligence**

Sr.No	Course content
1	Introduction, problem characteristics, issues in design of search algorithms.
2	Searching: Uninformed search techniques, alterative deepening. Heuristics search techniques, Constraint Satisfaction; Means Ends Analysis; Alternative search techniques, Evolutionary search techniques-working of Genetic Algorithm and simulated annealing
3	Game-playing: Single player game, Two player game, The Minmax procedure, Minmax Procedure with alpha-beta cutoffs, Quiescent search, search efficiency
4	Knowledge representation: The propositional Calculus – resolution in propositional calculus, entailment, PSAT problem, The Predicate calculus – resolution in predicate calculus, quantification, unification, horn clauses.
5	Expert System: introduction, knowledge representation in ES, reasoning with uncertain information, Bayes network, D-separation, probabilistic interfacing, inexact reasoning, representing common sense knowledge, non-monotonic and monotonic reasoning, forward and backward chaining.
6	Introduction to ANN, feed forward and feedback networks, perceptions linearly separable and non-separable problems, supervised and unsupervised learning, back propagation algorithm, introduction to fuzzy logic and fuzzy sets, membership function, defuzzification methods, fuzzy arithmetic.

Reference Books:

1. Nils J Nilson, Artificial intelligence: A new synthesis, Morgan Kaufmann Publishers.
2. E Rich and K Knight, Artificial intelligence, Tata MacGraw Hill Publishing
3. Giarratano and Tiley, Expert Systems – Principal and programming, Thomson Publishing.

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **RF AND MICROWAVE ENGINEERING**

Sr.No	Course content
1	INTRODUCTION
2	Conceptual understanding of wave propagation in the guided media such as transmission lines, rectangular and circular waveguides; Various characteristics and parameters such as wave velocity, dispersion, mismatch effects; voltage - current - field distributions.
3	Poynting Power / Vectors Theorem and Uniqueness Theorems, Maxwell time varying equations, Smith chart applications to RF and Microwave Engineering,
4	RF and MICROWAVE ANALYSIS
5	Impedance and Admittance Matrix, Hybrid matrix, Scattering matrix, ABCD Matrix, Discontinuities and Modal analysis, Signal flow graph representation, Various excitation and coupling methods to the waveguides.
6	MICROWAVE COMPONENTS
7	Understanding the in-depth principle, working, analysis and design of ferromagnetic:
8	Passive components such as microwave resonators, power dividers and couplers, filters and impedance transformers – Chebyshev, Binomial and Tapered.
9	Ferromagnetic components such as isolators, phase shifters, circulators.
10	MICROWAVE DEVICES AND CIRCUITS
11	Conceptual understanding the principle, working and applications of microwave circuits and active devices such as: Mixers, Detectors, Microwave Integrated Circuits, Monolithic Microwave Integrated Circuits, Microwave Amplifiers, Oscillators and Synthesizers.

Reference Books:

1. Pozar D M, Microwave Engineering, Wiley
2. Mishra Ravindra, RF and Microwave Communication, Wiley
3. Gupta K C, Microwaves, New Age International Publn
4. Collin R E, Foundations for Microwave Engineering, McGrawHill International
5. M. Golio & J. Golio, RF and microwave Technologies:Vol I,II,III,CRC Press

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **Digital VLSI Design**

Sr.No	Course content
1	Introduction to VLSI design, MOS Physics, Structure and operation of MOSFETs, MOSFET Modelling, MOSFET Scaling, MOSFET Capacitances.
2	Basics of Different fabrication Processes of MOS Integrated circuits, Processing Steps, Design Rules, Integrated Circuits Layout.
3	Design and Analysis of different MOS Inverters, Design and Analysis of MOS combinational logic circuits, CMOS logic structures: Static and Dynamic Logic, Design and Analysis of Sequential Circuits.

Reference Books:

1. Sung-Mo-Kanf and Yusuf Leblebici, CMOS Digital Integrated Circuits, Tata McGraw Hill
2. N.Weste and K. Eshranghian, Principles of CMOS VLSI Design, Addison Wesley.
3. L.Glaser and D. Dobberpuhl, The Design and Analysis of VLSI Circuits, Addison Wesley.
4. C. Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley.
5. J.P. Uyemura, Circuit Design for CMS BLSI, Kluwer
6. R.A.Geiger, P.E.Allen, N.R.Strader, VLSI Design Techniques for Anlog and Digital Circuits, McGraw Hill

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **RF Microelectronics**

Sr.No	Course content
1	Introduction to RF and Wireless Technology: Complexity, design and app Choice of Technology. Basic concepts in RF Design: Nonlinearly and Time inter symbol interference, random processes and Noise.
2	BJT and MOSFET behavior at RF frequencies Modeling of the transistors ar models.
3	Noise performance and limitation of devices, Integrated Parasitic element frequencies and their monolithic implementation.
4	Basic blocks in RF systems and their VLSI implementation : Low noise design in various technologies, Design of Mixers at GHz frequency range Mixers: their working and implementation, Oscillators : Basic topologies definition of phase noise.
5	Noise-Power trade-off. Resonator less VCO design, Quadrature and single sideband generators, Radio Frequency Synthesizes: PLLS, Various RF sy architectures and frequency dividers, Power Amplifiers design, Libe techniques, Design issues in integrated RF filters.

Reference Books:

1. B.Razavi, RF Microelectronics, Prentice-Hall PTR.
2. T.H.Lee, The Design of CMOS Radio Frequency Integrated Circuits, Cambridge University Press
3. R.Jacob Baker,H.W.Li and D.E.Boyce, CMOS Circuit Design, Lay out and Simulation,Prentice-Hall of India
4. Y.P.Tsividis, Mixed Analog and Digital VLSI Devices and Technology, McGraw Hill
5. B.Razavi, Design of Analog CMOS Integrated Circuits, Tata Mc-Graw Hill.

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **Optimization Techniques**

Sr.No	Course content
1	Motivation. Mathematical review, matrix factorization, sets and sequences, convex sets and functions.
2	Linear programming and simplex methods, Weierstrass' Theorem, Karush Kuhn Tucker optimality conditions, algorithms, convergence.
3	Unconstrained optimization, Line search methods, method of multidimensional search, method of multi dimensional search, steepest descent methods, Newton's method, trust region methods, conjugate gradient methods, quasi-Newton's methods.
4	Constrained optimization, penalty and barrier function methods, augmented Lagrangian methods, Polynomial time algorithm for linear programming.
5	Successive linear programming, successive quadratic programming.

Reference Books:

1. M.S.Bazaraa, H.D.Sherali and C. Shetty, Nonlinear Programming theory and Algorithms, John Wiley and Sons, New York.

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **Applied Linear Algebra in Engineering**

Sr.No	Course content
1	Introduction to Vector spaces, Subspace, linear independence, basis: Representation of linear transformations with respect to basis.
2	Inner product spaces, Subspace, linear functions; Riesz representation theorem and ad joints. Riesz representation theorem.
3	Projections, products of projections, orthogonal projections, direct sums; Unitary and orthogonal transformations, Complete orthogonal sets and Parseval's identity; Closed subspaces and the projection theorem for Hilbert spaces.
4	The Algebra of polynomials, matrix polynomials, annihilating polynomials and invariant subspaces, Jordal forms.
5	Applications: Complementary orthogonal spaces in networks, properties of graphs and their relation to vector space properties of their matrix representation ; Solution of state equations in linear system theory; Relation between the rational and Jordan forms.
6	Numerical linear algebra: Direct and iterative methods of solutions of linear equations: Matrices, norms, complete metric spaces and comlete normal linear spaces (Banach spaces); Least squares problems (constrained and unconstrained);Eigenvalue problem.

Reference Books:

1. B.V.Limaye, Functional Analysis, New Age International Publications, New Delhi.
2. V Krishnamurti, Introduction to linear algebra
3. Matrix Analysis R-Bhatiya Springer Verlag
4. K.Hoffman and R. Kunze, Linear Algebra, Prentice-Hall (India).
5. G.H Golub and C.F.Van Loan, Matrix Computations, North Oxford Academic.
6. G. Bachman and L. Narici, Functional Analysis, Academic Press.
7. E. Kreyszig, introductory functional analysis with application John Wiley.

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **Adaptive signal Processing**

Sr.No	Course content
1	Random variables, random processes, filtered random processes, Ensemble averages, correlation, covariance, power spectrum, cross power spectrum, Ergodicity, time averages, biased & unbiased estimators, consistent estimators.
2	Linear prediction Direct form linear prediction filtering, Normal equations for linear prediction filtering, Levinson algorithm, Linear prediction lattice filtering.
3	Digital Wiener filtering Wiener smoothing and prediction filters, Application of Wiener smoothing to noise cancelling, Application of Wiener prediction filters, Constrained, linear MMSE filtering,minimum variance beam forming.
4	Least mean squares adaptive filter LMS adaptive algorithm, Properties of LMS adaptive filter, Least squares adaptive filters, Godard algorithm.
5	Normalizes least mean square filters (NLMS), Recursive least square based (RLS) based filters.

Reference Books:

1. Statistical and Adaptive Signal Processing: Spectral Estimation, Signal
2. Modeling, Adaptive Filtering and Array Processing, D. Manolakis, V. Ingle, S. Kogan, McGraw Hill, 1999.
3. Adaptive Signal Processing, B. Widrow, S. Stearns, Prentice-Hall, 1985.
4. Theory and Design of Adaptive Filters, J. Triechler, C. Johnson, M. Larimore
5. Prentice-Hall, 1995.
6. Adaptive Filtering: Algorithms and Practical Implementation, P. Diniz,
7. Kluwer, 1997.
8. Adaptive Filters: Structures, Algorithms and Applications, M. Honig, D.
9. Messerschmitt, Kluwer, 1984.
10. Adaptive Signal Processing, L. Sibul, Ed., IEEE Press, 1987.

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **Microelectronics chip fabrication**

Sr.No	Course content
1	Environment for VLSI Technology: Clean room and safety requirements. Wafer cleaning processes and wet chemical etching techniques.
2	Impurity incorporation: Solid State diffusion modeling and technology; Ion Implantation modeling, technology and damage annealing; characterization of Impurity profiles.
3	Oxidation: Kinetics of Silicon dioxide growth both for thick, thin and ultra-thin films. Oxidation technologies in VLSI and ULSI; Characterization of oxide films; High k and low k dielectrics for ULSI.
4	Lithography: Photolithography, E-beam lithography and newer lithography techniques for VLSI/ULSI; Mask generation.
5	Chemical Vapour Deposition techniques: CVD techniques for deposition of poly-silicon, silicon dioxide, silicon nitride and metal films; Epi-taxial growth of silicon; modeling and technology, In-process measurements.
6	Metal film deposition: Evaporation and sputtering techniques. Failure mechanisms in metal interconnects; Multi-level metallization schemes.
7	Plasma and Rapid Thermal Processing: PECVD, Plasma etching and RIE techniques; RTP techniques for annealing, growth and deposition of various films for use in ULSI.
8	Carrier lifetime measurement techniques, Process integration for NMOS, CMOS and Bipolar circuits; Advanced MOS technologies.

Reference Books:

1. C.Y. Chang and S.M.Sze (Ed), ULSI Technology, McGraw Hill Companies Inc, 1996.
2. S.K. Ghandhi, VLSI Fabrication Principles, John Wiley Inc., New York, 1983.
3. S.M. Sze (Ed), VLSI Technology, 2nd Edition, McGraw Hill, 1988.

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **: Satellite communication**

Sr.No	Course content
1	Introduction, Kepler's First, second and third Law, Definitions of Terms for Earth-orbiting Satellites, Orbital Elements, Apogee and Perigee Heights, Orbital Perturbations, Effects of a Non spherical Earth, Atmospheric Drag, Inclined Orbits, Calendars, Universal Time, Julian Dates, Sidereal Time, The Orbital Plane,
2	Antenna Look Angels, The Polar Mount Antenna, Limits of Visibility, Near Geostationary Orbits, Earth Eclipse of Satellite, Sun Transit Outage, Launching Orbits, Attitude Control, Spinning Satellite Stabilization, Momentum Wheel Stabilization, Station Keeping, Thermal Control, TT&C Subsystem, Transponders, Demultiplexer Power Amplifier, Antenna Subsystem.
3	Receive-Only Home TV Systems, Master Antenna TV System Community Antenna TV System, Transmit-Receive Earth Stations, Equivalent Isotropic Radiated Power, Transmission Losses, Free-Space Transmission, Feeder Losses, Antenna Misalignment Losses, Fixed Atmospheric and Ionospheric Losses, Link Power Budget Equation, Overall System Noise Temperature, Carrier-to-Noise Ratio, Input Back Off, Combined C/N .
4	Pre assigned FDMA, Demand-Assigned FDMA, SPADE System. Bandwidth-limited a Power-limited TWT amplifier operation, FDMA downlink analysis. TDMA : Reference Burst; Preamble and Postamble, Carrier recovery, Network synchronization, unique word detection, On-board signal Processing, Satellite switched TDMA.
5	Introduction, Orbital Spacings, Power Rating and Number of Transponders, Frequencies and Polarization, Transponder Capacity, Bit Rates for Digital Television

Reference Books:

1. Timothy Pratt – Charles Bostian & Jeremy Allmuti, Satellite Comm. , John Willy & Sons (Asia) Pvt. Ltd. 2004.
2. Dennis Roddy, Satellite Communications, McGraw-Hill Publication
3. Third edition 2001.
4. Wilbur L. Pritchars Henri G.Suyder Hond Robert A.Nelson,
5. Satellite Comm. Systems Engg., Pearson Edu.Ltd., 2nd edition 2003.
6. Richharia : Satellite Communication Systems (Design Principles Macmillan Press Ltd. Second Edition 2003.

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **ANTENNA ENGINEERING AND DESIGN**

Sr.No	Course content
1	INTRODUCTION TO ANTENNAS Review the fundamental theory of antennas: Reciprocity theorem, Antenna equivalent circuit, Classification of antennas, Brief understanding of special types of Antennas.
2	Gain a thorough understanding of the important concepts: Radiation Impedance, Radiation Pattern, Antenna Impedance, Bandwidth, Directivity, Gain, Antenna efficiency, Radiation Efficiency, Antenna Polarization, Antenna Apertures, Antenna temperature, near-field and far-field concepts, and radiation mechanism.
3	ANTENNA SYNTHESIS, ANALYSIS and OPTIMIZATION TECHNIQUES Introduction to various methods of antenna synthesis such as Schelkunoff Polynomial, Fourier transform, Woodward Lawson.
4	Introduction to antenna analysis methods: Integral equation method, Moment method, Finite Difference Time Domain methods; Applications of these methods to the practical antennas such as dipole, loop, helical, microstrip patch, and PIFA.
5	Various optimization techniques (OT) such as Genetic algorithm, Artificial Intelligence, Fuzzy logic. Comparative analysis of the OT's for particular application and antenna type.
6	ANTENNA DESIGN Various impedance matching techniques such as Quarter wavelength transformer, T-match, Gamma Match, Omega match, Baluns and Transformers.
7	Analytical comparative study of wire type and aperture type, narrow band and wide band, element and antenna array antennas.
8	Designing an antenna with a set of given specifications using standard software.
9	Material selection for antenna to be designed, understanding the specifications – errors responses – corrections methods.
10	Concepts of antenna coupling, coupling methods, interferences and effects on performance of the antenna system.
11	SPECIAL TOPICS FOR ANTENNA DESIGN and MEASUREMENT Techniques to miniaturize an antenna for wireless LAN and Blue tooth applications, Wide-band and multi-band antennas, Mobile antennas and antenna diversity, Reconfigurable antennas, Practical consideration in designing antennas for wireless communications (such as the interaction between mobile antenna and human body).
12	Measurement of various antenna parameters necessarily needed for practical antennas.
13	Understanding the working and design of anechoic chamber, practical difficulties, types and applications.

Reference Books:

1. Balanis C A, Antenna Theory: design and applications, Wiley
2. Hohnson R C and H Jasik, Antenna Engineering Handbooks, McGraw Hill
3. Sadiku N O Mathew, Elements of Electromagnetics, Oxford Univ Press
4. Harrington R F, Time harmonic Electromagnetic Fields, McGraw Hill

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **Peripheral System Design & Interfacing**

Sr.No	Course content
1	Bus system Bus systems in microcomputers ST 100 bus, Multi bus, EISA, PCI Bus, HP IB/GPIB Bus, Bus and their applications. I/O
2	Interface Standard I/O interfaces RS-232 C, RS-232 D Centronics interface, current loop interface, and RS-449 communication interface.
3	Design criterion with PCs Application of PC buses (ISA, EISA, PCI, VESA-VL) and associated signals, Handshakes, I/O and Interrupt map, Programming methodology for input/output application, GPIB signals and GPIB programming techniques operating system calls.
4	Peripherals Peripherals like CRT controller, Communication controllers, DMA controller, Programmable keyboard/Display interfaces and Associated circuitries.
5	Controllers PID controllers, Programmable logic controllers, PC based data acquisition system, Interfacing PC to various cards- Stepper motor milli volts & milliamps.
6	Development tools Microprocessor development system, cross compilers, Simulator In circuit emulators, Automated test equipments etc.

Reference Books:

1. Intelligent Instrumentation by George C. Barney, PHI.
2. Student Reference Manual For Electronics Instrumentation Labs by Stanley wolf and Richard F.M. Smith, PHI.
3. Instrumentation for Engg. Measurement by James W. dally, William F. Riley, John Wilay and Sons
4. Interfacing A Laboratory Approach by Deonzo, PHI
5. Related IEEE/IEE publications

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **Computer Aided Design for VLSI**

Sr.No	Course content
1	Matrices: Linear dependence of vectors, solution of linear equations, bases of vector spaces, orthogonality, complementary orthogonal spaces and solution spaces of linear equations.
2	Graphs: representation of graphs using matrices; Paths, connectedness; circuits, cut-sets, trees; Fundamental circuit and cut-set matrices; Voltage and current spaces of a directed graph and their complementary orthogonality.
3	Algorithms and data structures: efficient representation of graphs; Elementary graph algorithms involving bfs and dfs trees, such as finding connected and 2- connected components of a graph, the minimum spanning tree, shortest path between a pair of vertices in a graph; Data structures such as stacks, linked lists and queues, binary trees and heaps. Time and space complexity of algorithms.

Reference Books:

1. K. Hoffman and R.E. Kunze, Linear Algebra, Prentice Hall (India), 1986
2. N.Balabanian and T.A. Bickart, Linear Network Theory : Analysis, Properties, Design and Synthesis, Matrix Publishers, Inc., 1981.
3. T.Cormen, C.Leiserson and R.A.Rivest, Algorithms, MIT Press and McGraw-Hill, 1990.

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **Digital Signal Processing and Applications**

Sr.No	Course content
1	Discrete Time Signals: Sequences representation of signals on orthogonal basis: Sampling and Reconstruction of signals;
2	Discrete systems: attributes, Z-Transform, Analysis of LSI systems, Frequency Analysis, Inverse Systems, Discrete Fourier Transform (DTF), Fast Fourier Transform algorithm, Implementation of Discrete Time Systems.
3	Design of FIR Digital filters; Window Method, Park-McClellan's method.
4	Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Lowpass, Band pass, Bandstop and High Pass Filters.
5	Effect of finite register length in FIR filter design
6	Parametric and non-parametric spectral estimation, Introduction to multirate signal processing. Application of DSP to Speech and radar signal processing.
7	Overview of DSP Processors, Harvard modified Harvard Architecture, MultiBus architecture, Floating point Vs Fix point dsp processor. Case Study.

Reference Books:

1. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall
2. John G.Proakis and D.G. Manolakis, Digital Signal Processing: Principle, Algorithms and Applications, Prentice Hall
3. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall
4. D.J. DeFatta, J.G.Lucas and W.S. Hodgkiss, Digital Signal Processing, J Wiley and Sons, Singapore.

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **Neuro Computing and Applications**

Sr.No	Course content
1	Biological and Artificial Neuron, Perceptron model, Adaline model, Different types of Activation functions.
2	Learning Techniques: Supervised and Unsupervised learning.
3	Multilayered feed forward Networks, Back propagation algorithms and its improvements.
4	Applications of back propagation algorithm to statistical pattern recognition, Classification and regression problems, Advantages of Neural Networks over statistical classification techniques,
5	Recurrent networks, Radial Basis Function Networks as an interpolation model, Time delay Neural Networks for forecasting problems, probabilistic Neural Networks,Kohonen's Self Organizing map, Self organizing map with quadratic functions and its applications medical imaging, Adaptive Resonance, Theory Model, Extensive sessions in MATLAB for solving statistical pattern recognition, classification, regression, and prediction problems using different kinds of Neural Network Models.

Reference Books:

1. Neuro-Fuzzy and Soft Computing Lee Jng, Chuentsaisun, E G Maizutani, PE India.

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **Machine Learning**

Sr.No	Course content
1	Introduction to Machine Learning, and Statistical Pattern Recognition.
2	Supervised learning: generative/discriminative learning, parametric/non-parametric learning, neural networks, support vector machines
3	Unsupervised learning: Clustering, Dimensionality reduction, Kernel methods, learning theory (bias/variance tradeoffs; VC theory; large margins); Reinforcement learning: Dynamic programming, Adaptive control. Recent applications of machine learning: Robotic control, Data mining, Autonomous navigation, Bioinformatics, Speech recognition, and Text and web data processing.

Reference Books:

1. Christopher Bishop, Pattern Recognition and Machine Learning. Springer, 2006.
2. Richard Duda, Peter Hart and David Stork, Pattern Classification, 2nd ed. John Wiley & Sons, 2001.
3. Tom Mitchell, Machine Learning. McGraw-Hill, 1997.
4. Richard Sutton and Andrew Barto, Reinforcement Learning: An introduction. MIT Press, 1998

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **Robotics and Intelligent Systems**

Sr.No	Course content
1	Robotic Systems: Overview and Preliminaries Biological Paradigms: Robotic Manipulators Sensors and Actuators: Low-Level Robot Control, Mobile Robots Modelling Dynamic Systems Kinematics and Dynamics of Rigid Bodies:Continuous- and Discrete-time Dynamic Models; Linearization and Linear Response
2	Intelligent Systems: Continuous- and Discrete-time Dynamic Models: Formal Logic and; Linearization, Turing Machines and Linear Response, Predicate Calculus; Crisp and Fuzzy Sets, Expert Systems: Inference and Knowledge Representation, Probability Theory Introduction to Optimization and Numerical Optimization: Least-Squares EstimationMonte Carlo Evaluation and Evolutionary Algorithms Learning (Knowledge Acquisition) Classification of Data Sets
3	Computational Neural Networks : Neural Networks: Training Neural Networks
4	Goal-Oriented Control : Optimal Control, Robust, Adaptive, and Neural Control, Task Planning and Multi-Agent Systems

Reference Books:

1. Autonomous Robots, G. Bekey, MIT Press, 2005

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **Linear System Theory**

Sr.No	Course content
1	Review of matrices and linear vector space including semigroup, group, rings and fields.
2	State variable modelling of continuous and discrete time systems, Linearization of state equations, Solutions of state equations of linear time-invariant and time-varying systems.
3	Controllability and Observability of dynamical systems
4	Minimal realization of linear systems and canonical forms
5	Liapunov's stability theory for linear dynamical systems.

Reference Books:

1. Linear System Theory, C.T.Chen

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **Soft Computing Technique and its Application in Engineering**

Sr.No	Course content
1	Introduction to Soft Computing: Introduction, Importance of Soft Computing, Main Components of Soft Computing, Fuzzy Logic, Artificial Neural Networks, Introduction to Evolutionary Algorithms, Hybrid Intelligent Systems
2	Artificial Neural Network and Supervised Learning: Introduction, Comparison of Neural Techniques and Artificial Intelligence, Artificial Neuron Structure, Adaline Model, ANN Learning, Back-Propagation Learning, Properties of Neural Networks, Limitations in the Use of Neural Networks.
3	Factors Affecting the Performance of Artificial Neural Network Models Network Complexity, Neuron Complexity, Number of Layers, Number of Neurons in Each Layer, Type and Number of Interconnecting Weights, Problem Complexity, Range of Normalization of Training Data, Type of Functional Mapping, Sequence of Presentation of Training Data, Repetition of Data in the Training Set, Permissible Noise in Data, Learning Complexity, Training Algorithms of ANN
4	Development of Generalized Neuron and Its Validation Existing Neuron Model, Development of a Generalized Neuron (GN) Model, Advantages of GN, Learning Algorithm of a Summation Type Generalized Neuron, Benchmark Testing of Generalized Neuron Model, Ex-OR Problem, The Mackey-Glass Time Series, Character Recognition Problem
5	Applications of Generalized Neuron Models
6	Application of GN Models to Electrical Machine, Electrical Load Forecasting Problem, Load Frequency Control Problem, Power System Stabilizer Problem, Aircraft Landing Control System Using GN Model
7	Introduction to Fuzzy Set Theoretic Approach Introduction, Uncertainty and Information, Types of Uncertainty, Introduction of Fuzzy Logic, Historical Development of Fuzzy Logic, Difference Between Precision and Significance, Fuzzy Set, Operations on Fuzzy Sets, Fuzzy Intersection, Fuzzy Union, Fuzzy Complement, Fuzzy Concentration, Fuzzy Dilation, Fuzzy Intensification, α-Cuts, Fuzzy Quantifier/Modifier/Hedges, Characteristics of Fuzzy Sets, Fuzzy Singletone, Height, Cardinality,
8	Properties of Fuzzy Sets: Commutative, Associative, Distributive Property, Idem Potency, Identity Involution, Excluded Middle Law, Law of Contradiction, Demorgan's Law, Transitive, Fuzzy Cartesian Product, Various Shapes of Fuzzy Membership Functions, Methods of Defining of Membership Functions, Fuzzy Compositional Operators, Fuzzy Relation, Operation of Fuzzy Relation, Projection and Cylindrical Extension, Approximate Reasoning, Defuzzification Methods, Fuzzy Rule Based System

9	Applications of Fuzzy Rule Based System Introduction, System's Modeling and Simulation Using Fuzzy Logic Approach, Selection of Variables, their Normalization Range and the Number of Linguistic Values, Selection of Shape of Membership Functions for Each Linguistic Value, Determination of Overlapping of Fuzzy Sets, Selection of Fuzzy Intersection Operators, Fuzzy Union Operators, Implication Methods, Compositional Rule, Defuzzification Method,
10	Control Applications: Adaptive Control, PID Control System, Fuzzy Control System, Power System Stabilizer Using Fuzzy Logic
11	Genetic Algorithms Introduction, History of Genetics, Genetic Algorithms, Crossover, Mutation, Survival of Fittest, Population Size, Evaluation of Fitness Function, Effect of Crossover Probability on GA Performance, Effect of Mutation Probability on GA Performance, Main Components of GA, Variants, Applications of Genetic Algorithms
12	Applications of Genetic Algorithms to Load Forecasting Problem
13	Integration of Neural Networks and Fuzzy Systems Introduction, Adaptive Neuro-Fuzzy Inference Systems, Constraints of ANFIS, HIV/AIDS Population Model Using Neuro-Fuzzy Approach
14	ANN – GA-Fuzzy Synergism and Its Applications Introduction, Training of ANN, Advantages of GA, ANN Learning Using GA, Validation and Verification of ANN-GA Model.

Reference Books:

1. Soft Computing Techniques and its Applications in Electrical Engineering
2. Devendra K. Chaturvedi, Springer
3. Fuzzy Logic with Engineering Applications
4. Timothy J Ross, John Wiley & Sons.
5. Neuro-Fuzzy and Soft Computing Lee Jng, Chuentsaisun, E G Maizutani, PE India.

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **Recent topics in Modern communication Engineering**

Sr.No	Course content
1	Recent upcoming technologies in area of modern digital/wireless communication are covered in subject.

Reference Books:

IEEE communication Magazine/conference/Journal papers.

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E

Communication Engineering

Subject Name **Wireless and Mobile Communication**

Sr.No	Course content
1	Introduction to mobile communication. Past, present and Future wireless– Mobile technology. Introduction to GSM and CDMA Technology. GSM system architecture overview, call management and system operation. CDMA based cellular system.
2	Cellular radio system design, frequency assignment, frequency reuse channels, Concept of cell splitting. Handover in cellular systems. Handoff algorithms.
3	Radio wave propagation, propagation models, reflection, scattering, fading, shadowing multi-path effects Path loss over hilly and flat terrain, Power prediction over flat and hilly terrain. RF design, received signal phase and envelope characteristic. Simulation of wireless channel.
4	Bandwidth and power spectral density, pulse shaping techniques, BPSK, QPSK, QQPSK, MSK, GMSK

Reference Books:

1. William C. Y. Lee, Mobile Communication Engineering, Theory and Applications, McGraw Hill.
2. Raj Pandya, Mobile and Personal Communication Systems and Services, PHI
3. Theodore S. Rappaport, Wireless Communications Principles and Practice, PE India.
4. WCY Lee, Mobile Cellular Telecommunications, McGraw Hill International Edition.
5. Raymond Steele, Mobile Radio Communications, IEEE Press, New York.
6. AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesly, New York.
7. VK Grag, and JE Wilkes, Wireless and Personal Communication Systems, Prentice Hall.