G.B. TECHNICAL UNIVERSITY, LUCKNOW
Study and Evaluation Scheme B. Tech. in Electronics Engg/ Electronics & Communication Engg/ Electronics & Telecomm Engg
[Effective from the session 2011-12]

YEAR 4th, SEMESTER-VII

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
						SESSIONAL EXAM.			ESE		
			L	T	P	CT	TA	Total			
THEORY SUBJECTS											
1.	EOE 07*	Open Elective-I**	3	1	0	30	20	50	100	150	4
2.	EOE 02*	Departmental Elective-II	3	1	0	30	20	50	100	150	4
3.	EEC 701	Optical Communication	3	1	0	30	20	50	100	150	4
4.	EEC 702	Data Communication Networks	3	1	0	30	20	50	100	150	4
5.	EEC 703	VLSI Design	3	1	0	30	20	50	100	150	4
6.	AUC 001	*Human Values & Professional Ethics	2	0	0	15	10	25	50	75	-
PRACTICAL/DESIGN/DRAWING											
7.	EEC 751	Microwave & Fiber Optic Lab	0	0	2	-	20	20	30	50	1
8.	EEC 752	Electronics Circuit Design Lab	0	0	3	-	20	20	30	50	2
9.	EEC 753	Industrial Training Viva-Voce	0	0	2	-	50	50	0	50	1
10.	EEC 754	Project	0	0	2	-	50	50	-	50	1
11.	GP 701	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	**15**	**5**	**9**	**150**	**210**	**410**	**590**	**1000**	**26**

** **Open Electives-I**

EOE-071	Entrepreneurship Development
EOE-072	Quality Management
EOE-073	Operation Research
EOE-074	Introduction to Biotechnology
EOE-075/EIC-034	Micro and smart systems

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YEAR 4th, SEMESTER-VIII

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
						SESSIONAL EXAM.			ESE		
			L	T	P	CT	TA	Total			
THEORY SUBJECTS											
1.	EOE 08*	Open Elective-II**	3	1	0	30	20	50	100	150	4
2.	EEC 03*	Departmental Elective-III	3	1	0	30	20	50	100	150	4
3.	EEC 801	Wireless & Mobile Communication	3	1	0	30	20	50	100	150	4
4.	EEC 802	Electronics Switching	3	1	0	30	20	50	100	150	3
5.	AUC 001	*Human Values & Professional Ethics	2	0	0	15	10	25	50	75	-
PRACTICAL/DESIGN/DRAWING											
6.	EEC 851	Project	0	0	12	-	100	100	250	350	8
7.	GP 801	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	**12**	**4**	**12**	**120**	**180**	**350**	**650**	**1000**	**24**

**** Open Electives-II**

EOE-081 Non Conventional Energy Resources
EOE-082 Nonlinear Dynamic system
EOE-083 Product Development
EOE-084 Automation and Robotics

LIST OF ELECTIVES:

Elective – I

1. EEC 011 Analog Signal Processing
2. EEC 012 Data Structure
3. EEC 013 Advance Semiconductor Devices
4. EEC 014 Microcontrollers

Elective – II

1. EEC 021 Satellite Communication
2. EEC 022 Digital Image Processing
3. EEC 023 ANN
4. EEC 024 Filter Design

Elective – III

1. EEC 031 Optical Networks
2. EEC 032 Digital System Design using VHDL
3. EEC 033 Speech Processing
4. EEC 034 Integrated Circuit Technology
5. EEC 035 Introduction to RADAR systems

SYLLABUS

EEC 701 OPTICAL COMMUNICATION		3 1 0
UNIT	TOPICS	LECTURES
I	Overview of optical fiber communication- The general system, advantages of optical fiber communications. Optical fiber wave guides- Introduction, Ray theory transmission, Optical fiber Modes and configuration, Mode theory for circular Waveguides, Step Index fibers, Graded Index fibers. Single mode fibers- Cut off wavelength, Mode Field Diameter, Effective Refractive Index. Fiber Material and its Fabrication Techniques	8
II	Signal distortion in optical fibers- Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses. Information capacity determination, Group delay, Attenuation Measurements Techniques, Types of Dispersion - Material dispersion, Wave-guide dispersion, Polarization mode dispersion, Intermodal dispersion. Pulse broadening. Overall fiber dispersion in Multi mode and Single mode fibers, Fiber dispersion measurement techniques, Non linear effects. Optical fiber Connectors: Joints, Couplers and Isolators.	8
III	Optical sources- LEDs, Structures, Materials, Quantum efficiency, Power, Modulation, Power bandwidth product. Laser Diodes- Basic concepts, Classifications, Semiconductor injection Laser: Modes, Threshold conditions, External quantum efficiency, Laser diode rate equations, resonant frequencies, reliability of LED & ILD	8
IV	Source to fiber power launching - Output patterns, Power coupling, Power launching, Equilibrium Numerical Aperture, Laser diode to fiber coupling. Optical detectors- Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photo detectors. Optical receiver operation- Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Probability of error, Quantum limit, Analog receivers	8
V	Link Design: Point to Point Links, Power Penalities, Error control,Multichannel Transmission Techniques, WDM concepts and component overview, OTDR and optical Power meter	8

TEXT BOOKS:

1. John M. Senior, “Optical Fiber Communications”, PEARSON, 3rd Edition, 2010.
2. Gerd Keiser, “Optical Fiber Communications”, TMH, 4th Edition, 2008.

REFERENCE BOOKS

1. Govind P. Agrawal, “Fiber Optic Communication Systems”, John Wiley, 3rd Edition, 2004.
2. Joseph C. Plais, “Fiber Optic Communication”, Pearson Education, 4th Ed, 2004.

EEC 702 DATA COMMUNICATION NETWORKS		3 1 0
Unit	**Topic**	**Lectures**
I	Introduction to Networks & Data Communications The Internet, Protocols & Standards, Layered Tasks, OSI Model, TCP / IP, Addressing, Line Coding Review, Transmission Media: Guided and unguided Media Review.	8
II	Switching: Datagram Networks, Virtual Circuit Networks, Structure of a switch ,Ethernet Physical Layer, Data Link Layer: Error detection and Correction Data Link Control: Framing, Flow and Error Control Protocols, Noiseless Channel and Noisy Channel Protocol, HDLC, Point-to-Point Protocol	8
III	Multiple Access : RANDOH, CDMA, CSMA/CD, CSMA/CA, Controlled Access, Channelization Wired LANs: IEEE Standards, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LAN IEEE 802.11, Bluetooth IEEE 802.16	8
IV	Network Layer : Design Issues. Routing Algorithms. Congestion control Algorithms.IPV4 Addresses, Connecting Devices, Virtual LAN IPV6 Addresses, Internet Protocol, Hardware Addressing versus IP Addressing, IP Data Gram	8
V	Transport Layer Protocol : UDP and TCP, ATM ATM, Cryptography, Network Security	8

Text Books:

1. B. A. Forouzan, “Data Communications and Networking”, MGH, 4th ed. 2007

Reference Books:

1. A. S. Tanenbaum, “Computer Networks”, PHI.
2. W. Stallings, “Data and Computer Communication”, PHI.

EEC 703 VLSI DESIGN		3 1 0
Unit	Topic	Lectures
I	Introduction: Overview of VLSI Design Methodologies, VLSI Design Flow, Design Hierarchy, Concepts of Regularity, Modularity and Locality. MOSFET Fabrication: Fabrication process flow, NMOS and CMOS fabrication, layout design rules, stick diagram and mask layout design. MOS Transistor : MOS Structure, The MOS System under external bias, Operation of MOSFET, MOSFET - Current /Voltage Characteristics, Scaling and Small geometry effects and capacitances	8
II	MOS Inverters: Introduction, Resistive Load Inverter, Inverters with n-type MOSFET load, CMOS Inverter. MOS Inverters - Switching Characteristics: Introduction, Delay – Time Definitions, Calculation of Delay Times, and Inverter Design with Delay Constraints.	8
III	Combinational MOS Logic Circuits: Introduction, MOS logic circuits with depletion NMOS Loads, CMOS logic circuits, complex logic circuits, CMOS transmission gates (pass gates) Sequential MOS Logic Circuits: Introduction, behaviour bistable elements, SR latch circuits, clocked latch and FF circuits, CMOS D latch and edge triggered FF.	8
IV	Dynamic logic circuits: Introduction, basic principle of pass transistor circuits, synchronous dynamic circuit techniques, dynamic CMOS circuit techniques, domino CMOS logic. Semiconductor memories: Introduction, DRAM, SRAM, ROM, flash memory.	8
V	Low – Power CMOS Logic Circuits: Introduction, Overview of Power Consumption, Low – Power Design through voltage scaling, Estimation and Optimization of switching activity, Reduction of Switched Capacitance and Adiabatic Logic Circuits. Design for Testability: Introduction, Fault Types and Models, Controllability and Observability, Ad Hoc Testable Design Techniques, Scan Based and BIST Techniques	8

Text Book:

1. Sung-Mo Kang & Yosuf Leblebici, "CMOS Digital Integrated Circuits: Analysis & Design", TMH, 3rd Edition.

Reference Books:

2. D. A. Pucknell and K. Eshraghian, "Basic VLSI Design: Systems and Circuits", PHI, 3rd Ed., 1994.
3. W.Wolf, Modern VLSI Design: System on Chip, Third Edition, Pearson, 2002.

ELECTIVES II

EEC 021 SATELLITE COMMUNICATIONS		3 1 0
Unit	**Topic**	**Lectures**
I	Elements of Satellite Communication. Orbital mechanics, look angle and orbit determination, launches & launch vehicle, orbital effects, Geostationary Orbit.	8
II	Satellite subsystems, attitude and orbit control systems, TTC&M, communication subsystem, satellite antenna Satellite link design: basic transmission theory, system noise temperature and G/T ratio, downlink design, uplink design, satellite systems using small earth station, design for specified C/N.	8
III	Propagation effects and their impact on satellite-earth links: attenuation and depolarization, atmospheric absorption, rain, cloud and ice effects etc. Introduction of various satellite systems: VSAT, low earth orbit and non-geostationary,	8
IV	Direct broadcast satellite television and radio, satellite navigation and the global positioning systems, GPS position location principle, GPS Receivers and Codes, Satellite Signal Acquisition, GPS Navigation Message, GPS Signal Levels, Timing accuracy, GPS Receiver Operation	8
V	Global Mobile Satellite Systems, Antenna System for mobile satellite applications, Evolution, Antenna Requirement and Technical Characteristics, Classification of Mobile Satellite Antenna(MSA), Low gain omni directional Antenna, Medium gain Directional Antenna, High gain Directional Aperture Antenna, Wire Quadrifilar Helix Antenna(WQHA) for Hand held Terminals, Antenna Systems for Mobile Satellite Broadcasting.	8

Text/ Reference Books:

1. B. Pratt, A. Bostian, “Satellite Communications”, Wiley India.
2. D. Roddy, “Satellite Communications”, TMH, 4th Ed.
3. S. D. Ilcev, “Global Mobile Satellite Communication”, Springer
4. R. Pandya, “Mobile and Personal Communication Systems and Services ”, PHI.

EEC 022 DIGITAL IMAGE PROCESSING		3 1 0
Unit	**Topic**	**Lectures**
I & II	Introduction: Fundamental steps in DIP, elements of DIP, Simple image model, sampling & quantization, basic relationships between pixels, colour image model. Image Transforms: One-dimensional & two-dimensional DFT, cosine, sine, Hadamard, Haar, and Slant & KL transforms. Image Enhancement: Introduction, point operations, histogram modelling, spatial operations, Transform operations.	8
III	Image Restoration: Introduction, image observation models, Inverse & Wiener filtering, difference between enhancement & restoration Restoration-spatial filtering, Noise reduction in frequency domain.	8
IV	Image Compression: Introduction, Pixel coding, Predictive coding, Transform coding, Inter-frame coding	8
V	Image Segmentation: Introduction, Spatial feature extraction, Transforms features, Edge detection, Boundary extraction, Segmentation techniques.	8

Text Books:

1. Rafael C. Gonzalez Richard E Woods, "Digital Image Processing", Pearson, 3rd Ed. 2009.
2. Anil K Jain, "Fundamentals of Digital Image Processing", PHI.

EEC 023 Artificial Neural Networks		3 1 0
Unit	Topic	Lectures
I	Introduction: Introduction and history, human brain, biological neuron, models of neuron, signal flow graph of neuron, feedback, network architecture, knowledge representation, Artificial intelligence and neural networks. Learning Process: Error correction learning, memory based learning, Hebbian learning, competitive learning, Boltzmann learning, learning with and without teacher, learning tasks, memory and adaptation.	4 4
II	Artificial neurons, Neural networks and architectures Introduction, neuron signal function, mathematical preliminaries, Feed forward & feedback architecture. Geometry of Binary threshold neurons and their networks Pattern recognition, convex sets and convex hulls, space of Boolean functions, binary neurons for pattern classification, non linear separable problems, capacity of TLN, XOR solution.	2 3
III	Perceptrons and LMS Learning objective of TLN, pattern space & weight space, perceptron learning algorithm, perceptron convergence theorem, pocket algorithm, α – LMS learning, MSE error surface, steepest descent search, μ – LMS and application. Back propagation and other learning algorithms Multilayered architecture, back propagation learning algorithm, practical considerations, structure growing algorithms, applications of feed forward neural networks, reinforcement learning	5
IV	Statistical Pattern Recognition Bayes' theorem, classical decisions with Bayes' theorem, probabilistic interpretation of neuron function, interpreting neuron signals as probabilities, multilayered networks & posterior probabilities, error functions for classification problems. RBF Networks Regularization networks, generalized RBF networks, RBF network for solving XOR problem, comparison of RBF networks & multilayer perceptrons. Stochastic Machines Statistical mechanics, simulated annealing, Boltzmann machine.	4 2 2
V	Adaptive Resonance Theory Building blocks of adaptive resonance, Adaptive Resonance Theory 1. Self Organizing Feature MAP Introduction, Maximal eigenvector filtering, principal component analysis, generalized learning laws, competitive learning, vector quantization, Mexican hat networks.	8

Text Books:

1. Kumar Satish, "Neural Networks", TMH
2. Simon Haykin, "Neural Networks", PHI
3. J. M. Zurada, "Introduction to Artificial Neural Systems", Jaico Publishers, 3rd Ed.

EEC 024 FILTER DESIGN		3 1 0
Unit	Topic	Lectures
I	Review of op-amps circuits, Categorization of filters-Low-pass filter, High-pass filter, band-pass filter, band-reject filter, Gain equalizers, and Delay equalizers.	8
II	Approximation Theory: Butterworth approximation, Chebyshev approximation, Inverse Chebyshev approximation, Basic of sensitivity, Frequency Transformations.	8
III	Three amplifier Biquad: Basic low pass and band pass circuit, realization of the general Biquadratic Functions, summing of four Amplifier biquad, feed forward three amplifier biquad, Passive Ladder structures, Inductor Substitution using Gyrator, Transformation of elements using the FDNR. Active ladder filters. Active R filters.	10
IV	Elementary transconductor building blocks, resistors, integrators, amplifiers, summers, gyrator, First and second order filters, higher order filters.	8
V	Switched capacitor filters: The MOS switch, The switched capacitor, first order building blocks, second order sections, sampled data operation, Switched capacitor first and second order filters, Bilinear transformation based SC filter design.	6

Text Book:

[1] Gobind Daryanani, “Principles of active network synthesis and design”,John Wiley & Sons.

[2] R. Schaumann, M. E. Van Valkenburg, “Design of analog filters”, Oxford University Press.

EEC 751 Microwave and Optical Communication Lab

Minimum Ten Experiments to be conducted:

Part – A (Any 6 Experiments):

1. Study of Reflex Klystron Characteristics.
2. Measurement of guide wavelength and frequency of the signal in a rectangular Waveguide using slotted line carriage in a Micro wave Bench.
3. Measurement of impedance of an unknown load connected at the output end of the slotted line carriage in a Micro wave Bench
4. Determine the S-parameter of any Three port Tee.
5. Determine the S-parameter of a Magic Tee.
6. Study various parameters of Isolator .
7. Measurement of attenuation of a attenuator and isolation, insertion loss, cross coupling of a circulator.
8. Determine coupling coefficient, Insertion loss, Directivity and Isolation coefficient of anty Multi-Hole directional coupler.
9. To study working of MIC Components like Micro strip Line, Filter, Directional Coupler, Wilkinson Power Divider, Ring resonator & coupler, antennas & amplifies.
10. Study of waveguide horn and its radiation pattern and determination of the beam width.
11. Study radiation pattern of any two types of linear antenna.

Part – B (Any 4 Experiments):

1. To setting up fiber optic analog link.
2. Study and measurement of losses in optical fiber.
3. Study and measurement of numerical aperture of optical fiber.
4. Study and perform time division multiplexing (digital).
5. Study of framing in time division multiplexing.
6. Study of Manchester coding and decoding.
7. Study of voice coding and codec chip.
8. Study and measure characteristics of fiber optic LED's and photo detector.

EEC 752 Electronic Circuit Design

In this practical course students will carry out a design oriented project work using various analog/ digital building blocks which they have already studied in their analog electronic/ digital electronic courses such as Electronic circuits, integrated circuits and filter design. The project may include but not restricted to any of the following:

1. Universal op-amp based biquad
2. Universal OTA biquad
3. Amplitude control or stabilization applied to any sinusoidal oscillators
4. Op-amp/ OTA based function generator
5. Any application of log/antilog circuits
6. Any applications of analog multiplier/ divider
7. Any digital system design and its hardware implementation using TTL/ CMOS ICs
8. Any circuit idea (not studied in the course) using 555 Timer in conjunction with any other ICs

The above must include

1. Design the circuit.
2. Make a hardware and measure various parameters.
3. Simulation in Spice of the designed circuit.
4. Comparison of measured and simulated results.
5. A report is to be made for evaluation.

EEC 801 Mobile and Wireless Communication		3 1 0
Unit	Topic	Lectures
I	Evolution of mobile radio communication fundamentals. Large scale path loss: propagation models, reflection, diffraction, scattering, practical link budget design using path loss model. Small scale fading & multipath propagation and measurements, impulse response model and parameters of multipath channels. Small scale Multipath Measurements, Parameters of Mobile Multipath Channels types of small scale fading.	8
II	Fundamentals of equalisation, Equalisers in communication receiver, Survey of equalisation techniques, linear equaliser, Algorithms for Adaptive Equalization, Diversity techniques, RAKE receiver. Characteristics of speech signals, quantisation techniques, vocoders, linear predictive coders, Multiple Access techniques for Wireless Communications.	8
III	Cellular concepts, Frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems.	8
IV	GSM system for mobile: Services and features, System Architecture, Radio Sub system Channel types, Frame Structure. CDMA Digital Cellular Standard (IS 95): Frequency and Channel specifications, Forward CDMA channel and reverse CDMA channel	8
V	Introduction to Mobile Adhoc Networks, Mobile data networks, wireless standards IMT2000, Introduction to 4G and concept of NGN.	8

Text Book:

1. T.S. Rappaport, "Wireless Communication-Principles and practice", Pearson, Second Edition.
2. T L Singal ,"Wireless Communications ",McGraw Hill Publications.
3. R. Pandya, " Mobile and personal communication system", PHI.

Reference Books:

1. Andrea Goldsmith, "Wireless Communications", Cambridge University press.
2. Andreas F. Molisch, "Wireless Communications", Wiley Student Edition.
3. S. Haykin & M. Moher, "Modern wireless communication", Pearson, 2005.

EEC 802 ELECTRONIC SWITCHING			3 1 0
Unit	Topic	Text Book/ Chapter	Lectures
I	Evolution of Switching systems: Introduction: Message switching, circuits switching, functions of a switching system, register-translator-senders, distribution frames, crossbar switch, a general trunking, electronic switching, Reed electronic system, digital switching systems.	2/3	8
II	Digital switching: Switching functions, space division switching, Time division switching, two dimensional switching, Digital cross connect systems, digital switching in analog environment.	3/5	8
III	Telecom Traffic Engineering: Network traffic load and parameters, grade of service and blocking probability, modelling switching systems, incoming traffic and service time characterization, blocking models and loss estimates, Delay systems.	1/8	8
IV	Control of Switching Systems: Introduction, Call processing functions; common control, Reliability availability and security; Stored program control. Signalling: Introduction, Customer line signalling, AF junctions and trunk circuits, FDM carrier systems, PCM and inter register signalling, Common channel signalling principles, CCITT signalling system No. 6 and 7, Digital customer line signalling.	2/7 2/8	8
V	Packet Switching: Packets formats, statistical multiplexing, routing control, dynamic, virtual path circuit and fixed path routing, flow control, X.25 protocol, frame relay, TCP/IP, ATM cell, ATM service categories, ATM switching, ATM memory switch, space memory switch, memory-space, memory-space-memory switch, Banyan network switch.	3/10	8

Text Books:

1. Thiagarajan Viswanathan, "Telecommunication switching System and networks", PHI.
2. J.E. Flood, "Telecommunication switching, Traffic and Networks", Pearson education.
3. J.C. Bellamy, "Digital Telephony", John Wiley, 3rd Ed.

ELECTIVE III

EEC 031 OPTICAL NETWORKS		3 1 0
Unit	Topic	Lectures
I	Introduction to Optical Networks- Principles and Challenges and its Generation, Characteristics of Optical Fiber in non linear region ,Optical Packet Switching, Transmission Basics, Multiplexers & Filters,	8
II	Optical Amplifiers ,Tunable Lasers, Switches, Wavelength Converters. Sub-Carrier Modulation and Multiplexing,Spectral efficiency,Crosstalk,Introduction of Soliton systems.	8
III	SONET/SDH: Multiplexing, SONET/ SDH Layers, Frame Structure, Physical Layer, Elements of a SONET/SDH Infrastructure, Ethernet. Optical Transport Network, Generic framing Procedure, IP routing and forwarding and QOS. WDM Network Elements Optical Line Terminals, Optical Line Amplifiers, Optical Add/ Drop Multiplexers, Optical Cross Connects.	8
IV	WDM Network Design Cost Trade-offs, Light path Topology Design, and Routing and wavelength assignment problems, Dimensioning Wavelength Routing Networks, Network Survivability Basic Concepts, Protection in SONET/SDH, Protection in client layer, Optical Layer Protection, Different Schemes, Interworking between Layers Access Networks Network Architecture Overview, Enhanced HFC, FTTC, PON evolution	8
V	Optical Switching OTDM, Synchronization, Header Processing, Buffering, Burst Switching. Deployment Considerations- SONET/SDH core Network	

Text Books:

1. R. Ramaswami, & K. N. Sivarajan, "Optical Networks a Practical perspective", Morgan Kaufmann Publishers, 3rd Ed.
2. U. Black, "Optical Networks: Third Generation Transport Systems"/ Pearson Educations

Reference Books:

1. Biswanath Mukherjee "Optical WDM Networks" Springer Pub 2006.

EEC 032 DIGITAL SYSTEM DESIGN USING VHDL		3 1 0
Unit	Topic	Lectures
I	Introduction to VHDL, reserve words, structures, modeling, objects, data type and operators, sequential statements and processes, sequential modeling and attributes, conditional assignment, concatenation and case, array loops and assert statements, subprograms.	8
II	Digital System Design Automation– Abstraction Levels, System level design flow, RTL design flow, VHDL. RTL Design with VHDL – Basic structures of VHDL, Combinational circuits, Sequential circuits, Writing Test benches, Synthesis issues, VHDL Essential Terminologies VHDL Constructs for Structures and Hierarchy Descriptions – Basic Components, Component Instantiations, Iterative networks, Binding Alternatives, Association methods, generic Parameters, Design Configuration	8
III	Concurrent Constructs for RT level Descriptions – Concurrent Signal Assignments, Guarded signal assignment Sequential Constructs for RT level Descriptions – Process Statement, Sequential WAIT statement, VHDL Subprograms, VHDL library Structure, Packaging Utilities and Components, Sequential Statements. VHDL language Utilities - Type Declarations and Usage, VHDL Operators, Operator and Subprogram overloading, Other TYPES and TYPE – related issues, Predefined Attributes	8
IV	VHDL Signal Model – Characterizing hardware languages, Signal Assignments, Concurrent and Sequential Assignments, Multiple Concurrent Drivers Standard Resolution	8
V	Hardware Cores and Models - Synthesis rules and styles, Memory and Queue Structures, Arithmetic Cores, Components with Separate Control and Data parts. Core Design Test and Testability - Issues Related to Design Test, Simple Test benches.	8

TEXT BOOKS:

1. Z. Navabi, “VHDL-Modular Design and Synthesis of cores and Systems”, TMH – 3rd Edition.
2. R.D.M. Hunter, T. T. Johnson, “Introduction to VHDL” Spriger Publication, 2010.

REFERENCE BOOKS:

3. C. H. Roth, “Digital System Design using VHDL”, PWS Publishing
4. Douglas Perry, “VHDL- Programming by examples”, MGH

EEC 033 SPEECH PROCESSING		3 1 0
Unit	Topic	Lectures
I	Digital models for speech signals: Mechanism of speech production & acoustic phonetics, the acoustic theory of speech production, lossless tube models, and digital models for speech signals.	10
II	Time Domain methods of speech sampling: Time dependent processing of speech, short time energy and average magnitude, short time average zero crossing rate, discrimination between speech& silence, pitch period estimation using parallel processing, short time autocorrelation function & AMDF, pitch period estimation using autocorrelation function.	10
III	Short time Fourier Analysis: Definition and properties, design of filter banks, implementation of filter bank summation method using FFT, spectrographic displays, pitch detection, analysis by synthesis phase, vocoder and channel vocoder.	10
IV	Homomorphic speech processing: Homomorphic system for convolution, complex cepstrum of speech, pitch detection using Homomorphic processing, formant estimation, Homomorphic vocoder.	6
V	Linear Predictive Coding of Speech: Basic principles of linear predictive analysis, the autocorrelation method, computation of the gain for the model, solution of LPC equations for auto correlation method, prediction error and normalized mean square error, frequency domain interpretation of mean squared prediction error relation of linear predictive analysis to lossless tube models, relation between various speech parameters, synthesis of speech from linear predictive parameters, application of LPC parameters.	10

Text / Reference Books:

1. R. L. Rabiner & R.W. Schafer, “Digital Processing of speech signals”, Pearson Education.
2. B. Gold and Nelson Morgon, “Speech and audio signal processing”, Wiley India Edition, 2006.

EEC 034 INTEGRATED CIRCUIT TECHNOLOGY		3 1 0
Unit	Topic	Lectures
I	Introduction To IC Technology: SSI, MSI, LSI, VLSI Integrated Circuits Crystal Growth and Wafer Preparation: Electronic Grade Silicon, Czochralski Crystal Growth, Silicon Shaping, Processing Considerations. Epitaxy: Vapor –Phase Epitaxy, Molecular Beam Epitaxy, Silicon on Insulators, Epitaxial Evaluation.	8
II	Oxidation: Growth Kinetics, Thin Oxides, Oxidation Techniques and Systems, Oxides Properties. Lithography: Optical Lithography. Photo masks, Wet Chemical Etching. Dielectric and Polysilicon Film Deposition: Deposition Processes, Polysilicon , Silicon Dioxide, Silicon Nitride.	8
III	Diffusion: Diffusion of Impurities in Silicon and Silicon Dioxide, Diffusion Equations, Diffusion Profiles, Diffusion Furnace, Solid, Liquid and Gaseous Sources , Sheet Resistance and its Measurement. Ion-Implantation: Ion-Implantation Technique, Range Theory, Implantation Equipment.	8
IV	Metallization: :Metallization Application, Metallization Choices, Physical Vapor Deposition, Vacuum Deposition, Sputtering Apparatus. Packaging of VLSI devices: Package Types, Packaging Design Consideration, VLSI Assembly Technologies, Package Fabrication Technologies.	8
V	VLSI Process Integration: Fundamental Considerations For IC Processing, NMOS IC Technology, CMOS IC Technology, Bipolar IC Technology, Monolithic and Hybrid Integrated Circuits, IC Fabrication	8

Text Book:

1. S. M. Sze, “VLSI Technology”, 2nd Edition, McGraw –Hill Publication.

Reference Books:

1. S.K. Ghandhi, “VLSI Fabrication Principles”, 2nd Edition,. Willy-India Pvt. Ltd.
2. J. D. Plummer, M. D. Deal and Peter B. Griffin, “Silicon VLSI Technology: Fundamentals, practice and modelling”, Pearson Education.
3. Stephen A. Campbell, “Fabrication Engineering at the micro and nano scale”, Oxford Univ Press.

EEC 035 INTRODUCTION TO RADAR SYSTEMS		3 1 0
Unit	Topic	Lectures
I	Introduction to Radar: Basic Radar, The Simply Form of the Radar Equations, Radar Block Diagram, Radar Frequencies, Applications of Radar. The Radar Equation: Detection of Signals in Noise, Receiver Noise and the Signal-to-Noise Ratio, Probabilities of Detection and False Alarm, Integration of Radar Pulses, Radar Cross Section of Targets, Radar Cross-Section of Targets, Radar Cross-Section Fluctuations, Transmitter Power, Pulse Repetition Frequency, Antenna Parameters, System Losses, Problems	8
II	MTI and Pulse Doppler Radar: Introduction to Doppler and MTI Radar, Delay-Line Cancelers, Staggered Pulse Repetition Frequencies, Doppler Filter Banks, Digital MTI Processing, Moving Target Detector, Limitations to MTI Performance.	8
III	Tracking Radar: Tracking with Radar, Mono pulse Tracking, Conical Scan and Sequential Lobing, Limitations to tracking Accuracy, Low-Angle Tracking, Tracking in Range, Other Tracking Radar Topics, Comparison of Trackers, Automatic Tracking with Surveillance Radars(ADT)	8
IV	Detection of Signals in Noise: Introduction, Detection Criteria, Detectors, Automatic Detection, Integrators, Constant-False-Alarm Rate Receivers.	8
V	Information from Radar Signals: Basic Radar Measurements, Theoretical Accuracy of Radar Measurements, Ambiguity Diagram, Pulse Compression, Target Recognition, Land Clutter, Sea Clutter, Weather Clutter	8

Text/ Reference Books:

1. Merrill I. Skolnik " Introduction to Radar Systems" Third Edition.
2. J.C. Toomay , Paul J. Hannen " Principles of Radar" Third Edition.

EIC-034/EOE-075 MICRO AND SMART SYSTEMS		3 1 0
UNIT	TOPICS	LECTURES
I	Introduction, Why miniaturization?, Microsystems versus MEMS, Why micro fabrication?, smart materials, structures and systems, integrated Microsystems, applications of smart materials and Microsystems,.	5
II	Micro sensors, actuators, systems and smart materials: Silicon capacitive accelerometer, piezoresistive pressure sensor, conductometric gas sensor, an electrostatic combo-drive, a magnetic microrelay, portable blood analyzer, piezoelectric inkjet print head, micromirror array for video projection, smart materials and systems.	8
III	Micromachining technologies: silicon as a material for micro machining, thin film deposition, lithography, etching, silicon micromachining, specialized materials for Microsystems, advanced processes for micro fabrication.	8
IV	Modeling of solids in Microsystems: Bar, beam, energy methods for elastic bodies, heterogeneous layered beams, bimorph effect, residual stress and stress gradients, poisson effect and the anticlastic curvature of beams, torsion of beams and shear stresses, dealing with large displacements, In-plane stresses. Modelling of coupled electromechanical systems: electrostatics, Coupled Electro-mechanics: statics, stability and pull-in phenomenon, dynamics. Squeezed film effects in electro-mechanics.	8
V	Integration of micro and smart systems: integration of Microsystems and microelectronics, microsystems packaging, case studies of integrated Microsystems, case study of a smart-structure in vibration control. Scaling effects in Microsystems: scaling in: mechanical domain, electrostatic domain, magnetic domain, diffusion, effects in the optical domain, biochemical phenomena.	

Text book:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalakrishnan, K. N. Bhat and V. K. Atre, “Micro and smart systems”, Wiley India, 2010.