SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
Accredited with 'A' grade by NAAC
Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai - 600 119.

School of Electrical and Electronics

Minutes of Board of Studies Meeting held on 1st June, 2020

(Virtual Meeting conducted on Zoom Platform (Time: 10.30 a.m. to 12 noon)

- Dr.N.M.Nandhitha, Prof. & Dean School of Electrical and Electronics started the meeting by welcoming both the external and the internal numbers to the Board of Studies meeting (30.6.2020, 10.30 a.m. to 12.00 noon)

- Dr M D Selvaraj. Professor, IIITDM accepted the changes suggested by Dr S Lakshmi. However he added that "Specialized services – E-mail, Video conferencing and internet connectivity" from Unit-5 can be replaced with 'Case studies on Weather Forecasting Satellites ' .

- Dr.Sivakumaran, Prof., NIT, Trichy accepted the changes proposed in 'MEMS and its Applications' and 'Automatic Speech Recognition'.

- Mr M Sugadev, presented the changes made in 'Advanced Electronic Test Engineering'. He also added that this course is conducted with the infrastructure sponsored by QMAX Technologies, Chennai. Mr J Visweeswaran, NI Electronics, appreciated the effort taken by the Department and the syllabus revision was accepted.

- Dr P Chitra, putforth the revisions for 'Pattern Recognition and Image Vision'. Dr M D Selvaraj accepted the revision and added that "Classification performance measures - Risk and error probabilities" can be replaced with "Non-metric methods for pattern classification on numeric data, Decision tress, Classification and Regression Trees (CART)".

- Dr S Lakshmi, proposed syllabus revision in 'Mobile Adhoc Networks and Spread Spectrum Communication'. Dr M D Selvaraj, accepted the syllabus revision.

- Dr T Ravi presented the syllabus revision on Nanoelectronics to the board. MrJVisweeswaran accepted the changes and added that 'Nanoelectronics in Random Access Memory, Mass Storage devices and related topics' can be included.

- Dr M Sumathi presented syllabus revision in 'Integrated Services Digital Network' and "Radar and Navigational Aids". Dr M D Selvaraj accepted the changes.

- Dr P Chitra proposed the revisions in 'Signals and Systems' to the board. Dr Sivakumaran accepted the changes and he suggested that "Speech Signal Processing" can also be included.

- Dr S Barani presented the syllabus revision in 'Digital Signal Processing' to the board. Dr N Sivakumaran suggested that "Audio Coding Techniques and Comparison Analysis and Related Topic" can be included.

- Dr T Ravi presented the syllabus revision in "Programming in HDL". Dr M D Selvaraj suggested that "Case Study on related topics" can be included.

- Mr M Sugadev presented syllabus revision in 'AI and Soft Computing' and 'SCADA Systems Applications' to the board. Dr M D Selvaraj readily accepted the revisions.

SL NO	COURSE CODE	COURSE NAME	DELETED TOPICS	ADDED TOPICS
	SEC1631	SATELLITE COMMUNICATIONS	**UNIT 1** satellite access, single access, pre-assigned FDMA, SCPC (spade system), TDMA, pre-assigned TDMA, demand assigned TDMA **UNIT 2** Effects of rain – Uplink rain– Fade margin – Downlink rain **UNIT 3** ascent guidance, satellite rendezvous. **UNIT 4** Advanced very high resolution radiometer	**UNIT 1** Multiple Access Techniques: Introduction, FDMA , SCPC Systems, MCPC Systems, TDMA, CDMA, SDMA **UNIT 2** Satellite Link Design Fundamentals: Transmission Equation, Satellite Link Parameters, Propagation considerations. **UNIT 3** Satellite subsystem: Power supply subsystem, Attitude and Orbit control, Tracking, Telemetry and command subsystem, Payload **UNIT 4** Satellite Instruments: Microwave Radiometer (MWR), Infra-red Camera (NIRST), High Sensitivity Camera (HSC),Data Collection System (DCS),Technological Demonstration Package (TDP).
	SEC1632	MEMS AND ITS APPLICATIONS	**UNIT 1** Working principle of micro system - Micro sensors, Micro actuators, Micro accelerometers and Micro fluidics **UNIT 4** case study - Capacitive RF MEMS switch	**UNIT 1** Overview of microelectronics manufacture and Microsystems technology. Laws of scaling. The multidisciplinary nature of MEMS. Survey of materials central to micro engineering. Applications of MEMS in variousindustries. **UNIT 2**

				Packaging: Microsystemspackaging,Essentialpackagingtechnologies,Selectionofpackagingmaterials. **UNIT 3** engineering mechanics behind these Microsensors, Actuation usingElectrostatic forces (Parallel plate, Torsion bar, Comb drive actuators),Casestudy:Combdriveactuators. **UNIT 4** RF MEMS relays andswitches-Micromachined RF filters-Micromachined antennas-Switched delay lines. Micromachined transmissionlines-RFMEMSbasedcircuitdesignandcasestudies **UNIT 5** Designconsiderations, Mechanical Design, Process design, Realization of MEMS components using intellisuite. Micro systempackaging,PackingTechnologies,AssemblyofMicrosystems,ReliabilityinMEMS.
	SEC1633	AUTOMATIC SPEECH RECOGNITION	**UNIT 4** Vector quantization,speechcoding **UNIT 5** Adapting to variability in speech (DTW).	**UNIT 2** Adaptation (Noise adaptation, Speaker adaptation/normalization, Language model adaptation), Qualityanalysisofspeechprocessingsystem **UNIT 3** Speech Signal Representation-Short-time FourierAnalysis,ParametricRepresentationoftheSpectralAnalysis **UNIT 5** Case study: Neural network-based acoustic modeling (Hybrid/Tandem/TDNN models), Convolutional Neural Networks in Speech, Speaker Adaptation.
	SEC1634	ADVANCED ELECTRONIC TEST ENGINEERING	**UNIT 1** Electrical tests -Text fixtures - Bed of nails fixtures - Cross talk test - Mock up test - In circuit test – Burn-in-test - Fault diagnostic methods. **UNIT 4** Digital Pin Electronics - Drive	**UNIT 1** Digital and Analog VLSI Testing-VLSI Technology Trends Affecting Testing . Fault Modeling **UNIT 2** FunctionalDSP-BasedTesting **UNIT 3** AnalogandMixed-SignalCircuitTest

			data formats - Digital High way - Analog Highway	**UNIT 4** Advantest Model T6682 ATE Generic Test Automation Architecture - Overview of the Gtaa, Test Generation Layer-Test Definition Layer- Test Generation Layer-Test Definition Layer- Test Generation Layer-Test Definition Layer-Troubleshooting Biomedical Equipment- Defibrillators- ECG Systems- ECG Machine Maintenance- EEG, Machines, Troubleshooting and Preventive Maintenance, Hemodialysis Machines and Troubleshooting.
	SEC1635	PATTERN RECOGNITION AND IMAGE VISION	**UNIT 1** studyofshapebyregion analysis **UNIT 4** FUZZY CLASSIFIERS- Fuzzy and crisp classification - Fuzzy clustering - Fuzzy pattern recognition -	**UNIT 1** feature detection, Applicationsofpatternrecognition **UNIT 2** Parzen-windowmethod. K-Nearest Neighbourmethod **UNIT 4** Sequential pattern recognition-Hidden Markov models (HMMs)-Discrete HMMs, Continuous HMMs **UNIT 5** AI in imaging system.
	SEC1636	MOBILE ADHOC NETWORKS	**UNIT 3** Introduction-IssuesinDesigningaRoutingProtocolforAdHocWirelessNetworks **UNIT 4** Battery Management Schemes - Transmission Power Management Schemes - System Power Management Schemes	**UNIT 2** Cross layer Design: need for cross layer design, cross layer optimization, parameter optimization techniques, cross layer cautionary perspective. Integration of adhoc with Mobile IP networks **UNIT 4** Security in Ad-hoc Wireless Networks, Issues and Challenges inSecurityProvisioning,NetworkSecurityAttacks,KeyManagementandSecureToutingAd-hocWirelessNetworks
	SEC1637	NANO ELECTRONICS	**UNIT 1** Quantumdot,currentflowintwoterminalQuantumdots,ballistictransport,SingleElectronTransistor	**UNIT 1** Introduction to nanotechnology,Impacts, Limitationsofconventionalmicroelectronics,Trendsinmicroelectronicsand optoelectronics Mesoscopic physics, trends in microelectronics and optoelectronics, characteristic lengths inmesoscopicsystems,Quantummechanicalcoherence Nanomaterials: Preparation – Plasma Arcing – Chemical Vapor Deposition – Sol-Gels – Electrode Position – Ball Milling –Applications Of Nanomaterials

				UNIT 4 Carbon Nanotube: Fullerenes - types of nanotubes – formation of nanotubes – assemblies – purification of carbon nanotubes – electronic properties – synthesis of carbon nanotubes **UNIT 5** Introductiontocharacterizationofnanostructures,toolsusedforofnanomaterials characterization,microscope-optical,electron,andelectronmicroscope, Micro Electronics.
	SEC1638	SPREAD SPECTRUM COMMUNICATION	**UNIT 1** Basic digital communication concepts, Impact of wide band, Detection of binary signals in additive white GaussianNoise, Differences between standard narrow-band communication systems and spread spectrum systems **UNIT 4** Problem definition and the optimum synchronizer, serial search synchronization techniques, general analysis ofaverage synchronization time, synchronization using a matched filter, synchronization by estimating the receivedspreading code, tracking loop pull-in, performance of spread spectrum system without coding, performance ofspreadspectrumsystemwithforwarderrorcorrection **UNIT 5** Calculation of theoretical capacity of a CDMA system, coding and decoding processes in CDMA,effects of interference in CDMA, and synchronization in CDMA wireless communication systems. 3G wirelesssystems using CDMA technologies, Major factors influencing the capacity of CDMA wireless networks, MulticarrierCDMA,Rakereceivers wirelessLANapplications, commercialandmilitaryapplications	**UNIT 1** Slow and fast frequencyhopping. General mechanism of ML sequence. Power spectral densit of ML sequence. General mechanism andpropertiesofWalshHadamardCode, OVSF,Barkercodes,GoldandKasamicodes **UNIT 2** Systems communications models – Performance without coding under AWGN and different jamming environments – spread spectrum systems performances with forward error correction -Block coding – Convolutional coding and specific error correcting codes – Inter leaving – Random coding bounds **UNIT 5** CDMA RF Propagation Principles, Antennas for Wireless Systems ,CDMA Traffic Engineering,CDMA Air Interface Overview, Key CDMA Performance Parameters and their Significance, Call Processing fromPerspectiveoftheSubscriberHandset,CDMAHandoffs
	SEC1639	RADAR AND NAVIGATIONALAIDS	**UNIT 5** DME and TACAN-Distance Measuring Equipment-	**UNIT 1** Maximum UnambiguousRange,RadarWaveforms,

			Operation of DME-TACAN-TACAN Equipment Aids toApproach and Landing-Instrument Landing System-Ground Controlled Approach System-Microwave LandingSystem(MLS) Doppler Navigation-The Doppler Effect-Beam Configuration-Doppler frequency Equation-Track Stabilization-Doppler Spectrum-Components of The Doppler Navigation System-Doppler Range Equation-Accuracy of Doppler Navigation System. Inertial Navigation-Principles of Operation-Navigation Over The Earth-ComponentsofaninertialNavigationSystem-EarthCoordinateMechanization-Strapped-DownSystems-Accuracyof Inertial Navigation Systems. Satellite Navigation System-The Transit System-Navstar Global Positioning System(GPS)-Nightvisionsystems	ModifiedRadarRange Equation **UNIT 2** Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar – Amplitude Comparison Monopulse (one- and two-coordinates), Phase Comparison Monopulse. Target Reflection Characteristics and Angular Accuracy. Tracking in Range, Acquisition and Scanning Patterns. Comparison of Trackers., MTI Improvement Factor, N-Pulse Delay-LineCanceler **UNIT 4** Instrument Landing System, Ground controlled Approach System **UNIT 5** 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
	SEC1640	INTEGRATED SERVICES DIGITAL NETWORKS		**UNIT 1** reviewofswitchingtechnologies **UNIT 3** Delay Analysis and Simulation, ISDN products, Switches,Multiplexers,Terminaladapters,ISDNchipsets. **UNIT 4** ATM-Broadband Network Protocol, ATM Network Components, ATM SwitchesTerminalEquipment,UniqueBenefits. **UNIT 5** PotentialB-ISDNSatelliteApplications,GeneralB-ISDNServiceRequirements,Architecture,TerrestrialB-ISDNSupport,SystemConceptTypesofServicesSupported,PrivateBasedB-ISDN,SystemConcept,TypesofServices Supported
	SECA1301	SIGNALS AND SYSTEMS		**UNIT 4** Spectrum of DT signals, Discrete Time Fourier Transform (DTFT)- Properties of DTFT - z-transform -Basic properties of Z transform Properties of ROC - Inverse z-transform, Convolution method and Partial fraction expansion- Discrete time Systems- Classification of systems,Linear time Invariant System -

				Difference equation - Computation of Impulse response, Frequency response, step response, natural response, forced response and Transfer function using Z Transform, Convolution Sum using matrix, graphical and tabulation method-Properties of convolution sum. **UNIT 5** Mathematical tools for the analysis of deterministic and random signals – Sampling theorem-Analysis and modeling of Signals -Speech, music, medical signals- Applications of Fourier Transform- Analysis and modeling of Systems- Systems that manipulate signals-analysis and synthesis of signals and their interaction with systems
	SEC1319	DIGITALSIGNALPROCESSING	**UNIT 1** Representation, Characterization and Classifications of Continuous Time (CT) & Discrete Time (DT) signals, Sampling, theorem - Aliasing effect, Operations on DT signals , Convolution, Advantages of DSP over ASP , Classification of CT &DTsystems , properties of Discrete time systems-Linearity-Time invariance-causality –stability-Linear time Invariant systems,Difference equation representation of LTI systems-The Z transform-properties of Z transform-Inverse Z transform-SystemtransferFunction	**UNIT 5** RealTimeDSPSystemArchitectureand FunctionalBlocks,AnalogInterface,SignalConditioning,generationanddetectionforrealtimeapplications,-DSPHardwares(DigitalSignalProcessor,FPGA,ARMProcessorwithDSP Extension)&itsapplications - Speech Signal Processing, Enhancements, Coding & Transcoding Techniques (A-Law, U-Law, G.711, G.723,G.729, GSM) for IP and Mobile Telephone applications - High Definition Audio Signal Processing,
	SEC1402	PROGRAMMINGINHDL	**UNIT 1** Digital system design process - Hardware simulation - Introduction to VHDL - Language elements of VHDL -Dataobjects-Datatypes-Operators-Signalassignments-Inertialdelaymechanism-Transportdelaymechanism - Variableassignments-ConcurrentandSequentialassignments-Deltadelay	**UNIT 1** Introduction to VHDL - Language elements of VHDL -Concurrent and Sequential assignments Data flow modeling - Concurrent Signal Assignment statements- Structural modeling- Component declaration-Component Instantiation-Behavioralmodeling-Processstatement-ExamplesforVHDLmodeling **UNIT 5** FPGA Design Flow - Architecture ofXilinx Artix7 FPGA - Input/Output Blocks (IOB) - Configurable Logic Blocks (CLB)-ProgrammableInterconnect - Internal Hard macros - Realizing applications in FPGA - combinational functions - N-bit functions, Encoder, Decoders - Sequential functions - N-bit

				register,shift registers, up/down counters- N-bit processor.
	SECA7017	AI AND SOFT COMPUTING	UNIT 5 Communication - Communication as action, A formal grammar for a fragment of English, Syntactic analysis Augmented grammars, Semantic interpretation, Semantic interpretation, Ambiguity and disambiguation, Discourse understanding-Grammar induction, Probabilistic language processing - Probabilistic language models, Information Retrieval and implementation, Information Extraction, Machine translation systems	**UNIT 5** Natural language processing – Text classsification - Information Retrieval and Exatraction-AugmentatedGrammers and Semantic Interpretation - Speech Recognition-Image formation-Object Recognition from structural information – Robotics – Machine learning in Robotic Perception –Path planning.
	SECA7024	SCADA SYSTEMS APPLICATIONS	**UNIT 2** SCADA Architectures - First generation - Monolithic, Second generation - Distributed, Third generation - Networked Architecture	**UNIT 2** Remote Terminal Unit (RTU), Interface units, Human- Machine Interface Units (HMI), Display Monitors/Data Logger Systems, Intelligent Electronic Devices (IED), Communication Network, SCADA Server, SCADA Control systems and Control panels

- Dr.N.M.Nandhitha informed the board that Dr.Krishnamoorthi of School of EE has developed software for Digital Logic Circuits Laboratory (virtual laboratory).
- Dr.R.Pandian proposed few additions in the course “Electrical and Electronic Measurements and Instrumentation”. He pointed out the topics which include Display devices, waveform generators and analyzers. Dr. Sivakumaran agreed and he suggested that it can be added in the syllabus. He also suggested to add polyphase metering.
- Dr.Lalithakumari presented the syllabus for an elective course ‘Automotive Instrumentation’. Dr.Sivakumaran suggested to include networks, Graphical User Interface in Automotive Instrumentation

COURSE CODE	COURSE NAME	DELETED TOPICS	INCLUDED TOPICS
SEIA1401	Electrical and Electronic Measurements and Instrumentation	--	Unit-5 DSO, DPO, MSO, Analog Recorders – Strip Chart and X-Y recorders, Digital Recorders Function generators, Signal generators, Waveform analyzers, Spectrum analyzers, Distortion analyzers

- Dr.V.Sivachidambaranathan,Prof.&Head, Dept. of Electrical and Electronics Engineering requested Dr.Vanitha, Faculty/EEE to present he curriculum revisions before the board.

- She has presented the old and new syllabus for Electrical Technology (theory and practical)before the board and discussed the valid additions made in the syllabus. Dr.Sivakumaran, Prof.,NIT, Trichy gave suggestions to include the standards, tools and grounding procedures and casestudiesinthe syllabus.

- Dr.M D Selvaraj insisted on the feasibility of conducting laboratory through Virtual Labs.Mr.J.Visweeswaran, National Instruments also welcomed the idea of virtual laboratory.

- Dr.V.Sivachidambaranathanputforth the syllabus of the new courses, 'Industrial Drives and automation' , 'Computer Control of Electric Drives'for the approval of the board. Dr N Sivakumaran approved the Syllabus for these new courses.

Name of the Course : **Electrical Technology**
Course Code :**SEEA1102**

UNIT	Content	Remarks
1	**MAGNETICCIRCUITS** Definition of MMF, Flux and Reluctance - Leakage Factor - Reluctances in Series and Parallel (Series and Parallel Magnetic Circuits) – Electromagnetic Induction - Fleming's Rule - Lenz's Law - Faraday's laws - statically and dynamically induced EMF- Self and mutual inductance – Analogy of Electric and Magnetic circuit. **INTRODUCTIONT OF ELECTRICAL STANDARDS** Indian Standard Electricity Rules - Domestic Wiring - Wiring Materials and Accessories - Staircase Wiring – Fluorescent Tubes– Earthing –Types of Earthing – Benefits of Earthing.	Shifted Magnetic circuit to Unit 2 Inclusion

2	**DCMACHINES** Construction, Principles of operation of DC Machines - Types - EMF Equation - Performance Characteristics, of Series andShuntGenerators-DCMotor-Torque-Speed-TorqueCharacteristicsofSeriesandShuntMotors - SpeedControlandApplications **DC GENERATORS** Construction, Principles and Working operation of DC Generators - EMF Equation – Types of Generators - Performance Characteristics of Series and Shunt Generators – Applications. **DC MOTORS** Construction, Principles and Working of operation of DC Motors – Torque Equation – Back EMF - Types of DC Motors - Torque - Speed Characteristics of Series and Shunt Motors - Speed Control of DC Motors - Applications.	To give more exposure on DC Machines, this can be split in to DC Generators in Unit 3 and DC Motors in Unit 4.
3	**TRANSFORMERS** Constructional Details and Principle of operation of Single -Phase Transformer - EMF Equation - Phasor Diagram on No Load and Loaded Transformer - Equivalent Circuit - Open Circuit and Short Circuit Test on Transformer - Regulation and Efficiency- Auto Transformer	Content included in Unit 5
4	INDUCTIONMOTORS(QUALITATIVETREATMENTONLY) Constructional Details of Three Phase Induction Motor - Slip Ring and Squirrel Cage Rotor- Principle of operation- Torque Equation - Torque / Slip Characteristics - Starters - Applications Introduction to Single Phase Induction Motors - Capacitor Start Capacitor Run Motor -Shaded Pole Motor.	Deletion DC Motor fromUnit 2 has shifted to Unit 4 instead of Induction motors.
5	**SYNCHRONOUSMACHINESANDSPECIALMACHINES(QUALITATIVETREATMENT ONLY)** Principles of Alternator - Construction Details - Types Special Machines: Stepper motor- Permanent magnet Stepper motor-Variable reluctance stepper motor- AC and DC Servomotor -Stepper Motor Selection and Control : An Industrial Case Study. UniversalMotor - Hysteresis Motor -Permanent Magnet Synchronous Motor - Switched Reluctance Motor - Brushless D.C Motor - Construction,WorkingandApplications.	Deletion Inclusion Transformers form Unit 3 has shifted in addition to special electrical machines

Name of the Course : **ELECTRICAL ENGINEERINGLAB** Course Code :**SEEA2102**		
	List of Experiments	**Remarks**
	1. Wiringcircuits for a. Calling bell. b. Staircase. c. Fluorescent lamp d. Basic house hold wiring using switches, fuses, Indicator–lamps etc. 2. Open circuit characteristics of separately excited dc	Theory related Experiments are executed

	shunt generator. 3. Load characteristics of self-excited dc shunt generator. 4. Load characteristics of dc Compound generator. 5. Load characteristics of dc shunt motor. 6. Speed control of dc shunt motor. 7. Load characteristics of dc series motor 8. Load test on single phase transformer 9. Open circuit and short circuit test on single phase transformer 10. Brake load test on three phase squirrel cage induction motor. 11. Load test on single phase Induction motor.	

- BoS members are happy that the revised courses enhance employability/ Entrepreneurship/Skills of the students. The meeting ended with a vote of thanks by Dr.N.M.Nandhitha who expressed her sincere gratitude to both the external and internal members for joining the meeting.

EXTERNAL MEMBERS:

1. Dr.N.Sivakumaran
2. Dr.M.D.Selvaraj
3. Mr.J.Visweswaran

INTERNAL MEMBERS:

1. Dr.N.M.Nandhitha
2. Dr.T.Ravi
3. Dr.P.Chitra
4. Dr.S.Barani
5. Dr.S.Poornapushpakala.
6. Dr.M.Sumathi
7. Dr.S.Lakshmi
8. Dr.P.Kavipriya
9. Mr M Sugadev
10. Ms.E.Anna Devi
11. Ms.S.Yogalakshmi
12. Dr.LalithaKumari.S

13. Dr.Pandian.R

14. Dr.Marshiana.D

15. Dr.V.Sivachidambaranathan

16. Dr.D.Susitra

17. Dr.R.Vanitha

18. Mrs.D.Ramya

19. Mrs.P.Sivagami

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SYLLABUS REVISION

SL.NO	COURSE CODE	COURSE NAME
1.	SEC1631	SATELLITE COMMUNICATIONS
2.	SEC1632	MEMS AND ITS APPLICATIONS
3.	SEC1633	AUTOMATIC SPEECH RECOGNITION
4.	SEC1634	ADVANCED ELECTRONIC TEST ENGINEERING
5.	SEC1635	PATTERN RECOGNITION AND IMAGE VISION
6.	SEC1636	MOBILE ADHOC NETWORKS
7.	SEC1637	NANO ELECTRONICS
8.	SEC1638	SPREAD SPECTRUM COMMUNICATION
9.	SEC1639	RADAR AND NAVIGATIONAL AIDS
10.	SEC1640	INTEGRATED SERVICES DIGITAL NETWORKS
11.	SECA1301	SIGNALS AND SYSTEMS
12.	SEC1319	DIGITAL SIGNAL PROCESSING
13.	SEC1402	PROGRAMMING IN HDL

		L	T	P	Credits	Total Marks
SEC1311 (old)	SATELLITE COMMUNICATIONS	3	0	0	3	100

UNIT 1 SATELLITE ORBIT AND ACCESS **9 hrs**

Introduction Kepler's Laws, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility –eclipse-Sub satellite point –Sun transit outage-Launching Procedures -launch vehicles and propulsion. Interference between satellite circuits, satellite access, single access, pre-assigned FDMA, SCPC (spade system), TDMA, pre-assigned TDMA, demand assigned TDMA, down link analysis, and comparison of uplink power requirements for TDMA & FDMA, on board signal processing satellite switched TDMA.

UNIT 2 LINK CALCULATIONS AND DESIGN **9 hrs**

Space craft configuration, payload and supporting subsystems, satellite uplink – downlink power budget equation – System noise – Antenna noise – Amplifier noise temperature – Amplifiers in cascade – Noise factor – Noise temperature of absorptive networks – Overall system noise temperature – Carrier toNoise ratio – Uplink – Saturation flux density – Input back off – The earth station HPA – Downlink – Output back off – Satellite TWTA output – Effects of rain – Uplink rain– Fade margin – Downlink rain – Fade margin – Combined uplink and downlink C/N ratio – Inter modulation noise

UNIT 3 SATELLITE CONTROL **9 hrs**

Attitude control of satellites, Reaction wheel, Momentum wheel, Thrusters, Stabilization satellites, Spin stabilization, Gravity gradient stabilization, control moment gyros, orbit determination of satellites, sensors in satellite ADCS. Dual spinners, navigation of satellites, ascent guidance, satellite rendezvous. Tethered satellite systems, satellite services, space stations, docking of spacecrafts. Earth solution design, tracking, small earth station antennas, Equipment for the Earth station.

UNIT 4 SATELLITE INSTRUMENTATION **9 hrs**

Advanced very high resolution radiometer, Magnetometer, Torque coil, high-resolution infrared radiation sounder, Microwave sounding unit, stratospheric sounding unit, advanced microwave sounding unit, solar backscatter ultraviolet radiometer, GOES imager and sounder.

UNIT 5 SATELLITE APPLICATIONS & DIRECT BROADCAST SATELLITE SERVICES **9 hrs**

INTELSAT series, INSAT, VSAT, Remote sensing, Mobile satellite Service: GSM, GPS, INMARSAT,LEO,MEO, Satellite navigation system, Direct Broadcast satellites(DBS),Direct to home broad cast (DTH), Digital audio broadcast (DAB) , World space services , Business TV(BTV), GRAMSAT, Specialized services – E-mail, Video conferencing and internet connectivity.

COURSE OUTCOMES:

On completion of this course, student will be able to

CO1	Analyze the different terminologies used in satellite Communication
CO2	Design the operation of space segment, Antenna segment and Earth segment
CO3	Apply the corrective & controlling techniques to bring back the satellite in active mode
CO4	Analyze the losses in satellite communication and calculate the link budget equation
CO5	Analyze the different multiple access techniques used in satellite communication
CO6	Develop the applications of satellite in network environment

TEXT / REFERENCE BOOKS:

1. Dennis Roddy, “Satellite communication”, 4th edition - Tata Mc Graw Hill Co. Special Indian print, 2009
2. Zhili Sun-John, “Satellite Networking Principles and Protocol”, W.& Sons 2005
3. Timothy Pratt & C W. Bostain, “Satellite communication”, Wiley 3rd Edition
4. K.N.Raja Rao, “Fundamentals of Satellite communication”. PHI 2004

		L	T	P	Credits	Total Marks
SEC1631 (revised)	**SATELLITE COMMUNICATIONS**	**3**	**0**	**0**	**3**	**100**

UNIT 1 SATELLITE ORBIT AND ACCESS **9 hrs**

Introduction Kepler's Laws, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility –eclipse-Sub satellite point –Sun transit outage-Launching Procedures -launch vehicles and propulsion. Interference between satellite circuits, Multiple Access Techniques: Introduction, FDMA , SCPC Systems, MCPC Systems, TDMA, CDMA, SDMA, down link analysis, and comparison of uplink power requirements for TDMA & FDMA, on board signal processing satellite switched TDMA.

UNIT 2 LINK CALCULATIONS AND DESIGN **9 hrs**

Satellite Link Design Fundamentals: Transmission Equation, Satellite Link Parameters, Propagation considerations. Space craft configuration, payload and supporting subsystems, satellite uplink – downlink power budget equation – System noise – Antenna noise – Amplifier noise temperature – Amplifiers in cascade – Noise factor – Noise temperature of absorptive networks – Overall system noise temperature – Carrier toNoise ratio – Uplink – Saturation flux density – Input back off – The earth station HPA – Downlink – Output back off – Satellite TWTA output – Fade margin – Combined uplink and downlink C/N ratio – Inter modulation noise

UNIT 3 SATELLITE CONTROL **9 hrs**

Satellite subsystem: Power supply subsystem, Attitude and Orbit control, Tracking, Telemetry and command subsystem, Payload. Attitude control of satellites, Reaction wheel, Momentum wheel, Thrusters, Stabilization satellites, Spin stabilization, Gravity gradient stabilization, control moment gyros, orbit determination of satellites, sensors in satellite ADCS. Dual spinners, navigation of satellites. Tethered satellite systems, satellite services, space stations, docking of spacecrafts. Earth solution design, tracking, small earth station antennas, Equipment for the Earth station.

UNIT 4 SATELLITE INSTRUMENTATION **9 hrs**

Satellite Instruments: Microwave Radiometer (MWR), Infra-red Camera (NIRST), High Sensitivity Camera (HSC),Data Collection System (DCS),Technological Demonstration Package (TDP). Magnetometer, Torque coil, high-resolution infrared radiation sounder, Microwave sounding unit, stratospheric sounding unit, advanced microwave sounding unit, solar backscatter ultraviolet radiometer, GOES imager and sounder.

UNIT 5 SATELLITE APPLICATIONS & DIRECT BROADCAST SATELLITE SERVICES **9 hrs**

INTELSAT series, INSAT, VSAT, Remote sensing, Mobile satellite Service: GSM, GPS, INMARSAT,LEO,MEO, Satellite navigation system, Direct Broadcast satellites(DBS),Direct to home broad cast (DTH), Digital audio broadcast (DAB) , World space services , Business TV(BTV), GRAMSAT Case study: Weather Forecasting Satellites: Fundamentals, Images, Orbits, Payloads, Applications.

COURSE OUTCOMES:

On completion of this course, student will be able to

CO1	Analyze the different terminologies used in satellite Communication
CO2	Analyze the operation of space segment, Antenna segment and Earth segment
CO3	Apply the corrective & controlling techniques to bring back the satellite in active mode
CO4	Analyze the losses in satellite communication and calculate the link budget equation
CO5	Analyze the different multiple access techniques used in satellite communication
CO6	Develop the applications of satellite in network environment

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1. Dennis Roddy, “Satellite communication”, 4th edition - Tata Mc Graw Hill Co. Special Indian print, 2009
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4. K.N.Raja Rao, “Fundamentals of Satellite communication”. PHI 2004

Color red indicates the deleted portion. Color yellow indicates the added portion

		L	T	P	Credits	Total Marks
SEC1612 (old)	MEMS AND ITS APPLICATIONS	3	0	0	3	100

UNIT 1 OVERVIEW OF MEMS AND MICROSYSTEMS **9 hrs**

Definition - Fundamentals - Properties, Introduction to MEMS and NEMS, Microsystems and miniaturization, Working principle of micro system - Micro sensors, Micro actuators, Micro accelerometers and Micro fluidics, MEMS materials: Silicon, silicon compounds, silicon Piezo- resistors, Gallium Arsenide, Quartz, Piezoelectric crystals, Polymers, Metals.

UNIT2 MEMS FABRICATION & PACKAGING **9 hrs**

Micro-system fabrication processes: Photolithography, Ion Implantation, Diffusion, and Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, LIGA Technology.

UNIT 3 MICRO SENSORS AND ACTUATORS **9 hrs**

Micro-sensing for MEMS: Piezo-resistive Pressure Sensor, Capacitive sensor, Piezoelectric sensing, Resonant sensing, Surface Acoustic Wave sensors-Electromechanical transducers: Piezoelectric transducers, Electrostrictive transducers, Magnetostrictive transducers- Electrostatic actuators, Electromagnetic transducers, Electro-dynamic transducers, Electro-thermal actuators, comparison of electro-thermal actuation process.

UNIT 4 MEMS DESIGN AND INTRODUCTION TO OPTICAL RF MEMS **9 hrs**

Micro system Design - Design consideration, process design, Mechanical design, Mechanical design using MEMS. Optical MEMS, System design basics - Gaussian optics, Matrix operations, Resolution. MEMS scanners and retinal scanning display, Digital Micro mirror devices. RF Mems - Design basics, case study - Capacitive RF MEMS switch, Performance issues.

UNIT 5 MEMS PACKAGING AND APPLICATIONS **9 hrs**

MEMS packaging: Role of MEMS packaging, Types of MEMS packaging, selection of packaging materials, flip-chip and multichip Unit packaging, RF MEMS packaging issues. Micro-machined transmission line and components, micro-machined RF Filters, Micro-machined Phase shifters, and Micro-machined antenna, Gyros and Bio-MEMS.

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Explain the operation of micro devices, micro systems and their applications
CO2	Design the micro devices, micro systems using the MEMS fabrication process
CO3	Analyze the approaches for various sensor design
CO4	Explain the approaches for various actuator design
CO5	Develop experience on micro/nano systems for computer-aided design
CO6	Discuss fabrication, analysis and characterization of nano-scale devices

TEXT / REFERENCE BOOKS:

1. Vijay K. Varadan, K. J. Vinoy and K. A. Jose , “RF MEMS & Their Applications”, John Wiley & Sons, 2003

2. Tai - Rai Hsu, “MEMS and Microsystems Design and Manufacturing”, Tata MC Graw Hill, New Delhi, Edition 2002

3. Gabriel M Rebeiz, “RF MEMS - Theory Design and Technology”, John Wiley and Sons, 2003

4. Nadim Maluf, “An introduction to Micro electro mechanical system design”, Artech House, 2000

		L	T	P	Credits	Total Marks
SEC1632 (revised)	MEMS AND ITS APPLICATIONS	3	0	0	3	100

UNIT 1 OVERVIEW OF MEMS AND MICROSYSTEMS **9 hrs**

Definition - Fundamentals - Properties, Introduction to MEMS and NEMS, Microsystems and miniaturization, MEMS materials: Silicon, silicon compounds, silicon Piezo- resistors, Gallium Arsenide, Quartz, Piezoelectric crystals, Polymers, Metals. Overview of microelectronics manufacture and Microsystems technology. Laws of scaling. The multi disciplinary nature of MEMS. Survey of materials central to micro engineering. Applications of MEMS in various industries.

UNIT2 MEMS FABRICATION & PACKAGING **9 hrs**

Micro-system fabrication processes: Photolithography, Ion Implantation, Diffusion, and Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, LIGA Technology. Packaging: Microsystems packaging, Essential packaging technologies, Selection of packaging materials.

UNIT 3 MICRO SENSORS AND ACTUATORS **9 hrs**

Micro-sensing for MEMS: Piezo-resistive Pressure Sensor, Capacitive sensor, Piezoelectric sensing, Resonant sensing, Surface Acoustic Wave sensors,- engineering mechanics behind these Microsensors, Electromechanical transducers: Piezoelectric transducers, Electrostrictive transducers, Magnetostrictive transducers, Actuation using Electrostatic forces (Parallel plate, Torsion bar, Comb drive actuators) Electrostatic actuators, Electromagnetic transducers, Electro-dynamic transducers, Electro-thermal actuators, comparison of electro-thermal actuation process. Case study: Comb drive actuators.

UNIT 4 MEMS DESIGN AND INTRODUCTION TO OPTICAL RF MEMS **9 hrs**

Micro system Design - Design consideration, process design, Mechanical design, Mechanical design using MEMS. Optical MEMS, System design basics - Gaussian optics, Matrix operations, Resolution. MEMS scanners and retinal scanning display, Digital Micro mirror devices. RF Mems - Design basics, Performance issues. RF MEMS relays and switches- Micromachined RF filters- Micromachined antennas- Switched delay lines. Micromachined transmission lines- RF MEMS based circuit design and case studies

UNIT 5 MEMS PACKAGING AND APPLICATIONS **9 hrs**

MEMS packaging: Role of MEMS packaging, Types of MEMS packaging, selection of packaging materials, flip-chip and multichip Unit packaging, RF MEMS packaging issues. Micro-machined transmission line and components, micro-machined RF Filters, Micro-machined Phase shifters, and Micro-machined antenna, Gyros and Bio-MEMS. Design considerations, Mechanical Design, Process design, Realization of MEMS components using intellisuite. Micro system packaging, Packing Technologies, Assembly of Microsystems, Reliability in MEMS.

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COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Analyze the operation of micro devices, micro systems and their applications
CO2	Design the micro devices, micro systems using the MEMS fabrication process
CO3	Apply the approaches for various sensor design
CO4	Apply the approaches for various actuator design
CO5	Develop experience on micro/nano systems for computer-aided design
CO6	Design nano scale devices by applying fabrication and analysis

TEXT / REFERENCE BOOKS:

1. Vijay K. Varadan, K. J. Vinoy and K. A. Jose , “RF MEMS & Their Applications”, John Wiley & Sons, 2003

2. Tai - Rai Hsu, “MEMS and Microsystems Design and Manufacturing”, Tata MC Graw Hill, New Delhi, Edition 2002

3. Gabriel M Rebeiz, “RF MEMS - Theory Design and Technology”, John Wiley and Sons, 2003

4. Nadim Maluf, “An introduction to Micro electro mechanical system design”, Artech House, 2000

		L	T	P	Credits	Total Marks
SEC1603 (Old)	AUTOMATIC SPEECH RECOGNITION	3	0	0	3	100

UNIT 1 FUNDAMENTALS OF SPEECH SIGNAL 9 hrs

History of speech recognition research, The Speech Signal: Speech production mechanism, Classification of speech, sounds, nature of speech signal, models of speech production. Speech signal processing: purpose of speech processing, digital models for speech signal, Digital processing of speech signals, Significance, short time analysis

UNIT 2 TIME DOMAIN METHODS FOR SPEECH PROCESSING 9 hrs

Time domain parameters of speech, methods for extracting the parameters, Zero crossings, Auto correlation function, pitch estimation

UNIT3 FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING 9 hrs

Short time Fourier analysis, filter bank analysis, spectrographic analysis, Formant extraction, pitch extraction, Analysis - synthesis systems. Homomorphic Signal Processing

UNIT4 SPEECH ANALYSIS AND SPEECH RECOGNITION 9 hrs

Cepstral analysis of speech, formant and pitch estimation, Mel frequency cepstrum computation, Applications of speech processing - Speech recognition, Speech synthesis and speaker verification, Basic pattern recognition approaches, Parametric representation of speech, Evaluating the similarity of speech patterns, Isolated digit Recognition System, Continuous digit Recognition System. Vector quantization, speech coding

UNIT5 HIDDEN MARKOV MODEL FOR SPEECH RECOGNITION 9 hrs

Introduction to Hidden Markov Model (HMM), Types of HMM, Hidden Markov Model (HMM) for speech recognition, Viterbi algorithm, Training and testing using HMMs, Adapting to variability in speech (DTW), Language models. Example of speech recognition project

Max. 45 hrs

COURSE OUTCOMES:

On completion of the course, students are able to

CO1	Recognize and acquire knowledge about the fundamentals of speech production
CO2	Understand the application of Time domain analysis in speech signals
CO3	Comprehend the application of Time and frequency domain analysis in speech signals
CO4	Implement the analyses of speech signals in speech recognition applications
CO5	Representation of speech signals using the parametric methods of Hidden Morkov model for speech recognition
CO6	Will be able to develop a speech processing and recognition system using various mathematical models and signal analysis tools

Color red indicates the deleted portion. Color yellow indicates the added portion

TEXT / REFERENCE BOOKS:

1. L. Rabiner and B.-H.Juang, “Fundamentals of Speech Recognition”, Prentice Hall, 1995, ISBN 0-1 3-015157-2
2. L. R. Rabiner and R. W. Schafer, “Digital Processing of Speech Signals”, Prentice-Hall, 1978, ISBN 0-13-213603-1
3. Douglas O’Shaughnessy, “Speech Communications: Human & Machine” -, 2nd ed., IEEE Press
4. Thomas F. Quateri, “Discrete Time Speech Signal Processing: Principles and Practice” - 1st Ed., PE
5. Claudio Becchetti and Lucio Prina Ricotti, “Speech Recognition”, Wiley

		L	T	P	Credits	Total Marks
SEC1633 (Revised)	**AUTOMATIC SPEECH RECOGNITION**	**3**	**0**	**0**	**3**	**100**

UNIT 1 FUNDAMENTALS OF SPEECH SIGNAL 9 hrs

History of speech recognition research, The Speech Signal: Speech production mechanism, Classification of speech, sounds, nature of speech signal, models of speech production. Speech signal processing: purpose of speech processing, digital models for speech signal, Digital processing of speech signals, Significance, short time analysis,

UNIT 2 TIME DOMAIN METHODS FOR SPEECH PROCESSING 9 hrs

Time domain parameters of speech, methods for extracting the parameters, Zero crossings, Auto correlation function, pitch estimation, Adaptation (Noise adaptation, Speaker adaptation/normalization, Language model adaptation), Quality analysis of speech processing system

UNIT3 FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING 9 hrs

Short time Fourier analysis, filter bank analysis, spectrographic analysis, Formant extraction, pitch extraction, Analysis - synthesis systems. Homomorphic Signal Processing, Speech Signal Representation- Short-time Fourier Analysis, Parametric Representation of the Spectral Analysis

UNIT4 SPEECH ANALYSIS AND SPEECH RECOGNITION 9 hrs

Cepstral analysis of speech, formant and pitch estimation, Mel frequency cepstrum computation, Applications of speech processing - Speech recognition, Speech synthesis and speaker verification, Basic pattern recognition approaches, Parametric representation of speech, Evaluating the similarity of speech patterns, Isolated digit Recognition System, Continuous digit Recognition System. Vector quantization, speech coding

UNIT5 HIDDEN MARKOV MODEL FOR SPEECH RECOGNITION 9 hrs

Introduction to Hidden Markov Model (HMM), Types of HMM, Hidden Markov Model (HMM) for speech recognition, Viterbi algorithm, Training and testing using HMMs, Adapting to variability in speech (DTW), Language models. Example of speech recognition project

Case study: Neural network-based acoustic modeling (Hybrid/Tandem/TDNN models), Convolutional Neural Networks in Speech, Speaker Adaptation.

Max. 45 hrs

Color red indicates the deleted portion. Color yellow indicates the added portion

COURSE OUTCOMES:

On completion of the course, students are able to

CO1	Analyze the knowledge about the fundamentals of speech production
CO2	Apply the application of Time domain analysis in speech signals
CO3	Apply the application of Time and frequency domain analysis in speech signals
CO4	Implement the analyses of speech signals in speech recognition applications
CO5	Analyze the speech signals using the parametric methods of Hidden Morkov model for speech recognition
CO6	Develop a speech processing and recognition system using various mathematical models and signal analysis tools

TEXT / REFERENCE BOOKS:

1. L. Rabiner and B.-H.Juang, “Fundamentals of Speech Recognition”, Prentice Hall, 1995, ISBN 0-1 3-051 57-2
2. L. R. Rabiner and R. W. Schafer, “Digital Processing of Speech Signals”, Prentice-Hall, 1978, ISBN 0-13-213603-1
3. Douglas O’Shaughnessy, “Speech Communications: Human & Machine” -, 2nd ed., IEEE Press
4. Thomas F. Quateri, “Discrete Time Speech Signal Processing: Principles and Practice” - 1st Ed., PE
5. Claudio Becchetti and Lucio Prina Ricotti, “Speech Recognition”, Wiley

		L	T	P	Credits	Total Marks
SEC1617 (Old)	ADVANCED ELECTRONIC TEST ENGINEERING	3	0	0	3	100

UNIT1 INTRODUCTION TO PCB TECHNOLOGY 9hrs

Printed Circuit Boards(PCB) - Construction - Types of PCB - Multilayer - Surface Mount technology – PCB Manufacturing process - PCB Inspection methods - Bare Board Testing - Optical and X-Ray Inspection - Electrical tests -Text fixtures - Bed of nails fixtures - Cross talk test - Mock up test - In circuit test – Burn-in-test - Fault diagnostic methods. Electromagnetic compatibility testing of electronic components, subassemblies, Measuring Instruments and systems

UNIT2 PCB TROUBLE SHOOTING PROCESS 9 hrs

Symptom Recognition - Bracketing Technique - Component failure Analysis - Fault types and causes in circuits- during manufacturing - Manual trouble shooting technique - Tools and Instruments DMM - CRO - PCO - Logic probes- Logic pulsar - Logic Analyzer-

UNIT3 AUTOMATED TROUBLE SHOOTING TECHNIQUES 9 hrs

ATE Techniques - CPU Emulator technique - ROM and ROM Emulators - In circuit Comparator - In Circuit Functional test - Trouble shooting digital gates - Testing Linear Integrated Circuits - Guarding Technique - VI trace Technique - Bus Cycle Signature System - Board functional test methods - Boundary scan test basics, ATE System Components - Digital Pin Electronics - Drive data formats - Digital High way - Analog Highway

UNIT4 ATE SYSTEM ARCHITECTURE 9 hrs

ATE System Components - Digital Pin Electronics - Drive data formats - Digital High way - Analog Highway –. Test Vector Generation - Creating test patterns - Fault Simulations. Technique - Bus Cycle Signature System - Board functional test methods - Boundary scan test basics.

UNIT5 DESIGN FOR TESTABILITY (DFT) 9 hrs

MDA test systems - Boundary scan test with I/O pin compatibility - Automatic optical inspection systems -Combinational ATE Systems - Design for testability - Observability and Controllability - Testing Flow diagram - Stuck at fault model - Fault simulation - Ad Hoc technique - Scan design technique - Basics of ATPG - BIST-Test pattern generation for built in self test - Exhaustive pattern generation and deterministic testing - Output response Analysis -Transition count syndrome checking - Signature Analysis - Circular BIST

Max. 45 hrs

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COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Identify various types of printed circuit boards and effectively use testing tools
CO2	Describe the working of automated test equipments
CO3	Identify faults in assembled PCBs using automated test equipments both at component level and board level
CO4	Design board fixtures to carry out customized board level testing
CO5	Develop test vectors and test patterns for fault identification in custom PCBs
CO6	Design and implement electronic systems with testability architectures

TEXT / REFERENCE BOOKS:

1 Michael L.Bushnell et al., “Essentials of Electronic testing for digital, memory and mixed signal VLSI circuit”,1st edition, Academic Press, 2002

2 Parag.K.lala, “Digital circuit Testing and Testability”, 1st edition, Academic press, 2001

3 Alfred L.Crouch, “Design for test for Digital ICs and Embedded core systems”, 2nd edition, PHI, 1999

4 Sabapathy S.R., “Test Engineering for electronic hardware”, Qmax publishers, 1st Edition, 2007

		L	T	P	Credits	Total Marks
SEC1634 (Revised)	**ADVANCED ELECTRONIC TEST ENGINEERING**	**3**	**0**	**0**	**3**	**100**

UNIT1 INTRODUCTION TO PCB TECHNOLOGY 9hrs

Printed Circuit Boards(PCB) - Construction - Types of PCB - Multilayer - Surface Mount technology – PCB Manufacturing process - PCB Inspection methods - Bare Board Testing - Optical and X-Ray Inspection Electromagnetic compatibility testing of electronic components, subassemblies, Measuring Instruments and systems- Digital and Analog VLSI Testing- VLSI Technology Trends Affecting Testing . Fault Modeling

UNIT2 PCB TROUBLE SHOOTING PROCESS 9 hrs

Symptom Recognition - Bracketing Technique - Component failure Analysis - Fault types and causes in circuits- during manufacturing - Manual trouble shooting technique - Tools and Instruments DMM - CRO - PCO - Logic probes- Logic pulsar - Logic Analyzer- Functional DSP-Based Testing

UNIT3 AUTOMATED TROUBLE SHOOTING TECHNIQUES 9 hrs

ATE Techniques - CPU Emulator technique - ROM and ROM Emulators - In circuit Comparator - In Circuit Functional test - Trouble shooting digital gates - Testing Linear Integrated Circuits - Guarding Technique - VI trace Technique - Bus Cycle Signature System - Board functional test methods - Boundary scan test basics, ATE System Components - Digital Pin Electronics - Drive data formats - Digital High way - Analog Highway- Analog and Mixed-Signal Circuit Test

UNIT4 ATE SYSTEM ARCHITECTURE 9 hrs

ATE System Components -– Advantest Model T6682 ATE . Test Vector Generation - Creating test patterns - Fault Simulations. Technique - Bus Cycle Signature System - Board functional test methods - Boundary scan test basics.- The Generic Test Automation Architecture - Overview of the gTAA - Test Generation Layer-Test Definition Layer- Test Execution Layer- Configuration Management of a TAS- Troubleshooting Biomedical Equipment- Defibrillators- ECG Systems- ECG Machine Maintenance- EEG Machines, Troubleshooting and Preventive Maintenance- Hemodialysis Machines and Troubleshooting

UNIT5 DESIGN FOR TESTABILITY (DFT) 9 hrs

MDA test systems - Boundary scan test with I/O pin compatibility - Automatic optical inspection systems -Combinational ATE Systems - Design for testability - Observability and Controllability - Testing Flow diagram - Stuck at fault model - Fault simulation - Ad Hoc technique - Scan design technique - Basics of ATPG - BIST-Test pattern generation for built in self test - Exhaustive pattern generation and deterministic testing - Output response Analysis -Transition count syndrome checking - Signature Analysis - Circular BIST

Max. 45 hrs

Color red indicates the deleted portion. Color yellow indicates the added portion

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Analyze various types of printed circuit boards and effectively use testing tools
CO2	Examine the working of automated test equipments
CO3	Identify faults in assembled PCBs using automated test equipments both at component level and board level
CO4	Design board fixtures to carry out customized board level testing
CO5	Develop test vectors and test patterns for fault identification in custom PCBs
CO6	Design and implement electronic systems with testability architectures

TEXT / REFERENCE BOOKS:

1 Michael L.Bushnell et al., “Essentials of Electronic testing for digital, memory and mixed signal VLSI circuit”,1st edition, Academic Press, 2002

2 Parag.K.lala, “Digital circuit Testing and Testability”, 1st edition, Academic press, 2001

3 Alfred L.Crouch, “Design for test for Digital ICs and Embedded core systems”, 2nd edition, PHI, 1999

4 Sabapathy S.R., “Test Engineering for electronic hardware”, Qmax publishers, 1st Edition, 2007

SEC1616	PATTERN RECOGNITION AND IMAGE VISION (Common to ETCE, E&C & EIE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 PRINCIPLES OF PATTERN RECOGNITION 9 hrs

Patterns and features, training and learning in pattern recognition approach, different types of pattern recognition. Statistical pattern recognition, feature selection, syntactic pattern recognition, clustering and non-supervised learning methods.

UNIT 2 OBJECT DETECTION METHODOLOGIES 9 hrs

Combined detection method, edge detection, edge linking, gradient. Laplacian, line detection, method based, point detection, snake methods. Boundary description detection, matching, merges segmentation, smoothing, splitting of boundaries syntactic, analysis of region boundaries, study of shape by region analysis.

UNIT 3 PATTERN CLASSIFICATION 9 hrs

DISTANCE FUNCTIONS - Pattern classification by distance functions - Minimum distance classification - Cluster and cluster seeking algorithms - Pattern classification by likelihood functions. Statistical Functions - Pattern classification using Statistical classifiers - Bayes' classifier - Classification performance measures - Risk and error probabilities.

UNIT 4 PATTERN RECOGNITION 9 hrs

FUZZY CLASSIFIERS- Fuzzy and crisp classification - Fuzzy clustering - Fuzzy pattern recognition - Syntactic pattern recognition- Selection of primitives - Syntax analysis for pattern recognition. NEURAL CLASSIFIERS- Introduction - Neural network structures for PR, Neural network based pattern associators - Feed forward networks trained by back propagation - ART networks.

UNIT 5 IMAGE EXTRACTION CONCEPTS 9 hrs

Introduction of Computer Vision, Computer Imaging System, Image Formation and sensing CVIP tools Software, Image representation. Area Extraction: Concepts, Data-structures, Edge, Line- Linking, Hough transform, Line fitting, Curve fitting.

Introduction BOUNDARY ANALYSIS AND MATCHING Region Analysis: Region properties, External points, spatial moments, mixed spatial gray-level moments, Boundary analysis: Signature properties, Shape numbers. General Frame Works for Matching: Distance relational approach.

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Understand the fundamentals of Pattern Recognition
CO2	Learn the various approaches to identify the patterns
CO3	Implement pattern classification
CO4	Analyze the fuzzy classifiers
CO5	Illustrate the concept of image extraction on computer vision
CO6	Apply the appropriate techniques on the real time application development

SEC1635 (Revised)	PATTERN RECOGNITION AND IMAGE VISION (Common to ETCE, E&C & EIE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 PRINCIPLES OF PATTERN RECOGNITION 9 hrs

Patterns and features, training and learning in pattern recognition approach, different types of pattern recognition. Statistical pattern recognition, feature selection, feature detection, syntactic pattern recognition, clustering and non-supervised learning methods. Applications of pattern recognition.

UNIT 2 OBJECT DETECTION METHODOLOGIES 9 hrs

Combined detection method, edge detection, edge linking, gradient. Laplacian, line detection, method based, point detection, snake methods. Boundary description detection, matching, merges segmentation, smoothing, splitting of boundaries syntactic, analysis of region boundaries, Parzen-window method. K-Nearest Neighbour method.

UNIT 3 PATTERN CLASSIFICATION 9 hrs

DISTANCE FUNCTIONS - Pattern classification by distance functions - Minimum distance classification - Cluster and cluster seeking algorithms - Pattern classification by likelihood functions. Statistical Functions - Pattern classification using Statistical classifiers - Bayes' classifier, Non-metric methods for pattern classification, on- numeric data, Decision tress, Classification and Regression Trees (CART).

UNIT 4 PATTERN RECOGNITION 9 hrs

Sequential pattern recognition-Hidden Markov models (HMMs)-Discrete HMMs, Continuous HMMs, - Syntactic pattern recognition- Selection of primitives - Syntax analysis for pattern recognition. NEURAL CLASSIFIERS- Introduction - Neural network structures for PR, Neural network based pattern associators - Feed forward networks trained by back propagation - ART networks.

UNIT 5 IMAGE EXTRACTION CONCEPTS 9 hrs

Introduction of Computer Vision, Computer Imaging System, Image Formation and sensing CVIP tools Software, Image representation. Area Extraction: Concepts, Data-structures, Edge, Line- Linking, Hough transform, Line fitting, Curve fitting.

Introduction BOUNDARY ANALYSIS AND MATCHING Region Analysis: Region properties, External points, spatial moments, mixed spatial gray-level moments, Boundary analysis: Signature properties, Shape numbers. General Frame Works for Matching: Distance relational approach. AI in imaging system.

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Illustrate the fundamentals of Pattern Recognition
CO2	Analyze the various approaches to identify the patterns
CO3	Implement pattern classification
CO4	Analyze the neural classifiers
CO5	Illustrate the concept of image extraction on computer vision
CO6	Apply the appropriate techniques on the real time application development

		L	T	P	Credits	Total Marks
SEC1613 (Old)	MOBILE AD-HOC NETWORKS	3	0	0	3	100

UNIT 1 INTRODUCTION **9hrs**

Origin of Adhoc:Packet Radio Networks - Technical Challenges - Architecture of PRNETs - Components of Packet Radios - Introduction to Adhoc networks - Definition, characteristics features - Issues in Mobile Ad Hoc networks- Types of Ad hoc Mobile Communications

Types of Mobile Host Movements - Ad hoc wireless Internet. Characteristics of Wireless channel Mobility models - Indoor and Outdoor

UNIT 2 MEDIUM ACCESS PROTOCOLS **9hrs**

MAC protocols: design issues, goals and classification. Contention based protocols - With reservation, scheduling algorithms, protocols using direction antennas - Distributed packet reservation - Multiple access protocol, collision avoidance time allocation protocol. IEEE standards: 802.11 a, 802.11 b, 802.11g

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UNIT 3 ROUTING PROTOCOLS AND MULTICAST ROUTING IN ADHOC NETWORKS **9hrs**

. Introduction - Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks - Classifications of Routing Protocols Table Driven routing protocols: Destination Sequenced Distance Vector Routing Protocol - Cluster head Gateway switched routing protocol. On Demand routing protocol: Dynamic source routing protocol, AODV routing protocol, temporarily ordered routing algorithm. Hybrid routing protocols: Zone routing protocol, Zone based Hierarchical link state routing protocol. Architecture Model for Multicast Routing Protocols - Classifications of Multicast Routing Protocols - Tree Based Multicast Routing Protocols - Mesh-Based Multicast Routing Protocols - Energy-Efficient Multicasting - Comparisons of Multicast Routing Protocols

UNIT 4 QOS AND ENERGY MANAGEMENT **9hrs**

Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks - Classifications of QoS Solutions - MAC Layer Solutions - Network Layer Solutions. Need for Energy Management in Ad Hoc Wireless Networks - Classification of Energy Management Schemes - Battery Management Schemes - Transmission Power Management Schemes - System Power Management Schemes

UNIT 5 ADHOC NOMADIC MOBILE APPLICATIONS **9hrs**

In the Office, While Traveling, Arriving Home, In the Car, Shopping Malls, The Modern battlefield, Car-to-Car Mobile Communications, Mobile Collaborative Applications - Location/context based mobile services - Introduction to wireless mesh networks and vehicular Adhoc networks

Color red indicates the deleted portion. Color yellow indicates the added portion

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Acquire knowledge about Adhoc networks and mobility models
CO2	Describe the design issues , classifications of MAC protocols
CO3	Explain the classifications of routing protocols
CO4	Analyze the QOS issues, Energy Management issues and challenges in Adhoc Networks
CO5	Develop Adhoc networks application
CO6	Explain the concepts of wireless mesh and vehicular networks

TEXT / REFERENCE BOOKS:

1. Toh.C.K, "Ad Hoc Mobile Wireless Networks: Protocols and Systems", Prentice Hall PTR, 2001

2. Siva ram Murthy.C and B S Manoj, "Ad Hoc Wireless Networks: Architecture and Protocols", Prentice Hall PTR, 2004

3. Charles E Perkins, Ad Hoc Networking", Addison Wesley, 2001

4. Xiuzhen Cheng, Xiao Huang, Ding Zhu Du, "Ad Hoc Wireless Networking", Springer Netherlands, 2004 5. Tavli

5. Bulent, Heinzelman, Wendi, "Mobile Ad Hoc Networks: Energy-Efficient Real-Time Data Communications", Springer, 2006

Aggelou, George, "Mobile Ad Hoc Networks: From Wireless LANs to 4g Networks", McGraw-Hill Professional Engineering, 2004

Color red indicates the deleted portion. Color yellow indicates the added portion

		L	T	P	Credits	Total Marks
SEC1636 (Revised)	MOBILE AD-HOC NETWORKS	3	0	0	3	100

UNIT 1 INTRODUCTION **9hrs**

Origin of Adhoc:Packet Radio Networks - Technical Challenges - Architecture of PRNETs - Components of Packet Radios - Introduction to Adhoc networks - Definition, characteristics features - Issues in Mobile Ad Hoc networks- Types of Ad hoc Mobile Communications

Types of Mobile Host Movements - Ad hoc wireless Internet. Characteristics of Wireless channel Mobility models - Indoor and Outdoor

UNIT 2 MEDIUM ACCESS PROTOCOLS AND CROSS LAYER DESIGN **9hrs**

MAC protocols: design issues, goals and classification. Contention based protocols - With reservation, scheduling algorithms, protocols using direction antennas - Distributed packet reservation - Multiple access protocol, collision avoidance time allocation protocol. IEEE standards: 802.11 a, 802.11 b, 802.11g

Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, cross layer cautionary perspective. Integration of adhoc with Mobile IP networks

UNIT 3 ROUTING PROTOCOLS AND MULTICAST ROUTING IN ADHOC NETWORKS **9hrs**

. Classifications of Routing Protocols Table Driven routing protocols: Destination Sequenced Distance Vector Routing Protocol - Cluster head Gateway switched routing protocol. On Demand routing protocol: Dynamic source routing protocol, AODV routing protocol, temporarily ordered routing algorithm. Hybrid routing protocols: Zone routing protocol, Zone based Hierarchical link state routing protocol. Architecture Model for Multicast Routing Protocols - Classifications of Multicast Routing Protocols - Tree Based Multicast Routing Protocols - Mesh-Based Multicast Routing Protocols - Energy-Efficient Multicasting - Comparisons of Multicast Routing Protocols

UNIT 4 QOS AND ENERGY MANAGEMENT **9hrs**

Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks - Classifications of QoS Solutions - MAC Layer Solutions - Network Layer Solutions. Need for Energy Management in Ad Hoc Wireless Networks - Classification of Energy Management Schemes - Security in Ad-hoc Wireless Networks, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management and Secure Touting Ad-hoc Wireless Networks

UNIT 5 ADHOC NOMADIC MOBILE APPLICATIONS **9hrs**

In the Office, While Traveling, Arriving Home, In the Car, Shopping Malls, The Modern battlefield, Car-to-Car Mobile Communications, Mobile Collaborative Applications - Location/context based mobile services - Introduction to wireless mesh networks and vehicular Adhoc networks

Color red indicates the deleted portion. Color yellow indicates the added portion

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Acquire knowledge about Adhoc networks and mobility models
CO2	Describe the design issues , classifications of MAC protocols and Cross Layer Design
CO3	Explain the classifications of routing protocols
CO4	Analyze the QOS issues, Energy Management and Security issues in Adhoc Networks
CO5	Develop Adhoc networks application
CO6	Explain the concepts of wireless mesh and vehicular networks

TEXT / REFERENCE BOOKS:

1. Toh.C.K, "Ad Hoc Mobile Wireless Networks: Protocols and Systems", Prentice Hall PTR, 2001

2. Siva ram Murthy.C and B S Manoj, "Ad Hoc Wireless Networks: Architecture and Protocols", Prentice Hall PTR, 2004

3. Charles E Perkins, Ad Hoc Networking", Addison Wesley, 2001

4. Xiuzhen Cheng, Xiao Huang, Ding Zhu Du, "Ad Hoc Wireless Networking", Springer Netherlands, 2004 5. Tavli

5. Bulent, Heinzelman, Wendi, "Mobile Ad Hoc Networks: Energy-Efficient Real-Time Data Communications", Springer, 2006

Aggelou, George, "Mobile Ad Hoc Networks: From Wireless LANs to 4g Networks", McGraw-Hill Professional Engineering, 2004

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SEC1615 (Old)	NANOELECTRONICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 FUNDAMENTALS OF NANOELECTRONICS **9hrs**

Moore's Law, Wave functions, wave packets, Schrodinger's wave equation, potential barriers and tunneling, Fermi-Dirac statistics, Density of states, Limitations of conventional FET in nanoscales, Quantum Well, Quantum wire, Quantum dot, current flow in two terminal Quantum dots, ballistic transport, Single Electron Transistor

UNIT 2 PHYSICAL DEPOSITION (THIN FILM) TECHNIQUES **9hrs**

Basics of physical methods, Glow discharge DC Sputtering, Triode sputtering, Getter sputtering, Radio frequency sputtering, Magnetron sputtering, Ion beam sputtering, AC sputtering, Vacuum evaporation, Resistive heat Evaporation, Flash Evaporation, Electron Beam Evaporation, LASER evaporation

UNIT 3 CHEMICAL DEPOSITION (THIN FILM) TECHNIQUES **9hrs**

Fundamentals of chemical methods, Chemical Vapour Deposition, LASER chemical Vapour Deposition, Photo Chemical Vapour Deposition, Plasma enhanced Vapour Deposition, Metal Organo Chemical Vapour Deposition, Chemical Bath Deposition, Electro less Deposition, Anodisation, Liquid Phase Epitaxy, Sol-Gel method, Spin Coating, Spray-Pyrolysis Technique, Polymer Assisted Deposition

UNIT 4 THIN FILM CHARACTERIZATION TECHNIQUES **9hrs**

Cyclic Voltammetry and Linear Sweep Techniques, Thickness measurement Techniques, X-Ray Diffraction Technique, Raman Spectral Study, Scanning Electron Microscopy, Energy Dispersive Analysis by X-rays measurements, Atomic Force Microscopy

UNIT 5 NANOELECTRONIC DEVICES **9hrs**

Digital and Switching abstraction, Quantum Cellular Automata (QCA), Realization of logic gates using QCA, Types and synthesis of molecular bundles, principle and types of spin wave devices, Array minimum/ maximum computation with spin wave devices

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COURSE OUTCOMES:
On completion of the course, students are able to

CO1	Explain the evolution and basics of Nanoelectronics
CO2	Classify the different physical deposition techniques for thin film deposition
CO3	Discuss the different types of chemical vapour decomposition techniques for thin film techniques
CO4	Appraise the various thin film characterization techniques
CO5	Assemble the basics of elementary quantum devices
CO6	Implement the techniques in Quantum devices

TEXT / REFERENCE BOOKS:

1. George W Hanson, “Fundamentals of Nanoelectronics”, Prentice Hall, 2008
2. Karl Goser, “Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices”, Springer, First edition,2005
3. Rainer Waser (Ed), “Nanoelectronics and Information Technology”, Second Edition, Wiley VCH, 2003
4. Mary Eshaghian-Wilner, “Bio inspired and Nano Scale Integrated Computing”, Wiley, 2009

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SEC1637 (Revised)	NANOELECTRONICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 FUNDAMENTALS OF NANOELECTRONICS **9hrs**

Introduction to nanotechnology, Impacts, Limitations of conventional microelectronics, Trends in microelectronics and optoelectronics Mesoscopic physics, trends in microelectronics and optoelectronics, characteristic lengths in mesoscopic systems, Quantum mechanical coherence
Nanomaterials: Preparation –Plasma Arcing – Chemical Vapor Deposition – Sol-Gels – Electrode Position – Ball Milling –Applications Of Nanomaterials

Moore's Law, Wave functions, wave packets, Schrodinger's wave equation, potential barriers and tunneling, Fermi-Dirac statistics, Density of states, Limitations of conventional FET in nanoscales, Quantum Well, Quantum wire,

UNIT 2 PHYSICAL DEPOSITION (THIN FILM) TECHNIQUES **9hrs**

Basics of physical methods, Glow discharge DC Sputtering, Triode sputtering, Getter sputtering, Radio frequency sputtering, Magnetron sputtering, Ion beam sputtering, AC sputtering, Vacuum evaporation, Resistive heat Evaporation, Flash Evaporation, Electron Beam Evaporation, LASER evaporation

UNIT 3 CHEMICAL DEPOSITION (THIN FILM) TECHNIQUES **9hrs**

Fundamentals of chemical methods, Chemical Vapour Deposition, LASER chemical Vapour Deposition, Photo Chemical Vapour Deposition, Plasma enhanced Vapour Deposition, Metal Organo Chemical Vapour Deposition, Chemical Bath Deposition, Electro less Deposition, Anodisation, Liquid Phase Epitaxy, Sol-Gel method, Spin Coating, Spray-Pyrolysis Technique, Polymer Assisted Deposition

UNIT 4 THIN FILM CHARACTERIZATION TECHNIQUES AND CARBON NANO TUBES **9hrs**

Cyclic Voltammetry and Linear Sweep Techniques, Thickness measurement Techniques, X-Ray Diffraction Technique, Raman Spectral Study, Scanning Electron Microscopy, Energy Dispersive Analysis by X-rays measurements, Atomic Force Microscopy
Carbon Nanotube: Fullerenes - types of nanotubes – formation of nanotubes – assemblies – purification of carbon nanotubes – electronic properties – synthesis of carbon nanotubes

UNIT 5 NANOELECTRONIC DEVICES **9hrs**

Introduction to characterization of nanostructures, tools used for of nano materials characterization, microscope-optical, electron, and electron microscope

Digital and Switching abstraction, Quantum Cellular Automata (QCA), Realization of logic gates using QCA, Types and synthesis of molecular bundles, principle and types of spin wave devices, Array minimum/ maximum computation with spin wave device Micro Electronics:Future applications: MEMS – robots – random access memory – mass storage devices.

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COURSE OUTCOMES:

On completion of the course, students are able to

CO1	Explain the evolution and basics of Nanoelectronics
CO2	Classify the different physical deposition techniques for thin film deposition
CO3	Discuss the different types of chemical vapour decomposition techniques for thin film techniques
CO4	Appraise the various thin film characterization techniques
CO5	Assemble the basics of elementary quantum devices
CO6	Implement the techniques in Quantum devices

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1. George W Hanson, "Fundamentals of Nanoelectronics", Prentice Hall, 2008
2. Karl Goser, "Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices", Springer, First edition,2005
3. Rainer Waser (Ed), "Nanoelectronics and Information Technology", Second Edition, Wiley VCH, 2003
4. Mary Eshaghian-Wilner, "Bio inspired and Nano Scale Integrated Computing", Wiley, 2009

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SEC1621 (Old)	SPREAD SPECTRUM COMMUNICATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION **9hrs**

Basic digital communication concepts, Impact of wide band, Detection of binary signals in additive white Gaussian Noise, Differences between standard narrow-band communication systems and spread spectrum systems. Spread-spectrum waveforms & its characteristics, spread spectrum communication system model, Techniques for reducing the impact of interference on spread spectrum signals, Jamming considerations

UNIT 2 BINARY SHIFT-REGISTER SEQUENCES AND CODE TRACKING LOOPS **9hrs**

Definitions , mathematical Background and Sequence generator fundamentals, Maximal-length Sequences, Direct Sequence and Spreading Codes Walsh Code, Pseudo Random Code, Mean and Variance of Random Codes Gold codes, Nonlinear code generators. Optimum tracking of wideband signals, Baseband Delay-lock Tracking Loop, Non-coherent Delay-lock Tracking loop, Tau-Dither non-coherent tracking loop, Double-Dither Non-coherent Tracking loop, Non-coherent Delay-Lock Tracking loop with arbitrary data and spreading modulation, Code tracking loops for Frequency-Hop systems

UNIT 3 DIRECT-SEQUENCE AND FREQUENCY- HOPPED SPREAD SPECTRUM **9hrs**

Types and advantages of spread spectrum modulation formats- BPSK, QPSK, MSK Direct -Sequence spread spectrum, coherent slow- Frequency hopped spread spectrum, non-coherent slow and fast Frequency hopped spread spectrum Hybrid Direct-sequence/Frequency-Hop spread spectrum, Complex-Envelop Representation of spread spectrum systems

UNIT 4 SYNCHRONIZATION AND PERFORMANCE ANALYSIS **9hrs**

Problem definition and the optimum synchronizer, serial search synchronization techniques, general analysis of average synchronization time, synchronization using a matched filter, synchronization by estimating the received spreading code, tracking loop pull-in, performance of spread spectrum system without coding, performance of spread spectrum system with forward error correction

UNIT 5 CODE DIVISION MULTIPLE ACCESS **9Hrs**

Cellular radio concept, CDMA digital cellular systems, examples of CDMA digital cellular systems, cellular CDMA applications, Analyze the performance of spread spectrum signals in the presence of multiple access interference (CDMA context), Calculation of theoretical capacity of a CDMA system, coding and decoding processes in CDMA, effects of interference in CDMA, and synchronization in CDMA wireless communication systems. 3G wireless systems using CDMA technologies, Major factors influencing the capacity of CDMA wireless networks, Multicarrier CDMA, Rake receivers wireless LAN applications, commercial and military applications

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COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Explain the features of Direct sequence spread spectrum
CO2	Classify the various jammer systems
CO3	Compare FH/QPSK and FH/DPSK
CO4	Demonstrate BPSK and QPSK
CO5	Describe the Matched Filter techniques
CO6	Create a simple CDMA based Spread spectrum

TEXT / REFERENCE BOOKS:

1. R. L. Peterson, R. E. Ziemer, and D. E. Borth, "Introduction to Spread Spectrum Communications", Prentice Hall, 2005 (ISBN 81-297-0973-2)
2. R. C. Dixon, "Spread Spectrum Systems", John Wiley & Sons, 1994, ISBN: 0471593427
3. D R Kamilo Feher, "Wireless digital communications Modulation & Spread Spectrum Applications", Prentice Hall of India, 1999, ISBN 81-203-1472-7
4. Andreas F.Molisch, "Wideband Wireless Digital Communications", Pearson Education, ISBN 81-7808-301-9, 2003
5. A. J. Viterbi, "CDMA: Principles of Spread Spectrum Communication", Addison-Wesley, 1995, ISBN: 0201633744
6. Bernard Sklar, Pabitra Kumar Ray, "Digital Communications", Pearson, ISBN 978-81 -31 7-2092-9, 2009

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SEC1638 (Revised)	SPREAD SPECTRUM COMMUNICATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION **9hrs**

Spread-spectrum waveforms & its characteristics, spread spectrum communication system model, Techniques for reducing the impact of interference on spread spectrum signals, Jamming considerations. Slow and fast frequency hopping. General mechanism of ML sequence. Power spectral densit of ML sequence. General mechanism and properties of Walsh Hadamard Code,OVSF, Barker codes,Gold and Kasami codes

UNIT 2 BINARY SHIFT-REGISTER SEQUENCES AND CODE TRACKING LOOPS **9hrs**

Definitions , mathematical Background and Sequence generator fundamentals, Maximal-length Sequences, Direct Sequence and Spreading Codes Walsh Code, Pseudo Random Code, Mean and Variance of Random Codes Gold codes, Nonlinear code generators. Optimum tracking of wideband signals, Baseband Delay-lock Tracking Loop, Non-coherent Delay-lock Tracking loop, Tau-Dither non-coherent tracking loop, Double-Dither Non-coherent Tracking loop, Non-coherent Delay-Lock Tracking loop with arbitrary data and spreading modulation, Code tracking loops for Frequency-Hop systems

UNIT 3 DIRECT-SEQUENCE AND FREQUENCY- HOPPED SPREAD SPECTRUM **9hrs**

Types and advantages of spread spectrum modulation formats- BPSK, QPSK, MSK Direct -Sequence spread spectrum, coherent slow- Frequency hopped spread spectrum, non-coherent slow and fast Frequency hopped spread spectrum Hybrid Direct-sequence/Frequency-Hop spread spectrum, Complex-Envelop Representation of spread spectrum systems

UNIT 4 Performance of Spread Spectrum System **9hrs**

Systems communications models – Performance without coding under AWGN and different jamming environments – spread spectrum systems performances with forward error correction -Block coding – Convolutional coding and specific error correcting codes – Inter leaving – Random coding bounds

UNIT 5 CODE DIVISION MULTIPLE ACCESS **9hrs**

Cellular radio concept, CDMA digital cellular systems, examples of CDMA digital cellular systems, cellular CDMA applications, Analyze the performance of spread spectrum signals in the presence of multiple access interference (CDMA context), CDMA RF Propagation Principles, Antennas for Wireless Systems ,CDMA Traffic Engineering, CDMA Air Interface Overview, Key CDMA Performance Parameters and their Significance, Call Processing from Perspective of the Subscriber Handset, CDMA Handoffs

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COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Explain the features of Direct sequence spread spectrum
CO2	Classify the various jammer systems
CO3	Compare FH/QPSK and FH/DPSK
CO4	Demonstrate BPSK and QPSK
CO5	Describe the Matched Filter techniques
CO6	Create a simple CDMA based Spread spectrum for different application

TEXT / REFERENCE BOOKS:

1. R. L. Peterson, R. E. Ziemer, and D. E. Borth, "Introduction to Spread Spectrum Communications", Prentice Hall, 2005 (ISBN 81-297-0973-2)
2. R. C. Dixon, "Spread Spectrum Systems", John Wiley & Sons, 1994, ISBN: 0471593427
3. D R Kamilo Feher, "Wireless digital communications Modulation & Spread Spectrum Applications", Prentice Hall Of India, 1999, ISBN 81-203-1472-7
4. A. J. Viterbi, "CDMA: Principles of Spread Spectrum Communication", Addison-Wesley, 1995, ISBN: 0201633744
5. Bernard Sklar, Pabitra Kumar Ray, "Digital Communications", Pearson, ISBN 978-81 -31 7-2092-9, 2009
6. Andreas F.Molisch, "Wideband Wireless Digital Communications", Pearson Education, ISBN 81-7808-301-9,2003

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		L	T	P	Credits	Total Marks
SEC1060 (old)	RADAR AND NAVIGATIONAL AIDS	3	0	0	3	100

UNIT1 INTRODUCTION TO RADAR **9 hrs**

Basic Radar-The Origins of Radar, Simple form of Radar Equation-Radar Block Diagram-Radar Frequencies-Application of Radar. The Radar Equation: Introduction-Detection of Signals in noise-Receiver noise and the Signal-to-Noise Ratio-Probability Density Function-Probabilities of Detection and False Alarm-Integration of Radar pulses-Radar Cross Section of Targets-Radar Cross Section Fluctuations-Transmitter Power-Pulse Repetition Frequency-Antenna Parameters-System Losses-Other Radar Equation Considerations

UNIT2 BASIC AND MTI RADAR, TRACKING **9 hrs**

Introduction To Doppler and MTI Radar-Delay- Line Cancellers-Staggered Pulse Repetition Frequencies-Doppler Filter Banks-Digital MTI Processing-Moving Target Detector-Limitation of MTI Performance-Pulse Doppler Radar- Other Doppler Radar Topics-Tracking with Radar-Monopulse Tracking-Conical Scan and Sequential Lobing- Limitation to Tracking Accuracy-Low-Angle Tracking-Tracking in Range-other Tracking Radar Topics-Comparison of Trackers-Automatic Tracking with Surveillance Radars(ADT)

UNIT3 RADAR TRANSMITTERS AND RECEIVERS **9 hrs**

Detection of Signals in Noise: Introduction-Matched-Filter Receiver-Detection Criteria-Detectors-Automatic Detector-Integrators-Constant-False-Alarm Rate Receivers-The Radar Operator-Signal Management-Propagation Radar waves-Atmospheric Refraction-Standard Propagation-Non Standard Propagation. The Radar Antennas: Reflector Antennas-Electronically Steered Phased Array Antennas-Phase Shifter-Frequency-Scan Arrays Radar Transmitters: Introduction-Linear Beam Power Tubes-Solid State RF Power Sources-Magnetron-Crossed Field Amplifer-Other RF Power Sources-Other aspects of Radar Transmitter. Radar Receivers: The Radar Receiver-Receiver Noise Figure-Super heterodyne Receiver-Duplexers and Receivers Protectors-Radar Displays

UNIT4 DETECTION OF SIGNALS IN NOISE 9 hrs

Introduction-Four Method of Navigation-Radio Direction Finding-The Loop Antenna-Loop Input Circuits-An Aural Null Direction Finder-The Goniometer-Error In Direction Finding-Adcock Direction Finders-Direction Finding at very High Frequencies-Automatic Direction Finders-The Commutated Aerial Direction Finders-Range and Accuracy of Direction Finders Radio Ranges-The LF/MF Four Course Radio Range-VHF Omni directional Range (VOR)-VOR Receiving Equipment-Range and accuracy of VOR-Recent Development Hyperbolic System of Navigation (Loran and Decca)-Loran-A-Loran-A Equipment-Range and Precision of Standard Loran-Loran-C-The Decca Navigation System-Decca Receiver-Range and Accuracy of Decca-The Omega System

UNIT5 ADVANCED RADARS AND RADAR NAVIGATION 9 hrs

DME and TACAN-Distance Measuring Equipment-Operation of DME-TACAN-TACAN Equipment Aids to Approach and Landing-Instrument Landing System-Ground Controlled Approach System-Microwave Landing System(MLS) Doppler Navigation-The Doppler Effect-Beam Configuration-Doppler frequency Equation-Track Stabilization-Doppler Spectrum-Components of The Doppler Navigation System-Doppler Range Equation-Accuracy of Doppler Navigation System. Inertial Navigation-Principles of Operation-Navigation Over The Earth-Components of an inertial Navigation System-Earth Coordinate Mechanization-Strapped-Down Systems-Accuracy of Inertial Navigation Systems. Satellite Navigation System-The Transit System-Navstar Global Positioning System (GPS)-Night vision systems

COURSE OUTCOMES:

On completion of the course, student will be able to–

CO1	Explain the basic knowledge of Radar and Detection of Signals in noise
CO2	Describe the features of Doppler and MTI Radar
CO3	Classify various types of the Radar Antennas
CO4	Describe the methods of Navigation
CO5	Explain the Microwave Landing System
CO6	Implement Doppler Navigation

TEXT / REFERENCE BOOKS:

1. George W Hanson, “Fundamentals of Nanoelectronics”, Prentice Hall, 2008.
2. Karl Goser, “Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices”, Springer, First edition, 2005.
3. Rainer Waser (Ed), “Nanoelectronics and Information Technology”, Second Edition, Wiley VCH, 200
4. Mary Eshaghian-Wilner, “Bio inspired and Nano Scale Integrated Computing”, Wiley, 2009

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		L	T	P	Credits	Total Marks
SEC1640 (Revised)	**RADAR AND NAVIGATIONAL AIDS**	**3**	**0**	**0**	**3**	**100**

UNIT1 INTRODUCTION TO RADAR **9 hrs**

Basic Radar-The Origins of Radar, Simple form of Radar Equation-Radar Block Diagram-Radar Frequencies-Application of Radar. The Radar Equation: Introduction-Detection of Signals in noise-Receiver noise and the Signal-to-Noise Ratio-Probability Density Function-Probabilities of Detection and False Alarm-Integration of Radar pulses-Radar Cross Section of Targets-Radar Cross Section Fluctuations-Transmitter Power-Pulse Repetition Frequency-Antenna Parameters-System Losses-Other Radar Equation Considerations, Maximum Unambiguous Range, Radar Waveforms, Modified Radar Range Equation

UNIT2 BASIC AND MTI RADAR, TRACKING **9 hrs**

Introduction To Doppler and MTI Radar-Delay- Line Cancellers-Staggered Pulse Repetition Frequencies-Doppler Filter Banks-Digital MTI Processing-Moving Target Detector-Limitation of MTI Performance-Pulse Doppler Radar-Other Doppler Radar Topics-Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar – Amplitude Comparison Monopulse (one- and two- coordinates), Phase Comparison Monopulse. Target Reflection Characteristics and Angular Accuracy. Tracking in Range, Acquisition and Scanning Patterns. Comparison of Trackers., MTI Improvement Factor, N- Pulse Delay-Line Canceler

UNIT3 RADAR TRANSMITTERS AND RECEIVERS **9 hrs**

Detection of Signals in Noise: Introduction-Matched-Filter Receiver-Detection Criteria-Detectors-Automatic Detector-Integrators-Constant-False-Alarm Rate Receivers-The Radar Operator-Signal Management-Propagation Radar waves-Atmospheric Refraction-Standard Propagation-Non Standard Propagation. The Radar Antennas: Reflector Antennas-Electronically Steered Phased Array Antennas-Phase Shifter-Frequency-Scan Arrays Radar Transmitters: Introduction-Linear Beam Power Tubes-Solid State RF Power Sources-Magnetron-Crossed Field Amplifer-Other RF Power Sources-Other aspects of Radar Transmitter. Radar Receivers: The Radar Receiver-Receiver Noise Figure-Super heterodyne Receiver-Duplexers and Receivers Protectors-Radar Displays

UNIT4 DETECTION OF SIGNALS IN NOISE **9 hrs**

Introduction-Four Method of Navigation-Radio Direction Finding-The Loop Antenna-Loop Input Circuits-An Aural Null Direction Finder-The Goniometer-Error In Direction Finding-Adcock Direction Finders-Direction Finding at very High Frequencies-Automatic Direction Finders-The Commutated Aerial Direction Finders-Range and Accuracy of Direction Finders Radio Ranges-The LF/MF Four Course Radio Range-VHF Omni directional Range (VOR)-VOR Receiving Equipment-Range and accuracy of VOR-Recent Development Hyperbolic System of Navigation (Loran and Decca)-Loran-A-Loran-A Equipment-Range and Precision of Standard Loran-Loran-C-The Decca Navigation System-Decca Receiver-Range and Accuracy of Decca-The Omega System, Instrument Landing System, Ground controlled Approach System

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UNIT5 ADVANCED RADARS AND RADAR NAVIGATION **9 hrs**

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

COURSE OUTCOMES:

On completion of the course, student will be able to–

CO1	Explain the basic knowledge of Radar and Detection of Signals in noise
CO2	Describe the features of Doppler and MTI Radar
CO3	Classify various types of the Radar Antennas
CO4	Describe the methods of Navigation
CO5	Explain the Microwave Landing System
CO6	Implement Doppler Navigation

TEXT / REFERENCE BOOKS:

1. George W Hanson, “Fundamentals of Nanoelectronics”, Prentice Hall, 2008.
2. Karl Goser, “Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices”, Springer, First edition, 2005.
3. Rainer Waser (Ed), “Nanoelectronics and Information Technology”, Second Edition, Wiley VCH, 200
4. Mary Eshaghian-Wilner, “Bio inspired and Nano Scale Integrated Computing”, Wiley, 2009

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

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SEC1611 (old)	INTEGRATED SERVICES DIGITAL NETWORKS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 ISDN BASICS **9 hrs**

Evolution of ISDN - Definition of ISDN- ISDN System Architecture- ISDN integrated access- ISDN Digital Services- Digital Telephones - Types of switched networks - OSI reference model- ISDN channels-Access interfaces- Functional Devices and reference points

UNIT 2 ISDN SERVICES **9 hrs**

Standard Organization- Services Requirement- ISDN Services- bear services-Teleservices- Broadband Services- Service attributes- Packeted frame - mode bearer Services

UNIT 3 ISDN PROTOCOL AND SIGNALING SCHEMES **9 hrs**

Protocol Architecture - Physical layer protocol - D-Channel - Data link and layer 3 protocols - Numbers and Address. Signaling System No.7 – SS7 protocol and Services

UNIT 4 ATM **9 hrs**

Broadband Services and Call Relay switching – ATM Overview – BISDN Architecture – BISDN Protocol- ATM layer – ATM Adopter layer

UNIT 5 ISDN APPLICATION AND IMPLEMENTATIONS **9 hrs**

ISDN Centrax configuration – ISDN and LANs – Metropolitan Area Network.- TCP/IP and Interworks – Application – Video conferencing , Telemedicine – User configuration – Intention ISDN Activities

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1	Discuss the evolution and architecture of ISDN
CO2	Identify various switching network and SS7 Protocol
CO3	Define the various OSI reference model
CO4	Classify broadband services and call relay
CO5	Examine the various layers of ATM
CO6	Apply the concepts of ISDN, LANs, TCP/IP networks in real time applications

TEXT / REFERENCE BOOKS:

1. Gray.C.Kessler, ISDN, McGraw Hill, International 4th Edition, 2007 Reprint
2. William Stallings, ISDN and Broadband ISDN with frame relay and ATM, 4th edition, Prentice Hall Inc, U.K, 2005 Reprint
3. John Ranayne, ISDN, Wheels Publication, India, 2007 reprint.
4. Andrew S.Tanenbaum, Computer network, 2nd Edition, 2004 reprint.
5. Gray.C.Kessler, ISDN, McGraw Hill, International 4th Edition, 2007 Reprint
6. William Stallings, ISDN and Broadband ISDN with frame relay and ATM, 4th edition, Prentice Hall Inc, U.K, 2005 Reprint
7. John Ranayne, ISDN, Wheels Publication, India, 2007 reprint.
8. Andrew S.Tanenbaum, Computer network, 2nd Edition, 2004 reprint.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 hrs**

Part A: 10 questions of 2 marks each -No choice **20 Marks**

Part B: 5 questions from each unit with internal choice, each carrying 16 marks **80 Marks**

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SEC1640 (Revised)	INTEGRATED SERVICES DIGITAL NETWORKS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 ISDN BASICS **9 hrs**

Evolution of ISDN - Definition of ISDN- ISDN System Architecture- ISDN integrated access- ISDN Digital Services- Digital Telephones - Types of switched networks - OSI reference model- ISDN channels-Access interfaces- Functional Devices and reference points, review of switching technologies

UNIT 2 ISDN SERVICES **9 hrs**

Standard Organization- Services Requirement- ISDN Services- bear services-Teleservices- Broadband Services- Service attributes- Packeted frame - mode bearer Services

UNIT 3 ISDN PROTOCOL AND SIGNALING SCHEMES **9 hrs**

Protocol Architecture - Physical layer protocol - D-Channel Delay Analysis and Simulation- Data link and layer 3 protocols - Numbers and Address. Signaling System No.7 – SS7 protocol and Services, ISDN products, Switches, Multiplexers, Terminal adapters, ISDN chip sets.

UNIT 4 ATM **9 hrs**

Broadband Services and Call Relay switching – ATM Overview – BISDN Architecture – BISDN Protocol- ATM layer – ATM Adopter layer, ATM-Broadband Network Protocol, ATM Network Components, ATM Switches Terminal Equipment, Unique Benefits.

UNIT 5 ISDN APPLICATION AND IMPLEMENTATIONS **9 hrs**

ISDN Centrax configuration – ISDN and LANs – Metropolitan Area Network- TCP/IP and Interworks –Application – Video conferencing, Telemedicine – User configuration – Intention ISDN Activities- Potential B-ISDN Satellite Applications, General B-ISDN Service Requirements, Architecture, Terrestrial B-ISDN Support, System Concept Types of Services Supported, Private Based B-ISDN, System Concept, Types of Services Supported .

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1	Discuss the evolution and architecture of ISDN
CO2	Identify various switching network and SS7 Protocol
CO3	Define the various OSI reference model
CO4	Classify broadband services and call relay
CO5	Examine the various layers of ATM
CO6	Apply the concepts of ISDN, LANs, TCP/IP networks in real time applications

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2 William Stallings, ISDN and Broadband ISDN with frame relay and ATM, 4th edition, Prentice Hall Inc, U.K, 2005
3 Reprint
4 John Ranayne, ISDN, Wheels Publication, India, 2007 reprint.

5 Andrew S.Tanenbaum, Computer network, 2nd Edition, 2004 reprint.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 hrs**
Part A: 10 questions of 2 marks each -No choice **20 Marks**
Part B: 5 questions from each unit with internal choice, each carrying 16 marks **80 Marks**

		L	T	P	Credits	Total Marks
SEC1208 (Old)	SIGNALS AND SYSTEMS	3	0	0	3	100

UNIT 1 CLASSIFICATION OF SIGNALS **9 hrs**

Continuous time signals(CT signals)and Discrete time signals(DT signals)-Basic operations on signals-elementary signals- Step, Ramp, Pulse, Impulse, Exponential-Classification of CT and DT systems-Periodic and Random signals, Real and complex signals-Energy and Power signals.

UNIT 2 ANALYSIS OF CONTINUOUS TIME SIGNALS **9 hrs**

Continuous time Fourier Transform –Properties of CTFT-Inverse Fourier Transform-Unilateral and bilateral Laplace Transform analysis with examples-Basic properties-Parseval's relation-Convolution in time and frequency domain-Relation between Fourier transform and Laplace transform-Fourier series analysis.

UNIT 3 LINEAR TIME INVARIENT CONTINUOUS TIME SYSTEM **9 hrs**

Concept of CT systems-Linear time invariant Systems-Basic properties of continuous systems-Linearity,Causality,Time invariance, Stability-Frequency response of LTI systems-Analysis and characterization of LTI systems using Laplace transform- Differential equation -Computation of impulse response ,step response, natural response, forced response, frequency response and transfer function --Convolution integral-Properties of Convolution Integral.

UNIT 4 ANALYSIS OF DISCRETE TIME SIGNALS **9hrs**

Spectrum of DT signals, Discrete Time Fourier Transform(DTFT)-Properties of DTFT-z transform-Basic Properties of Z transform -Region of Convergence-Properties of ROC- -Poles and Zeros-Inverse z transform using contour integration-Residue theorem, power series expansion and partial fraction expansion method-Relation between Z-transform and DTFT.

UNIT 5 LINEAR TIME INVARIANT DESCRETE TIME SYSTEMS

Concept of LTI-DT Systems-Properties and types of LTIDT systems-Causality, stability,invertibility,time invariant, linearity-interconnection of LTI Systems-Difference equation- Computation of impulse response ,step response, natural response ,forced response, frequency response and transfer function –Convolution sum using matrix, graphical and tabulation method-properties of convolution sum.

COURSE OUTCOMES:

On completion of this course, student will be able to

CO1	Explain the basic concept of signals and systems, the basic mathematical operations on Continuous Time (CT) and Discrete Time (DT) signals
CO2	Analyze the suitability of Laplace transform and Fourier transform in CT signals
CO3	Evaluate the response of Linear Time invariant systems
CO4	Examine the suitability of Z transform, DTFT in DT signals
CO5	Categorize the different domain transformation and evaluate the various system responses
CO6	Development of the mathematical skills to solve problems involving convolution, filtering, modulation and sampling

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TEXT / REFERENCE BOOKS:

1. Allen V.Oppenheim et al," Signals and Systems", 2nd Edition, Prentice Hall of India. Ltd, 1997
2. P.Ramesh Babu et al. "Signals and Systems, 4th Edition, SciTech Publishers, 2010
3. Haykin. S and Van Been.B. "Signals and Systems", 2nd Edition, John Wiley & Sons, 2003
4. Rao.P, "Signals and Systems", 1st Edition, Tata McGraw Hill, 2008
5. Mrinal Mendal,Amir Asif, "Continuous and Discrete Time signals", Cambridge University Press 2007
6. Roberts, M.J. "Fundamentals of Signals and Systems", 1st Edition, Tata McGraw Hill 2007
7. S.Salivahanan et al, "Digital Signal Processing", 2nd Edition Tata McGraw Hill, 2009
8. H P Hsu, "Signals and Systems", 2nd Edition, Tata McGraw Hill,2008
9. B. P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford University Press, 2009

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 hrs**

Part A: 10 questions of 2 marks each -No choice **20 Marks**
Part B: 5 questions from each unit with internal choice, each carrying 16 marks **80 Marks**

Color red indicates the deleted portion. Color yellow indicates the added portion

SECA1301 (Revised)	SIGNALS AND SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To introduce the fundamental signals like Step, Ramp, Pulse, Impulse, Exponential, Sinusoidal Signals and its various operation.
- To analyze the continuous time signals by applying the knowledge of Fourier series, Fourier transform and Laplace transform.
- To study the characteristics of continuous time systems and analyze the properties using Fourier series, Fourier transform and Laplace transform.
- To analyze the discrete time signals and characteristics of discrete time systems by applying the knowledge of Discrete Fourier transform and Z transform.
- To study the characteristics of discrete time systems and analyze the properties using Discrete Fourier transform and Z transform.

UNIT 1 INTRODUCTION TO SIGNALS 9 Hrs.

Signals- Continuous time signals (CT signals) and Discrete time signals (DT signals) -Step, Ramp, Pulse, Impulse, Exponential and Sinusoidal Signal – Basic Operations on signals -Amplitude Scaling, Time Scaling, Time Reversal, Time Shifting, Signal Addition, Subtraction-classification of CT and DT signals-Deterministic and Non-deterministic Signals, Even and Odd Signals, Periodic and Aperiodic Signals, Energy and Power Signals, Real and Imaginary Signals

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UNIT 2 ANALYSIS OF CONTINUOUS TIME SIGNALS 9 Hrs.

Fourier series analysis –Continuous Time Fourier Transform -Properties of CTFT-Inverse Fourier transform- unilateral and bilateral Laplace Transform analysis with examples - Basic properties – Parseval' s relation - Convolution in time and frequency domain-Inverse Laplace transform using partial fraction expansion method - Relation between Fourier transform and Laplace transform

UNIT 3 LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS 9 Hrs.

Continuous time Systems- Classification of systems - Static and dynamic, Linear and non-linear, Time-variant and time- invariant, Causal and non-causal, Stable and unstable -Linear time Invariant System- Frequency response of LTI systems - Analysis and characterization of LTI systems using Laplace transform - Differential equation- Computation of impulse response, step response, natural response ,forced response and transfer function using Laplace transform - Convolution integral -Properties of convolution integral.

UNIT 4 ANALYSIS OF DISCRETE TIME SIGNALS AND LTI DISCRETE TIME SYSTEMS 9 Hrs.

Spectrum of DT signals, Discrete Time Fourier Transform (DTFT)- Properties of DTFT - z-transform -Basic properties of Z transform Properties of ROC - Inverse z-transform, Convolution method and Partial fraction expansion- Discrete time Systems- Classification of systems,Linear time Invariant System - Difference equation - Computation of Impulse response, Frequency response, step response, natural response, forced response and Transfer function using Z Transform, Convolution Sum using matrix, graphical and tabulation method-Properties of convolution sum.

UNIT 5 REAL TIME APPLICATIONS OF SIGALS AND SYSTEMS 9 Hrs.

Mathematical tools for the analysis of deterministic and random signals –Sampling theorem-Analysis and modeling of Signals -Speech, music, medical signals- Applications of Fourier Transform- Analysis and modeling of Systems- Systems that manipulate signals-analysis and synthesis of signals and their interaction with systems Speech signal processing

COURSE OUTCOMES **Max. 45 Hrs.**

On completion of the course, student will be able to

CO1 - Understand mathematical description and representation of continuous and discrete time signals and systems. CO2 - Analyse the spectral characteristics of continuous-time periodic and a periodic signals using Fourier analysis. CO3 - Classify systems based on their properties and determine the response of LSI system using convolution.

CO4 - Analyze system properties based on impulse response and Fourier analysis.

CO5 - Apply the Laplace transform and Z- transform for analyze of continuous-time and discrete-time signals and systems.

CO6 - Build and analyze real time system for various real time signals

Color red indicates the deleted portion. Color yellow indicates the added portion

TEXT / REFERENCE BOOKS:

1. Allen V.Oppenheim et al," Signals and Systems", 2nd Edition, Prentice Hall of India. Ltd, 1997
2. P.Ramesh Babu et al. "Signals and Systems, 4th Edition, SciTech Publishers, 2010
3. Haykin. S and Van Been.B. "Signals and Systems", 2nd Edition, John Wiley & Sons, 2003
4. Rao.P, "Signals and Systems", 1st Edition, Tata McGraw Hill, 2008
5. Mrinal Mendal,Amir Asif, "Continuous and Discrete Time signals", Cambridge University Press 2007
6. Roberts, M.J. "Fundamentals of Signals and Systems", 1st Edition, Tata McGraw Hill 2007
7. S.Salivahanan et al, "Digital Signal Processing", 2nd Edition Tata McGraw Hill, 2009
8. H P Hsu, "Signals and Systems", 2nd Edition, Tata McGraw Hill,2008
9. B. P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford University Press, 2009

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 hrs**

Part A: 10 questions of 2 marks each -No choice **20 Marks**
Part B: 5 questions from each unit with internal choice, each carrying 16 marks **80 Marks**

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		L	T	P	Credits	Total Marks
SEC1314 (Old)	DIGITAL SIGNAL PROCESSING	3	1	0	4	100

UNIT 1 INTRODUCTION TO SIGNALS AND SYSTEMS **12 hrs**

Representation, Characterization and Classifications of Continuous Time (CT) & Discrete Time (DT) signals, Sampling theorem - Aliasing effect, Operations on DT signals , Convolution, Advantages of DSP over ASP , Classification of CT & DT systems , properties of Discrete time systems-Linearity-Time invariance- causality –stability-Linear time Invariant systems, Difference equation representation of LTI systems-The Z transform- properties of Z transform- Inverse Z transform-System transfer Function

UNIT 2 DISCRETE FOURIER TRANSFORM (DFT) AND FAST FOURIER TRANSFORM (FFT) **12 hrs**

DFT and its properties, Relation between DTFT and DFT, FFT computations using Decimation in time (DIT) algorithms and Decimation in frequency (DIF) algorithms, Auto correlation, Cross correlation, and their properties. Realization of Discrete Time System: introduction, Basic Realization block diagram and the signal flow graph, Realization of recursive and non recursive systems - Direct Form I and Form II - Cascade and parallel realization

UNIT 3 DIGITAL FILTER DESIGN **12 hrs**

Design of Digital Filters: General considerations: causality and its implications, characteristics of practical frequency selective filter. Design of FIR filter using window method - Rectangular, Hanning and Hamming Windows. Design of IIR filters using Impulse invariant and Bilinear transformation method. Review of Butterworth and Chebyshev approximations, Frequency selective filters: Ideal filter characteristics, low pass, high pass and band pass filters, Properties of IIR and FIR filters

UNIT 4 FINITE WORD LENGTH EFFECTS **12 hrs**

Fixed point and floating point number representations - Comparison - Truncation and Rounding errors - Quantization noise - derivation for quantization noise power -coefficient quantization error - Product quantization error - Overflow error - Round off noise power - limit cycle oscillations due to product round off and overflow errors -signal scaling

UNIT 5 MULTIRATE SIGNAL PROCESSING **12 hrs**

Introduction to Multirate signal processing-Decimation-Interpolation- Poly phase implementation of FIR filters for interpolator and decimator -Multistage implementation of sampling rate conversion- Design of narrow band filters-Applications of Multirate signal processing, Speech compression, Adaptive filter, Musical sound processing, Image enhancement.

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the various types of signals and systems and its operations
CO2	Apply various transforms for different types of signals
CO3	Design IIR & FIR filter using various filter approximations
CO4	Make use of the concept of finite word length effects and its applications in signal processing
CO5	Elaborate the concept of Multirate signal processing
CO6	Explain the perception of Multirate signal processing in real time applications

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TEXT / REFERENCE BOOKS:

1. John G. Proakis & Dimitris G.Manolakis, "Digital Signal Processing - Principles, Algorithms & Applications", Fourth Edition, Pearson education / Prentice Hall, 2009
2. Sanjit K. Mitra , Digital Signal Processing: A Computer - Based Approach, McGraw-Hill Education, 4th dition,2013
3. B.P.Lathi, "Signal Processing & Linear systems", Oxford University Press, 2nd edition, 2009
4. Lyons, "Understanding Digital Signal Processing", Prentice Hall, 3rd edition, 2010
5. Johny R. Johnson, "Introduction to Digital Signal Processing", PHI, 2006
6. Alan V. Oppenheim, Ronald W. Schafer, Discrete-Time Signal Processing, Pearson, 3rd Edition,2010
7. Salivahanan, "Digital Signal Processing, 2nd Edition, TMH, 2010

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 hrs**

Part A: 10 questions of 2 marks each -No choice **20 Marks**
Part B: 5 questions from each unit with internal choice, each carrying 16 marks **80 Marks**

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		L	T	P	Credits	Total Marks
SEC1319 (Revised)	DIGITAL SIGNAL PROCESSING	3	1	0	4	100

UNIT 1 DISCRETE FOURIER TRANSFORM (DFT) AND FAST FOURIER TRANSFORM (FFT) 12 hrs

Review of Signals and Systems, DFT and its properties, Relation between DTFT and DFT, FFT computations using Decimation in time (DIT) algorithms and Decimation in frequency (DIF) algorithms, Auto correlation, Cross correlation, and their properties. Realization of Discrete Time System: introduction, Basic Realization block diagram and the signal flow graph, Realization of recursive and nonrecursive systems - Direct Form I and Form II - Cascade and parallel realization

UNIT 2 DIGITAL FILTER DESIGN 12 hrs

Design of Digital Filters: General considerations: causality and its implications, characteristics of practical frequency selective filter. Design of FIR filter using window method - Rectangular, Hanning and Hamming Windows. Design of IIR filters using Impulse invariant and Bilinear transformation method. Review of Butterworth and Chebyshev approximations, Frequency selective filters: Ideal filter characteristics, low pass, high pass and band pass filters, Properties of IIR and FIR filters

UNIT 3 FINITE WORD LENGTH EFFECTS 12 hrs

Fixed point and floating point number representations - Comparison - Truncation and Rounding errors - Quantization noise - derivation for quantization noise power -coefficient quantization error - Product quantization error - Overflow error - Round off noise power - limit cycle oscillations due to product round off and overflow errors -signal scaling

UNIT 4 MULTIRATE SIGNAL PROCESSING 12 hrs

Introduction to Multirate signal processing-Decimation-Interpolation- Poly phase implementation of FIR filters for interpolator and decimator -Multistage implementation of sampling rate conversion- Design of narrow band filters-Applications of Multirate signal processing, Speech compression, Adaptive filter, Musical sound processing, Image enhancement.

UNIT 5 REAL TIME DIGITAL SIGNAL PROCESSING 12 hrs

Real Time DSP System Architecture and Functional Blocks, Analog Interface, Signal Conditioning, generation and detection for real time applications, - DSP Hardwares (Digital Signal Processor, FPGA, ARM Processor with DSP Extension) & its applications - Speech Signal Processing, Enhancements, Coding & Transcoding Techniques (A-Law, U-Law, G.711, G.723, G.729, GSM) for IP and Mobile Telephone applications - High Definition Audio Signal Processing, Audio Coding Techniques and Comparison Analysis, Transcoding

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Apply various transforms for different types of signals
CO2	Design IIR & FIR filter using various filter approximations
CO3	Make use of the concept of finite word length effects and its applications in signal processing
CO4	Elaborate the concept of Multirate signal processing
CO5	Explain the perception of Multirate signal processing in real time applications
CO6	Develop real time applications with DSP hardwares

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TEXT / REFERENCE BOOKS:

1. John G. Proakis & Dimitris G.Manolakis, "Digital Signal Processing - Principles, Algorithms & Applications", Fourth Edition, Pearson education / Prentice Hall, 2009
2. Sanjit K. Mitra , Digital Signal Processing: A Computer - Based Approach, McGraw-Hill Education, 4th dition,2013
3. B.P.Lathi, "Signal Processing & Linear systems", Oxford University Press, 2nd edition, 2009
4. Lyons, "Understanding Digital Signal Processing", Prentice Hall, 3rd edition, 2010
5. Johny R. Johnson, "Introduction to Digital Signal Processing", PHI, 2006
6. Alan V. Oppenheim, Ronald W. Schafer, Discrete-Time Signal Processing, Pearson, 3rd Edition,2010
7. Salivahanan, "Digital Signal Processing, 2nd Edition, TMH, 2010

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 hrs**

Part A: 10 questions of 2 marks each -No choice **20 Marks**
Part B: 5 questions from each unit with internal choice, each carrying 16 marks **80 Marks**

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SEC1402 (Old)	PROGRAMMING IN HDL (For ECE and EEE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT1 BASIC CONCEPTS IN VHDL **9 hrs**

Digital system design process - Hardware simulation - Introduction to VHDL - Language elements of VHDL - Data objects - Data types - Operators - Signal assignments - Inertial delay mechanism - Transport delay mechanism - Variable assignments - Concurrent and Sequential assignments- Delta delay.

UNIT2 MODELING IN VHDL **9 hrs**

Data flow modeling - Concurrent Signal Assignment statements - Structural modeling - Component declaration - Component Instantiation - Behavioral modeling - Process statement - wait statement - Conditional and loop statements - Generics and configurations - Examples for modeling.

UNIT3 INTRODUCTION TO VERILOG HDL **9 hrs**

Basic concepts - Levels for design description - Module - Delays - Language elements - Compiler directives - value set - data types - Parameters - Expressions - Operands - operators in Verilog HDL.

UNIT4 STYLES OF MODELING **9 hrs**

Gate level modeling -Primitive Gates- Multiple input and multiple output gates - User Defined Primitives -Combination UDP - Sequential UDP- Data flow modeling - Behavioral modeling - procedural constructs - procedural assignments - conditional and loop statements - Structural Modeling - Examples for modeling.

UNIT5 FEATURES IN VERILOG HDL **9 hrs**

Tasks- Functions -systems tasks and functions - Verification - Modeling a test bench - timing and delays -Switch level modeling - state machine modeling - Moore FSM – Melay FSM - Design of memories - Design of microcontroller CPUs.

Max. 45 hrs

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Identify the use of HDL language in constructing digital logic circuits
CO2	Analyze the combinational sequential logic circuit in gate and switch level modeling
CO3	Conceptualize the system through design and modeling various architectures
CO4	Develop any design based upon the system requirements for solving real time problems
CO5	Validate and Verify the system design
CO6	Design a test bench for any logic circuit

TEXT / REFERENCE BOOKS:

1. J.Bhaskar, “A VHDL Primer”, Pearson. 3rd edition, 2013
2. Douglas L. Perry, "VHDL Programming by Example", McGraw Hill, 4th edition, 2012
3. J.Bhaskar, “A Verilog HDL Primer”, Star Galaxy Publishing. 3rd edition, 2011
4. Stephen Brown, "Fundamental of Digital logic with VHDL Design", Tata McGraw Hill,3rd edition, 2012

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 hrs**

Part A: 10 questions of 2 marks each -No choice **20 Marks**

Part B: 5 questions from each unit with internal choice, each carrying 16 marks **80 Marks**

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Sathyabama Institute of Science and Technology

Department of Electronics and Communication Engineering

SEC1406 (Revised)	PROGRAMMING IN HDL (For ECE and EEE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 CONCEPTS IN VHDL 9 hrs

Introduction to VHDL - Language elements of VHDL -Concurrent and Sequential assignments -Data flow modeling - Concurrent Signal Assignment statements - Structural modeling - Component declaration - Component Instantiation - Behavioral modeling - Process statement - Examples for VHDL modeling

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UNIT2 INTRODUCTION TO VERILOG HDL 9 hrs

Basic concepts - Levels for design description - Module - Delays - Language elements - Compiler directives – value set - data types - Parameters - Expressions - Operands - operators in verilog HDL

UNIT3 STYLES OF MODELING 9 hrs

Gate level modeling -Primitive Gates- Multiple input and multiple output gates - User Defined Primitives - Combination UDP - Sequential UDP- Data flow modeling - Behavioral modeling - procedural constructs – procedural assignments - conditional and loop statements - Structural Modeling - Examples for modeling.

UNIT4 FEATURES IN VERILOG HDL 9 hrs

Tasks- Functions -systems tasks and functions - Verification - Modeling a test bench - timing and delays -Switch level modeling - state machine modeling - Moore FSM - Melay FSM - Design of RAM, ROM.

UNIT5 REALIZING APPLICATIONS IN FPGA 9 hrs

FPGA Design Flow - Architecture of Xilinx Artix7 FPGA - Input/Output Blocks (IOB) - Configurable Logic Blocks (CLB)- Programmable Interconnect - Internal Hard macros - Realizing applications in FPGA - combinational functions - N-bit functions, Encoder, Decoders - Sequential functions - N-bit register, shift registers, up/down counters- N-bit processor. Case Study: study of protocols I2C, SPI, UART and APB.

Max. 45 hrs

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Identify any design requirements to solve problems in various domains.
CO2	Analyse the sequential logic both in synchronous and Asynchronous modes for various complex logic and switching devices and validate the outputs.
CO3	Conceptualize the system through design and modeling various architectures.
CO4	Develop any design based upon the system requirements for solving real time problems.
CO5	Validate and Verify the system design
CO6	Design a test bench for any logic circuit

TEXT / REFERENCE BOOKS:

1. J.Bhaskar, “A VHDL Primer”, Pearson. 3rd edition, 2013
2. Douglas L. Perry, "VHDL Programming by Example", McGraw Hill, 4th edition, 2012
3. J.Bhaskar, “A Verilog HDL Primer”, Star Galaxy Publishing. 3rd edition, 2011
4. Stephen Brown, "Fundamental of Digital logic with VHDL Design", Tata McGraw Hill,3rd edition, 2012

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 hrs**

Part A: 10 questions of 2 marks each -No choice **20 Marks**

Part B: 5 questions from each unit with internal choice, each carrying 16 marks **80 Marks**

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