Bachelor of Technology (Electronics & Communication Engineering)
Scheme of Studies/Examination
Semester VII

S.No.	CourseNo.	Subject	L:T:P	Hours/Week	Examination Schedule(Marks)				Duration of Exam(Hrs)
					Theory	Sessionals	Practical	Total	
1	ECE-401N	Microcontroller & Embedded Systems Design	3:0:0	3	75	25	0	100	3
2	ECE-403N	Digital Image Processing	4:0:0	4	75	25	0	100	3
3	ECE-405N	Power Electronics	3:0:0	3	75	25	0	100	3
4		Core Elective -I**	3:0:0	3	75	25	0	100	3
5		Core Elective -II**	3:0:0	3	75	25	0	100	3
6	ECE-407N	Microcontroller & Embedded Systems Design Lab	0:0:3	3	0	40	60	100	3
7	ECE-409N	Digital Image Processing Lab	0:0:3	3	0	40	60	100	3
8	ECE-411N***	Project-1	0:0:10	10	0	100	100	200	3
9	ECE-413N*	Industrial Training Viva	2:0:0	2	0	100	0	100	
		Total		**34**	**375**	**405**	**220**	**1000**	

**The performance of the student will be evaluated by the technical training (undertaken after 6th semester) seminar and the report submitted by the student which should also include the Industrial/Research problems faced & suggested solutions.*

*** The students should select two departmental electives subjects from the list of core elective subjects.*

****Theprojectshouldbeinitiatedbythestudentinthe7thsemesterbeginningandwillbeevaluatedintheendofthesemesteronthebasisof a presentation and report submitted to the department.*

KURUKSHETRA UNIVERSITY, KURUKSHETRA

Bachelor of Technology(Electronics &Communication Engineering)
Scheme of Studies/Examination
SemesterVIII

S.No.	CourseNo.	Subject	L:T:P	Hours/Week	Examination Schedule(Marks)				Duration of Exam(Hrs)
					Theory	Sessionals	Practical	Total	
1	ECE-402N	Wireless & Mobile Communication	4:0:0	4	75	25	0	100	3
2	ECE- 404N	Microwave Engineering	3:0:0	3	75	25	0	100	3
3		Core Elective -III**	3:0:0	3	75	25	0	100	3
4		Core Elective -IV**	3:0:0	3	75	25	0	100	3
5	ECE-406N***	Project-II	0:0:14	14	0	100	100	200	3
6	ECE-408N	Wireless & Mobile communication lab	0:0:3	3	0	40	60	100	3
7	ECE-410N	Microwave Engineering Lab	0:0:3	3	0	40	60	100	3
8	ECE-412N*	Seminar & Report Writing	2:0:0	2	0	100	0	100	3
		Total		**35**	**300**	**380**	**220**	**900**	
9	ECE-440N****	General Fitness &Professional Aptitude						100	3

** The performance of the student will be evaluated by the presentation delivered and the report submitted by the student related to Industrial/Research problems &it s suggested solutions.*

*** The students should opt two departmental electives subjects from the list of core elective subjects.*

****The project should be initiated by the student in continuation of the7thsemester and will be evaluated in the end of the semester on the basis of a presentation and Report.*

*****A viva of the students will be taken by external examiner (Principal/Director/Professor/or any senior Person with Experience more than10 years)at the end of the semester and grades will be given according to the grade chart.*

S. No.	Core Electives-7thSem.		S. No.	Core Electives-8thSem.	
1	ECE-415N	Advance DigitalCommunication	1	ECE-414N	DSPProcessor
2	ECE-417N	NanoElectronics	2	ECE-416N	Mobile CommunicationNetworks
3	ECE-419N	OpticalCommunications	3	ECE-418N	MEMS
4	ECE-421N	AdaptiveSignalProcessing	4	ECE-420N	Transducers&ItsApplications
5	ECE-423N	Satellite Communication	5	ECE-422N	RadarEngineering
6	ECE-425N	DigitalVLSIDesign	6	ECE-424N	High Frequency Circuit andSystems
7	ECE-427N	AnalogCMOS ICDesign	7	ECE-426N	Biomedical Signal Processing
8	ECE-429N	ConsumerElectronics	8	ECE-428N	Multimedia Communications
9	ECE-431N	Robotics	9	ECE-430N	MixedVLSIDesign
10	ECE-433N	Non-ConventionalEnergyResources	10	ECE-432N	MicrostripAntenna
11	ECE-435N	Microstrip lineAnalysis	11	ECE-434N	Strategic Electronics
12	ECE-437N	SoftwareDefined Radios	12	ECE-436N	Cognitive Radios

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ECE-401N	MICROCONTROLLER ANDEMBEDDEDSYSTEMDESIGN					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
3	**0**	**0**	**75**	**25**	**100**	**3Hr.**
Pre-requisites: Microprocessor						
CourseOutcomes						
CO1	*Acquired knowledge about the architecture of microcontrollers.*					
CO2	*Acquired knowledge about instruction set and programming concepts in C and assembly language.*					
CO3	*To understand peripheral interfacing to microcontrollers.*					
CO4	*To design the systems /models based on microcontrollers*					

Unit- I

INTRODUTION: Microprocessor and Microcontroller, Different types of Microcontrollers, 4 bit, 8 bit, 16 bit, and 32 bit Microcontrollers, Processor Architectures: Harvard & Princeton, CISC & RISC, Microcontrollers memory types, Microcontrollers features, Criteria for choosing a microcontroller, Applications of microcontrollers.

Embedded System, Embedded Processors, Hardware units, Devices and Software in a system, Embedded system on chip, Complex Systems design and processors, Design examples.

Unit- II

8051 ARCHITECTURE: 8051 Architecture, On-chip memory organization – general purpose registers, SFR registers, Internal RAM and ROM, Oscillator and Clock circuits. Pin Diagram of 8051, I/O Pins, Port, Connecting external memory, Counters and Timers, Purpose of TCON & TMOD registers, Serial data transmission/reception and transmission modes, Purpose of SCON & PCON registers, Different Types of Interrupts, Purpose of Time Delays.

Unit- III

8051 INSTRUCTION SET AND PROGRAMMING : Instruction syntax, Assembler directives, Addressing modes, Data transfer instructions, arithmetic and logical instructions, Jump and Call instructions, I/O port, Timer and Counter programming, Serial port and Interrupt programming.

PIC MICROCONTROLLER ARCHITECTURE: Introduction to PIC Microcontroller families, Different features of PIC16 Microcontrollers, PIC16 Architecture and Pipelining, Pin Configuration of PIC16, Program memory considerations, Register file structure, Addressing modes, Instruction set.

Unit-IV

APPLICATION DESIGN & HARDWARE INTERFACING WITH 8051: Interfacing Matrix Keyboards, LCD, ADC, DAC, Temperature Sensor, Stepper and DC motor, Relay and PWM.

Introduction of Advanced Microcontrollers: AVR and ARM microcontrollers.

Text Books:

1. Kenneth Ayala," The 8051 Microcontroller" 3rd ed. CENGAGE Learning.
2. M.A. Mazidi, J.G. Mazidi, R. D. McKinlay," The 8051 Microcontroller and Embedded systems using assembly and C" -2nd Ed, Pearson Education.
3. John. B. Peatman, "Design with PIC Microcontroller", Pearson Education, 2003.

References Books:

1. MykePredko, "Programming and Customizing the 8051 Microcontroller", TMH.
2. Manish K Patel,"Microcontroller based embedded system", McGraw Hill Education.
3. Raj Kamal, "Embedded systems architecture, programming and design"-2ndnd. McGraw-Hill Companies.
4. Intel's manual on "Embedded Microcontrollers".
5. MykePredko, "Programming and customizing PIC microcontroller" Mc- Graw Hill.

6. M.A. Mazidi, R. D. McKinlay,Causey," The PIC microcontroller and Embedded Systems using assembly and C for PIC18" -2nd Ed, Pearson.
7. M.A. Mazidi,Naimi" The AVR microcontroller and Embedded Systems using assembly and C" -2nd Ed, Pearson.

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ECE-403N	DIGITAL IMAGE PROCESSING					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
4	**0**	**0**	**75**	**25**	**100**	**3 Hr.**
CourseOutcomes						
CO1	***Students should be able to explain the basics of Digital Image processing***					
CO2	***Student will be able to explain sampling and quantization of digital image***					
CO3	***Student will be able to analyze the image enhancement operations on digital image***					
CO4	***Students will be able to analyze the various image analysis and computer vision algorithm***					

Unit-I

Introduction: Processing and applications, Image representation and modeling, Image Enhancement, Restoration, analysis, reconstruction from Projections, Image Data Compression. Image Perception: Light, Luminance, Brightness, Contrast, MFT of visual System, Visibility Function, Image fidelity, Color representation, color matching and reproduction, color vision Model

Unit-II

Image sampling and Quantization: Introduction, Two dimensional sampling theory, practical limitations in sampling and reconstruction, Image quantization, Optimum mean square or Lloyd-Max quantizer.

Unit-III

Image Enhancement: Introduction, Point Operation, Histogram Modeling, Spatial Operations, Transform Operations, Multispectral Image enhancement, Color Image enhancement.

Unit-IV

Image Analysis and Computer Vision: Introduction, Spatial Feature Extraction, Transform features, Edge Detection, Boundary Extraction, Shape features, Image segmentation.

Text Books:

1. Digital Image Processing, third edition by Rafael C. Gonzalez and Richard E Woods. Publisher: Pearson Education.
2. Digital Image Processing by S. Sridhar , Publisher: Oxford

Reference Books:

1. Fundamentals of Digital Image Processing by Anil K Jain, Publisher: Prentice Hall

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ECE-405N	**POWER ELECTRONICS**					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
3	**0**	**0**	**75**	**25**	**100**	**3 Hr.**
Purpose	***To understand and acquire knowledge about various power semiconductor devices. To prepare the students to analyze and design different power converter circuits.***					
Course Outcomes						
CO1	***Acquire knowledge about fundamental concepts and techniques used in power electronics.***					
CO2	***Ability to analyze various single phase and three phase power converter circuits and understand their applications.***					
CO3	***Foster ability to identify basic requirements for power electronics based design application.***					
CO4	***To develop skills to build, and troubleshoot power electronics circuits.***					

Unit-1

Introduction: Concept of Power Electronics, Applications of power electronics, Advantages and disadvantages of power-electronic converters, Power electronic systems, Power semiconductor devices, Types of power electronic converters. Power semiconductors: The p-n junction, Basic structure of power diodes, Characteristics of power diodes, Power transistors, Power MOSFETS, Insulated gate bipolar transistor, Static induction transistor.

Unit-II

Thyristors :Terminal characteristics of thyristors, thyristor turn on methods, Switching characteristics of thyristors, Thyristor gate characteristics, Two-transistor model of a thyristor, Thyristor ratings, Thyristor protection, Improvement of thyristor characteristics, Series and parallel operation of thyristors, Gate turn off thyristor, Firing circuits for thyristors.

Thyristor Commutation: Class A commutation: Load commutation, Class B commutation: Resonant commutation, Class C commutation: Complementary commutation, Class D commutation: Impulse commutation, Class E&F commutation.

Unit–III

Phase Controlled Rectifiers: Principle of phase control, Full wave controlled converters, Single phase full wave converters, Single phase symmetrical and asymmetrical semi converters, three phase rectifiers and thyristor converters, Performance parameters of three phase full converters, Effect of source impedance on the performance of converters. Principle of chopper operation, Control strategies, Step up choppers, Types of chopper circuits, Single phase voltage source inverters: Operating principle, Force commutated thyristor inverters, Voltage control in single phase inverters.

Unit-IV

AC Voltage Controllers: Principle of phase control, Principle of integral cycle control, single phase ac voltage controller with R load and RL load.

Cycloconverters: Principle of cycloconverter operation, step up and step down cycloconverters, Three phase half wave converters, Output voltage equation for a cycloconverter, Load commutated cycloconverter.

Text Books

1. P S Bimbhra: Power Electronics, Khanna Publishers.

Reference Books

1. M. H. Rashid. : Power Electronics – circuits, devices & applications, Pearson Education.

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ECE-407N	MICROCONTROLLERANDEMBEDDEDSYSTEMDESIGN LAB					
Lecture	**Tutorial**	**Practical**	**Sessionals**	**Practical**	**Total**	**Time(Hrs)**
0	**0**	**3**	**40**	**60**	**100**	**3**
Course Objectives	*1. To design of microcontroller based systems.* 2. *To impart practical knowledge of 8051 and PIC Microcontrollers*					
CourseOutcomes						
CO1	*To familiarization with 8051 and PIC Microcontrollers.*					
CO2	*Ability to write a C language and assembly language program for 8051 Microcontroller.*					
CO3	*Ability to interfacing the various Peripheral to 8051 Microcontrollers.*					
CO4	*Ability to design the embedded systems based on 8051 Microcontrollers.*					

List of experiments to be performed using 8051 Microcontrollers

1. (a) To study different commands of 8051 trainer kit with their function.

   (b) To study architectural block and pin diagram of 8051 microcontroller and PIC16C74 microcontroller.
2. To write an ALP to perform addition, subtraction, multiplication and division of two unsigned numbers.
3. To write an ALP to perform logical operation i.e., AND, OR, XOR and Complement of two unsigned numbers.
4. To write an ALP to perform multi byte addition and subtraction of two unsigned number.
5. To write an ALP to perform rotate operations i.e., RL, RLC, RR, RRC.
6. To write an ALP for flashing message “WELCOME M51-02 KIT” on LCD screen.
7. To write an ALP for identifying pressed number is even or odd. If number is even, message displays on LCD “NUMBER IS EVEN” and if number is odd, message displays on LCD “NUMBER IS ODD”.
8. To write an ALP to perform data transfer between internal & external memory using all available addressing modes.
9. To write an embedded C program for interfacing LCD to port P0 and display message “LCD Display” on LCD screen.
10. To write an embedded C program for interfacing keypad to port P0 .Whenever a key is pressed; it should be displayed on LCD.
11. To write an embedded C program for interfacing a switch and a buzzer to two different pins of a Port such that the buzzer should sound as long as the switch is pressed.
12. To write an embedded C program for interfacing stepper motor to rotate clockwise and anticlockwise directions.
13. To write an embedded C program for interfacing relay and buzzer.
14. To write an embedded C program for interfacing PWM module to control speed of motor.
15. To write an embedded C program for interfacing LED to glow in different pattern i.e., even odd, rotate left, rotate right.
16. To write an embedded C program for interfacing temperature sensor.
17. Design an Obstacle Detector system through Ultra Sonic obstacle detection using ultrasonic transmitter receiver.

ECE-409N	DIGITAL IMAGE PROCESSING LAB					
Lecture	**Tutorial**	**Practical**	**Sessionals**	**Practical**	**Total**	**Time**
-	**-**	**3**	**40**	**60**	**100**	**3 Hr.**
CourseOutcomes						
CO1	***Students should be able to explain the basics of Digital Image processing***					
CO2	***Student will be able to explain sampling and quantization of digital image***					
CO3	***Student will be able to analyze the image enhancement operations on digital image***					
CO4	***Students will be able to analyze the various image analysis and computer vision algorithm***					

List of Experiments:

1. Study of Image processing toolbox of Matlab.
2. WAP to read and show various images of at least five different formats.
3. WAP to extract R, G, B component of Color Image.
4. WAP to convert a color image into gray scale and save it in new format.
5. WAP to invert a gray scale image.
6. WAP to implement Morphological operations on an image.
7. WAP to implement Histogram equalization.
8. WAP to implement various edge detection algorithms.
9. WAP to implement image segmentation
10. WAP to implement boundary extraction of basic structure.

ECE-402N	**WIRELESS&MOBILECOMMUNICATION**					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
4	0	**0**	**75**	**25**	**100**	**3**
Purpose	*Tointroducetheconceptsofwireless/mobilecommunicationusingcellularenvironment.Tomaketh estudentstoknowaboutthevariousmodulationtechniques,ppropagationmethods,andmultiaccess techniquesusedinthemobilecommunication.*					
Course Outcomes						
CO1	*Itdealswiththefundamentalcellularradioconceptssuchasfrequencyreuseandhandoff.*					
CO2	*Thisalsodemonstratestheprincipleoftrunkingefficiencyandhowtrunkingandinterferenceissuesb etweenmobileandbasestationscombinetoaffecttheoverallcapacity of cellularsystems.*					
CO3	*Itprovidesideaaboutanalogandigitalmodulationtechniquesusedinwirelesscommunication.*					
CO4	*Itpresentsdifferentwaystoradiopropagationmodelsandpredictthelarge–scaleeffects ofradio propagation in manyoperatingenvironment.*					

Unit–I

IntroductiontoWirelessCommunicationSystems: Evolutionofmobileradiocommunications,exampl esof wirelesscomm.systems,pagingsystems,Cordless telephonesystems,comparisonofvariouswirelesssystems.
ModernWirelessCommunicationSystems:Secondgenerationcellularnetworks,thirdgenerationwirele ssnetworks,wirelessinlocalloop,wirelesslocalareanetworks,Bluetooth and PersonalAreanetworks.

Unit–II

IntroductiontoCellularMobileSystems:SpectrumAllocation,basicCellularSystems,performanceCrit eria,Operationofcellularsystems,analogcellularsystems,digitalCellularSystems.
CellularSystemDesignFundamentals:FrequencyReuse,channelassignmentstrategies,handoffStrateg ies,Interferenceandsystemcapacity,trackingandgrade off service, improvingcoverage and capacity.

Unit– III

MultipleAccessTechniquesforWirelessCommunication:Introductionto MultipleAccess,FDMA,TDMA,SpreadSpectrummultipleAccess,spacedivisionmultipleaccess, packetratio,capacity ofa cellularsystems.

Unit–IV

WirelessStandards-GSM,IS-95,UMTS-IMT-2000,Signaling,CallControl,MobilityManagement and locationTracing.

Suggested Books:

1. TheodoreS.Reppaport,WirelessCommunicationsPrinciples and Practice,IEEEPress,PrenticeHall.
2. WilliamC.Y.Lec,MobileCellularTelecommunications,AnalogandDigitalSystems,Mc-Graw Hill Inc.
3. KamiloFeher,WirelessDigitalCommunications,Modernization&SpreadSpectrumApplications, PrenticeHall of India,New Delhi.
4. KavehPahlavanandAllenH.Levesque“WirelessInformationNetworks”,WileySeries, JohnWiley and Sons Inc.

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ECE-404N	MICROWAVE ENGINEERING					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
3	**0**	**0**	**75**	**25**	**100**	**3 Hrs**
Purpose	*AsapartofRFcommunicationtechnologythepurposeofthiscourseistocreateawarenessaboutconventionalmicrowaveresonators,generators,componentsanddevices alongwiththeimportanceofscatteringparameterssothat thelearnerisabletodesignandapplythesebasicapproachesincommercialaswellas defenseapplications*					
CourseOutcomes						
CO1	***Learnerwillbeabletomathematicallydesignbasicresonatorcavitiesandwillbeabletomeasuremicrowaveparameterssuchasimpedance,frequencyandVSWRetc.***					
CO2	***Learnerwill learnthe conventional methods to generate the microwaves.***					
CO3	***Learnerwillknowabouttheimportanceofscatteringparametersalongwithitsapplications in the analysis ofbasic microwavecomponents.***					
CO4	***Learnerwilllearnabouttransferredelectronandavalanchetransittimedevicesindetail.***					

Unit-I

MicrowaveResonators:
Briefdescriptionofwaveguides,coplanarwaveguides,cavityresonators:rectangular,cylindrical,sphericalandcoaxial,excitationandcouplingofcavities,Qfactor.MicrowaveMeasurements:MeasurementofFrequency, Impedance(usingslottedsection)attenuation,power,dielectricconstant,measurement of V.S.W.R.,insertion loss andpermeability

Unit-II

MicrowaveGenerators:
Construction,characteristics,operatingprincipleandtypicalapplicationsofKlystron(twocavity,multicavity),ReflexKlystron,magnetron(CylindricalmagnetronanddescriptionofΠ modeapplications)andTravelingWaveTube(TWT).

Unit-III

Matrix Description of MicrowaveCircuits:
ScatteringMatrix:properties,measurementofscatteringcoefficients,scatteringmatricesforcommonmicrowavesystems.MicrowaveComponents:Waveguidetees-E-plane,H-plane,magic tee, rat race,directionalcoupler,tuningscrewsandstubs,isolators and circulators-theirconstructionalfeaturesandapplications.Microwavefilters,Phaseshifters,attenuators,andfrequencymeter.

Unit-IV

Solid State MicrowaveDevices: TransferredElectronDevices-GunnEffect;negativedifferentialresistancephenomenon,fielddomainformation,Gunndiodestructure.Avalanchetransittimedevices:IMPATT,TRAPATT,BARITT diodes,Parametricamplifiers

Text Book:

1. Samuel Y. Liao, Microwave Engineering, Pearson Education 3rd/4th/ higher Ed.

Reference Books:

2. Annapurna&SisirK.Das,MicrowaveEngineering,TataMcGraw-Hill.
3. David M. Pozar,MicrowaveEngineering, John Wiley and Sons Inc.

ECE-408N	WIRELESS&MOBILECOMMUNICATIONLAB					
Lecture	**Tutorial**	**Practical**	**Sessionals**	**Practical**	**Total**	**Time**
-		**3**	**40**	**60**	**100**	**3Hour**
Purpose	***TogivethestudentsanideaabouttheWirelesscommunicationtheoryandtechnologyusingtheNI-LabviewsoftwareandRFcommunicationmodule.***					
Course Outcomes						
CO1	***Tostudy thewirelesscommunication using NI-Labview***					
CO2	***Tolearn aboutthefunctioning of Universal Software Radio Peripheral (USRP)***					
CO3	***Tolearntheimplementationofdifferent analogmodulationschemes using the USRP.***					
CO4	***Tolearntheimplementationofdifferent digital modulationschemes using the USRP.***					

List of Experiments:

1. Introductionto NI-LabVIEWand familiarizationwith its basicfunctions.
2. Study of modulationtoolkit andits usage in WirelessCommunication.
3. Study the interfacing of hardware(USRPmodule)with the PCand configuring the same.
4. Implementation of AM using SoftwareDefinedRadio(SDR).
5. Implementation of FM using SDR withapplication such as transfer of files
6. Implementation of M-PSK transmitter using SDR concept.
7. Implementation of M-PSK receiverusingSDR
8. Implementation of M-QAMtransmitter using SDR.
9. Demonstrates the use of theBluetoothfunctionsto set up data transfervia Bluetoothbetween a serverVI anda clientVI.
10. Designtwo-dimensionalconvolutionto performimage edge detection.
11. Implementation of M-QAMreceiver using SDR.
12. Implementation of PSKModulationsystemwithConvolutionalCoding.
13. Implementation of FSKModulationsystemwithBCHCoding.
14. Implementation of QAMModulationsystemwithGolayCoding

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ECE-410N	**MICROWAVE ENGINEERING LAB**					
Lecture	**Tutorial**	**Practical**	**Sessionals**	**Practical**	**Total**	**Time**
-		**3**	**40**	**60**	**100**	**3Hour**
Purpose	***Togivethestudentsanideaaboutthestudy and analysis of components used in Microwave Engg.***					
Course Outcomes						
CO1	***Students will learn the steps to analyze microwave components.***					
CO2	***Students will be able to find the characteristics of microwave components.***					
CO3	***Students will learn the steps to analyze various antennas.***					
CO4	***Students will be able to find the characteristics of various antennas.***					

List of Experiments:

1. To study microwave components.
2. To study the characteristics of the reflex Klystron tube and to determine its electronic tuning range.
3. To determine the frequency and wavelength in a rectangular waveguide working in TE_{10} mode.
4. To determine the standing wave ratio and reflection coefficient.
5. To study the I-V characteristics of gunn diode.
6. To study the magic Tee.
7. To study the isolator and attenuator.
8. To measure the coupling coefficient and directivity of a waveguide directional coupler.
9. To measure the polar pattern and the gain of a waveguide horn antenna.
10. To measure the insertion loss and attenuation.

ECE-415N	**Advance Digital Communication**					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
4	**0**	**0**	**75**	**25**	**100**	**3 Hr.**
Purpose	***To understand and acquire knowledge about various power semiconductor devices. To prepare the students to analyze and design different power converter circuits.***					
Course Outcomes						
CO1	***Acquire knowledge about fundamental concepts and techniques used in digital communications***					
CO2	***Ability to analyze various techniques of communication and understand their applications.***					
CO3	***Foster ability to identify basic requirements for power digital communication based design application.***					
CO4	***To develop skills to build, and troubleshoot on digital communication circuits***					

Unit-I

Probability and Stochastic Processes: Probability: Random Variables, Probability Distribution, and Probability Densities, Functions of Random Variables, Statistical Average of Random Variables, Some Useful Probability Distributions, Upper Bounds on the Tail Probability, Sums of Random Variables and Central Limit Theorem.Stochastic Processes: Statistical Averages, Power Density Spectrum, Response of a Linear Time - Invariant System to a Random Input Signal, Sampling Theorem for Band- Limited Stochastic Processes, Discrete-time Stochastic Signals and Systems, Cyclostationary processes.

Unit -II

Source coding: Mathematical Models for Information Sources, A Logarithmic Measure of information: Average Mutual Information and Entropy, Information Measure for Continuous Random Variables. Coding for Discrete Sources: Coding for Discrete Memory less sources, Discrete Stationary Sources, The Lempel-Ziv Algorithm.Coding for Analog Sources-Optimum Quantization: Rate- Distortion Function, Scalar Quantization, Vector Quantization. Coding Techniques for Analog Sources: Temporal Waveform Coding, Spectral Waveform Coding, Model- Based Source Coding.

Unit -III

Characterization of Communication Signal and Systems: Signal Space Representation: Vector Space Concept, Signal Space Concept, Orthogonal Expansion of Signals, Gram Schmitt Procedure.
Optimum Receivers for the Additive White Gaussian Noise Channel: Performance of the Optimum Receiver for Memory Less Modulation: Probability of Error for Binary Modulation, Probability of Error for M- ary Orthogonal Signals, Probability of Error for M- ary Binary- Coded Signals, Probability of Error for M-ary PAM, Optimum Receiver for Binary Signals.

Unit -1V

Carrier and Symbol Synchronization: Signal Parameter Estimation: The Likelihood Function, Carrier Recovery and Symbol Synchronization in Signal Demodulation.Carrier Phase Estimation: Maximum Likelihood Carrier Phase Estimation, The Phased – Locked Loop, Effect of Additive Noise on the Phase Estimate, Decision Directed Loops, Non- Decision Directed Loops.

Text Book:*Digital Communication*, J.G. Proakis, Prentice Hall India.
Reference Book: *Principles of Communication Systems,*Taub& Schilling,McGraw Hill Education; 3rd.

ECE-417N	**NANO ELECTRONICS**					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
4	**0**	**0**	**75**	**25**	**100**	**3Hour**
Course Outcomes						
CO1	***Studentswillbeusingphysics,mathematics,andmaterialscienceengineeringtounderstandthelatestdevelopmentintheareaof Microelectronicsleadingto Nanoelectronics.***					
CO2	***StudentsbeabletounderstandthefundamentalsofclassicalCMOStechnologyandissuesinscalingMOSFETinthesub-100nmregime***					
CO3	***Understandingbasicprinciplesofnon-classicaltransistorswithnewdevicestructureandnanomaterials.***					
CO4	***UnderstandtheissuesinrealizingGermaniumandcompoundsemiconductorMOSFET.***					
CO5	***Studentswilllearnmaterialscharacterizationtechniquesextensively.***					

Unit-I

Overview:Nanodevices,Nanomaterials,DefinitionofTechnologynode,BasicCMOSProcessflow,MOS Scalingtheory,Issuesinscaling,Shortchanneleffects,Descriptionofatypical65nmCMOStechnology,Requirements forNonclassicalMOStransistor,MOScapacitor,Roleofinterfacequalityandrelatedprocesstechniques,Gateoxidethicknessscalingtrend,SiO2vsHigh-kgatedielectrics.Integrationissuesofhigh-k,Interfacestates,bulkcharge,bandoffset,stability,etc.

Unit-II

MetalGateTransistor:Motivation,requirements,IntegrationIssues,TransportinNanoMOSFET,velocitysaturation,ballistictransport,injectionvelocity,velocityovershoot,SOI-PDSOIandFDSOI.,UltrathinbodySOI-doublegatetransistors,Verticaltransistors-FinFETandSurroundgateFET,Metalsource/drainjunctions-PropertiesofschotkyjunctionsonSilicon,Germaniumandcompoundsemiconductors–Workfunctionpinning,GermaniumNanoMOSFETs:strain,quantization,AdvantagesofGermaniumover Silicon.

Unit-III

PMOSversusNMOS,Compoundsemiconductors-materialproperties,MESFETsCompoundsemicocnductorsMOSFETsinthecontextofchannelquantizationandstrain,HeterostructureMOSFETsexploitingnovelmaterials,strain,quantization.
SynthesisofNanomaterials:CVD,NucleationandGrowth,ALD,Epitaxy,MBE.Compoundsemiconductorhetero-structuregrowth,emergingnanomaterials:Nanotubes,nanorodsandothernanostructures,LBtechnique,Softlithographyetc.Microwaveassistedsynthesis,Selfassemblyetc.

Unit-IV

Characterization:QuantumwellsandThicknessmeasurementtechniques:Contact-stepheight,Optical-reflectanceandellipsometry,AFM,NanomaterialsCharacterizationtechniques:FTIR,XRD,AFM,SEM, TEM,EDAXandinterpretationofresults.

Books:

1. FundamentalsofModernVLSIDevices,Y.TaurandT.Ning,CambridgeUniversityPress.SiliconVLSITechnology,Plummer,Deal,Griffin,PearsonEducationIndia.
2. EncyclopediaofMaterialsCharacterization,Editedby:Brundle,C.Richard;Evans,CharlesA.Jr.;Wilson,Shaun;Elsevier.

ECE - 419N	OPTICAL COMMUNICATION					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
3	**0**	**0**	**75**	**25**	**100**	**3 Hr.**
Purpose	*To familiarize the students with the concepts of Optical communication covering thecontents of optical fibers, losses in fibers, optical sources, detectors etc.*					
Course Outcomes						
CO1	*Students will be able to understand the structure of fiber and the mechanism of light travelling in the fiber.*					
CO2	*Students will be able to analyze various losses associated with fibers.*					
CO3	*Students will learn about the optical sources and optical detecters.*					
CO4	*Students will be able to understand the various components needed in optical networks*					

Unit – I

INTRODUCTION : Optical Fibers: Structure, Propagation within the fiber, Numerical aperture of fiber, step index and graded index fiber, Modes of propagation in the fiber, Single mode and multi mode fibers. Splices and connectors. Optical Power Launching and Coupling. Fiber-to-fiber joints.

Unit–II

LOSSES IN OPTICAL FIBER : Rayleigh Scattering Losses, Absorption Losses, Leaky modes, Mode coupling losses, Bending Losses, Combined Losses in the fiber.

DISPERSION EFFECT: Effect of dispersion on the pulse transmission Intermodal dispersion, Material dispersion, Wave guide dispersion, Polarization Mode Dispersion Total dispersion, Transmission rate. Dispersion Shifted Fibers, Dispersion Compensating Fibers.

Unit – III

LIGHT SOURCES : LEDS, Laser Action in semiconductor Lasers, Semiconductor Lasers for optical communication – Laser modes, Spectral Characteristics, Power Voltage Characteristics, Frequency response.

DETECTORS : P-I-N Photodiode, APD, Noise Analysis in detectors, Coherent and non-coherent detection, Infrared sensors. Bit error rate.

Unit– IV

THE FIBER-OPTIC COMMUNICATION SYSTEM: Design considerations of fiber optic systems: Analog and digital modulation. Optical Devices: Optical coupler, space switches, linear divider-combiners, wavelength
division multiplexer and demultiplexer, optical amplifier

OPTICAL NETWORKS: Elements and Architecture of Fiber-Optic Network, Optical link network-single hop ,multihop, hybrid and photonic networks.

Suggested Books:

1.John Power, An Introduction to Fiber optic systems, McGraw Hill International.
2. John Gowar , Optical communication Systems.
3. R. Ramaswamy, Optical Networks, Narosa Publication
4. John M. Senior,Optical Fiber Communication
5. Gerd Keiser, Optical Fiber Communication

ECE - 421N	ADAPTIVE SIGNAL PROCESSING					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
3	**0**	**0**	**75**	**25**	**100**	**3 Hr.**
Purpose	*To familiarize the students with various stochastic processes and models, analysis of wiener filters, steepest descent algorithms. Also, students will be able to understand LMS & RLS algorithms and check the robustness and study the Finite-Precision effects on LMS and RLS algorithms.*					
Course Outcomes						
CO1	*To understand various stochastic processes and models in adaptive signal processing.*					
CO2	*To understand the analysis of wiener filters, the concept of the linear prediction and steepest descent algorithms.*					
CO3	*To understand the concept and use of Least-Mean-Square (LMS) & Recursive Least-Squares (RLS) algorithms with applications to specific engineering problems.*					
CO4	*To apply the concept robustness and analysis the Finite-Precision effects on LMS and RLS algorithms.*					

Unit -I

Stochastic Processes and Models: Partial Characterization of a Discrete-Time Stochastic Process, Mean Ergodic Theorem, Correlation Matrix, Correlation Matrix of Sine Wave Plus Noise, Stochastic Models, Wold Decomposition, Asymptotic Stationarity of an Autoregressive Process, Yule—Walker Equations.

Wiener Filters: Linear Optimum Filtering: Statement of the Problem, Principle of Orthogonality, Minimum Mean-Square Error, Wiener-Hopf Equations, Error-Performance Surface, Multiple Linear Regression Model.

Unit -II

Linear Prediction: Forward Linear Prediction, Backward Linear Prediction, Levinson-Durbin Algorithm, Properties of Prediction-Error Filters, Schur-Cohn Test.

Method of Steepest Descent: Basic Idea of the Steepest-Descent Algorithm, The Steepest-Descent Algorithm Applied to the Wiener Filter, Stability of the Steepest-Descent Algorithm, Example, The Steepest-Descent Algorithm as a Deterministic Search Method, Virtue and Limitation of the Steepest-Descent Algorithm.

Unit -III

The Least-Mean-Square (LMS) Algorithm: Signal-Flow Graph, Optimality Considerations, Applications, Statistical Learning Theory, Transient Behavior and Convergence Considerations, Efficiency.

The Recursive Least-Squares (RLS) Algorithm: Some Preliminaries, The Matrix Inversion Lemma, The Exponentially Weighted RLS Algorithm, Selection of the Regularization Parameter, Update Recursion for the Sum of Weighted Error Squares, Example: Single-Weight Adaptive Noise Canceller.

Unit -IV

Robustness: Robustness, Adaptation, and Disturbances, Robustness: Preliminary Considerations Rooted in H∞ Optimization, Robustness of the LMS Algorithm, Robustness of the RLS Algorithm, Comparative Evaluations of the LMS and RLS Algorithms from the Perspective of Robustness.

Finite-Precision Effects: Quantization Errors, Least-Mean-Square (LMS) Algorithm, Recursive Least-Squares (RLS) Algorithm, Summary and Discussion.

TEXT BOOKS:

1. S. Haykin, Adaptive filter theory, Pearson

REFERENCE BOOKS:

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ECE-423N	SATELLITE COMMUNICATION					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
3	**0**	**0**	**75**	**25**	**100**	**3 Hr.**
Purpose	*To familiarize the students with the concepts of Satellite communication and various terms, laws and multiple access schemes used in its working***.**					
Course Outcomes						
CO1	***To understand the concept of basics of satellite communication and various basic laws and terms of satellite communication.***					
CO2	***To understand the concept and processes of various communication satellites used in satellite communication.***					
CO3	***To familiarize with the concept and design issues of satellite link design and satellite access.***					
CO4	***To familiarize with the concepts of Multiple access schemes used in satellite communication.***					

Unit-I

SATELLITE ORBITS: Orbital Mechanics- Kepler's laws ,locating the satellite in the Orbit, locating the satellite with respect to the earth, Orbital elements, look angle determination, Sub satellite point, Azimuth and elevation angle calculation, Orbital perturbations, Longitudinal and Inclination changes; Launches and launch vehicles-ELV's, Placing the satellite into geostationary orbit, Doppler shift, range variations, solar eclipse, sun transit outage.

Unit-II

COMMUNICATION SATELLITES: Satellite Subsystems, Attitude and Orbit Control system(AOCS), Telemetry, Tracking, Command and Monitoring (TTC&M), Power System, Communication Subsystems-description, Transponders, satellite antennas-basic antenna types, basic antennas in practice.

Unit-III

Satellite link design and Satellite access: Basic transmission theory**,** system noise temperature and G/T ratio; Downlink design-link budget; Uplink design; design for specified C/N, uplink and downlink attenuation in rain, communication link design procedure; system design examples.

Unit–IV

Multiple access schemes: FDMA, TDMA, CDMA, DAMA; VSAT systems-basic techniques, VSAT earth station engineering, system design; DBS systems-C-band and Ku band home TV, digital DBS; satellite mobile systems; GPS

Text Books:

1. Timothy Pratt, Satellite Communications, Wiley India edition

Reference Books:

1. Anil K Maini, Satellite Communication, Wiley India edition

ECE-425N	**Digital VLSI Design**					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
3	**-**	**-**	**75**	**25**	**100**	**3 Hr.**
Purpose	*Analog CMOS circuits are used in amplifiers and various filters circuits. This course teaches design methods of CMOS IC circuits.*					
Course Outcomes						
CO1	*To understand MOS digital circuits concepts*					
CO2	*To understand the MOS inverter and its design*					
CO3	*To learn MOS combinational and sequential circuit design*					

Unit-I

Introduction: Introduction to MOSFETs : MOS Transistor Theory – Introduction MOS Device, Fabrication and Modeling , Body Effect, Noise Margin; Latch-up

Unit-II

MOS Inverter: MOS Inverter, MOS Transistors, MOS Transistor Switches, CMOS Logic, Circuit and System Representations, Design Equations, Static Load MOS Inverters, Transistor Sizing, Static and Switching Characteristics; MOS Capacitor.

Unit-III

MOS Combinational circuits: Combinational MOS Logic Circuits: Pass Transistors/Transmission Gates; Designing with transmission gates, Primitive Logic Gates; Complex Logic Circuits.

Unit-IV

MOS Sequential Circuits: Sequential MOS Logic Circuits: SR Latch, clocked Latch and flip flop circuits, CMOS D latch and edge triggered flip flop.

Books:

1. S. M. Kang and Y. Leblebici, CMOS Digital Integrated Circuits : Analysis and Design, Third Edition,
MH, 2002.
2. N. Weste, K. Eshraghian and M. J. S. Smith, Principles of CMOS VLSI Design : A Systems Perspective, Second Edition (Expanded), AW/Pearson, 2001.
3.J. P. Uyemura, CMOS Logic Circuit Design, Kluwer, 1999.

ECE-427N	Analog CMOS IC Design					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
3	**-**	**-**	**75**	**25**	**100**	**3 Hr.**
Purpose	*Analog CMOS circuits are used in amplifiers and various filters circuits. This course teaches design methods of CMOS IC circuits.*					
Course Objectives						
CO1	*To understand CMOS digital circuits concepts*					
CO2	*To design Analog circuits using CMOS.*					
CO3	*To learn modeling of CMOS based amplifiers circuits*					

Unit-I

Basic Analog CMOS Circuits: Introduction to analog design, Passive and active current mirrors, Switched Capacitor circuits - basic principles, sampling switches, switched capacitor integrator, switched capacitor amplifier.

Unit-II

CMOS single stage Amplifiers: Common-Source stage with resistive load and diode connected load, source follower, common-gate stage, cascode stage, folded cascode stage. Frequency responses of CS stage, CD stage, CG stage, cascode stage.

Unit-III

Differential Amplifier & Op-Amp: Single-ended and differential operation, basic differential pair – qualitative and quantitative analyses, common-mode response, differential pair with MOS loads, Performance parameters of op-amp, one stage op-amp, two-stage CMOS op-amp, slew rate, power supply rejection.

Unit-IV

Oscillators: General considerations, Ring oscillators, LC oscillators – cross-coupled oscillators, Colpitts oscillator, One-port oscillator, and voltage controlled oscillators.

Books:

1.Razavi, “Design of analog CMOS integrated circuits”, McGraw Hill, Edition 2002.

2. Allen, Holberg, “CMOS analog circuit design”,Oxford UniversityPress, 2nd Edition, 2012.

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ECE-429N	CONSUMERELECTRONICS					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
3	**0**	**0**	**75**	**25**	**100**	**3Hr.**
Purpose	*Tofamiliarizethestudentswiththeconceptsofaudioandvideosystemsandalso Withvariousadvancedelectronicgadgetsandhomeappliances*					
CourseOutcomes						
CO1	***Tounderstandtheconceptofbasicaudiosystemand AM/FMtuners.***					
CO2	***TounderstandtheconceptofVideoSystems.***					
CO3	***Tounderstandthevariousadvancedelectronicgadgets.***					
CO4	***Tounderstandthevariouselectronichomeappliances.***					

Unit-I

AudioSystem: Wavemotion,Microphones,HeadphonesandHeadsets,Loudspeakers,Acoustics,DiscrecordingandDistortionindiscandtape,Opticalrecordingandreproduction,Controlcircuits,Amplifyingsystems,PortablestereoTheatresoundsystemandAM/FMtuners.

Unit-II

VideoSystems:MonochromeTVstandardsandsystems,ColourTVstandardsandsystems,MonochromeandcolourTVcontrols,VideoTaperecordingandreproduction,videodiscrecordingandplayback,Remotecontrolsand Videosystems.

Unit-III

ElectronicGadgets:TelecommunicationSystems,SwitchingSystems,Modulationtechniques,Fiberoptics,MobileSystems,XerographyandFascimilefax,AutomatedTellerMachinesandTopBoxes.

Unit-IV

HomeAppliances:Digitalclocks,In-CarComputers,Microwaveovens,WashingMachines,AirConditionersandRefrigerators.

ReferenceBooks:

1. ConsumerElectronicsByS.P.Bali,PearsonEducation,1st edition.
2. Colour Television-principles&practiceR.RGulatibyWileyEasternLimited,NewDelhi.
3. ColourTelevision&VideoTechnologybyA.K.MainiCSBPublisher
4. VCR-principles,maintenance&repairbyS.P.Sharma,TataMcGrawHill,New Delhi
5. Colour TVbyA.Dhak.

ECE-431N	**ROBOTICS**					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
3	**0**	**0**	**75**	**25**	**100**	**3 Hr.**
Course Outcomes						
CO1	***The basic concepts related to robot, Parts of robots, End effectors and to make the student familiar with the various drive systems for robot.***					
CO2	***Various sensors and machine vision and their applications in robots.***					
CO3	***About various control system, robot programming, Artificial intelligence and safety standards of robots***					
CO4	***Industrial and Non-industrial Applications of robots.***					

Unit–I

Fundamentals of Robot: Definition, History and Development in robot technology. Robot Technology: Characteristics, Basic Components, Robot Anatomy, Robot Generations, Robot selection, Present and Future Applications.

Robot Drive Systems and End Effectors: Robot Classification: Arm geometry, Degrees of freedom, Power sources, Types of motion, Path Control. Robot End Effectors: Mechanical grippers, Vacuum, Magnetic, Adhesive. Special purpose grippers, Process tooling, Compliance, Robot Drive systems: Hydraulic, Pneumatic and Electric system.

Unit-II

Sensor : Requirements of a sensor, Sensor classification, Principles and Applications of the following types of sensors : Position of sensors (Potentiometer, Encoder, LVDT, Resolvers, LMDT, Hall – effect sensors),Velocity sensors(Encoder, Tachometer, Differentiation of position signal),Acceleration sensors, Force and Pressure Sensors(Piezoelectric, Force sensing resistor, Strain Gauge, Antistatic foam), Torque Sensors, Micro switches, Visible light and Infrared Sensors, Touch and Tactile sensors, Proximity Sensors(Magnetic, optical, Ultrasonic, Inductive, Capacitive, Eddy Current), Range Finder (Ultrasonic, Light-based, GPS), Sniff Sensors, Taste Sensors, Vision Sensors, Voice recognition devices, Voice synthesizers, RCC.

Machine Vision : Visual sensing, Architecture of robotics vision system, Machine vision: Image acquisition (Vidicon tube, CCD), Digitization, Image processing, Image Analysis, Image interpretation. Machine vision application, other optical methods.

Unit-III

Control System, Programming and Artificial Intelligence: Control Systems: PLC, PID, CNC, MPU, URC. Robot programming: Programming methods, Languages, levels of robot programming, Program statements. Elements of Artificial Intelligence, System architecture, Application of fuzzy logic in robotics, Robot Safety, safety standards.

Unit–IV

Robot Applications: Industrial applications, Automation in manufacturing, Robot applications, Material handling, Processing application, Assembly application, Inspection application, evaluating the potential of a robot application, future applications, challenge for the future, Innovations, Non-industrial application.

Text Books:

1. James G. Keramas, " Robot technology fundamentals", Delmar Publishers.
2. Saeed B. Niku, "Introduction to robotics analysis,control and applications", 2nd ed., Wiley India.
3. R. K. Mittal,I.J.Nagrath, "Robotics and Control", TMH Education Pvt. Lmt.

ECE-433N	NON-CONVENTIONAL ENERGY RESOURCES					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
3	**-**	**-**	**75**	**25**	**100**	**3Hour**
Course Outcomes						
CO1	***Tounderstandtheenergydemandofworld,nationandavailableresourcestofulfill the demand***					
CO2	***Toknowabouttheconventionalenergyresourcesandtheireffectiveutilization***					
CO3	***Toacquiretheknowledgeofmodernenergyconversiontechnologies***					
CO4	***Tobeabletounderstandandperformthevariouscharacterizationtechniquesoffuels***					
CO5	***Tobeabletoidentifyavailablenonconventional(renewable)energyresourcesandtechniquestoutilizethemeffectively.***					

Unit-I

Introduction: Energydemandofworldandcountryandgapanalysis,Fossilfuelbasedsystems,Impactoffossilfuel basedsystems,Nonconventionalenergy–seasonalvariationsandavailability,Renewableenergy–sourcesandfeatures,Hybridenergysystems.Distributedenergysystemsanddispersedgeneration(DG).

Unit-II

Solarthermalsystems: Solarradiationspectrum,Radiationmeasurement,Technologies,Applications,Heating,Cooling,Drying,Distillation,Powergeneration;Costing:Lifecyclecosting(LCC),Solarthermalsystem SolarPhotovoltaicsystems,Operatingprinciple,Photovoltaiccellconcepts,Cell,module,array,Seriesandparallelconnections,Maximumpowerpointtracking,Applications,Batterycharging,Pumping,Lighting,Peltiercooling,Costing:Lifecyclecosting,SolarPVsystem

Unit-III

Microhydel:
Operatingprinciple,Componentsofamicrohydelpowerplant,Typesandcharacteristicsofturbines,Selectionand modification,Loadbalancing,Costing:Lifecyclecosting-Microhydel
Wind;Windpatternsandwinddata,Siteselection,Typesofwindmills,Characteristicsofwindgenerators,Loadmatching,Lifecyclecosting-WindsystemLCC

Unit-IV

Biomass:Learningobjectives,Operatingprinciple,Combustionandfermentation,Anaerobic digester,Woodgassifier,Pyrolysis,Applications,Biogas,Woodstoves,Biodiesel,Combustionengine,Lifecyclecosting-BiomasssystemLCC
HybridSystems,NeedforHybridSystems,RangeandtypeofHybridsystems,CasestudiesofDiesel-PV,Wind-PV,Microhydel-PV,Biomass-Dieselsystems,electricandhybridelectricvehicles

SuggestedBooks:

1. Ashok V Desai,Non-Conventional Energy, WileyEasternLtd,New Delhi, 2003
2. Mittal KM, Non-Conventional Energy Systems, Wheeler Publishing Co.Ltd,New Delhi,20033.Ramesh R & Kumar KU, Renewable Energy Technologies,Narosa PublishingHouse,New Delhi,2004
4.Wakil MM,PowerPlant Technology,McGraw Hill Book Co,New Delhi, 2004.

ECE-435N	MICROSTRIP LINE ANALYSIS

KURUKSHETRA UNIVERSITY, KURUKSHETRA

Lecture	Tutorial	Practical	Theory	Sessionals	Total	Time
3	-	-	75	25	100	3Hour
Purpose	*To create awareness about the basics of designing the modern tuned circuit based on microstrip circuit theory.*					
Course Objectives						
CO1	***Tounderstandtheneed of microstripline analysis.***					
CO2	***To be able to acquire knowledgeaboutthedispersion models and measurements.***					
CO 3	***To familiarize with quasi static analysis of microstrip line.***					
CO 4	***To acquire the knowledge of importance and applications of slotline type of microstrip..***					

Unit -I

Microstrip Lines I: Quasi- Static Analyses, Dispersion Models, and Measurements

Introduction, Quasi-Static Analyses of a Microstrip, Microstrip Dispersion Models, Microstrip Transitions, Microstrp Measurements.

Unit -II

Microstrip Lines II: Fullwave Analyses, Design Considerations, and Applications

Methods of Full Wave Analysis, Analysis of Open Microstrip, Analysis of Enclosed Microstrip, Design Considerations, Other Types of Microstrip Lines, Microstrip Applications.

Unit -III

Microstrip Discontinuities I: Quasi- Static Analysis and Characterization

Introduction, Discontinuity Capacitance Evaluation, Discontinuity Inductance Evaluation, Characterization of Various Discontinuities, Compensated Microstrip Discontinuities.

Unit -IV

Slotlines

Introduction, Slotline Analysis, Design Considerations, Slotline Discontinuities, Other Slotline Configurations, Slotline Transitions, Slotline Applications.

Text Book: K.C. Gupta, Ramesh Garg, InderBhal and ParkashBhartia, ***Microstrip lines &Slotlines,*** Second ed., Artech House, London

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ECE-437N	SOFTWAREDEFINED RADIOS					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
3		**-**	**75**	**25**	**100**	**3**
Purpose	***Tounderstand Modern RadioCommunication Systemthat can bereconfigured.***					
CourseOutcomes						
CO 1	***Conceptualize the SDR and implementationdetails***					
CO 2	***DesignSDRfor a specificapplication***					
CO 3	***Identify the challengesin the maintenance of SDR***					
CO 4	***Analyse the transmitterandreceiver architectures***					

Unit-I

Introduction–SoftwareDefinedRadio–ATraditionalHardwareRadioArchitecture–SignalProcessingHardwareHistory–SoftwareDefinedRadioProjectComplexity.
ABasicSoftwareDefinedRadioArchitecture– Introduction– 2GRadio ArchitecturesHybridRadioArchitecture-BasicSoftwareDefinedRadioBlockDiagram-SystemLevelFunctioningPartitioning-DigitalFrequencyConversionPartitioning.

Unit-II

Analog-to-DigitalandDigital-to-AnalogConversion-Introduction–DigitalConversionFundamentals-SampleRate-BandpassSampling-Oversampling-AntialiasFiltering–Quantization–ADCTechniques-SuccessiveApproximation-FigureofMerit-DACs-DACNoiseBudget-ADC Noise Budget.

Unit-III

DigitalFrequencyUp-andDownConverters-Introduction-FrequencyConverterFundamentals-DigitalNCO-DigitalMixers-DigitalFilters-HalfbandFilters-CICFiltersDecimation,Interpolation,andMultirateProcessing-DUCs-CascadingDigitalConvertersandDigitalFrequencyConverters.
SignalProcessingHardwareComponents-Introduction-SDRRequirementsforProcessingPower-DSPs-DSPDevices-DSPCompilers-ReconfigurableProcessorsAdaptiveComputingMachine-FPGAs

Unit-IV

SoftwareArchitectureandComponents–Introduction-MajorSoftwareArchitectureChoices–Hardware–SpecificSoftwareArchitecture-SoftwareStandardsforSoftwareRadio-SoftwareDesignPatterns-ComponentChoices-RealTimeOperatingSystems-HighLevelSoftwareLanguages- HardwareLanguages.

TextBooks

1. PaulBurns,SoftwareDefinedRadiofor3G,ArtechHouse,2002.
2. Tony J Rouphael,RF and DSP for SDR,ElsevierNewnes Press, 2008
3. JoukoVanakka,DigitalSynthesizers and TransmitterforSoftwareRadio,Springer,2005.
4. PKenington,RF and BasebandTechniquesforSoftwareDefinedRadio,ArtechHouse, 2005.

ECE-414N	DSP PROCESSOR					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
3	**-**	**-**	**75**	**25**	**100**	**3Hour**

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Course Objectives	***1. To study Programmable DSP Processors.*** ***2. To provide an understanding of the fundamentals of DSP techniques.*** ***3. To study implementation & applications of DSP techniques.*** ***4. To understand architecture of DSP processor*** ***5. To understand DSP system design using FPGA.***
Course Outcomes	
CO1	*To describe the detailed architecture, addressing mode, instruction sets of TMS320C5X.*
CO2	*To write program of DSP processor.*
CO3	*To describe the detailed architecture, addressing mode, instruction sets of TMS320C54X.*
CO4	*To know DSP system design using FPGA.*

Unit-I

INTRODUCTION: Digital Signal Processing, Advantages of DSP, Applications of DSP.
Fundamentals Of Programmable Dsps: Multiplier and Multiplier accumulator, Modified Bus Structures and Memory access in P-DSPs, Multiple access memory , Multi-ported memory , VLIW architecture, Pipelining , Special Addressing modes in P- DSPs , On chip Peripherals.

Unit-II

ARCHITECTURE OF TMS320C5X: Architecture, Bus Structure & memory, CPU, addressing modes. Programming TMS320C5X: Assembly language syntax, Assembly language Instructions, Simple ALP – Pipeline structure, Operation Block Diagram of DSP starter kit, Application Programs for processing real time signals.

Unit -III

PROGRAMMABLE DIGITAL SIGNAL PROCESSORS: Block diagrams of 54X internal Hardware, buses , internal memory organization, Data Addressing modes of S320C54XX Processors, Program Control, On-chip peripheral, Interrupts ofTMS320C54XX processors, Pipeline Operation of TMS320C54XX Processors.

Unit-IV

ADVANCED PROCESSORS and FPGA: Code composer studio - Architecture of TMS320C6X, Introduction to FPGA, Design flow for an FPGA based system design, FPGA based DSP system design. Comparison of the performance of the system designed using FPGA and Digital signal processors, Application note on DSP systems.

Text- Books:

1. B. Venkataramani and M. Bhaskar, Digital Signal Processors -Architecture, Programming and Applications 2nd edition, Mc Graw Hills 2011.
2. Avtar Singh, S. Srinivasan DSP Implementation using DSP microprocessor with Examples from TMS32C54XX –Thamson.

Reference Books:

1. DSP Processor Fundamentals, Architectures & Features – Lapsleyet al. , S. Chand & Co, 2000.
2. Digital signal processing-Jonathen Stein John Wiley 2005.
3. S.K. Mitra, Digital Signal Processing, Tata McGraw-Hill Publication, 2001.
4. B. Venkataramani, M. Bhaskar, Digital Signal Processors, McGraw Hil

ECE-416N	MOBILE COMMUNICATIONNETWORK					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
3		**-**	**75**	**25**	**100**	**3**
Purpose	*Toexposethestudentstothemostrecenttechnologicaldevelopmentsin Mobilecommunication systems.*					
CourseOutcomes						
CO 1	***Fundamentalconcepts inwireless,cellulartechnology***					
CO 2	***Standardsevolved***					
CO 3	***Models of mobile radio channels***					
CO 4	***Communicationtechnologiesadapted,Wireless networks***					

Unit-I

IntroductionToMobileRadioSystemsEvolutionofMobileradiocommunications– MobileradiosystemsintheU.S.andaroundtheworld– ExamplesofMobileradiosystems.**StandardsandCellularConceptCellularconcept**–Frequencyreuse– ChannelAssignmentstrategies–Handoffstrategies –InterferenceandSystem capacity–TrunkingandGrade of service – Improvingcapacityin cellularsystems.

Unit-II

MobileRadioPropagationSmall-scalemultipathpropagation–Impulseresponseofamultipathchannel– Parametersofmobilemultipathchannel–Typesofsmall-scalefading–RayleighandRiciandistributions – Statisticalmodelsformultipathfadingchannels.

Unit-III

MobileSystemandNetworkArchitecturesGSMServicesandFeatures–GSMsystemarchitecture– GSMradiosubsystem–FramestructureforGSM–SignalprocessinginGSM–GPRSnetworkarchitecture– GPRSservicesandfeatures–3GUMTSnetworkarchitecture –UMTS services and features.

Unit-IV

WirelessStandardsMultipleaccesstechniques–FDMA,TDMAandCDMA–Wirelessnetworking – Designissues in personalwirelesssystems –Cordlesssystems andWirelessLocalLoop(WLL) – IEEE802.16 FixedBroadbandWirelessAccessstandard –MobileIP andWireless ApplicationProtocol.

Text Books

1. Rappaport,T.S.,"WirelessCommunications",PrinciplesandPractice,PrenticeHall,NJ,1996.
2. WilliamStallings,"WirelessCommunicationand Networking",PearsonEducation, 2002.
3. SiegmundM.Redl,MathiasK.Weber,MalcolmW.Oliphant,"AnIntroductiontoGSM",ArtechHousePublishers,1995.
4. Kraus,J.D.,"Antennas",IIEdition,JohnWileyandSons,NY,1977.5.Collin,R.E.andZucker,F., - "Antennatheory:PartI",TataMcGraw Hill,NY, 1969.

ECE-418N	MEMS

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Lecture	Tutorial	Practical	Theory	Sessionals	Total	Time
3	**-**	**-**	**75**	**25**	**100**	**3**
CourseOutcomes						
CO 1	***Studentswillbeusingknowledgeofmathematics,science,andengineeringtounderstandvariousMEMSdevices.***					
CO 2	***Studentsbeabletounderstandvariousprocessesusedsuchasoxidation,metallization,fabricationandpackagingofMEMSdevices.***					
CO 3	***Understandingbasicprinciplesofbulkmicromachiningandcleanroomspractices***					
CO 4	***UnderstandmaterialsandMEMSpackagingtechniques.***					
CO 5	***Studentscanwriteanengineeringreportontheoneofpotential MEMSdevicesandgiveaneffectiveoralpresentation.***					

Unit-I

IntroductiontoMicrosystems:
OverviewofmicroelectronicsmanufactureandMicrosystemstechnology.Definition-MEMSmaterials.Lawsofscaling.ThemultidisciplinarynatureofMEMS.Surveyofmaterialscentralto microengineering.ApplicationsofMEMSinvariousindustries.

Unit-II

MicroSensorsandActuators: WorkingprincipleofMicrosystems-microactuationtechniques,microsensors–types,Microactuatorsandtypes,micropump,micromotors,micro–valves,microgrippers–micro-accelerometers.

Unit-III

FabricationProcessSubstrates-
singlecrystalsiliconwaferformation,Cleanroompractices,Photolithography,Ionimplantation,Diffusion,Oxidation,CVD-Physicalvapordeposition,epitaxy-etchingprocess.

Unit-IV

MicroSystemManufacturingBulkMicromanufacturing-surfacemicromachining–LIGAMicrosystempackagingmaterials-dielevel-devicelevel-systemlevel-packagingtechniques–diepreparation–surfacebondingwirebonding-sealing.Introductiontoassembly,IntroductiontoMicro-system design.

TextBooks

1. MEMSandMicrosystemsDesignandManufacture"byTai-RanHsu.TataMcGraw-Hill PublishingCompanyLtd.
2. FoundationofMEMS"byChangLiu.PearsonEducation.
3. MEMSHandbook",MohamedGad–el–Hak,CRCPress,2002.
4. Rai-ChoudhuryP.MEMSandMOEMSTechnologyandApplications",PHILearningPrivateLimited,2009.
5. SabrieSolomon,"SensorsHandbook,"McGrawHill,1998.

References

1. FrancisE.H.TayandChoong.W.O,"MicrofluidicsandBiomemsapplication",IEEEPressNew York,1997.
2. TrimmerWilliamS.,Ed.,"MicromechanicsandMEMS",IEEEPressNewYork,1997.

3. Maluf,Nadim,"AnintroductiontoMicroelectromechanicalSystemsEngineering",ARTechhouse,Boston2000.
4. JulianW.Gardner,VijayK.Varadan,OsamaO.AwadelKarim,"MicrosensorsMEMSandSmartDevices",JohnWiby&sonsLtd.,2001.

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ECE-420N	TRANSDUCERS & ITS APPLICATIONS						
Lecture	**Tutorial**	**Practical**	**Credit**	**Theory**	**Sessionals**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hr.**
Purpose	*Understanding the structural and functional principles of sensors and transducers used for various physical and non electric quantities and how to use them to measure these quantities*						
Course Outcomes							
CO1	***Explain the principles of operation of the sensor parameters and generators.***						
CO2	***Interpretation of the measurement results by using transducers.***						
CO3	***Development of measurement schemes for different nonelectrical quantities.***						
CO4	***Assimilating knowledge about the implementation of sensors and transducers.***						

Unit-I

Definition of transducer, Advantages of an electrical signal as output. Basic requirements of transducers, Primary and Secondary Transducer, Analog or digital types of transducers, Resistive, inductive, capacitive, piezoelectric, photo electric and Hall Effect tranducers

Unit-II

Measurement of Pressure: Manometers, Force summing devices and electrical transducers
Measurement of Temperature: Metallic resistance thermometers, semi conductor resistance sensors (Thermistors), thermo-electric sensors, pyrometers

Unit-III

Measurement of Displacement–Potentiometric resistance type transducers, inductive type transducers, differential transformer (L.V.D.T), capacitive transducers, Hall effect devices, strain gage transducers
Measurement of Velocity–variable reluctance pickup, electromagnetic tachometers, photo electric tachometer, toothedrotor tachometer generator

Unit-IV

Measurement of Force: Strain gage load cells, pneumatic load cell, LVDT type force transducer
Measurement of Torque: Torque meter, torsion meter, absorption dynamometers, inductive torque transducer, digital methods

Suggested Books:

1. B.C.Nakra, K.K.Chaudhry,"Instrumentation Measurement and Analysis," Tata McGraw-Hill Publishing Company Limited, NewDelhi.
2. Thomas G.Beckwith etc.all,"Mechanical Measurements (International Student Edition), Addison-Wesley Longman, Inc. England.
3. A.K.Sawhney,"A Course in Electrical and Electronic Measurements and Instrumentation," DhanpatRai&Sons,Delhi-6

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ECE-422N	RADAR ENGINEERING						
Lecture	**Tutorial**	**Practical**	**Credit**	**Theory**	**Sessionals**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hr.**
Purpose	*To familiarize the students with the concepts of radar, various types of radar, radar mixers and various other technologies.*						
Course Outcomes							
CO1	***To understand the concept of basics of radar, its equation and signals associated with radar.***						
CO2	***To understand the concept of CW and MTI radar.***						
CO3	***To familiarize with the concept of tracking radar.***						
CO4	***To familiarize with the concept of radar receiver, mixers and duplexers.***						

Unit-I

Radar BASICS: Radar Block Diagram & operation, Applications of Radar.
Radar Equation: Simple form of Radar Equation, Detection of signals in noise, Signal to Noise ratio, Transmitter Power. Pulse repetition frequencies & range ambiguities, System losses, Propagation effects

Unit-II

CW& Frequency Modulated Radar: The Doppler Effect, CW Radar, FM-CW Radar, Multiple Frequency CW Radar
MTI & Pulse Doppler Radar: Introduction, Delay Line Cancellors, Multiple or staggered Pulse repetition frequencies, range-Gated Doppler Filters, Limitation of MTI performance, Non-coherent MTI, Pulse Doppler radar, MTI from a moving platform

Unit-III

Tracking Radar: Tracking with Radar, Sequential Lobbing, Conical Scan, Mono-pulse Tracking Radar, Tracking in range, Acquisition, Low angle tracking

Unit-IV

Receivers, Displays & Duplexers: Radar Receivers, Noise Figure, Mixer Low-noise Front ends, Displays, Duplexer, Receiver protectors

Text Book:

1. Introduction to Radar Systems: Merrill I. Skolnik,; MGH

Reference Book:

1. Electronic Communication Systems: Kennedy; TMH.

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ECE-424N	HIGH FREQUENCY CIRCUITS AND SYSTEMS					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
3	**0**	**0**	**75**	**25**	**100**	**3Hr.**
Purpose	*This course aims to introduce the design of high frequency CMOS circuits suitable for transmitter and receiver of modern communication devices*					
CourseOutcomes						
CO1	***To explore the various performance measures of high frequency circuits.***					
CO2	***To learn the design of high frequency filters, amplifiers and oscillators.***					

Unit-I

PARAMETERS OF HIGH FREQUENCY CIRCUITS

Gain Parameters, Non-linearity parameters, Noise figure, Phase Noise, Dynamic range, RF front end performance parameters, performance trade offs in an RF circuit.

Unit-II

HIGH FREQUENCY FILTER DESIGN

Modern filter design, Frequency and impedance scaling, High Pass filter design, Band pass filter design, Band reject filter design, the effects of finite Q.

Unit- III

HIGH FREQUENCY AMPLIFIER DESIGN

Zero as bandwidth enhances,Shunt-series amplifier, Bandwidth enhancement with frequency Doublers, Tuned amplifiers, Neutralization and unilateralization , cascaded Amplifiers.

Unit-IV

MIXERS AND OSCILLATORS

Mixer fundamentals, Non linear systems as Linear mixers, multiplier based mixers, Subsampling mixers. Problems with purely linear oscillators, Tuned oscillator, Negative Resistance oscillators, frequency synthesis.

BOOKS

1. AleksandarTasic, Wouter.A.Serdijn, John.R.Long, "Adaptive Low Power Circuits for Wireless Communication (Analog Circuits and Signal Processing)", Springer, 1st Edition, 2006.

2. Chris Bowick, "RF Circuit design", Newnes (An imprint of Elesvier Science), 1st Edition, 1997. Thomas.H. Lee, "The design of CMOS Radio-Frequency Integrated Circuits",CambridgeUniversity Press, 2nd Edition, 2004.

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ECE-426N	BIO-MEDICAL SIGNAL PROCESSING					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
3		**-**	**75**	**25**	**100**	**3**
Purpose	*Tounderstand theconcept of Bio-Medical Signal Processing.*					
CourseOutcomes						
CO 1	*Introduction to signal and information.*					
CO 2	*Introduction to Biomedical Signals and ECG.*					
	Introduction to Adaptive filtering and EEG.					
CO 4	*Introduction to Event detection and waveform analysis.*					

Unit – I

Signals and Information: Definitions and properties of Laplace transform, Basic of DFT and FFT, z-transform, Sampling theorem.
Linear Time-Invariant (LTI) Systems: definitions and properties; causality, stability, impulse response, convolution, poles and zeros, frequency response, group delay, phase delay, Applications of Digital Signal Processing.

Unit – II

Introduction to Biomedical Signal: General measurement and diagnostic system, classification of signals, introduction to biomedical signals, Biomedical signal acquisition and processing.
ECG: ECG signal origin, ECG parameters-QRS detection different techniques, ST segment analysis, Arrhythmia, Arrhythmia analysis, Arrhythmia monitoring system.

Unit – III

Adaptive Filtering: Introduction, General structure of adaptive filters, LMS adaptive filter, adaptive noise cancellation, cancellation of ECG from EMG signal, Cancellation of maternal ECG in fetal ECG.
EEG: EEG signal characteristics, Sleep EEG classification and epilepsy.

Unit – IV

Event Detection and waveform analysis: Need for event detection, Detection of events & waves, Correlation analysis of EEG signals, Identification of heart sounds, Morphological analysis of ECG waves.
Frequency Domain Analysis: Introduction, Spectral analysis, linear filtering, Removal of high frequency noise (power line interference), motion artifacts (low frequency) and power line interference in ECG.

Text Book:

1. Biomedical Signal Analysis" A case study approach, Rangaraj M Rangayyan, John Wiley publications.

Reference Books:

1. "Biomedical Signal Processing Time and Frequency Domains Analysis (Volume I)", Arnon Cohen, CRC press.
2. "Biomedical Signal Processing Principles and Techniques" D.C.Reddy, Tata Mc Graw-Hill
3. "Biomedical Digital Signal Processing", Willis J. Tompkins, PHI

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ECE-428N	MULTIMEDIACOMMUNICATIONS					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
3	**0**	**0**	**75**	**25**	**100**	**3Hr.**
Purpose	*Tofamiliarizethestudentswiththeconceptsofbasicmultimediacommunicationsystemsandvariouscompressionalgorithmsoftext,audio,imageandvideo.*					
CourseOutcomes						
CO1	***Tounderstandtheconceptofbasicmultimediacomm.Systemandvarioustypesofnetworksandapplications.***					
CO2	***Tounderstandtheconcepttextandimagecompression.***					
CO3	***Tounderstandtheconceptofaudioandvideocompression.***					
CO4	***Tounderstandtheconceptofmultimediasynchronizationandvideoindexing.***					

Unit - I

MultimediaCommunication:Introduction,Multimedianetworks:Telephonenetworks,Datanetworks,ISDN,B-ISDN.MultimediaApplications:Interactiveapplicationsovertheinternetandentertainmentapplications. DigitizationPrinciples,RepresentationofText,Images,AudioandVideo.

Unit - II

TextCompression: Compressionprinciples,TextCompressiontechniques:StaticHuffmanCoding,Dynamic HuffmanCoding,ArithmeticCoding,LempelZivandLempelZivwelshcoding.

ImageCompression:Graphicsinterchangeformat,Taggedimagefileformat,JPEGindetail.

Unit - III

AudioCompression:DifferentialPulseCodeModulation,AdaptiveDifferentialPCM,AdaptivePredictivecoding,LinearpredictivecodingandMPEGaudiocoders,

VideoCompression:VideoCompressionprinciples,Frametypes,Motionestimationandcompensation,H.261, H.263

Unit - IV

MultimediaSynchronization: Basicdefinitionsandrequirements,TimestampingandPackarchitecture.

VideoIndexing:Basicsofcontentbasedimageretrievalandvideocontentrepresentation.

ReferenceBooks:

1. Multimediacommunications:FredHalsall;PearsonEducationAsia.
2. MultimediaSystems"byRalfSteinmetzandKlaraNahrstedt
3. MultimediaSystems,Standards,andNetworks"byA.PuriandT.Chen

ECE-430N	MIXED VLSI DESIGN

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Lecture	Tutorial	Practical	Theory	Sessionals	Total	Time
3	**0**	**0**	**75**	**25**	**100**	**3Hr.**
Purpose	*This course teaches how in real life applications both analog and digital circuits can implemented for various system design.*					
CourseOutcomes						
CO1	***To know mixed signal circuits like DAC, ADC, PLL etc.***					
CO2	***To gain knowledge on filter design in mixed signal mode.***					
CO3	***To acquire knowledge on design of different architectures in mixed signal***					

Unit-I

PHASE LOCKED LOOP

Characterization of a comparator, basic CMOS comparator design, analog multiplier design, PLL - simple PLL, charge-pump PLL, applications of PLL.

Unit- II

SAMPLING CIRCUITS

Basic sampling circuits for analog signal sampling, performance metrics of sampling circuits, different types of sampling switches. Sample-and-Hold circuit with miller capacitance.

Unit- III

D/A CONVERTER

Input/output characteristics of an ideal D/A converter, performance metrics of D/A converter, D/A converter in terms of voltage, current, and charge division or multiplication, switching functions to generate an analog output corresponding to a digital input.

Unit- IV

A/D CONVERTER

Input/output characteristics and quantization error of an A/D converter, performance metrics of pipelined architectures, Successive approximation architecture.

BOOKS:

1. S. M. Kang and Y. Leblebici, CMOS Digital Integrated Circuits : Analysis and Design, Third Edition, TMH, 2002.
2. Razavi, "Design of analog CMOS integrated circuits", McGraw Hill, Edition 2002.
3. Jacob Baker, "CMOS Mixed-Signal circuit design", IEEE Press, 2009.
4. Gregorian, Temes, "Analog MOS Integrated Circuit for signal processing", John Wiley & Sons, 1986.

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ECE-432N	MICROSTRIP ANTENNA					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
3	**0**	**0**	**75**	**25**	**100**	**3Hr.**
Purpose	*Tofamiliarizethestudentswiththeconceptsofbasic Antenna*.					
CourseOutcomes						
CO1	***TounderstandtheconceptofbasicAntenna.Systemandvarioustypesofapplications.***					
CO2	***Tounderstandtheconcept of microstrip antenna and its analytical modeling***					
CO3	***To understand the different designs of microstrip antenna***					
CO4	***To understand the applications of different designs of microstrip antenna***					

Unit-1

Micro Strip Radiator

Introduction, Microstrip Antenna Configurations, Feeding Techniques and Modeling of Microstrip Antenna, Radiation field, Surface wave and Photonic Bandgap Structures and Applications

Unit- 2

Analytical Modeling and Full Wave Analysis

Introduction, Transmission Line Model, Cavity model, Radiation Fields, Aperture and Mutual admittance, conductance. **Full wave analysis:** Input Impedance and Radiation efficiency, Radiation pattern, Mixed Potential Integral Equation Analysis, Greens function, Finite Difference Time-Domain Analysis.

Unit-3

Rectangular and Circular Microstrip Antenna

Introduction, Models for Rectangular Patch Antennas, Design Consideration for Rectangular Patch antennas, Tolerance Analysis, Mechanical Tuning, Quarter-wave Rectangular Patch Antenna, **Circular Microstrip Antenna:** Analysis of Circular disk, Cavity and Transmission line modeling of circular antennas.

Unit- 4

Circularly Polarized and Broadband Microstrip Antenna Design

Circular Polarization, Rectangular and Circular Circularly polarized Antennas, Power divider : T Junction and Wilkinson.
Effect of Substrate Parameter on Bandwidth, Selection of suitable Patch Shape, Feeding Techniques, MultimodingTechniques , Impedance Matching, Resistive Loading.

Textbook: Ramesh Garg, Prakash Bhartiya, InderBahl, ApisakIttipboon, "**Microstrip Antenna Design Handbook",** Artech House Boston, London.

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ECE-434N	STRATEGIC ELECTRONICS					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
3	**0**	**0**	**75**	**25**	**100**	**3Hr.**
CourseOutcomes						
CO1	***Studentswillbeawareofstate-oftheartinflexibleelectronics***					
CO2	***StudentsbeabletounderstandthefundamentalsofSmartStructureandMaterials***					
CO3	***Understandingbasicprinciplesoffabricationtechniquesusedforthefabricationoffuturisticflexibleelectronicdevices,structure,sensorsandtransducers.***					
CO4	***Understandthecharacterizationtechniquesusedinfuturisticelectronicdevices,smartmaterials,structures,etc.***					

Unit-I

Emergingflexibleelectronicstechnology,involvingnewmaterialsandprocessingtechniquessuchasamorphousandnanocrystallinesilicon,organicandpolymericsemiconductors,solutioncastfilmsofcarbonnanotubes,andgraphene.Realdevicearediscussedincludinghighspeedtransistors,photovoltaics,flexible flat-panel displays,etc.

Unit – II

StrainMeasuringTechniquesusingElectricalstraingauges,Types–Resistance–CapacitanceInductance–Wheatstonebridges–Pressuretransducers–Loadcells–TemperatureCompensation–StrainRosettes.SensingTechnology–TypesofSensors–PhysicalMeasurementusingPiezoElectricStrainmeasurement –InductivelyReadTransducers–TheLVOT–FiberopticTechniques.ChemicalandBio-ChemicalsensinginstructuralAssessment–Absorptivechemicalsensors–Spectroscopes–FibreOpticChemicalSensingSystemsandDistributedmeasurement.

Unit - III

Cleanroompractices,Photolithography,Ionimplantation,Diffusion,Oxidation,CVD-Physicalvapordeposition,epitaxy-etchingprocess.
BulkMicromanufacturing-surfacemicromachining–LIGA,Microsystempackagingmaterials-dielevel-devicelevel-systemlevel-packagingtechniques–diepreparation–surfacebonding-wirebonding-sealing.Introductiontoassembly,IntroductiontoMicro-systemdesign

Unit - IV

CharacterizationTechniques:QuantumwellsandThicknessmeasurementtechniques:Contact-stepheight,Optical-reflectanceandellipsometry,AFM,NanomaterialsCharacterizationtechniques:IV-CVElectrochemicalImpedance,FTIR,XRD,AFM,SEM,TEM,EDAXandinterpretationofresults.

Books:

1.FlexibleElectronics:MaterialsandApplications,Editors:**Wong**,WilliamS.,**Salleo**,Alberto(Eds.)2.BrainCulshaw–SmartStructureandMaterialsArtechHouse–Borton.London-1996.
3. MEMSandMicrosystemsDesignandManufacture"byTai-RanHsu.TataMcGraw-HillPublishingCompanyLtd
4. MarcFMadou,"FundamentalsofMicroFabrication",CRCPress,2ndEdition,2002.
5. SemiconductorMaterialandDeviceCharacterizationByDieterK.Schroder,WilleyPublications

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ECE-436N	COGNITIVERADIOS					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
3		**-**	**75**	**25**	**100**	**3**
Purpose	***Tounderstand theconcept of CognitiveRadioand Spectrumsharing***					
CourseOutcomes						
CO 1	*Conceptualize the CR andimplementationdetails*					
CO 2	*DesignCR for a specific application*					
CO 3	*Identify the challengesin the maintenance of CR*					
CO 4	*Analyse the transmitterandreceiver architectures*					

Unit-I

RFSystemDesign–Introduction-NoiseandChannelCapacity-LinkBudget-ReceiverRequirements-MulticarrierPowerAmplifiers-SignalProcessingCapacityTradeoff.

Unit-II

CRArchitecture-CognitiveRadioArchitecture,DynamicAccessSpectrum,SpectrumEfficiency,SpectrumEfficiencygaininSDRandCR,SpectrumUsage,SDRasaplatformforCR,OFDMasPHY layer,OFDMModulator,OFDMDemodulator,OFDMBandwidth,Benefitsof OFDM in CR, SpectrumSensing in CR,CRNetwork

Unit-III

SmartAntennasUsingSoftwareRadio-Introduction-3GsmartAntennaRequirements PhasedAntennaArrayTheory-ApplyingSoftwareRadioPrinciplestoAntennaSystems SmartAntennaArchitectures-OptimumCombining/AdaptiveArrays-DOAArrays-BeamFormingforCDMA-DownlinkBeam Forming.

Unit-IV

ApplicationofSDR-ApplicationofSDRinAdvanceCommunicationSystem-CaseStudy,ChallengesandIssues,Implementation,ParameterEstimation–Environment,Location,otherfactors,VerticalHandoff,NetworkInteroperability.

TextBooks:

1. Jeffrey.H.Reed,SoftwareRadio:AModern Approach toRadioEngineering , Pearson ,ReferenceBooks:1.MarkusDillinger,KambizMadani,NancyAlonistioti,SoftwareDefinedRadio : Architectures ,Systems andFunctions,Wiley
2. Tony .J. Rouphael ,RF and DSPforSDR, Elsevier NewnessPress,2008
3. Dr.TajStruman,Evaluation of SDR –Main Document
4. SDR–Handbook,8thEdition,PENTEK5.Brucea.Fette,CognitiveRadioTechnology,Newness,Elsevier.