SEMESTER VII

Code	Course of Study	L	T	P	C
EC401	Networks and Protocols	3	0	0	3
EC403	Communication Switching Systems	3	0	0	3
EC405	Fiber Optic Communication	3	0	0	3
EC407	Microwave Electronics	3	0	0	3
	Elective-2	3	0	0	3
	Elective-3	3	0	0	3
EC409	Fiber Optic Communication Laboratory	0	0	3	2
EC411	Microwave Laboratory	0	0	3	2
EC447	Comprehensive Evaluation	0	0	0	2
EC497	Project Phase-1	0	0	2	1
	TOTAL	**18**	**0**	**6**	**25**

SEMESTER-VII

Code	Course of Study	L	T	P	C
EC451	Digital Image Processing	3	0	0	3
EC453	ARM System Architecture	3	0	0	3
EC455	Microwave and Integrated Circuit Design	3	0	0	3
EC459	Analog CMOS Design	3	0	0	3
	RF Engineering				
	Power Electronics				

SEMESTER VII

EC401 NETWORKS AND PROTOCOLS (3 – 0 - 0) 3

Objectives:

To get an understanding on the fundamentals of networks and issues involved. To acquire an understanding on the set of rules and procedures that mediates the exchange of information between communicating devices.

Topics Covered:

Unit-1: Data link layer

Data link layer services. Overview of circuit and packet switches Comparison of OSI and internet protocol stacks.

Unit-2:Network layer.

Network layer.Datagram and virtual circuit service, routing principles.IPV4 and IPV6, multicast routing.

Unit-3: Transport layer

Transport layer services, TCP/UDP transport, principles of reliable data transfer, Principles of congestion control. Introduction to Mobile TCP

Unit-4: Application layer

Overview of HTTP, FTP, SMTP, MIME, DNS, Multimedia networking applications, streaming stored video and audio, internet phone, RTP.

Unit-5: Queing theory

Discrete time and continuous time Markov chains- Poisson process- Queuing models for Datagram networks- M/M/1 queuing systems- M/M/m/m queuing models- M/G/1 queue- Mean value analysis

Course Outcome:

Compare and examine, OSI and TCP/IP protocol stacks Categorize services offered by all layers in TCP/IP protocol stack Analyze a network under congestion and propose solutions for reliable data transfer Examine the protocols operating at different layers of TCP/IP model.

Text Books:

1. J.F.Kurose&K.W.Ross, Computer Networking (3/e) Pearson.
2. W.Stallings, Wireless Communication and Networks, Pearson, 2003

EC403COMMUNICATION SWITCHING SYSTEMS (3-0-0)3

Pre-Requisite:EC305

Objective :

To understand the working principles of switching systems from manual and electromechanical systems to stored program control systems.

Topics Covered :

Unit -1: Switching Systems and Signalling

Basic elements of communication network.Switchingsystems.Signaling and signaling functions.

Unit -2: Digital Telephone Network

Digital telephone network.T1 Carrier systems.TDMhierarchy.Data under voice.Digital switching. Echo cancellers.

Unit -3: Synchronous and Asynchronous Transmission

Synchronous versus asynchronous transmission.Line coding .Error performance.TDM.TDM loops and rings.

Unit -4: Switches

Space and time divided switches. Multistage switches. Design examples. Path finding.Switching matrix control.Digital time division switch. Time Space switching. Time Space Time switching. Digital Switching in analog environment.

Unit -5: Network synchronization and Traffic Analysis

Timing recovery. Jitter. Network synchronization.Digital subscriber access-ISDN network.ADSL.Traffic analysis.

Course Outcomes :
Students are able to

1. Explain the working principle of switching systems involved in telecommunication switching
2. Assess the need for voice digitization and T Carrier systems
3. Compare and analyze Line coding techniques and examine its error performance
4. Design multi stage switching structures involving time and space switching stages
5. Analyze basic telecommunication traffic theory

Text Books:

1. J.C. Bellamy, Digital Telephony, (3/e), Wiley, 2000.
2. E. Keiser & E. Strange, Digital Telephony and Network Integration, (2/e), Van Nostrand, 1995.

Reference Books:

1. ThiagarajanViswanathan, Telecommunication Switching Systems and Networks, PHI, 2006.
2. J.E. Flood, Telecommunications Switching, Traffic and Networks, Prentice Hall, 1995.
3. M.T. Hills ,Telecommunication Switching Principles, London : Allen and Unwin, 1979.

EC405 FIBER OPTIC COMMUNICATION (3-0-0)3

Pre-Requisite: EC205 and EC305

Objective:

To expose the students to the basics of signal propagation through optical fibers, fiber impairments, components and devices and system design.

Topics Covered:

Unit -1: Introduction
Optical Fibers: Structure, Waveguiding. Step-index and graded index optical fibers. Modal analysis.Classification of modes.Single Mode Fibers.

Unit -2: Dispersion
Pulse dispersion- Material and waveguide dispersion.Polarization Mode Dispersion-Absorption, scattering and bending losses. Dispersion Shifted Fibers-Dispersion Compensating Fibers.

Unit -3: Fiber connector and couplers
Optical Power Launching and Coupling.Lensing schemes for coupling improvement.Fiber-to-fiberjoints.Splicingtechniques.Opticalfiber connectors.

Unit -4: Sources and detectors
Optical sources and detectors.Laser fundamentals. Semiconductor Laser basics. LEDs.PIN and Avalanche photodiodes, Noise and Detection, Thermal and shot Noise, Signal to Noise Ratio.

Unit -5: Sources and detectors
Design considerations of fiber optic systems: Analog and digital modulation. Noise in detection process. Bit error rate. Optical receiver operation. Power Budget and Rise time Budget. WDM.

Course Outcomes:

1. Able to propagation of signal through Fiber cable.
2. Able to understand the various modes of propagation and its importance.
3. Able implement Fiber optics systems.

Text Books:

1. *G. Keiser, Optical Fiber Communications (4/e), TMH, 2008.*
2. *Optical Fibre Communication: Principals and Techniques", John M. Senior, PHI New Delhi 3/e,2008*

Reference Books:

1. *MMK. Liu, Principles and Applications of Optical Communications, TMH, 2010.*
2. *G.P. Agrawal, Fiber Optic Communication Systems, (3/e), Wiley, 2002.*
3. *J. Gowar, Optical Communication Systems, (2/e), PHI, 2001.*

EC407 MICROWAVEELECTRONICS (3-0-0)3

Pre-Requisite: EC306

Objective:

To impart knowledge onmicrowave electron beam devices and their applications in X band frequency and to expose basics of microwave measurements.

Topics Covered:

Unit-1: Microwave measurements
Frequency – wavelength – VSWR - Insertion loss - Attenuation measurement - Impedance determination - Antenna Radiation pattern measurement - S-parameter measurements -Network analyzer

Unit-2: Klystrons
Two-cavity and multicavity – klystrons -Reflex klystron – modes - admittance spiral - power output and efficiency.

Unit-3: Travelling Wave Tube
Slow-wave structures - Helix and coupled cavity TWTs - Amplification process - convection current - Wave modes and gain - Backward wave oscillators.

Unit-4: Cross field devices
Magnetrons - Principle of operation and characteristics - Hull cut-off condition - Hartree Condition – Carcinotron - Gyrotron.

Unit-5: Microwave Solid State Devices

Microwave transistors and FETs - Physical structures - Microwave characteristics - High electron-mobility transistors - Tunnel Diode - PIN diodes - Transferred electron devices - Gunn effect diodes - Gunn diode as an oscillator - Avalanche transit time devices – IMPATT - TRAPATT - BARITT

Course Outcomes:

Students are able to

1. Apply the basic knowledge of waveguide and microwave resonator circuits.
2. Asses the methods used for generation and amplification of the microwave power
3. Distinguish between the linear and cross field electron beam microwave tubes.
4. Critically analyze the operating principles and performances of the microwave semiconductor devices.
5. Identify the suitable microwave power sources of given specification for the selected application.
6. Aware of current technological changes in the engineering aspects of microwave components.

Text Books:

1. S.Y.Liao, "Microwave Devices and Circuits", 3rd edition,PHI, 2008
2. AnnapurnaDas,SisirK.Das,"MicrowaveEngineering", 2nd edition, TMHCo.,Ltd.,2010.

References:

1. R.E.Collin, "Foundations for Microwave Engineering", 2nd edition, Mc Graw–Hill, 2009.

EC409FIBER OPTIC COMMUNICATION LABORATORY (0-0-3-2)

List of Experiments:

1. Handling of Fibers
2. Characteristics of Laser Diode
3. Characteristics of Photodetector
4. Characteristics of APD
5. Numerical Aperture Measurement
6. Measurement of Attenuation and Bending Loss
7. Proximity Sensor
8. Photonics CAD-WDM link
9. LED Modulation
10. Fiber Dispersion Measurement
11. Study of BER.
12. Study the effect of optical Receiver Characteristics on a system performance.

EC411 MICROWAVE LABORATORY(0-0-3-2)

The following List of experiments but not limited to

1. Mode Characteristics of Klystron Oscillator.
2. Characteristics of Gunn diode Oscillator.
3. Determination of guide wavelength, frequency measurement.
4. Characteristics of Variable Attenuator.
5. Radiation Pattern of Antenna.
6. VSWR Measurements
7. Determination of unknown load.
8. Characteristics of Directional Coupler
9. Characteristics of Tee Junctions
10. Characteristics of Phase Shifters
11. CAD of Microwave Filters
12. CAD of Microstrip Antenna
13. Smith Chart using MATLAB

EC 456 DIGITAL IMAGE PROCESSING (3-0-0-3)

Objective:

1. This course develops an overview of the field of image processing and help to understand the fundamental algorithms and how to implement them.
2. Provide an experience in applying image processing algorithms to real problems.

Topics Covered:

Unit-1: Digital Image Processing

Examples of Digital Image Processing - Components of image processing -Elements of Visual perception - Image sensing and acquisition using single sensor - sensor strips and sensor arrays - Image sampling and quantization: Basic concepts of sampling and quantization - Spatial and Gray level representation - Aliasing and Moire Patterns

Unit-2: Image Enhancement

Spatial Domain: Grey level transformation - Image negatives - Log transformations - Power law transformations - Piecewise linear transformation - Histogram Processing - Enhancement using Arithmetic and Logic operation - Smoothing Spatial Filter - Linear filter, Order Statistics filter - Sharpening Spatial Filters

Frequency Domain:Introduction to the Fourier Transform and the Frequency Domain - Smoothing Frequency Domain Filters - Sharpening Frequency Domain Filters - Homomorphic Filtering

Unit-3: Color image processing and image Restoration:

Noise Models - Restoration in the Presence of Noise Only - Spatial Filtering - Mean Filters, Order-Statistics Filters - Adaptive Filters - Periodic Noise Reduction by Frequency Domain Filtering Linear - Position Invariant Degradations - Estimating the Degradation Function

Color Image Processing: Color Fundamentals - Color Models, Pseudo-color Image Processing - Intensity Slicing - Gray Level to Color Transformations - Basics of Full- Color Image Processing - Color Transformations - Smoothing and Sharpening - Color Segmentation

Unit-4: Wavelets and Multi-resolution Processing

Image Pyramids - Sub-band Coding -TheHaar Transform - Multi-resolution Expansions -Wavelet Transforms in One Dimension - Wavelet Transforms in Two Dimension

Unit-5: Image Compression, Segmentation and Morphological Image Processing

Compression: Redundancy - Image Compression Models - Elements of Information Theory - Error-Free Compression -Lossy Compression - Image Compression Standards

Segmentation: Detection of Discontinuities - Edge Linking and Boundary Detection Thresholding - Region-Based Segmentation - Segmentation by Morphological Watersheds

Morphological Image Processing: Basic Concepts from Set Theory - Logic Operations Involving Binary Images - Dilation and Erosion - Opening and Closing, Hit-or-Miss Transformation - Basic Morphological Algorithms -Gray-Scale Morphology

Outcomes:

1. Students learn about image processing tools
2. Apply the image processing for practical applications

Text Books:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd ed, Prentice Hall, 2008
2. R. C. Gonzalez, R. E. Woods, and S. L. Edins, Digital Image Processing with MATLAB, Prentice Hall, 2004
3. The FundamentalsImage Processing, Maria Petrou, Costas Petrou, Wiley Publisher, 2nd Edition, 2010
4. Fundamentals on Digital Image Processing, A. K. Jain, PHI, 2005

EC453 ARM SYSTEM ARCHITECTURE (3-0-0)3

Pre-Requisite: None

Objective:

The objective of this course is to give the students a thorough exposure to ARM architecture and make the students to learn the ARM programming & Thumb programming models.

Topics Covered:

Unit-1: RISC machine.ARM programmer's model. ARM Instruction Set. Assembly level language programming. Development tools.

Unit-2: ARM organization.ARM instruction execution.ARMimplementation.ARM coprocessor interface. . Interrupt response.

Unit-3: Floating point architecture.Expressions.Conditionalstatements.Loops.Functions and procedures. Run time environment.

Unit-4: Thumb programmer's model. Thumb Instruction set. Thumb implementation.

Unit-5: Memory hierarchy.Architectural support for operating system.Memory size and speed.Cache memory management.Operatingsystem.ARM processor chips.

Course Outcomes:

Students are able to

1. Describe the programmer's model of ARM processor and create and test assembly level programming.
2. Analyze various types of coprocessors and design suitable co-processor interface to ARM processor.
3. Analyze floating point processor architecture and its architectural support for higher level language.
4. Become aware of the Thumb mode of operation of ARM.
5. Identify the architectural support of ARM for operating system and analyze the function of memory Management unit of ARM.

Text Books:

1. S. Furber, ARM System Architecture, Addison-Wesley, 1996.

2. Andrew Sloss, Dominic Symes and Chris Wright, ARM system Developer's guide, Elsevier.2005.

Reference Books:

1. Technical reference manual for ARM processor cores, including Cortex, ARM 11, ARM 9 and ARM 7 processor families.
2. User guides and reference manuals for ARM software development and modeling tools.
3. David Seal, ARM Architecture Reference Manual, Addison-Wesley.

EC455MICROWAVE INTEGRATED CIRCUITDESIGN(3-0-0)3

Pre-Requisite: EC306

Objective:

To impart knowledge ondesign and analysis of various MIC components and circuits.

Topics Covered:

Unit-1: Power dividers design:
Design and realization of power dividers, hybrids, directional couplers etc using strip lines and microstrip lines.

Unit-2 Advanced Filter design Techniques
Kuroda identities.K and J inverters. Filter transformations. Realization using strip lines and microstrip lines.

Unit-3: Transistor amplifiers design
Power gain equations - Stability considerations – Analysis - Design using MICs.

Unit-4: Transistor oscillators design
Active devices for microwave oscillators - Three port S parameter characterization of transistors - Oscillation and stability conditions.

Unit-5: Mixers& Phase Shifters design
Single ended mixer - Balanced mixer -Image rejection mixer - Phase shifter design - PIN diode - Phase shifter.

Course Outcome:

1. Know the design of MIC Circuit.
2. Perform the complete design and layout of MIC components.

Text Books:

1. I.J.Bhal&P.Bhartia, “Microwave Solid state Circuit Design”, 2nd edition, Wiley Publishers, 2003
2. George D. Vendelin, Anthony M. Pavio& Ulrich L. Rohde “Microwave Circuit Design using Linear and Nonlinear Techniques”, 2nd edition, Wiley Publishers, 2005.

EC459 ANALOG CMOS DESIGN (3-0-0)3

Pre-Requisite: EC308

Objectives:

1.To teach MOSFET Amplifier issues
2. To make student to learn design issues related to various MOS amplifiers

Topics Covered:

Unit-1: Introduction
MOS Capacitor-CV characteristics, Ideal MOSFET equation-Small Signal Model-AC Analysis-MOS Models-Spice Model, 2nd order effects.

Unit-2;Current source
Current source and Sinks-Current Mirror-Cascode Connection-Temperature Analysis, transient Response

Unit-3; Voltage source
Voltage References, MOSFET Divider-Threshold Voltage References-Diode referenced, Bandgap Voltage References.

Unit -4: Feedback Amplifier
MOS Amplifiers-Feedback Amplifier-Various Topologies-Negative Feedback-Open loop and closed loop analysis.

Unit -5: Operational Amplifier
Differential Amplifier, Source coupled pair, Operational Amplifier, Characteristics, Cascode Input Op-Amp, OperationalTransconductance Amplifier

Course Outcomes:

1. Able to design analog circuits**.**
2. Able to understand design issues related to stability of Opamps
3. Able implement designs using spice tool.

Text Books:

1. *Design of Analog CMOS Integrated Circuits, by BehzadRazavi, McGraw-Hill 2000*
2. CMOS Analog Circuit Design, Phillip E. Allen and Douglas R. Holberg, Oxford University Press

Reference Books:

1. *Pucknell&Eshraghian, Basic VLSI Design, PHI, (3/e).*
2. *Uyemura, Introduction to VLSI Circuits and Systems, Wiley, 2002.*