E.G.S. PILLAY ENGINEERING COLLEGE

(Autonomous)

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai

Accredited by NAAC with 'A' Grade | Accredited by NBA (CSE, EEE, MECH)

NAGAPATTINAM – 611 002

M.E. COMMUNICATION SYSTEMS

Full Time Curriculum and Syllabus

First Year – Second Semester

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
Theory Course								
1702CO201	FPGA Based Communication System Design	3	0	0	3	40	60	100
1702CO202	Microwave Integrated Circuits	3	0	0	3	40	60	100
1702CO203	Optical Switching and Networking	3	0	0	3	40	60	100
1702CO204	Information Theory and Coding	3	0	0	3	40	60	100
	Elective – II	3	0	0	3	40	60	100
	Elective – III	3	0	0	3	40	60	100
Laboratory Course								
1704CO205	RF System Design Laboratory	0	0	4	2	50	50	100
1704CO206	Technical Seminar	0	0	2	1	100	0	100
1704CO207	Communication Skills Laboratory -II	0	0	2	1	100	0	100

L – Lecture | T – Tutorial | P – Practical | C – Credit | CA – Continuous Assessment | ES – End Semester

1702CO201 FPGA BASED COMMUNICATION SYSTEM DESIGN

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To elicit, analyze, prioritize, and manage both functional and quality requirements
2. To estimate efforts required, plan, and track the plans
3. To understand and apply configuration and quality management techniques

UNIT I WIRELESS COMMUNICATION BASICS 9 Hours

Digital communication systems- minimum bandwidth requirement, the Shanon limit- overview of modulation schemes- classical channel- wireless channel description- path loss- multipath fading basics of spread spectrum and spread spectrum techniques- PN sequence.

UNIT II TRANSCEIVER ARCHITECTURE 9 Hours

Transceiver design constraints- baseband subsystem design- RF subsystem design- Super heterodyne receiver and direct conversion receiver- Receiver front-end- filter design- non-idealities and design parameters- derivation of noise figure and IP3 of receiver front end.

UNIT III LOW POWER DESIGN TECHNIQUES 9 Hours

Source of power dissipation- estimation of power dissipation- reducing power dissipation at device and circuit levels- low voltage and low power operation- reducing power dissipation at architecture and algorithm levels.

UNIT IV WIRELESS CIRCUITS 9 Hours

VLSI Design of LNA-wideband and narrow band-impedance matching. Automatic Gain Control (AGC) amplifier-power amplifier- Active mixer- analysis, conversion gain, distortion analysis- low frequency and high frequency case, noise. Passive mixer- sampling mixer and switching mixer analysis of distortion, conversion gain and noise in these mixers.

UNIT V VLSI DESIGN OF SYNTHESIZERS 9 Hours

VLSI design of Frequency Synthesizers (FS) – Parameters of FS - VCO- LC oscillators- ring oscillator- phase noise- loop filter description, design approaches, PLL based frequency synthesizer, phase detector/charge pump- dividers

TOTAL: 45 HOURS

FURTHER READING:

VLSI architecture for Multitier Wireless System - Hardware Design Issues for a Next generation CDMA System

Efficient VLSI Architecture for Base Band Signal processing.- Phase Noise - A Complete Synthesizer Design Example (DECT Application).

VLSI architecture for Multitier Wireless System - Hardware Design Issues for a Next generation CDMA System

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1: Understanding of application of VLSI circuits in wireless communication
CO2: Knowledge of various architectures used in implementing wireless systems
CO3: Discussion about design and simulation of low power techniques using software
CO4: Learn the VLSI design of wireless circuits

REFERENCES:

1. Bosco Leung, VLSI for Wireless Communication, Springer, 2011.
2. Elmad N Farag and Mohamed I Elmasry, Mixed Signal VLSI Wireless Design-Circuits and Systems, Kluwer Academic Publishers, 2002.

1702CO202	MICROWAVE INTEGRATED CIRCUITS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To understand the fundamentals of RF radio system design
2. To understand the various components that constitute an RF radio system for wireless Communications
3. To know the basic analysis techniques needed for evaluating the performance of an RF radio system for Wireless applications

UNIT I CMOS PHYSICS, TRANSCEIVER SPECIFICATIONS AND ARCHITECTURES **9 Hours**

CMOS: Introduction to MOSFET Physics – Noise: Thermal, shot, flicker, popcorn noise transceiver Specifications: Two port Noise theory, Noise Figure, THD, IP2, IP3,Sensitivity, SFDR, Phase noise - Specification distribution over a communication link Transceiver Architectures: Receiver: Homodyne, Heterodyne, Image reject, Low IF Architectures – Transmitter: Direct up conversion, Two step up conversion

UNIT II INTRODUCTION TO RF FILTER, OSCILLATOR AND MIXER **9 Hours**

Overview –basic resonator and filter configuration-special filter realization-filter implementation. Basic oscillator model-high frequency oscillator configuration-basic characteristics of mixer- phase locked loops-RF Directional Couplers - hybrid couplers –detector and demodulator circuits.

UNIT III INTRODUCTION TO MICROWAVE CIRCUITS **9 Hours**

Definitions – Frequency Bands – Lumped versus Distributed Circuits - Behavior of finite length transmission lines – General Characteristics of PC Boards – Transmission Lines on PC Boards – Passives made from Transmission Lines – Resonators - Combiners, Splitters and Couplers

UNIT IV MATCHING NETWORKS AND AMPLIFIERS **9 Hours**

Circuit Representation of two port RF/Microwave Networks: Low Frequency Parameters, High Frequency Parameters, Transmission Matrix, ZY Smith Chart, Design of Matching Circuits using Lumped Elements, Matching Network Design using Distributed Elements, Amplifiers: Stability considerations in active networks – Gain Consideration in Amplifiers – Noise Consideration in active networks – Broadband Amplifier design – Low Noise Amplifier Design.

UNIT V MICROWAVE IC DESIGN AND MEASUREMENT TECHNIQUES **9 Hours**

Microwave Integrated Circuits – MIC Materials- Hybrid versus Monolithic MICs – Multichip Module Technology - Fabrication Techniques, Miniaturization techniques, Introduction to SOC, SOP, Test fixture measurements, probe station measurements.

TOTAL: 45 HOURS

FURTHER READING:

Thermal and cryogenic measurements, experimental field probing techniques

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1: Design RF circuits
CO2: Analyse the performance of RF circuits

REFERENCES:

1. T. Lee, ”Design of CMOS RF Integrated Circuits”, Cambridge, 2004
2. B.Razavi, “RF Microelectronics”, Pearson Education, 1997.
3. Jan Crols, MichielSteyaert, ”CMOS Wireless Transceiver Design”, Kluwer Academic Publications, 1997
4. B. Razavi, Design of analog CMOS Integrated Circuits”, McGraw Hill,2001
5. D. Robertson &S. Lucy szyn, “RFIC and MMIC Design and Technology”, IEE Circuits, Devices and Systems series 13, London, UK, 2001

1702CO203 OPTICAL SWITCHING AND NETWORKING

L	T	P	C
3	0	0	3

Course Objectives:

1. To enable the student to understand the importance of optical switches and network architecture and connections
2. To enable the student to understand the differences in routing, switching and the resource allocation methods and the network management and protection methods .
3. To expose the student to the advances in networking and switching domains and recent trends in optical network

UNIT I OPTICAL SWITCHES **9 Hours**

Introduction to Optical Switches, Electro-Optical switches, Thermo-optical switches, Magneto-optical switches, MEMs based optical switches, SOA based optical switches, Liquid crystal optical switches, Photonic crystal all-optical switches and its application

UNIT II OPTICAL NETWORK ARCHITECTURES AND CONNECTIONS **9 Hours**

Introduction to Optical Networks, Need for Multi-layered Architecture, Layers and Sub-layers, Spectrum partitioning, Optical Net-work Nodes, Network Access Stations, Overlay Processor, Logical network overlays, Generalized Multiprotocol Label Switching, Connection Management and Control, Static Networks, Wavelength Routed Networks, Linear Light wave networks, Logically Routed Networks, Routing and Wavelength Assignment , Traffic Grooming in Optical Networks.

UNIT III OPTICAL NETWORK SURVIVABILITY **9 Hours**

Protection and Restoration Objectives, Fault Protection and Restoration Techniques in the Logical Layer - Point-to-Point Systems, Protection in SONET/SDH and client layer, Self-Healing Rings, Interconnection Techniques, Architectures with Arbitrary Mesh Topologies, Optical-Layer Protection: Point-to-Point and Ring Architectures, Mesh Architectures, Survivability Techniques for Multicast Connections

UNIT IV OPTICAL PACKET SWITCHING NETWORKS **9 Hours**

Optical Packet-Switching Network Architectures, Contention Resolution, OPS Enabling Technologies, Optical Burst Switching, Contention Resolution in OBS Networks, Optical Label Switching, All-Optical Label Swapping, Contention Resolution in OLS

UNIT V NETWORK PERFORMANCE AND RECENT TRENDS **9 Hours**

Performance Impairments in an Optical Network Environment, The Passive Optical Networks, Metropolitan Area Networks, Long-Haul and Ultra Long-Haul Networks, Introduction to Software Defined Networking, Reconfigurable Optical Add/Drop Multiplexer (ROADM).

TOTAL: 45 HOURS

FURTHER READING:

Plastic optical fiber, Fiber optic Connectors, Li-Fi technology, Test equipments-Fault locators, fiber identifiers

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1: Use the backbone infrastructure for our present and recent communication needs

CO2: Compare the differences in routing, switching, resource allocation methods, network management and protection methods

CO3: Describe the advances and recent trends in the networking and switching approaches

REFERENCES:

1. Thomas E. Stern, Georgios Ellinas, Krishna Bala, ―Multi wavelength Optical Networks – Architecture, Design and control ―, Cambridge University Press, 2nd Edition, 2009
2. Rajiv Ramaswami and Kumar N. Sivarajan, ―Optical Networks: A Practical Perspective‖, Harcourt Asia Pte Ltd., Second Edition 2006
3. C. Siva Ram Moorthy and Mohan Gurus amy, ―WDM Optical Networks : Concept, Design and Algorithms‖, Prentice Hall of India, Ist Edition, 2002
4. P.E. Green, Jr., ―Fiber Optic Networks‖, Prentice Hall, NJ, 1993
5. Biswanath Mukherjee, ―Optical WDM Networks‖, Springer, 2006
6. S J Chua B Li-Optical Switches, Wood head Publishing,2010
7. Thomas E. Stern, Georgios Ellinas, Krishna Bala, ―Multi wavelength Optical Networks – Architecture,

Design and control ―, Cambridge University Press, 2nd Edition, 2009
8. Rajiv Ramaswami and Kumar N. Sivarajan, ―Optical Networks: A Practical Perspectivel, Harcourt Asia Pte Ltd., Second Edition 2006

1702CO204 INFORMATION THEORY AND CODING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To have a complete understanding of Information Theory
2. To understand Source coding and Channel coding theorem
3. To have a complete understanding of error control coding
4. To introduce methods for the generation of these codes and their decoding techniques

UNIT I INFORMATION THEORY **9 Hours**

Introduction-Measure of information- Average information content of symbols in long independent sequences-Average information content of symbols in long dependent sequences-Mark-off statistical model for information source-Entropy and information rate of mark-off source.

UNIT II SOURCE CODING AND FUNDAMENTAL LIMITS ON PERFORMANCE **9 Hours**

Encoding of the source output-Shannon's encoding algorithm-Communication Channels-Discrete communication channels-Continuous channels-Source coding theorem-Huffman coding-Discrete memory less Channels-Mutual information-Channel Capacity

UNIT III CHANNEL CODING THEOREM AND BINARY CYCLIC CODES **9 Hours**

Channel coding theorem-Differential entropy and mutual information for continuous ensembles-Channel capacity Theorem. Binary Cycle Codes-Algebraic structures of cyclic codes

UNIT IV INTRODUCTION TO ERROR CONTROL CODING **9 Hours**

Introduction-Types of errors-examples-Types of codes Linear Block Codes: Matrix description-Error detection and correction-Standard arrays and table look up for decoding

UNIT V RS CODES, GOLAY CODES, SHORTENED CYCLIC CODES AND CONVOLUTION CODES **9 Hours**

RS codes-Golay codes-Shortened cyclic codes-Burst error correcting codes-Burst and Random Error correcting codes-Convolution Codes-Time domain approach-Transform domain approach

TOTAL: 45 HOURS

FURTHER READING:

Encoding using an (n-k) bit shift register-Syndrome calculation-BCH codes

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1: Able to understand the concept of Information theory
CO2: Able to illustrate the practical implementation issues, such as Error control coding, convolution code
CO3: Able to know various coding techniques.

REFERENCES:

1. Simon Haykin, Communication Systems, John Wiley & Sons. Pvt. Ltd, 2009
2. Taub& Schilling, Principles of Communication Systems, Tata McGraw-Hill, 2007
3. Das, Mullick& Chatterjee, Principles of Digital Communication ,Wiley Eastern Ltd,2002
4. Shu Lin & Daniel J. Costello, Error Control Coding Fundamentals and Applications, Jr., Prentice Hall Inc,2004
5. Information Theory and Reliable Communication, R. G. Gallager, Wiley, 1966

1704CO205	RF SYSTEM DESIGN LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

1. To provide experience in Simulation & Implementation of the Micro strip antennas and planar array antenna
2. To provide experience in design, Implementation and testing of a Micro strip coupler and coplanar waveguides using simulation software

LIST OF EXPERIMENTS:

1. Characteristics of RF diodes, transistors
2. Determination of S-parameter for MIC components
3. Design and simulation of Micro strip filters and switches
4. Design and implementation of Micro strip Couplers
5. Design and simulation of Phase shifters
6. Design parameters of planar waveguides
7. Design and simulation of wired and Micro strip antenna
8. Design and simulation of Micro strip antenna arrays

MINI PROJECT

9. Design and implementation of RF circuits like amplifiers, mixers and oscillators
10. Analysis and testing the performance of thin film resistances
11. Design and analysis of antenna arrays

TOTAL: 30 HOURS

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1: Understanding of various MIC technologies
CO2: Knowledge of micro strip transmission lines and their parameters
CO3: Discussion about passive and non-passive reciprocal devices and their analysis
CO4: Learn the various coplanar MICs and their applications
CO5: Design of various microwave circuits like amplifiers, oscillators and mixers

1704CO207	COMMUNICATION SKILLS LAB II (Common to all M.E Progarmmes)	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

1. To acquire skills for using English in business environment.
2. To communicate appropriately in business contexts.
3. To prepare students for taking BEC Vantage level examination conducted by the Cambridge English Language Assessment (CELA).

SPEAKING

Non-verbal communication – agreeing / disagreeing, reaching decisions, giving and supporting opinions – making mini presentations – extending on conservations – collaborative task – tongue twisters.

WRITING

Business letters – fax – Shorter Documents: e-mail - memo – message - note – report writing – formal / informal styles.

TOTAL: 15 HOURS

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1: To enable students to acquire business terms for communication.

CO2: To use English confidently in the business contexts.

CO3: To be able to take part in business discussion and write formal and informal business correspondences.

REFERENCES:

1. Guy Brook-Hart, "BEC VANTAGE: BUSINESS BENCHMARK Upper-Intermediate – Student's Book", 1st Edition, Cambridge University Press, New Delhi, 2006.
2. Cambridge Examinations Publishing, "Cambridge BEC VANTAGE – Self-study Edition", Cambridge University Press, UK, 2005.
3. Swets, Paul. W. 1983. The Art of Talking So That People Will Listen: Getting
4. The Process of Writing: Planning and Research, Writing, Drafting and Revising

1703CO001 ADVANCED DIGITAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To understand basics of color image processing
2. To know image segmentation and representation
3. To understand object recognition

UNIT I FUNDAMENTALS OF DIGITAL IMAGE PROCESSING 9 Hours

ElementsofVisualPerception-Imageacquisition,digitization-Histogram-Image enhancement–Spatial filters for smoothing and sharpening–Discrete 2Dtransforms-DFT,DCT,Walsh-Hadamard,Slant,KL,Wavelet Transform–Haarwavelet.

UNIT II COLOR IMAGE PROCESSSING 9 Hours

Color Image Fundamentals-Color Models-RGB,CMY, CMYK and HISColor Models-PseudocolorImage Processing-Intensity Slicing-IntensitytoColortransformations-BasicsofColorImageProcessing-Color Transformation-ColorImageSmoothingandSharpening-ColorSegmentation -Noise in Color Images.

UNIT III MORPHOLOGICAL IMAGE PROCESSING 9 Hours

Preliminaries- Basic Concepts from Set Theory-Logic Operations Involving Binary Images-Dilation and Erosion–Opening and Closing-Hit-or-MissTransformation-BasicMorphologicalAlgorithms-Boundary Extraction-Region Filling- Extraction of Connected Components-Convex Hull- Thinning-Thickening-Skeletons-Pruning--Gray-Scale Morphology.

UNIT IV SEGMENTATION, REPRESENTATION AND DESCRIPTION 9 Hours

Edge Detection - Edge Linking and Boundary Detection -Thresholding- Segmentation by Morphological Watershed Segmentation Algorithm-Use of Markers-Representation and Boundary Descriptors

UNIT V OBJECT RECOGNITION AND IMAGE PROCESSING APPLICATIONS 9 Hours

Patterns and Pattern Classes -Recognition Based on Decision-Theoretic Methods -Matching - Optimum Statistical Classifiers-Neural Networks, Watermarking-Steganography.

TOTAL: 45 HOURS

FURTHER READING:

Fuzzy Systems-GA.Imagecompression-JPEG,JPEG2000JBIG standards-

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1: Demonstrate knowledge of image acquisition, digitization and spatial filters for enhancement
CO2: Employ color image processing techniques
CO3: Apply morphological image processing algorithms
CO4: Apply segmentation algorithms and descriptors for image processing.
CO5: Use neural networks, fuzzy logic and genetic algorithms in object recognition
CO6: Apply compression, watermarking and Steganographyalgorithms to images

REFERENCES:

1. Rafael C.Gonzalez,**"DigitalImage Processing",**PearsonEducation,Inc.,3rdEdition,2008
2. MilmanSonka, Vaclav Hlavac, Roger Boyle, **"Image Processing, Analysis and Machine Vision",** Brooks/Cloe,VikasPublishingHouse2ndEdition,1999
3. Khalid Sayood,**"Data Compression",**MorganKaufmann Publishers(Elsevier).,3rdEdition,2006
4. RafaelC.Gonzalez, RichardsE.Woods,StevenEddins,"**Digital Image Processing using MATLAB"**, PearsonEducation,Inc.,2004
5. WillamK.Pratt,**"DigitalImage Processing",**JohnWiley,NewYork,2002

1703CO017 MOBILE AD HOC NETWORKS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To introduce the characteristic features of ad hoc wireless networks and their applications to the students
2. To enable the student to understand the functioning of different access and routing protocols that can be used for ad hoc networks
3. To enable the student to understand the need for security and the challenges and also the role of cross layer design in enhancing the network performance

UNIT I INTRODUCTION **9 Hours**

Introduction to Ad Hoc networks – definition, characteristics features, applications. Characteristics of Wireless channel, Adhoc Mobility Models: - entity and group models

UNIT II MEDIUM ACCESS PROTOCOLS **9 Hours**

MAC Protocols: design issues, goals and classification. Contention based protocols, reservation based protocols, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN

UNIT III NETWORK PROTOCOLS **9 Hours**

Addressing issues in ad hoc network, Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, Unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, Power/ Energy aware routing algorithm, Hierarchical Routing, QoS aware routing

UNIT IV END -TO - END DELIVERY AND SECURITY **9 Hours**

Transport layer: Issues in designing- Transport layer classification, adhoc transport protocols. Security issues in adhoc networks: issues and challenges, network security attacks, secure routing protocols

UNIT V CROSS LAYER DESIGN AND INTEGRATION **9 Hours**

Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, Cross layer cautionary perspective, Co-operative networks:- Architecture

TOTAL: 45 HOURS

FURTHER READING:

Methods of co-operation, co-operative antennas, Integration of ad hoc network with other wired and wireless networks

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1: The student would be able to demonstrate an understanding of the trade-offs involved in the design of adhoc networks

CO2: The student would be able to design and implement protocols suitable to adhoc communication scenario using design tools and characterize them

CO3: The student is exposed to the advances in adhoc network design concepts

REFERENCES:

1. C.Siva Ram Murthy and B.S.Manoj, ―Ad hoc Wireless Networks Architectures and protocols‖, 2nd edition, Pearson Education. 2007
2. Charles E. Perkins, ―Ad hoc Networking‖, Addison – Wesley, 2000
3. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, ―Mobile adhoc networking‖, Wiley-IEEE press, 2004
4. Mohammad Ilyas, ―The handbook of adhoc wireless networks‖, CRC press, 2002
5. T. Camp, J. Boleng, and V. Davies ―A Survey of Mobility Models for Ad Hoc Network Research,‖ Wireless Communication and Mobile Comp., Special Issue on Mobile Ad Hoc Networking Research, Trends and Applications, vol. 2, no. 5, 2002, pp. 483–502
6. Fekri M. Abduljalil and Shrikant K. Bodhe , ―A survey of integrating IP mobility protocols and Mobile Ad hoc networks‖, IEEE communication Survey and tutorials, v 9.no.1 2007
7. ErdalÇayırcı and ChunmingRong c, ― Security in Wireless Ad Hoc and Sensor Networks2009, John Wiley & Sons, Ltd. ISBN: 978-0-470-02748-6