KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University Established Under Section 3 of UGC Act, 1956)
Pollachi Main Road, Eachanari PO, Coimbatore – 641 021, India

DEPARTMENT OF ELECTRONICS AND COMMUNICATION SYSTEMS

Content

KARPAGAM ACADEMY OF HIGHER EDUCATION

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M.Phil./Ph.D. – Syllabus

ELECTRONICS

Paper-I: Research Methodology and Pedagogy [15RELE101]

(Effective from the academic year 2015-2016 onwards)

COURSE OBJECTIVES

- Understand some basic concepts of research and its methodologies
- Identify and discuss the issues an d concepts salient to the research
- process
- Select and define appropriate research problem and parameters
- Identify and discus the complex issues inherent in selecting a research problem, selecting an appropriate research design and implementing research project
- Identify and discuss the concepts and procedures of sampling, data collection, analysis and reporting.

COURSE OUTCOMES

- Explain key research concepts and issues
- Demonstrate knowledge of research processes
- Perform literature reviews using print and online databases
- Identify, explain, compare and prepare the key elements of a research proposal
- Compare an contrast quantitative an qualitative research
- Describe sampling methods measurement scales and instruments and appropriate uses of each.

UNIT I

Research Methodology

Ethics of Research - Objectives of Research - Motivations in Research - Types of Research - Research Approaches - Significance of Research - Research Methods v/s Methodology - Research and Scientific Methods - Research Process - Criteria of Good Research - Funding agencies - Defining the Research Problem: Research Problem - Selecting the Problem - Necessity of Techniques in defining the Problem.

UNIT II

Research Design

Concepts - Features of Good Design– Types - Basic Principles of Experimental Design- Developing a Research Plan - Sample Design: Implication – Steps - Criteria for selecting a Sample procedure - Characteristics of Good sampling Procedure- Types of Sample Design - Experimental Design: Regarding observation - Types of observation - Laboratory setting sample - Data Collection - Presentation and analysis of collected data -Preparation of result reports and publication of research findings in peer reviewed journals - Impact factors.

UNIT III

Scientific Papers, Presentations and Report Writing

Organizing and Writing a rough draft – Searching and reviewing scientific literature – Publishing in Scientific Journals – Ethical and Legal Issues – Scientific Presentations – Oral presentation – Poster Presentation - Preparation of research report - Steps involved in writing a good report - Concepts of bibliography and references - Role of computer in design and planning phase- Computer and Collaborative learning- Application of computer packages - Educational and Research Resources on Internet - Data Analysis and Display using software- INFLIBNET - Use of E Journals - Use of E library - Use of EBSCO HOST online database of academic libraries.

UNIT IV

Probability Distribution

Mean-Median-Mode-Peak alue and Standard Deviation – Binomial Distribuion – Poisson istribution – Gaussian and Normal EWrroe Ditribution – Moes of Distribution – Error Analysis: Instrimental and Statistical uncertainties – Propagation of errors – Estimation of mean and errors – Method of pf least squares – Statistical Fluctuations – Chi Square test of a distribution.

UNIT V

Pedagogical Methods and Techniques of Higher Education

Historical perspective – Objectives and role of higher education – Learning and learning hierarchy – Information processing – Learning events and outcomes – Motivation. Methods and Techniques of Teaching: Large group techniques - Lecture – Modified lecture – Seminar – Symposium – Panel discussion – Team teaching – Project approach and workshop - Small group techniques - Group

discussion – Simulation – Role playing – Buzz techniques – Brain storming – Case discussion – Assignment – System approach in education.

Evaluation: A Conceptual Framework - Methods of Evaluation – Self Evaluation and Student Evaluation in Higher Education - Diagnostic Testing and Remedial Teaching.

Suggested Readings:

- Research Methodology Methods and Techniques, C. R. Kothari, New Age International Pvt. Ltd., Publishers, third edition, 2014
- Research Methodology: A Step by Step Guide for Beginners, Ranjit Kumar, Sage Publications, Second Edition, 2005.
- Research Methodology: An Introduction, Wayne Goddard and Stuart Melville, Juta Academic Publication, Second Edition, 2004
- Scientific Papers and Presentations, Martha Davis, San Diego: Academic Press, 1997.
- Teaching technology for College Teachers, E.G. Vedanayagam, Sterling Publishers (P) Ltd., 1989

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ELECTRONICS

Paper II: Trends in Electronics [15RELE201]

(Effective from the academic year 2015-2016 onwards)

COURSE OBJECTIVES

- Ability to design different types of Electronic Circuits such as Amplifiers and Oscillators.
- To understand and implement the advanced electronic circuits such as amplifiers etc with the help of theoretical and practical problem solving.
- To learn the designing procedure and operation of circuits used for communication
- Ability to design an Embedded System, component or process to meet desired needs within realistic constraints.
- Analyze & compare different signal processing strategies.
- To get an exposure on Discrete Fourier Transforms (DFT), its applications and implementation by FFT techniques

COURSE OUTCOMES

- Design simple circuits and know the benefits of feedback in amplifier
- Develop the ability to compare and contrast the strengths and weaknesses of various communication systems.
- Use of different modulation and demodulation techniques used in analog communication
- Explore the features of the microcontroller and provide solutions for embedded applications
- Ability to compute various transform analysis of Linear Time Invariant Systems
- Apply design techniques for FIR type digital filters

UNIT I

Analog and Digital Electronic Circuits

Rectifiers - Voltage regulated ICs and regulated power supply - Biasing of Bipolar junction transistors and JFET - Single stage amplifiers, multistage amplifiers - Operational Amplifiers(OPAMP) -Characteristics and Applications - Computational Applications – Integrator – Differentiator - Wave shaping circuits - F to V and V to F converters - Logic families - Flip Flops – Gates - Boolean algebra and minimization techniques - Multivibrators and clock circuits - Counters – Ring – Ripple - Synchronous – Asynchronous - Up and Down shift registers - Multiplexes and Demultiplexers - A/D and D/A converters**.**

UNIT II

Digital Communication Technology

Digital communication principles - FDM, TDM and WDM systems – PCM - Delta modulation - Transmission coding - Code compression - Encryption/decryption algorithms – MODEM - Shift Keying Techniques - Spread Spectrum modulation - FDMA - TDMA and CDMA - Telephone communication - Switching networks - Analog and digital exchanges - Speech digitization and transmission - Traffic engineering - Numbering and charging plan – Facsimile - Mobile communication systems - Cellular concepts – UMTS - Frequency Reuse – Roaming – SMS – GSM – GPRS - CDMA and EDGE - GPS.

UNIT-III

Embedded System Design: Hardware and Software Interaction

Introduction - From Simple Compiler to Software Design for MPSoC - MPSoC Architecture MPSoC Programming Steps - Hardware/Software Abstraction Levels - Concept of Mixed Architecture/Application Model - Examples of Heterogeneous MPSoC Architectures-Examples of Multimedia Applications - Programming Models for MPSoC - Software Stack for MPSoC - Hardware Components - Software Layers.

UNIT IV

VLSI Design Technology

The VLSI design process – Architectural design – Logical design – Physical design –Layout styles – Full custom – Semi custom approaches - Basic electrical properties of MOS and CMOS circuits: Ids versus Vds relationships – Transconductance – Pass transistor – NMOS inverter – Determination of pull up to pull down ratio for an NMOS -inverter – CMOS inverter – MOS transistor circuit model.

UNIT V

Digital Signal and Image Processing

Methods and techniques for digital signal processing - Review of sampling theorems - Z-transform methods - Linear shift - Invariant systems - Difference equations – Correlation and convolution - Canonical forms - Design of digital filters - IIR and FIR filters - FFT techniques - Image acquisition

- Image representations - Image digitalization - Sampling - Quantization - Histograms - Image Quality - Noise in Images - Basic operations on images - Image Enhancement - Pixel intensity transformations - Histogram equalization and matching - noise removal - Edge sharpening - Image smoothing.

Suggested Readings :

- Electronic Devices and Circuits, S.Salivahanan, N.Suresh Kumar & A.Vallavaraj, ,Tata Mc Graw –Hill Publishing Company Limited, Fourth Edition,2013.
- Embedded Systems Architecture Programming and Design, Rajkamal, Tata McGraw - Hill Publishing Company Limited, Third Edition, 2014.
- Principles of Communication Engineering, Anok Singh & A K Chhabra ,S.chand Publications , Seventh Edition,2010
- Electronic Communication Systems, Kennedy and Davis,Tata McGraw Hill, fifth Edition, 2012.
- VHDL:Programming by Examples, Douglas.P.Perry, Mc Graw Hill Publications, Fourth Edition, 2014.
- Low Power CMOS VLSI circuit design, K.Roy and S.C. Prasad, Wiley Publications, 2011.
- Discrete Time Signal Processing, Oppenheim A.V and Schaffer RW, Buck .C, Prentice Hall India, Second Edition, 2013.
- Digital Image Processing, Rafael C. Gonzalez, Richard E Woods, Pearson Education, 2014

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ELECTRONICS

Paper III : Special Paper I - Wireless Communication Systems [15RELE301]

(Effective from the academic year 2015-2016 onwards)

COURSE OBJECTIVES

- To know the fundamental concept of Mobile Communication.
- To understand the concept of Protocol standards and security tasks.
- Provides the concept of Cellular Networks, GPRS, Wi-Fi, WiMax Systems
- Encompasses the various Mobile Communication Technologies and the Structure of Protocols
- To make students familier with fundamentals of mobile communication systems 2. To choose system (TDMA/FDMA/CDMA) according to the complexity, installation cost, speed of transmission, channel properties etc
- To identify the requirements of mobile communication as compared to static communication

COURSE OUTCOMES

- Understand the basics of information theory, source coding techniques and calculate Entropy of source
- To make students familiar with various generations of mobile communications
- To understand the concept of cellular communication
- To understand the basics of wireless communication
- Knowledge of GSM mobile communication standard, its architecture, logical channels, advantages and limitations.
- To under multicarrier communication systems. 8. To differentiate various Wireless LANs. Acquire knowledge about embedded processors and their applications

UNIT I

Digital Cellular Systems

GSM architecture – Layer modeling – Transmission – Data service – Multiple access scheme – Channel Coding Interleaving – Radio resource management – Mobility management – Communication management – Network management – TDMA architecture – Transmission and modulation – CDMA – Terms of CDMA systems – Call processing – Handover procedures.

UNIT – II

Intelligent Network for Wireless Communication

Intelligent cell concept – Intelligent micro cell operation – Applications – Advanced Intelligent Network (AIN): Evaluation – Architecture – ISDN for AIN – AIN for mobile – Asynchronous Transfer Mode (ATM) technology - ATM network concept – Applications – Wireless information super highway.

UNIT III

Mobile Communication

Frequency management – Channel assignment- hand off procedures - Mobile Network layer - Mobile IP – Dynamic Host Configuration Protocol – Mobile Ad-hoc networks - Mobile Transport Layer Traditional TCP - Classical TCP improvements – TCP over 2.5/3G wireless networks - 3G Networks – Introduction - Principles of WCDMA - UMTS network architecture and protocols.

UNIT IV

WiFi, WLL, WiMAx

Architecture-WiFi-802.11b-802.11g-802.11a-802.16-WLL–overview–WLL Configurations - Benefits – Highlights - Propagation - Considerations - Standards of IEEE 802.16 -WiMax Architecture - MAC layer-IEEE 802.16 Protocol – Channel Acquisition –IP Connectivity –Radio Link Control (RLC) –Interferences – Security in WiMax Networks-PKM Protocol.

UNIT V

Wireless Sensor Technology

Sensor node technology – Sensor Network Architecture - Sensor taxonomy – MAC protocols – Transport protocols - Routing Protocols – Routing challenges and design issues in wireless sensor networks – Network management design issues – Operating system design issues – Applications of WSN.

Suggested Readings:

- Mobile Communications, Jochen Schiller, Pearson Education, Second Edition, 2010
- Electronic Communication Systems, Kennedy and Davis, Tata McGraw Hill, Fifth Edition, 2012.
- Mobile Computing, Hasan Ahmed, Roopa Yavagal, Asoke K, McGraw Hilll Education Private India, Second Edition, 2011.
- Wireless Sensor Network Technology, Protocols and Applications, Kazem Sohraby, Daniel Minoli and Taieb Znati, John Wiley and Sons, Second Edition, 2010.
- Principles ofMobile Computing,Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thom as Stober, Springer, 2010
- Clint Smith ,P.E Daniel Collins, 3G Wireless Networks, Tata McGraw Hill International Edition, 2nd Edition, 2009.

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ELECTRONICS

Paper III: Special Paper II - Embedded Systems [15RELE302]

(Effective from the academic year 2015-2016 onwards)

COURSE OBJECTIVES

- Ability to design an Embedded System, component or process to meet desired needs within realistic constraints.
- To develop the next generation technologies, methods and tools for modeling, design, implementation and operation of hardware/software systems embedded in intelligent devices
- To understand the need and applications of Microcontrollers n embedded system.
- To understand architecture and features of typical Microcontroller.
- Learn interfacing of real world input and output devices
- To study various hardware and software tools for developing applications embedded systems

COURSE OUTCOMES

- Understand hardware and software design requirements of embedded systems.
- Acquire knowledge about embedded processors and their applications
- Analyze the embedded systems specification and develop software programs.
- Ability to design an Embedded System, component or process to meet desired needs within realistic constraint
- Evaluate the requirements of programming embedded systems and tool chain for embedded systems.
- Explore the features of the microcontroller and provide solutions for embedded applications

UNIT I

Introduction

Definition and classification – Overview of microprocessor - Microcontroller - DSP – exemplary high performance processors – CISC and RISC architecture – Hardware unit in an embedded system - Software embedded into a system – Exemplary applications – Embedded systems on a chip and in VLSI circuit – Over view of 8051 family – 8051 instruction set and registers - 8051 assembly programming - Addressing modes – Assembler directives - Programming with C - Data types –

Time delay programming – I/O programming – programming of 8051 timer - 8051 serial Communication - 8051 interrupts.

UNIT II

Architecture of Embedded System

Hardware components – SOC – Processors – CPU – Types of memory – Memory management – I/O devices and interfacing – Software components – Interpreter – Compiler – Assembler – Cross Assembler – RTOS – Languages for embedded applications – Hardware and software architecture. Examples**:** Cell Phone – Smartcard - Digital Thermometer.

UNIT III

Embedded System Design

Design of Embedded systems - Microcontroller architecture and microcontroller based system design - Case studies - Interfacing Memory and I/O devices - Synchronous and Asynchronous transfer – Interrupts – DMA - Serial data transfer – GPIB - RS-232C, I2C, CAN bus protocols - RFID, Smart cards - PDA's, Zip drives - Development and troubleshooting tools - Single board microcomputer kits – Simulators - In Circuit Emulators, IDE - Logic analyzer.

UNIT IV

Performance Issues of an Embedded System

CPU performance – CPU Power Consumption – Analysis and Optimization of CPU- Power Consumption program execution time – Analysis and optimization of energy and power – Analysis of program size – Hardware accelerators.

UNIT V

Introduction to Operating System

Introduction to real time theory – Operating System Services – Real time Operating System Concepts – Basic design using a RTOS – Underground tank monitoring system Process Management & Inter Process Communication – Semaphores - Conditional critical regions - Events - Queues – Deadlock - Processor management - Scheduling algorithms - Queuing system model - Memory management - File System Organization.

Suggested Readings:

- ARM Microcontroller, B.Shantha Kumar Naik, Saona Book House, First Edition, 2013.
- Programming and Customizing the PIC Microcontroller, Myke Predko Tata McGraw - Hill Education, Third Edition,2010.
- Embedded Systems Architecture, Programming and Design, Rajkamal, Tata McGraw Hill Publications, Third Edition, 2014.
- Programming and Customizing the PIC Microcontroller, Myke Predko, Tata McGraw - Hill Education, Third Edition, 2010.
- Embedded Systems Architecture Programming and Design, Rajkamal, TataMcGraw Hill Publications, Second Edition, 2008.

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ELECTRONICS

Paper III: Special Paper III - VLSI Design Techniques [15RELE303]
(Effective from the academic year 2015-2016 onwards)

COURSE OBJECTIVES

- To learn the fabrication techniques of Integrated Circuits.
- To know the fundamental rules of layout design.
- To design the fundamental blocks of a VLSI circuits, both by circuit schematic and physical layout
- Importance of CMOS and Mixed Signal VLSI design in the field of Electronics and Telecommunication
- Underlying methodologies for analysis and design of fundamental CMOS Analog and Mixed signal Circuits like Current and Voltage references, Single stage Amplifiers, Operational Amplifiers, Data Converters
- The issues associated with Mixed Signal VLSI Circuits.

COURSE OUTCOMES

- Realize logic circuits with different design styles.
- Understand working principle of operation of different types of memories.
- Familiarize with the fabrication techniques of Integrated Circuits.
- Design the fundamental blocks of a VLSI circuits, both by circuit schematic and physical layout.
- Express the layout of simple MOS Circuit using Lambda based design rules.
- Design an application using Verilog HDL

UNIT I

VLSI Design Process

Architectural design - Logical design - Physical design – CMOS Technology – Integrated Circuit Design Techniques - Transistors and Layout : Introduction – Fabrication processes –Layout design and tools – Threshold Voltage – Body Effect – Design Equations – Second Order Effects – MOS Models and Small Signal AC Characteristics.

UNIT II

Inverters and Logic Gates

NMOS and CMOS Inverters - Stick diagram, Inverter ratio - DC and Transient characteristics - Switching time - Super buffers - Driving Large Capacitance loads - MOS logic structures -

Transmission gates - Static CMOS Design - Dynamic CMOS design – Combinational logic functions – Static complementary gates – Switch logic – Low power gates – Delay through resistive interconnect - Delay through Inductive Interconnect.

UNIT III

Design Tools

Grounds rules for successful design – Design styles and philosophy – CAD tools for design & simulation: Textual entry layout language – Graphical entry layout – Design verification – Design rule checkers – Simulators – Tests & testability - PLA – Finite state machine – PLA based finite state machine design – Design of 4-bit shifter – Design of ALU subsystem: Adders – Multiplexers

UNIT IV

Sequential Machines and Subsystem Design

Introduction – Latches and flip-flops – Sequential systems and Clocking disciplines – sequential system design – Power optimization – Design validation – Sequential testing -Introduction – Subsystem design principles – Combinational shifters–High density memory – Programmable gate arrays – Programmable logic arrays.

UNIT V

VERILOG Hardware Description Language

Overview of digital design with VERILOG HDL - Hierarchical modeling concepts - Modules and port definitions - Gate level modeling - Data flow modeling - Behavioral modeling - Task and functions - Test Bench.

Suggested Readings:

- VHDL: Programming by Examples, Douglas.P.Perry, Mc Graw Hill Publications, Fourth Edition, 2014
- Principles of VLSI Design, S.Sumathi, Scitech Publications (India) Pvt., Ltd, 2012.
- A VHDL Primer, J.Bhasker , Pearson Education, Third Edition, 2010.
- HDL Programming VHDL and Verilog, Nazeih M.Botros, Wiley India Pvt.Ltd, First Edition, 2012
- Basic VLSI Design, Pucknell D.A., & Eshraghian K., PHI, Third Edition, 2009.

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ELECTRONICS

Paper III : Special Paper IV - Digital Image processing [15RELE304]
(Effective from the academic year 2015-2016 onwards)

COURSE OBJECTIVES

- To get an exposure on Discrete Fourier Transforms (DFT), its applications and implementation by FFT techniques.
- To understand the fundamental concepts and theory of Discrete Fourier Series and Discrete Fourier Transform.
- To acquire the fundamental concepts of a digital image processing system
- To identify and exploit analogies between the mathematical tools.
- To design and implement with MATLAB algorithms for digital image process.
- Discuss techniques specific to 2D system

COURSE OUTCOMES

- Understand the need for image transforms different types of image transforms and their properties.
- Develop any image processing application.
- Learn different techniques employed for the enhancement of images.
- Learn different causes for image degradation and overview of image restoration techniques.
- Understand the need for image compression and to learn the spatial and frequency
- Apply design techniques for FIR type digital filters

UNIT I

Digital Image Fundamentals

Elements of digital image processing systems - Vidicon and Digital Camera - Working principles - Elements of visual perception – Brightness – Contrast – Hue – Saturation - Mach Band Effect - Image Sampling – Quantization – Dither – Two dimensional Mathematical preliminaries.

UNIT II

Image Transforms

Introduction to Fourier transform – DFT – Properties of two dimensional FT – Separability – Translation – Periodicity – Rotation - Average value – FFT algorithm – Walsh transform –

Hadamard transform – Discrete cosine transform - 1D DFT - 2D transforms – DFT – DCT - Discrete Sine – Walsh – Hadamard – Slant – Haar - KLT – SVD - Wavelet transform.

UNIT III

Image Enhancement and Restoration

Histogram modification - Noise distributions - Spatial averaging - Directional Smoothing – Median - Geometric mean - Harmonic mean - Contraharmonic and Yp mean filters - Image restoration – Degradation model - Unconstrained and Constrained restoration - Inverse filtering – Removal of blur caused by uniform linear motion - Wiener filtering - Geometric transformations – Spatial transformations – Gray level interpolation.

UNIT IV

Image Segmentation and Recognition

Image segmentation – Edge detection - Edge linking and boundary detection - Region growing - Region splitting and Merging - Image Recognition – Patterns and pattern classes - Matching by minimum distance classifier - Matching by correlation - Neural networks – Back propagation network and training - Neural network to recognize shapes.

UNIT V

Image Compression

Need for data compression – Huffman - Run Length Encoding - Shift codes - Arithmetic coding - Vector Quantization - Block Truncation Coding - Transform coding - JPEG standard - JPEG 2000 – SPIHT - MPEG

Suggested Readings:

- Digital Image Processing, Rafael C. Gonzalez, Richard E Woods, Pearson Education, 2014.
- Digital Image Processing, S. Sridhar, Oxford University Press, First Edition, 2011
- Fundamentals of Digital Image Processing, Anil K.Jain, Pearson Education, 2010.
- Digital Image Processing, Rafael C. Gonzalez, Richard E. Woods, Pearson Education, Inc., Second Edition, 2004
- Digital Image Processing using MATLAB, Rafael C.Gonzalez, Richard E.Woods, Steven Eddins, Pearson Education, Inc., 2004