# 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**

| S. No. | Course | Course Code | Title of the course |
|---|---|---|---|
| 01 | Paper – 1 | 16RELE101 | Research Methodology and Pedagogy |
| 02 | Paper – 2 | 16RELE 201 | Trends in Electronics |
| 03 | Paper – 3 (Special paper) | 16RELE 301 | Wireless Communication Systems |
| | | 16RELE 302 | Embedded Systems |
| | | 16RELE 303 | VLSI Design Techniques |
| | | 16RELE 304 | Biomedical Instrumentation |
| | | 16RELE 305 | Digital Image Processing |
| | | 16RELE 306 | Nano Science and Technology |

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**M.Phil./Ph.D. – Syllabus**

**ELECTRONICS**

**Paper-I: Research Methodology and Pedagogy [16RELE101]**

**(Effective from the academic year 2016-2017 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 [16RELE201]**

**(Effective from the academic year 2016-2017 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 [16RELE301]**

**(Effective from the academic year 2016-2017 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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**M.Phil./Ph.D. – Syllabus**

**ELECTRONICS**

**Paper III: Special Paper II - Embedded Systems [16RELE302]**

**(Effective from the academic year 2016-2017 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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**M.Phil./Ph.D. – Syllabus**

**ELECTRONICS**

**Paper III: Special Paper III - VLSI Design Techniques [16RELE303]**
**(Effective from the academic year 2016-2017 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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**M.Phil./Ph.D. – Syllabus**

**ELECTRONICS**

**Paper III: Special Paper IV – Biomedical Instrumentation [16RELE304]**

**(Effective from the academic year 2016-2017 onwards)**

## COURSE OBJECTIVES

- To know the fundamental concept of origin of Bio-electric signals and recording it with highly precision equipment.
- To learn the various medical equipment used for diagnosis and therapeutic purpose.
- To provide a large number of quality trained Medical Electronics professionals for preventive and maintenance work needed to maintain hi-tech medical equipments in hospitals to ensure good health care.
- To explore the human body parameter measurements setups
- To give basic ideas about how multimedia evidences are useful in crime investigation.
- Understanding basic principles and phenomena in the area of medical diagnostic instrumentation, theoretical and practical preparation enabling students to maintain medical instrumentation.

## COURSE OUTCOMES

- Understand the fundamental concept of origin of Bio-electric signals and recording it with highly precision equipment.
- Differentiate and analyze the biomedical signal sources.
- Identify common biomedical signals and distinguish characteristic features.
- Ability to study various transducers
- Identify common signal artifacts, their sources and formulate strategies for their suppression.
- Familiarize with patient safety issues related to biomedical instrumentation.

## UNIT I

### Bioelectric Signals

Physiological Systems of the body - Man Instrument System – Bioelectric signals – Cells and their structures - Transport of ions through cell membrane - Resting and Action Potential – Propagation of action potential - Sodium pump - Nervous system-CNS-PNS –Nerve cell-Synapse - Cardio pulmonary system - Physiology of heart and lungs Circulation and respiration.

## UNIT II

**Electro-Physiological Measurements**

Basic Electrode Theory - Bio-potential Electrodes – Biochemical Electrodes – Electrical Conductivity of electrode jellies and creams – Transducers and Transduction Principles - Different types - Piezoelectric, ultrasonic, resistive, capacitive, inductive transducers - Selection criteria - Transducers for Biomedical Applications – Biosensors and Smart Sensors

**UNIT III**

**Biomedical Recording and Patient Monitoring System**

Electrocardiography (ECG) – ECG Lead Configuration – ECG Amplifiers – ECG Recorder – Electro Encephalo Graphy (EEG) – EEG Recorder – Electro Myo Graph (EMG) – Electro Retino Graphy(ERG) – Electro Oculo Graphy (EOG) - Patient Monitoring System Concepts – Measurement of Heart Rate – Blood Pressure Measurement – Respiration Measurement.

**UNIT IV**

**Diagnostic and Therapeutic Equipments**

X-ray imaging - Radio fluoroscopy - Image Intensifiers - Angiography - Endoscopy – Pacemakers – Energy requirements to excite hear muscle – Methods of stimulation – Different modes of operation – Pacemaker batteries – Defibrillators – Different type of defibrillators. - Anesthesia Machine – Ventilators - Thermography - Nerve and muscle stimulators-Diathermy - Heart-Lung machine-Audio meters - Dializers- Electrical safety.

**UNIT V**

**Advancements in Medical Instrumentation**

Lasers in Medicine - Computerized Axial Tomography (CAT) Scanner - Ultrasonic scanner - Magnetic Resonance Imaging – Tscan – Mammography - Computer based Patient Monitoring System - Biotelemetry - Elements of telemetry system - Different types of biotelemetry systems and patient monitoring.

**Suggested Readings:**


- Introduction to Biomedical Instrumentation, Mandeep Singh, PHI Learning Private Limited, 2010.
- Electronics and Medicine and Biomedical Instrumentation, Nandini.K.Jog, Prentice Hall of
- India, Private Limited, First Edition, 2013
- Biomedical Instrumentation and Measurements**,** Leslie Cromwell, Fred. J. Weibell, Erich A. P. Feiffer, Prentice Hall of India, Second Edition, 2010
- Biomedical Instrumentation Application and Design**,** John G Webster, Wiley India Pvt Ltd, 2012.
- Handbook of Biomedical Instrumentation**,** R.S.Khandpur, Tata McGraw Hill, 2004**.**

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**M.Phil./Ph.D. – Syllabus**

**ELECTRONICS**

**Paper III : Special Paper V - Digital Image processing [16RELE305]**
**(Effective from the academic year 2016-2017 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

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**Part-I-M.Phil./Ph.D. – Syllabus**

**ELECTRONICS**

**Paper III Special Paper VI: Nano Science and Technology [16RELE306]**

**(Effective from the academic year 2016-2017 onwards)**

## COURSE OBJECTIVES

- To discuss about the latest technology on nano systems based Nanoelectronics.
- To know the various methods to fabricate and measure Nanoscale features.
- To identify the critical parameters that one must evaluate when considering any new Nanoelectronics device.
- Know the types of nanotechnology, atomic structure, molecular technology and• preparation of nano materials
- Understand the fundamentals of nano electronics and its properties.
- Know the Silicon MOSFET's, QTD and carbon nano tubes

## COURSE OUTCOMES

- Understand the fundamentals of Nano Electronics and its properties**.**
- Gain the concepts of quantum theory.
- Understand the latest technology on nano systems based Nano electronics
- Identify the various methods to fabricate and measure Nanoscale features.
- Evaluate the critical parameters when considering any new Nano electronics device.
- Understand the applications of Nano Electronics

## UNIT I

### Introduction and Classification

Classification of nanostructures - Nanoscale architecture – Effects of the nano metre length scale – Changes to the system total energy - Changes to the system structures - Vacancies in nanocrystals - Dislocations in nanocrystals – Effect of nanoscale dimensions on various properties – Structural, thermal, chemical, mechanical, magnetic, optical and electronic properties – Effect of nanoscale dimensions on biological systems.

## UNIT II

### Nanomaterials

Preparation Methods -Fabrication methods – Top down processes – Milling, lithographics, machining process – Bottom-up process – Vapour phase deposition methods - Plasma-assisted deposition process - MBE and MOVPE - Liquid Phase methods - Colloidal and Solgel methods – Methods for templating the growth of nanomaterials – Ordering of Nanosystems - Self-assembly and Self organization – Preparation, safety and storage issues.

**UNIT III**

**Characterization Techniques**

General classification of characterization methods – Analytical and imaging techniques – Microscopy techniques - Electron microscopy - Scanning electron microscopy - Transmission Electron Microscopy – STM - Field ion microscopy - Scanning Tunnelling Microscopy - Atomic force microscopy - X ray diffraction - Absorption spectroscopy – Photo-luminescence - Raman Spectroscopy.

**UNIT IV**

**Nano Electronics and Integrated Systems**

Basics of nanoelectronics – Single Electron Transistor – Quantum Computation – Tools of micro nanofabrication – Nanolithography – Neural networks in nanoelectronics - Quantum electronic devices – MEMS and NEMS – Dynamics of NEMS – Limits of Integrated Electronics.

**UNIT V**

**Nano Devices and Applications**

Nanomagnetic materials – Particulate nanomagnets and geometrical nanomagnets – Magneto resistance – Probing nanomagnetic materials – Nanomagnetism technology – Nanosystems as functional machines – Requirements of nano systems - Carbon nanotubes – fabrication- applications – Organic FET, organic LED's – Organic photovoltaics – Injection lasers - Optical memories

**Suggested Readings:**


- Basics of Nano Electronics, G.P.Singh, Animol Publications, Private Limited, First Edition, 2011
- Nanao Electronics and Nano Systems: From Transistors to Molecular and Quantum Devices, Karl Goser Springer, NewDelhi, First Edition, 2005.
- Nanotechnology: Introduction to Nanostructuring Techniques, Michael Kohler, Wolfgang, Fritzsche, 2004.
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