

## **K A R P A G A M 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**

<b>S. No.</b>	<b>Course</b>	<b>Course Code</b>	<b>Title of the course</b>
01	Paper – 1	17RELE101	Research Methodology and Pedagogy
02	Paper – 2	17RELE 201	Trends in Electronics
03	Paper – 3 (Special paper)	17RELE 301	Wireless Communication Systems
		17RELE 302	Embedded Systems
		17RELE 303	VLSI Design Techniques
		17RELE 304	Biomedical Instrumentation
		17RELE 305	Digital Image Processing
		17RELE 306	Nano Science and Technology

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**M.Phil./Ph.D. – Syllabus**

**ELECTRONICS**

**Paper-I: Research Methodology and Pedagogy [17RELE101]**

**(Effective from the academic year 2017-2018 onwards)**

**COURSE OBJECTIVES**

- Understand some basic concepts of research and its methodologies
- Identify and discuss the issues and concepts salient to the research process
- Select and define appropriate research problem and parameters
- Identify and discuss 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 and contrast quantitative and 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 value and Standard Deviation – Binomial Distribution – Poisson distribution – Gaussian and Normal Distribution – Modes of Distribution – Error Analysis: Instrumental and Statistical uncertainties – Propagation of errors – Estimation of mean and errors – Method of 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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**M.Phil./Ph.D. – Syllabus**

**ELECTRONICS**

**Paper II: Trends in Electronics [17RELE201]**

**(Effective from the academic year 2017-2018 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:  $I_{ds}$  versus  $V_{ds}$  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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**M.Phil./Ph.D. – Syllabus**

**ELECTRONICS**

**Paper III : Special Paper I - Wireless Communication Systems [17RELE301]  
(Effective from the academic year 2017-2018 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 familiar 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 understand 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 Hill 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 of Mobile Computing, Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, Springer, 2010
- Clint Smith, P.E Daniel Collins, 3G Wireless Networks, Tata McGraw Hill International Edition, 2<sup>nd</sup> Edition, 2009.

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**M.Phil./Ph.D. – Syllabus**

**ELECTRONICS**

**Paper III: Special Paper II - Embedded Systems [17RELE302]**

**(Effective from the academic year 2017-2018 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 in 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, Tata McGraw Hill Publications, Second Edition, 2008.

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### **M.Phil./Ph.D. – Syllabus**

### **ELECTRONICS**

#### **Paper III: Special Paper III - VLSI Design Techniques [17RELE303] (Effective from the academic year 2017-2018 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 [17RELE304]**

**(Effective from the academic year 2017-2018 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 [17RELE305]  
(Effective from the academic year 2017-2018 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 nano electronics – Single Electron Transistor – Quantum Computation – Tools of micro nanofabrication – Nanolithography – Neural networks in nano electronics - Quantum electronic devices – MEMS and NEMS – Dynamics of NEMS – Limits of Integrated Electronics.

### **UNIT V**

#### **Nano Devices and Applications**

Nanomagnetic materials – Particulate nano magnets 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.
- Handbook of Nano Science Engineering and Technology, William Goddard, Donald W Brenner, CRC Press, 2004.