DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

Syllabus for
Doctor of Philosophy (Ph.D) Course Work

Choice Based Credit System (CBCS)

RAJIV GANDHI UNIVERSITY,
RONO HILLS, DOIMUKH

(YEAR 2021-22 ONWARDS)

Ph.D Course Work Structure

Paper Code	Title	Credit (L-T-P)	Mark Distribution				Examination time (in hours) (T-P-S)
			End Semester		In Semester	Total	
			Theory	Practical	Sessional		
PHDEC-601	Research Methodology	3-1-0	80	0	20	100	3-0-1½
PHDEC-602	Research and Publication Ethics	1-0-1	25	15	10	50	1-1-1
PHDEC-61X	Elective – I (***Any one from the list***)	3-1-0	80	0	20	100	3-0-1½
	PHDEC-611: Advance MEMS and Micro-fabrication						
	PHDEC- 612: Advanced Biomedical Signal Processing						
	PHDEC-613: Artificial Intelligence						
	PHDEC-614: Data Science						
	PHDEC-615: Electromagnetic Theory and Antennas						
	PHDEC-616 MOS-VLSI Circuit Design						
	PHDEC-617 Wireless Sensors Networks						
PHDEC-62X	Elective – II (***Any one from the list***) (Practical only)	0-0-2	0	25	25	50	0-2-2
	PHDEC-621: Programming with MATLAB						
	PHDEC-622: Modeling and Simulation using COMSOL						
	PHDEC623: Programming with Verilog HDL						
Total Credit		**12**					

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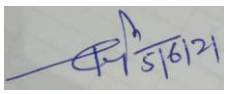
PROGRAM OBJECTIVES:

- To develop an understanding of various research designs and techniques.
- To provide students an understanding of the expectations from research work.
- To improve research skills of engineering students
- To bridge the skill gaps and make students research ready
- To provide an opportunity to students to develop inter-disciplinary skills.
- The program focusses on research skill development and more than 50% of the time is spent on practical training and problem solving, to provide the requisite understanding towards application of academic topics from Electronics & Communication Engineering disciplines into real world engineering research projects.



PHDEC-601: RESEARCH METHODOLOGY (3-1-0)

COURSE OBJECTIVES:

- To develop understanding of the basic framework of research process, publication and patent scopes.
- To develop an understanding of various research designs and techniques.
- To identify various sources of information for literature review and data collection.
- To develop an understanding of the ethical dimensions of conducting applied research.
- Appreciate the components of scholarly writing and evaluate its quality.

LEARNING OUTCOMES :

Students who successfully complete this course will be able to:

- Explain key research concepts and issues
- Read, comprehend, and explain research articles in their academic discipline.

Contents:

Unit 1: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2: Effective literature studies approaches, Analysis plagiarism, Research ethics,

Unit 3: Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Unit 4: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 5: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System

Text Books/References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall, "Industrial Design", McGraw Hill, 1992.
6. Niebel, "Product Design", McGraw Hill, 1974.
7. Asimov, "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

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PHDEC-602: RESEARCH AND PUBLICATION ETHICS (1-0-1)

COURSE OBJECTIVES:

- Provide students with the fundamental knowledge of basics of philosophy of science and ethics, research integrity, publication ethics.
- Hands-on sessions are designed to identify research misconduct and predatory publications.
- Indexing and citation databases, open access publications, research metrics (citations, *h* index, Impact Factor etc).
- Guide and mentor students in presenting plagiarism tools for a valid and ethical research report.

LEARNING OUTCOMES :

- To be able to describe and apply theories and methods in ethics and research ethics
- To acquire an overview of important issues in research ethics, like responsibility for research, ethical vetting, and scientific misconduct.
- To acquire skills of presenting arguments and results of ethical inquiries.

Contents:

Unit-1: Philosophy and Ethics: Introduction to Philosophy: definition, nature, scope, concept, branches Ethics: definition, moral philosophy, nature of moral judgment and reactions

Unit -2: Scientific Conduct: Ethics with respect to science and research; Intellectual honesty and research integrity, copyright, Scientific misconduct: falsification, fabrication and Plagiarism (FFP); Redundant Publication: duplication and overlapping publication, salami slicing; Selective reporting and misrepresentation of data

Unit – 3: Publication Ethics:

Publication Ethics: definition, introduction and importance Best practice/standard setting initiative and guidelines: COPE, WAME, etc. Conflict and interest

Publication misconduct: definition, concept, problems that leads to unethical behaviour and vice versa, type Violation of publication ethics, authorship and contributorship Identification of publication misconduct, complaint and appeals Predatory publisher and journals Avoiding Plagiarism. Preparing documents for MoUs, Confidentiality Agreements

Unit – 4: Open access publishing: Open access publication and initiatives SHERPA/RoMEO online resource to check publisher copyright and self-archiving policies Software tool to identify predatory publication developed by SPPU Journal finder/journal suggestion tools viz. JANE, Elsevier Journal finder, Springer, Journal Suggester, etc.

Unit – 5:

A. Group Discussion: Subject Specific Ethical Issues FFP, authorship Conflict interest, Complaints and appeals: examples and fraud from India and abroad
B. Software tools: Use of plagiarism software like turnitin, Urkund and other open source software tools

Unit – 6:

A. Database: Indexing database, Citation database: web of science, scopus, etc.
B. Research metrics: Impact factor of Journal as per journal citation report, SNIP,SJR,IPP, Cite

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Score Metrics: h-index, g-index, i-10 index, altmetrics

(Note : Practical based on topics mentioned in Unit 4 5, and 6)

Text Books/References:

1. Nicholas H. Steneck. Introduction to the Responsible Conduct of Research. Office of Research Integrity. 2007. Available at: https://ori.hhs.gov/sites/default/files/rcrintro.pdf
2. The Student's Guide to Research Ethics By Paul Oliver Open University Press, 2003
3. Responsible Conduct of Research By Adil E. Shamoo; David B. Resnik Oxford University Press, 2003
4. Ethics in Science Education, Research and Governance Edited by KambadurMuralidhar, Amit Ghosh Ashok Kumar Singhvi. Indian National Science Academy, 2019.
5. Anderson B.H., Dursaton, and Poole M.: Thesis and assignment writing, Wiley Eastern 1997.
6. BijornGustavii: How to write and illustrate scientific papers? Cambridge University Press.
7. Bordens K.S. and Abbott, B.b.: Research Design and Methods, Mc Graw Hill, 2008.
8. Graziano, A., M., and Raulin, M.,L.: Research Methods – A Process of Inquiry, Sixth Edition, Pearson, 2007.

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PHDEC-611: Advanced MEMS and Micro-fabrication (3-1-0)

COURSE OBJECTIVES:

- This course will provide interdisciplinary knowledge to the students on Micro-electro-mechanical systems (MEMS) from basics to advanced level.
- Students will also learn concepts related to advanced sensor and system designs using MEMS technologies for different applications.
- Concepts on modeling of a MEMS device will be provided to the students.

LEARNING OUTCOMES :

- Students will be able to design and develop MEMS based sensors and systems for specific purpose using MEMS techniques.
- Students will be able to model any microstructure made using MEMS technology.

Contents:

UNIT-1 Basic Concepts on MEMS
Definition of MEMS, Advantages of MEMS, Evolution of MEMS and Microsystems, Microstructure, Micro Actuation, Micro-sensing, Actuation Methods: Electrostatic Actuation, Thermal Actuation, piezoelectric and piezoresistive actuation, MEMS Sensors, Types and Characteristics, Application of MEMS devices.

UNIT-2 MEMS Materials and Fabrication
Materials for Substrate, Polymers, Metals and dielectrics, Mechanical Properties, Micromachining Process: Surface and Bulk Micromachining, Micro-fabrication Techniques: Clean Room, Oxidation, Ion Implantation, Lithography, Metallization, Deposition Methods: CVD, PVD, PECVD, Etching Process: Dry and Wet Etching Process, Packaging and reliability Concepts

UNIT-3 Mechanics related to MEMS Devices
Mechanical Properties: Stress, Strain, Fatigue, Strength, buckling etc., Stress and Strain in Beam Structure, Hooke's law.

Unit- 4 Case Studies: Stress and Strain in a Bent Beam, Bending moment and Moment of Inertia, Displacement of Beam structures under-weight: Cantilever beam with concentrated end loading, Bending of a Cantilever beam under-weight, double clamped beam (Bridge), double clamped beam with a central mass, Basic Mechanics of Diaphragm.

UNIT-5 MEMS Devices and Working Principle
MEMS Switches, MEMS Accelerometers, Energy Harvesters, MEMS Bio-sensors, Pressure Sensors, Gas sensors, Drug delivery systems, Basic concept of MOEMS devices.

Text Book/References:

1. Analysis and Design Principles of MEMS Devices, Minhang Bao, ELSEVIER, 2005, ISBN: 0 444 51616
2. Microsystem Design, Stephen D.Senturia, Kluwer Academic publishers, ISBN: 0-7923-7246-8
3. Microsensors, MEMS, and Smart Devices, Julian W. Gardner, Vijay K. , Awadelkarim, John Wiley & Sons, Ltd, ISBN 0-471-86109-X
4. Handbook Of Modern Sensors Physics, Designs, and Applications, Jacob Fraden, Springer, ISBN 0-387-00750-4.

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PHDEC-612: Advanced Biomedical Signal Processing (3-1-0)

COURSE OBJECTIVES:

- Help students learn, understand, and practice biomedical signal processing and classification techniques, which include the study of modern methods for ECG and EEG analysis.
- Understand the various noise removal and data compression techniques.

LEARNING OUTCOMES:

- Conceptualization and summarization of various biomedical signals, analysis of ECG and EEG signal, noise removal, and data compression techniques.

Contents:

Unit-1

Introduction to Biomedical Signals: The nature of Biomedical Signals, Examples of Biomedical Signals, Biomedical signal origin and dynamics.

Electrocardiography: Basic electrocardiography, ECG leads systems, ECG data acquisition, ECG signal characteristics.

Signal Conversion: Simple signal conversion systems, Conversion requirements for biomedical signals, Signal conversion circuits.

Unit-2

Noise cancelling: Use of blind source separation techniques: principal component analysis (PCA), Independent component analysis (ICA) algorithms for filtering. The Fourier transform, wavelet approximation, discrete wavelet series, discrete wavelet transform (DWT), Multi-resolution analysis, Pyramid algorithm, their use in biomedical signal processing.

Unit-3

Data Compression Techniques: Turning point algorithm, AZTEC algorithm, Fan algorithm, Huffman coding, data reduction algorithms The Fourier transform, Correlation, Convolution, Power spectrum estimation, Frequency domain analysis of the ECG.

Unit-4

Cardiological signal processing: Basic Electrocardiography, ECG signal characteristics (parameters and their estimation), and QRS detector, Power spectrum of the ECG, Band pass filtering techniques, Differentiation techniques, Template matching techniques, A QRS detection algorithm, Real time ECG processing algorithm, ECG interpretation.

Unit-5

Neurological Signal Processing: Introduction to brain potential and EEG Signals, its origin, characteristics, frequency division, and evoked potentials. Analysis and detection of spikes and spindles in different frequency bands, Auto Regressive (AR) method for transient detection in case of seizure and sleep stage analysis. Case study: Brain computer interfacing (BCI).

Text Books/References:

1. Rangaraj M. Rangayyan "Biomedical Signal Analysis". IEEE Press, 2001.
2. D.C.Reddy, Biomedical Signal Processing- principles and techniques, Tata McGraw-Hill.
3. Biomedical Digital Signal Processing, Willis J.Tompkins, PHI

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PHDEC-613: Artificial Intelligence (3-1-0)

COURSE OBJECTIVE:

- To make understand the key concept of Artificial Intelligence.
- To apply concepts of Artificial Intelligence techniques in research work.

COURSE OUTCOMES:

At the end of this course, students will be able to

- Understand the different search technique, Neural Network and Genetics Algorithm.
- Understanding reasoning and fuzzy logic for artificial intelligence, Machine Vision.

Contents:

UNIT 1:

Advance Search: Introduction, Constraint Satisfaction Search, Forward Checking, Most-Constrained Variables, Example: Cryptographic Problems, Heuristic Repair, Combinatorial Optimization Problems, Local Search and Metaheuristics, Exchanging Heuristics, Iterated Local Search, Tabu Search, Ant Colony Optimization, Simulated Annealing, Uses of Simulated Annealing, Genetic Algorithms for Search, Real-Time A*, Iterative-Deepening A* (IDA*), Parallel Search, Task Distribution, Tree Ordering, Search Engines, Bidirectional Search, Nondeterministic Search, Island-Driven.

UNIT 2:

Neural Network: Introduction, Neurons, Biological Neurons, Artificial Neurons, Perceptrons, Multilayer Neural Networks, Backpropagation, Improving the Performance of Backpropagation, Recurrent Networks, Hopfield Networks. Bidirectional Associative Memories (BAMs), Unsupervised Learning Networks, Kohonen Maps, Kohonen Map Example, Hebbian Learning, Evolving Neural Networks. Introduction to Convolutional Network (CNN): Working principle of CNN, Architecture of CNN, and Application of CNN.

UNIT 3:

Genetic Algorithm: Introduction, Representations, The Algorithm, Fitness, Crossover, Mutation, Termination Criteria, Optimization of a Mathematic Function, Why Genetic Algorithms Work, Schemata, How Reproduction Affects Schemata, How Mutation and Crossover Affect Schemata, The Building-Block Hypothesis, Deception, Messy Genetic Algorithms, Prisoner's Dilemma, Diversity, Evolving Pictures, Predators and Coevolution.

UNIT 4:

Fuzzy logic: Introduction, Fuzzy set, Set operation, Boolean logic, Basic Concept of Fuzzy set, Representation of Fuzzy Set, Fuzzy set Properties, Operation of Fuzzy set, Algebraic Operations on Fuzzy Sets, Classical Relations, Classical Reasoning, Fundamentals of Fuzzy Relations, Operations on Binary Fuzzy Relations, Types of Fuzzy Relations, Fuzzy Reasoning, Examples.

UNIT 5:

Machine Vision: Introduction, Human Vision, Image Processing: Edge Detection, Convolution and the Canny Edge Detector, Segmentation, Classifying Edges in Line Drawings, Using Texture, Identifying Textures, Structural Texture Analysis, Determining Shape and Orientation from Texture, Interpreting Motion, Making Use of Vision.

Text Books/References:

1. Elaine Rich and Kevin Knight "Artificial Intelligence", 2nd Edition, Tata Mcgraw-Hill, 2005.
2. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd
   a. Edition, Prentice Hall, 2009
3. "Neural Networks A comprehensive foundation", Simon Haykin, Prentice Hall International, Inc., ISBN 0139083855, Second Edition.
4. "Artificial Intelligence A modern approach", Stuart J. Russell and Peter Norvig, Prenyice Hall, Inc., ISBN 0131038052, 1995.
5. "Artificial Intelligence Illuminated", Ben Coppin, Jones and Batlett Publishers, 2004, ISBN 076373230.
6. "Artificial intelligence A system Approach", M.Tim Jones, Infinity Science Press LLC, 2008, ISBN: 978-0-9778582-3-1
7. Elaine Rich and Kevin Knight "Artificial Intelligence", 2nd Edition, Tata Mcgraw-Hill, 2005.

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PHDEC-614: Data Science (3-1-0)

COURSE OBJECTIVES:

- Help students learn, understand, and practice big data Analytics and machine learning approaches, which include the study of modern computing Big data technologies.
- Scaling up machine learning techniques focusing on industry applications.

LEARNING OUTCOMES:

- Conceptualization and summarization of big data and machine learning, trivial data versus big data, big data computing technologies, machine learning techniques, and scaling up machine learning approaches.

Contents:

Unit 1: Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.

Unit 2: Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources

Unit 3: Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

Unit 4: Data visualization: Introduction, Types of data visualization, Data for visualization, Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.

Unit 5: Applications of Data Science, Technologies for visualization, Bokeh, Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.

Text Books / References:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly.
2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press

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PHDEC-615: Electromagnetic Theory and Antennas (3-1-0)

COURSE OBJECTIVES:

- Help students learn, understand, and practice electromagnetic theories alongwith different types of antenna design for various applications.
- Different studies on types of antenna structures will provide open door for designing new and novel antenna system design.

LEARNING OUTCOMESS:

- At the end of this course the students will be able to understand, design and develop antennas for highly efficient systems.

Contents:

Unit-I Maxwell's equations, electromagnetic radiation, plane waves in dielectric and conducting media, reflection and refraction of waves, transmission lines, smith chart and its applications

Unit-II Rectangular wave guide, rectangular cavity, modes in waveguides and cavities, dielectric filled wave guides, dielectric slab guide, surface guided waves, non-resonant dielectric guide, modal expansion of fields and its applications**.**

Unit-III Antenna characteristics: radiation patterns, directive gain, side lobe, back lobe, polarization, co-polarization and cross polarization level, , frequency reuse, beam width, input impedance, bandwidth, efficiency,

Unit-IV Antenna types: wire, loop and helix antennas, aperture antenna - slot, waveguide and horn antenna; parabolic reflector antenna, microstrip antenna: rectangular and circular patch, feed for microstrip antennas: probe feed, microstrip line feed, aperture feed, electromagnetically fed microstrip patch; circularly polarized microstrip antennas, wide band and multi-frequency antennas,

Unit-V Planar array, phased array and adaptive antenna, feed network of microstrip antenna array, antenna for mobile communication: handset antenna and base station antenna.

Books/References:

1. Electromagnetic Theory by J. A. Stratton (IEEE Press)
2. Microstrip Antenna Theory and Design by J. R. James, P. S. Hall and C. Wood (IEE Publication)
3. Antennas by J. D. Kraus (McGraw Hill).

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PHDEC-616: MOS-VLSI Circuit Design (3-1-0)

COURSE OBJECTIVES
To develop the knowledge about the CMOS logic
To understand the logic gate realization using CMOS logic
To develop an understanding of dynamic logic circuits

LEARNING OUTCOMES
Understand the CMOS logic design
Understand logic circuit realization and analysis

Contents:

UNIT-I: INTRODUCTION
Classification of CMOS digital circuits and Circuit design, Overview of VLSI design methodologies, VLSI design flow, Design hierarchy and concepts, VLSI design styles, Design quality, Packing technology, CAD technology, Fabrication process flow, CMOS n-well process, layout design rules.

UNIT-II: MOS TRANSISTOR AND CIRCUIT MODELING
MOS structure, MOS system under external bias, structure and operation of MOS transistor, MOSFET
currentvoltage characteristics, MOSFET scaling and small-geometry effects, MOSFET capacitances, Modeling of MOS transistor using SPICE.

UNIT-III: MOS INVERTER STATIC CHARACTERISTICS AND INTERCONNECT EFFECTS
Introduction, Resistive-Load Inverter, Inverter with n-type MOSFET load, CMOS Inverter, Delay-Time
Definitions, Calculation of Delay Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitics, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters.

UNIT-IV: COMBINATIONAL AND SEQUENTIAL MOS LOGIC CIRCUITS
Introduction, MOS logic circuits with depletion nMOS loads, CMOS logic Circuits, Complex logic circuits, CMOS transmission gates (Pass gates), Behavior of bistable elements, SR latch circuit, clocked
latch and flip-flop circuits, CMOS D-latch and Edge-triggered flip-flop.

UNIT-V: DYNAMIC LOGIC CIRCUITS
Basic principles of pass transistor circuits, voltage bootstrapping, synchronous dynamic circuit techniques, Dynamic CMOS circuit techniques, Highperformance dynamic CMOS circuits.

Text Books/References:
1. Sung-Mo Kang, Yusuf Leblebici, “CMOS Digital Integrated Circuits” TMH 2003
2. Neil H. E. Weste and David. Harris Ayan Banerjee “CMOS VLSI Design” - Pearson Education, 1999.
3. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, “Digital Integrated Circuits” Pearson Education, 2003
4. Wayne Wolf, “Modern VLSI Design ", 2nd Edition, Prentice Hall,1998.
5. Kamran Ehraghian, Dauglas A. Pucknell and Sholeh Eshraghiam, “Essentials of VLSI Circuits and Systems” – PHI, EEE, 2005 Edition.

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PHDEC-617: Wireless Sensors Networks (3-1-0)

COURSE OBJECTIVES

- Use operating systems and programming languages for wireless sensor nodes, performance of wireless sensor networks systems and platforms.
- Handle special issues related to sensors like energy conservation and security challenges.

COURSE OUTCOMES:

At the end of this course, students will be able to

- Design wireless sensor network system for different applications under consideration.
- Understand the hardware details of different types of sensors.
- Understand radio standards and communication protocols.

Contents:

Unit-1

Applications of Ad Hoc Wireless Networks, Issues in Ad Hoc Wireless Networks: Medium Access Scheme, Routing, Multicasting, Transport Layer Protocols, Quality of Service Provisioning, self-organization, Security Addressing and Service Discovery - Energy management Scalability-Deployment Considerations, Ad Hoc Wireless Internet.

Unit-2

Challenges for WSNs–Difference between sensor networks and Traditional sensor networks, types of applications, Enabling Technologies for Wireless Sensor Networks –Single Node Architectures, Hardware Components, Energy Consumption of Sensor Nodes, Issues in Designing a Multicast Routing Protocol.

Unit-3

Flooding and Gossiping, Data gathering Sensor Network Scenarios, Optimization Goals and Figures of Merit, Design Principles for WSNs Gateway Concepts, Need for gateway.

Unit-4

WSN to Internet Communication, Internet to WSN Communication –WSN Tunnelling ,MAC Protocols for Sensor Networks, Location Discovery, Quality of Sensor Networks, Evolving Standards, Other Issues- Low duty cycle and wake up concepts- The IEEE802.15.4 MAC Protocols- Energy Efficiency.

Unit-5

Mobile nodes - Gossiping and Agent based Unicast Forwarding-Energy Efficient Unicast, Broadcast and Multicast, Geographic Routing.

Text Book and References:

1. Holger Karl and Andreas Wiilig, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley & Sons Limited 2008.
2. I.F .Akyildiz and Weillian, “A Survey on Sensor Networks”, IEEE Communication Magazine, August 2007.
3. Jon S. Wilson, “Sensor Technology hand book”, Elsevier publications, 2005.
4. Anna Hac, “Wireless Sensor Networks Design” ,John Wiley& Sons Limited Publications 2003
5. C. Siva Ram Murthy and B.S. Manoj, “Ad Hoc Wireless Networks”, Pearson Edition 2005

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PHDEC-621: Programming with MATLAB (0-0-2)

COURSE OBJECTIVES:

- To enhance programming knowledge in Research and Development with MATLAB software.
- To provide a working introduction to the MATLAB technical computing environment viz. Themes of data analysis, visualization, programming etc.

LEARNING OUTCOMESS :

- Learn to apply R MATLAB for breaking a complex task up into smaller, simpler tasks for data processing.
  Able to Tabulate results , analyze and visualize data

Contents:

Introduction to Programming with MATLAB; Programming Environment; Graph Plots; Procedures and Functions; Control Statements; Manipulating Text; GUI Interface; Discrete Linear Systems; Spectral Analysis; Speech Signal Analysis

Text Books/References:

1. Stormy Attaway, MATLAB: A Practical Introduction to Programming and Problem Solving, 3rd edition, Elsevier, 2013
2. Hunt, Brian R., Ronald L. Lipsman, and Jonathan M. Rosenberg. A guide to MATLAB: for beginners and experienced users. Cambridge university press, 2014.
3. Gilat, A., *MATLAB: An introduction with applications* (4th Ed). New York: Wiley, 2012.
4. Stephen J. Chapman, MATLAB Programming for Engineers, 6E,Cengage Learning India Pvt. Ltd., 2019

PHDEC-622: Modeling and Simulation using COMSOL (0-0-2)

COURSE OBJECTIVES:

- Introduce the COMSOL Multiphysics tool.
- Introduce methods to perform different studies of microstructures.
- Study and simulate different phenomenon in MEMS microstructures.

LEARNING OUTCOMESS :

- Enable students to understand COMSOL for designing and simulation
- Enable students to design application specific structures and study them.
- Modeling different mechanics in semiconductor and MEMS devices

Contents:

Introduction to COMSOL Multiphysics software, design and simulation of PN Junction, transport and adsorption phenomenon for Bio-chip, thin film resistance, cooling and solidification of metals, DC characteristics of MOSFET, piezoelectric energy harvester.

Text Books/References:

1. Roger W. Pryor, Multiphysics Modeling Using COMSOL: A First Principles Approach Hardcover – Import, December 2009
2. Ashim Datta, Vineet Rakesh, An Introduction to Modeling of Transport Processes:

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Applications to Biomedical Systems (Cambridge Texts in Biomedical Engineering) Hardcover – 12 November 2009

PHDEC623: Programming with Verilog HDL (0-0-2)

COURSE OBJECTIVES:

- To enhance programming knowledge in Research and Development with Verilog HDL.
- To provide a working introduction to the Verilog HDL for combinational circuits, sequential, finite state machine.

LEARNING OUTCOMESS :

- Learn to apply verilog HDL for breaking a complex task up into smaller, simpler tasks for design of digital circuits.
- Able to analyze the test bench, analyze the synthesis and simulation of digital circuits.

Contents:

Introduction to Programming with Verilog HDL; synthesis of digital circuits; simulation; test bench; different types of programming style; deployment of programs on FPGA kit.

Text Books/References:

1. Samir Palnitkar , Verilog HDL – Guide to Digital Design and Synthesis-, Pearson Education, 3rd Edition, 2003.
2. Jayaram Bhaskar A, VHDL Primer, Prentice-Hall India, 1999.

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