

Solapur University, Solapur
Electronics Engineering
(Faculty of Engineering & Technology)
Syllabus for Ph.D. Course Work - Revised



<i>Paper</i>	<i>Subject</i>	<i>Examination Scheme Theory paper</i>
I	Research Methodology & Information Communication Technology	100 Marks
II	Advances in Electronics Engineering	100 Marks
III	Elective – Advanced Development in Electronics Engineering	100 Marks

Elective –

1. Advances in Image Processing
2. Advanced CMOS VLSI Design
3. Soft Computing Paradigms

Note – 1. Candidate shall select an elective in consultation with guide from any of below Ph.D. course work-

- a. Electronics Engineering*
- b. Electronics & Telecommunication Engineering*
- c. Computer Science & Engineering*

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Paper I– Research Methodology & Information Communication Technology

Unit 1: Basics of Research:

Definition, objectives, motivation, types of research and approaches: descriptive research, conceptual, theoretical, applied and experimental.

Unit 2: Formation of Research Problem:

Research Process: To determine what type of research to be done, plan of research work, Selection of research area, prioritization of research. Literature review: importance and methods, sources, Objectives and scope of work, Developing Research Plan and Schedule: Scheduling Constraints, steps, problems in scheduling, limitations

Unit 3: Mathematical Modelling and Simulation:

- a) Modelling: Concept of modelling, classification of mathematical models, modelling with ordinary differential equations, difference equations, partial differential equations, graphs,
- b) Simulation: concept, types (quantitative, experimental, computer, fuzzy theory, statistical) processes of formulation of model based on simulation. Variables and measurement

Unit 4: Experimental Modelling:

- a) Definition of experimental design, examples, single factor experiments blocking and Nuisance factors, guidelines for designing experiments.
- b) General model of process: Input factors/ variables, Output parameters / variables controllable / uncontrollable variables, dependent / independent variables, experimental validity.
- c) Introduction to Risk assessment, reliability, sustainability, and uncertainty

Unit 5: Analysis of data:

Types of data: parametric and nonparametric, descriptive and inferential data, collection of data: normal distribution, calculation of co-relation coefficient
Data processing: analysis, error analysis, meaning, different methods: analysis of variance, significance of variance, analysis of covariance, multiple regression, testing linearity / nonlinearity of model, testing adequacy of model. Introduction software used data

Unit 6: Research Deliverables:

Various Forms of Publication: Thesis, Paper, Research proposal
Thesis Writing: Introduction, Literature Review or State-of-the-Art, Research Approach(methodology), Results or findings, Discussions, Conclusions, Scope for future work References, Appendices Presentation: Poster, thesis, proposal and paper

Unit 7: Components of ICT

- a) Impact factor
- b) e-information
- c) Patents : Agencies, national /International , procedure for filing.
- d) e-submission
- e) International publications: notes, Letters/communications, full papers Review.
- f) h-index
- g) Citation index

• Reference Books

1. C. R. Kothari, “Research Methodology”, Willy Estern Ltd. ND.
2. Wayne Goddard and Stuart Melville, “Research Methodology-An Introduction”, Juta & Co, Ltd, 2006
3. Lucienne T.M. Blessing, Amaresh Chakrabarti, “DRM, a Design Research Methodology,” Springer-Verlag London Limited 2009
4. Yogesh Kumar Singh, “Fundamentals of Research Methodology and Statistics,” NEW AGE INTERNATIONAL (P) LIMITED, PUBLISHERS
5. Douglas Montgomery, “Design of Experiments”
6. Willkinsion K.P. L., Bhandarkar, “Formulation of Hypothesis”, Himalaya publishing, Mumbai.
7. Schank Fr, “Theories of Engineering Experiments”, Tata McGraw Hill

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Paper II– Advances in Electronics Engineering



1. Unit 1 – Network Services and Layered Architectures

Applications, traffic Characterization and QOS, network services, high performance networks, network elements, network mechanisms, layered architecture, open data network model, network architectures, network bottleneck

2. Unit 2- Internet & TCP/IP Networks

Wireless internet, issues, mobile IP, TCP in wireless domain, WAP, Optimization

3. Unit 3 – Ad Hoc Wireless Networks

Introduction, issues, ad hoc wireless internet, applications

4. Unit 4 – The Evaluation Generation and Third generation (3G) Overview

Introduction, enhancements over 2G, GPRS overview , EDGE overview, AMR half rate traffic channels, GSM/GPRS/EDGE traffic channels, HSCSD, CDMA2000 (1XRTT) overview, WAP, SMS, migration path from 2G to 2.5G to 3G

5. Unit 4- Third Generation (3G) Overview

3G - Introduction, UMTS overview, CDMA 2000 overview, TD CDMA, TD SCDMA

6. Unit 5- Multimedia on Wireless Networks

Digitizing audio and video, streaming stored and live audio- video, real time interactive audio video, RTP,RTCP, voice over IP

• **References –**

1. High Performance Communication Networks, Jean Wallard, Pravin Varaiya, Morgan Kaufmann Publishers (Elsevier), Second Edition
2. 3G Wireless Networks, Clint Smith, P.E., Daniel Collins, McGraw Hill Communications, Tata McGraw – Hill Edition, Second Edition
3. Data Communications and Networking, Behrouz Forouzan, Tata McGraw Hill Education Private Limited, Fourth Edition
4. Ad hoc Wireless Networks : Architectures and Protocols, C. Siva Ram Murthy, B.S. Manoj, Pearson Education
5. IEEE Transaction on Communications
6. IEEE Journal on Selected Areas in Communications
7. IEEE Transaction on Wireless Communications

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Paper III– Elective – Advances in Image Processing



1. Unit 1 – Image Segmentation

Introduction, point, line and edge detection, thresholding, region based segmentation, use of motion in segmentation

2. Unit 2- Image Representation and Description

Image representation, boundary descriptors, regional descriptors, principal components for description, relational descriptors

3. Unit 3 – Image Analysis

Patterns and pattern classes, scene segmentation and labeling, counting objects, perimeter measurements, boundary following, projection, Hough transform, least squares and Eigenvector line fitting, shapes of regions, morphological operations, Fourier transforms, color,

4. Unit 4 – Texture

Statistical texture descriptors, syntactic texture descriptors, hybrid texture description methods, texture recognition method applications

5. Unit 5- Modern Image Quality Assessment

Subjective Vs objective image quality measures, problems with MSE, classification of objective image quality measures, HVS features, image quality assessment algorithms based on HVS

6. Unit 6 – Applications of Image Processing

Fingerprints, face recognition, iris recognition, watermarking, medical image processing, industrial machine vision, remote sensing

• **References –**

1. Digital Image Processing, Rafael C. Gonzalez, Richard E. Woods, Pearson Education, Third Edition
2. Digital Image Processing and Computer Vision, Milan Sonka, Vaclav Hlavac, Roger Boyle, Cengage Learning
3. Pattern Recognition and Image Analysis, Earl Gose, Richard Johnsonbaugh, Steve Jost
4. Digital Image Processing: An algorithmic Approach, Madhuri A. Joshi, Prentice Hall of India Pvt. Ltd
5. Modern Image Quality Assessment, Zhou Wang, Alan C. Bovik, Morgan & Claypool Publishers

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Paper III – Elective -Advanced CMOS VLSI Design



1. Unit 1 – Fundamentals of MOS Structures & Transistor Theory

Introduction to Band Theory, effective mass, Fermi level, energy diagrams, MOS structure, MOS capacitor, physical and electrical behavior with gate bias, (CV plots). NMOS transistor, Physical structure of MOS transistor, MOS transistor under static conditions, secondary effects, Models for MOS transistor, Process variation, Technology Scaling

2. Unit 2 – Circuit Simulation

The wire, Interconnect parameters (C, R, L), Electrical wire models

3. Unit 3 – CMOS Inverter

CMOS inverter, Static and Dynamic behavior of CMOS inverter, Power, Energy and Energy-Delay, Technology Scaling and Impact on inverter metrics

4. Unit 4- Combinational & Sequential Logic Designs in CMOS

Static CMOS design, Dynamic CMOS Design, Static latches and registers, Dynamic latches and registers, Pipelining

5. Unit 5 – Timing issues in Digital Circuits

Timing Classification of Digital Circuits, Synchronous Design (Clock Skew, Jitter, Clock Distribution, Latch Based Clocking), Self Timed Circuits Design (An Asynchronous Techniques), Synchronizers and Arbiters Using PLL for Clock Synchronization, DLL

6. Unit 6 – Designing Building Blocks

Adders, Multipliers, Shifters, Power and Speed Trade-Off in Datapath Structures, Introduction, Memory Core, Memory Peripheral Circuitry, Memory Reliability and Yield, Power Dissipation In Memories

7. Unit 7– CMOS Manufacturing Process

Basic CMOS technology, (n-well CMOS, p-well, CMOS, twin tub process), logic design rules, latch-up problem

• **References –**

1. “Digital Integrated Circuits”, Rabey, Chandrakasan, Nikolic, Pearson Education
2. “Principles of CMOS VLSI Design”, Neil Weste, Kamran Esharghian, Addison Wesley/ Pearson Education

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Paper III– Elective – Soft Computing Paradigms



1. Unit 1 – Pulsed Neuron Models

Spiking neuron model, integrate and finite model, conductance based models, computing with spiking neurons

2. Unit 2- Applications of ANN

Pattern classifications, optimization, vector quantization, control applications, speech applications- vowel classification, recognition of consonant vowel segments, image processing applications -printed character recognition, handwritten character recognition

3. Unit 3 – Fuzzy Pattern Recognition

Feature analysis, partitions, single sample identification, multifeature pattern recognition, image processing, syntactic recognition

4. Unit 4 – Genetic Modeling

Inheritance, cross over, inversion, deletion, mutation, bitwise operator, generation cycle, convergence of GA, applications, multilevel optimization, real life problems, advances

5. Unit 5 – Hybrid Systems I

Hybrid systems, neuro- fuzzy, neuro-genetic, fuzzy-genetic hybrids, GA based backpropagation, applications

6. Unit 6- Hybrid Systems II

Fuzzy backpropagation, fuzzy Artmap, Fuzzy associative memory

• **References –**

1. Neural Networks : A Classroom Approach, Satish Kumar, Tata McGraw Hill Publishing Company Ltd
2. Neural Networks, Fuzzy Logic and Genetic Algorithms , Synthesis & applications, S. Rajasekaran, G A Vijayalakshmi Pai, Prentice Hall of India Pvt. Ltd.
3. Neuro Fuzzy and Soft Computing: A Comprehensive Approach to Learning & Machine Intelligence, J S R Jang, C T Sun, E Mizutani, Prentice Hall of India Pvt. Ltd.
4. Artificial Neural Networks, B Yegynanarayan, Prentice Hall of India Pvt. Ltd.
5. Introduction to Artificial Neural Systems, Jacek M Zurada, Jaico Publishing House
6. Fuzzy Logic with Engineering Applications, Timothy J Ross, McGraw-Hill, Inc