Solapur University, Solapur

Electronics Engineering

(Faculty of Engineering & Technology)

Syllabus for Ph.D. Course Work

paper	*Subject*	*Examination Scheme Theory paper*
I	Research Methodology & Information Communication Technology	100 Marks
II	Recent Trends in Electronics Engineering	100 Marks
III	Modern Topics in Electronics Engineering	100 Marks
IV	Elective – Advanced Development in Electronics Engineering	100 Marks

Elective –

1. Advanced Development in Image Processing
2. Advanced Development in CMOS VLSI Design
3. Advanced Development in 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

Solapur University, Solapur

Ph.D. Course Work

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Paper-II Recent Trends in Electronics Engineering

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1. Unit 1 – MATLAB Basics

Introduction, environment, variables, arrays, operations, branching and program design, script and functions, files, simple plotting.

2. Unit 2 – MATLAB Advanced Features

Additional data types, sparse arrays, cell arrays, structures, function handlers.

3. Unit 3 – Input/Output Functions

Binary input/output, formatted input/output, file handling.

4. Unit 4 - Graphics

MATLAB graphics system, object handles, changing properties, charts, graphs.

5. Unit 5 – Digital Signal Processing Applications with MATLAB

Simulating discrete time signals and FIR filters using MATLAB, Signal Processing Toolbox – features, functions for waveform generation, digital filters, transforms and statistical signal processing.

6. Unit 6 – Image Processing Applications with MATLAB

Image Processing Toolbox – features, functions for reading, writing and displaying images, transforms, filters.

- **References –**

1. Programming in MATLAB for Engineers, Stephen J. Chapman, Cengage Learning.
2. Digital Image Processing using MATLAB, Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Pearson
3. Digital Signal Processing: A MATLAB Based Approach, Vinay K. Ingale, John G. Prokis, Cengage Learning.
4. Using MATLAB (User's Guide), Math Works Inc.
5. MATLAB Image Processing Toolbox User's Guide, Math Works Inc.
6. MATLAB Signal Processing Toolbox User's Guide, Math Works Inc.
7. MATLAB Web Site – http://www.mathworks.com

Solapur University, Solapur

Ph.D. Course Work

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Paper-III Modern Topics in Electronics Engineering

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1. Unit 1 – Network Services and Layered Architectures

Applications, traffic Characterization and QOS. N etwork 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 (IXRTT) overview, WAP, SMS, migration path from 2G to 2.5G to 3G

5. Unit 5 – Third Generation (3G) Overview

3G – Introduction, UMTS overview, CDMA 2000 overview, TD CDMA, TD SCDMA.

6. Unit 6 – Multimedia on Wireless Networks

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

- **Reference –**

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, Tara 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.

Solapur University, Solapur

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Electronics Engineering

(Faculty of Engineering & Technology)

Paper-IV - Elective – Advanced Development in Image Processing

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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.

Solapur University, Solapur

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Paper-IV - Elective – Advanced Development in CMOS VLSI Design

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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 wir, 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 Structure, 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.

- **Reference –**

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-IV - Elective – Advanced Development in Soft Computing Paradigms

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1. Unit 1 – Pulsed Neuron Models

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

2. Unit 2 – Application 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 System II

Fuzzy backpropagation, fuzzy Artmap, Fuzzy associative memory.

- **Reference –**

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.