M. Phil/ Pre Ph.D.
Paper I: Research Methodology

Unit –I Introduction to Research Methodology
Research Methodology: An Introduction Objectives of Research, Types of Research, Research Methods and Methodology, Defining a Research Problem, Techniques involved in Defining a Problem
Research Design Need for Research Design, Features of Good Design, Different Research Designs, Basic Principles of Experimental Designs, Sampling Design, Steps in Sampling Design, Types of Sampling Design, Sampling Fundamentals, Estimation, Sample size Determination, Random sampling   [15 Hrs]

Unit –II Research Tools
Measurement and Scaling Techniques Measurement in Research, Measurement Scales, Sources in Error, Techniques of Developing Measurement Tools, Scaling, Meaning of Scale, Scale Construction Techniques   [15 Hrs]

Unit –III Hypothesis and Research Methodology
Methods of Data Collection and Analysis Collection of Primary and Secondary Data, Selection of appropriate method Data Processing Operations, Elements of Analysis, Statistics in Research, Measures of Dispersion, Measures of Skewness, Regression Analysis, Correlation
Techniques of Hypotheses, Parametric or Standard Tests Basic concepts, Tests for Hypotheses I and II, Important parameters limitations of the tests of Hypotheses, Chi-square Test, Comparing
Variance, As a non-parametric Test, Conversion of Chi to Phi, Caution inusing Chi-square test [15Hrs]

Unit –IV Research Output Techniques
Analysis of Variance and Co-variance ANOVA, One way ANOVA, Two Way ANOVA, ANOCOVA Assumptions in ANOCOVA, Multivariate Analysis Technique Classification of Multivariate Analysis, factor Analysis, R-type Q Type factor Analysis, Path Analysis   [15 Hrs]

Reference Books:

1. "Research Methodology", C.R. Kothari, Wiley Eastern.
2. "Formulation of Hypothesis", Willkinson K.P, L Bhandarkar, Hymalaya Publication, Bombay.
3. "Research in Education", John W Best and V. Kahn, PHI Publication.
4. "Research Methodology- A step by step guide for beginners", Ranjit Kumar, Pearson Education
5. "Management Research Methodology-Integration of principles, methods and Techniques", K.N. Krishna swami and others, Pearson Education

M.Phil. / Pre Ph.D. Paper II

Advances in Electronics

Unit 1: Microelectronics and VLSI

Microelectronic devices, characteristics, mathematical modeling, performance

parameters, design aspects, parasitic, integration issues, layout rules, optimization

techniques. Chip architecture, Clock & power related issues, SRC, DRC, I/O architectures, Wire parasitic, Design validation, MEMs.

Unit 2: Advances in Communication Electronics

Coding and Modulation Techniques in Communication

Digital communication system architectures, Source coding, Channel coding,

Performance measures of communication systems, PLD based system implementations

and related issues.

Advanced Topics in Signal Processing

Modeling different Signals and systems, various transforms, System design and

Implementation issues, DSP architectures and related issues, Evaluation parameters for

the various applications.

Unit 3: **Advance topics in Biomedical, Networking and Power electronics.**

Biomedical Signals, Biomedical Systems, Analysis, Implementation issues,

performance measures. Various IEEE standards, performance issues, Trade-offs, network architectures, security algorithms with their performance measures.

Evolution of micro-controllers, Micro-controller development systems; dsPIC Series microcontrollers - architecture - hardware description. Assembly language programming – C program structure, data acquisition. Typical applications in the control

of power electronic converters for power supplies and electric motor drives.

Unit 4: Soft Computing

Human Machine Interface

Different techniques used for HMI, Algorithms, Related issues and constraints,

Performance issues, Applications.

Machine Vision

Human vision, Expert systems, Algorithms, Implementation issues and trade offs,

Performance measures and analysis.

Reference Books:

1. M.J. Roberts, "Signals and Systems", Tata McGraw Hill Publications, 2003.

2. M. Burns, "Introduction to Mixed Signal IC Test and Measurement", Oxford University Press Publications, New York.

3. Xilinx, "The Programmable Logic Data Book", Xilinx, California.

4. Hu, Yu Hen, "Handbook of Neural Network Signal Processing", CRC Press Publications.

5. Yacoub M.D., "Wireless Technology", CRC Press Publications.

6. Gold B., "Speech and Audio Signal Processing", John Wiley Publications.

7. Kuo B.C., "Digital Control System", Sounders College Publications, New York.

8. Comer "Digital Logic and State Machine Design", Sounders College Publications, New York.

9. Prokis J.G., "Digital Signal Processing", PHI Publications.

10. Alley, Charles L, "Micro Electronics", McGraw Hill Publications.

11. Ha, Tri T., "Digital Satellite Communication", McGraw Hill Publications.

12. Peebles, "Probability and Random Signals", McGraw Hill Publications.

13. Balanis, "Antenna Theory analysis and Design", John Wiley Publications.

14. Gray R.P.," Analysis and Design of Analog ICs", John Wiley Publications.

15. Tompkins J.W., "Biomedical Digital Signal Processors", PHI Publications.

16. Collin E.R., "Foundations for Microwave Engineering", McGraw Hill Publications.

17. Freeman R.L., "Radio System Design for Telecommunication", John Wiley Publications.

18. Kronsjo L., "Advances in Parallel Algorithm", Blackwell Scientific Publication, London.

19. Xavier, Eugune S.P., "Statistical Theory of Communication", New Age International

Publication.

20. Baker R.J., "CMOS: Circuit Design, Layout and Simulation", IEEE Press Publication.

21. McGillen C.D., "Continuous and Discrete Signal and System Analysis", Oxford University Press.

22. Russ J.C., "The Image Processing Handbook", CRC Press Publications.

23. Franssila S., "Introduction to Micro fabrication", John Wiley Publications.

24. Park J., "Practical Embedded Controllers", Elsevier Publications, Amsterdam.

25. Kabatiansky G., "Error Correcting Coding and Security for Data Network", John Wiley Publications.

26. Lee K., "Semiconductor Device Modeling For VLSI", PHI Publications.

27. Maxfield C.M., "The Design Warriors Guide to FPGA", Elsevier Publications, Amsterdam.

28. *Carsten Steger, Markus Ulrich, Christian Wiedemann,* "Machine *Vision Algorithms and Applications"*, Wiley-VCH, Weinheim Publications.

29. Pires, J. Norberto, "Human Machine Interface for Industrial Robotic Cells", Springer Publications.

Paper III

Advances in Power Electronics

1. **UNIT 1**
   Power Semiconductor devices

   Ideal switch, diode, transistor, power MOSFET, IGBT, Diac, MCT MOSFET, Snubber circuit, power factor and convertor

   DC-DC line regulation – line regulator topology, parameter of line regulator, Analysis of regulators, Basic DC-DC convertor (Boost, BUCK, Buck-Boost) practical issues.

2. **UNIT 2**
   DC-AC switch mode convertor

   Inverter topology, self-driven inverter, quassi-square wave inverter, three phase inverter and PWM inverter.

   Design of magnetics

   Dissipative components flux and flux density, potential transformer, current transformer, etc.

   Modeling of system – I/O relations, transfer function, block diagram, bode graphs and space vector modeling.

3. **UNIT 3**
   Control system essentials

   Representation of system in digital domain, Z-transform, digital filter, mapping between S-plane and Z- plane, effect of sampling, control system basics, state space method.

   Digital controller design – control design technique, bode diagram method, PID controller, root locus method, state space method, full state feedback, tracker controller design, IM control with o/p feedback, optimal and robust controller design

4. **UNIT 4**
   Discrete computation essentials

   Number formulas, normalization, Arithmetic operations. Thermal aspects, reliability modeling and predictions.

   References
   1. Power Electronics: Essentials and Applications, L Umanand, Wiley
   2. Power Electronics: Circuits, Devices And Applications, M.H.Rashid, Pearson Education India, 01-Sep-2003
   3. Modern Power Electronics and AC Drives, Bimal K Bose, Academic Press, 28-Jul-2006

Advances in Embedded Systems and VLSI Design

Chapter 1: State of Art Techniques in Embedded System Design (15)

Latest design techniques in Embedded systems, hardware/software codesign, Embedded micro controller cores, embedded memories, Examples of embedded systems, sensors and interfacing techniques, Real-time concepts, real-time operating systems, Required RTOS services/capabilities (in contrast with traditional OS). Resource Management/scheduling paradigms: static priorities, static schedules, dynamic scheduling, best effort current best practice in scheduling (e.g. Rate Monotonic vs. static schedules), Real-world issues: blocking, unpredictability, interrupts, caching, Examples of OSs for embedded systems - RT Linux, VRTX.

Chapter 2: Programming Aspect of Embedded Systems (15)

Programming languages for embedded systems e.g., Handel-C and Esterel, system support for embedded systems, selected embedded system-based applications: process-control, robotics, etc. Software Development Methodology: Model based development, Statecharts, etc. Case studies, Controlling an Injection molding process, Flight simulator, digital call center handler, codec.

Chapter 3: Latest Techniques in VLSI Design (15)

Introduction to hierarchical structural design.Role of CAD in VLSI design process. Techniques and algorithms for symbolic layout and routing. CMOS processing technology, CMOS building blocks and other approaches for reusing digital soft IP cores

Chapter 4: Advances in VLSI System Design (15)

Use of pipelining and parallelism, self-synchronized esigns, VLSI computing structures. Introduction to systolic arrays, mapping algorithms on systolic arrays, design of systolic arrays, system examples and design exercises.

References:
1. Jack Ganssle, "The Art of Designing Embedded Systems", Newnes, 1999.
2. David Simon, "An Embedded Software Primer", Addison Wesley, 2000.
3. RTS: Real-Time Systems, by C.M. Krishna and Kang G. Shin, McGraw-Hill, 1997, ISBN 0-07-057043.
4. J. A. Stankovic and K. Ramamritham, Advances in Hard Real-Time Systems, IEEE Computer Society Press, Washington DC, September 1993, 777 pages.Selected papers and references
5. C. Mead and L. Conway.Introduction to VLSI Systems, Addison Wesley, 1980.
6. N. Weste and K. Eshraghian.Principles of CMOS VLSI Design, A Systems Perspective, Addison Wesley, 1988.
7. S. Y. Kung.VLSI Array Processors, Prentice Hall, 1991.
8. K. Hwang and F. A. Briggs.Computer Architecture and Parallel Processing, Mc Graw Hill, 1985.

Paper III

Problem Solving With Soft Computing

Unit I: Pulsed Neuron Models: The New Generation

Introduction pulsed neuron model, Spiking Neuron Model, Integrate-and-Fire Neurons, Conductance Based Models, Computing with Spiking Neurons.

Unit II: Fuzzy Sets, Fuzzy Systems and Application

Need For Numeric And Linguistic Processing, Fuzzy Uncertainty And The Linguistic Variable, Membership Function, Geometry Of Fuzzy Sets, Simple Operation Of Fuzzy Sets, Fuzzy Rules For Approximate Reasoning, Rule Composition And Defuzification.

Unit III: Genetic Algorithm

What Are GA? Why Are GA, Mechanics Of Biological Evolution, Artificial Evolution: Taxonomy And Search Optimization-Enumerative, Calculus-Based And Guided Random Search Techniques, Evolutionary Algorithms

Unit IV: Neural Networks and the Soft Computing Paradigm

Soft Computing-Neural-Fuzzy-Evolutionary, Genetic Algorithms, Neural Networks and Fuzzy Logic, Neuro-Fuzzy-Genetic Integration, application of soft computing in industrial control , Expert system ,industrial optimization problems, industrial fault diagnosis and analysis.

Reference Books

1. S.Kumar, Neural networks-A Classroom approach, The McGraw-Hill Companies(New Delhi),2008
2. A. M. Ibrahim, Introduction to Applied Fuzzy Electronics, Prentice Hall, Upper Saddle River, NJ, 1997.
3. Ahmad M. Ibrahim, Fuzzy Logic for Embedded Systems Applications, Elsevier Science (USA) 2004
4. J. Yen and R. Langari, Fuzzy Logic Intelligence control and information, Pearson, 2009.
5. S.N Sivanandam and S.N. Deepa, Principles of Soft Computing, Wiley India, 2008.

Paper III

Modern communication System

1. **Antenna Parameter Measurement [15]**
   Introduction, directional pattern, gain, absolute method, comparison method, celestial radio sources, radar techniques, phase, direct method, reference antenna method, deferential method, polarization, impedance, efficiency, directivity/gain method, radiometric method, random field method, wheeler cap method, other measurement method for small antennas, current distribution, vector network analyzer, field strength meter.
   (Ref. Antenna and wave propagation John D Kraus, Ronald J Marhefka Ahmad S Khan Tata McGraw Hill Education Private Limited Fourth Edition)

2. **Antenna Measurement Ranges [15]**
   Introduction, Basic Concept, reciprocity in antenna measurement, Near-field, far-field, Co-ordinate system, measurement ranges, elevated ranges, ground reflection ranges, anechoic chambers and absorbing materials, compact antenna test ranges, near field ranges, testing of ranges, instrumentation, transmitter and receiver, data processing. Typical sources error in antenna measurement, phase error and amplitude taper, reflections, other sources of error
   (Ref. Antenna and wave propagation John D Kraus, Ronald J Marhefka Ahmad S Khan Tata McGraw Hill Education Private Limited Fourth Edition)

3. **Satellite communication [15]**
   The earth segment, receive only home TV system, the outdoor unit, the indoor unit for analog(FM) TV, master antenna TV system, DTH TV System, transit-receive Earth station.
   Transmission losses, free space transmission, Feeder losses, antenna misalignment losses, antenna noise, Amplification noise temperature, System noise, effect of rain.
   Satellite dish antenna, Antenna design considerations for satellite communication, example on parabolic dish design.
   (Ref. Satellite Communication Dennis Robby McGraw Hill Publication Fourth Edition (International Edition))

4. **Antenna positioning System and Algorithms [15]**
   Pointing error sources, models, control algorithms, command preprocessor, AZ track imperfection, conscan.
   (Ref. Wodek Gawronski, "Control and Pointing Challenges of the NASA deep space Network antennas," 8th IEEE International Conference on methods and model in automation and robotics szczcin, Poland, Sept 2002.)
   Antenna under test (Control engineer point of view), performance criteria and design goals, PI controller, LQG controller, H∞ controller, Hardware restriction.

(Ref. Wodek Gawronski, "Antenna Control System: From PI to H∞," IEEE antennas and Propagation Vol. 43, No. 1, 2001)

Open loop model, PI controller and rigid antenna, LQG controller and flexible antenna, Properties of LQG weight, limits of LQG weight, LQG controller tuning procedure.

(Ref. Wodek Gawronski,"Antenna LQG controllers: Properties, Limits of Performance and Tuning Procedure," Proceeding of the 16th IFAC world congress 2005 vol. 16, part.1)

Mechanical drives, gear drives, classification of gears, selection of types of gears, law of gearing, standard system of gear teeth, backslash, number of teeth face width

(Ref. Design of Machine Elements V.B. Bhandari Tata McGraw Hill Education Private Limited Third Edition-2011)

References

1. Antenna and wave propagation John D Kraus, Ronald J Marhefka Ahmad S Khan Tata McGraw Hill Education Private Limited Fourth Edition
2. Antenna and Wave propagation G.S.N. Raju Pearson Publication Fifth Impression-2011
3. Satellite Communication Dennis Reddy McGrawHill Publication Fourth Edition(International Edition) 2006
4. Design of Machine Elements V.B. Bhandari Tata McGraw Hill Education Private Limited Third Edition-2011
5. Wodek Gawronski, "Control and Pointing Chanllenges of NASA deep space network antennas", 8th IEEE international conference on methods and model in automation and robotics szczcin, Poland, sept 2002
6. Wodek Gawronski, Antenna control system: from PI to H∞", IEEE antennas and propagation vol. 43 No.1 2001
7. Wodek Gawronski,"Antenna LQG controllers: Properties, Limits of Performance and Tuning Procedure," Proceeding of the 16th IFAC world congress 2005 vol. 16, part.1