

Ph. D. Course work In Instrumentation Science, University of Pune

1. Research Methodology

Research Strategy: meaning of research, motivation, objective and significance of research, theoretical approaches problem and purpose statements research question/hypothesis, survey research, literature reviews, data collection and writing up and interpreting statistical results, graphical representation of experimental data.

Research procedure: Research framework, conceptualization phase, empirical and design approach, research material, research strategy, time planning

[1] Leedy, P D and Ormrod, J E *Practical Research: Planning and design* (8th ed,) Pearson Educational International and Prentice Hall: New Jersey, 2005.

[2] Badenhorst, Cecile *Research Writing: Breaking the Barriers*, Van Schaik, Pretoria, 2007.

2. Mathematical Methods for Instrumentation

Infinite series : Fundamental concepts, convergence tests, alternating series, series of finite numbers, Taylor's expansion, power series; review of linear ordinary, differential equations, singular points. Bessel functions, Legendre functions, Fourier series – advantages, uses, applicators, properties, integral transforms: development of Fourier integral, Laplace transforms its derivatives.

Books:

- 1) Mathematical methods for Physics & Engineering - K. E. Riley, M. P. Hobson and S. J. Bence published by Cambridge University Press, UK.
- 2) Mathematical Methods in the Physical Sciences - Mary L. Boas and published by Wiley Students Edition.
- 3) Mathematical methods for Physics – George Arfken

3. Soft Computing- Theory and Application

Numerical Analysis Using Soft Computing

Numerical Analysis, Euler's method, The trapezoidal rule, Runge–Kutta methods, the Poisson equation: Finite difference schemes, The finite element method, FORTRAN for use in system modeling, testing and specific instrumentation applications.

Software tools like MATLAB/ LABVIEW/ FORTRAN/C

OR

Computer Added Designing and Virtual Instrumentation

ORCAD and PSpice : Introduction to PCB design and cad, design flow by example, project structures and the layout tool set , introduction to industry standards, institute for printed circuits (IPC-association connecting , introduction to design for manufacturing, PCB design for signal integrity, making and editing capture parts, making and editing layout footprints, using off-page connectors with wires,

AUTOCAD: 3 - D solid modelers and constructive solid geometry: CAD system utilization and (10) application, Hidden surface algorithms and shading, Finite element systems, Computer aided drafting systems. Auto LISP: Basic arithmetic functions, advanced mathematical functions, various get functions, decision making, looping functions, handling system variables, file handling.

LabVIEW: Introduction to Windows API, Introduction to Lab VIEW, “G” language concept, Introduction to VI, Sample VI – making and execution on PC, use of signal accessories, DAQ and signal conditioning.

MATLAB: Introduction to MATLAB, Mathematical operations and handling of arrays, Matrices, Programming in MATLAB, File I/O handling, 2D plots, graphical user interface.

Software tools like AUTOCAD, ORCAD, PSpice

OR

4. Advance technique in signal conditioning and analysis

Type of noise, noise measurement and reduction techniques, discrete time and frequency analysis, DFT, STFT, discrete wavelet transform and multi-resolution representation of the signals, noise reduction techniques and designing of digital filters.

Reference Books:

- [1] Introductory methods of Numerical Analysis - Rajaraman
- [2] A First Course in the Numerical Analysis of Differential Equations - Arieh Iserles, Cambridge Texts in Applied Mathematics.
- [3] Computer Oriented Numerical Methods - Rajaraman V.
- [4] Professional Programmer's Guide to Fortran 77 - Clive G. Page
- [5] LabVIEW Graphical Programming - Gary W. Johnson, Richard Jennings, McGraw-Hill Professional Publishing.
- [6] Advanced LabVIEW Labs - John Essick, Prentice Hall.
- [7] LabVIEW for Everyone - Jeffrey Travis, Prentice Hall Virtual Instrumentation Using LabVIEW by Sanjay Gupta & Joseph John, Tata McGraw Hill, New Delhi.

- [8] Complete PCB Design Using OrCad Capture and Layout - Kraig Mitzner . Elsevier, Newnes.
- [9] Orcad Capture- User's Guide, Cadence PCB Systems Division (PSD) offices,
- [10] Computer aided design and manufacturing - C. B. Basat and C.W.K. Liu
- [11] Mathematical elements of computer graphics - Rogers and Adams
Illustrated Auto lisp by William Oliver
- [12] Engineering Drawing - N. D. Bhatt
- [13] MATLAB Programming by Y. Kirani Singh, B. B. Chaudhuri,
Prentice Hall of India.
- [14] Learning with LabVIEW 7 Express - Dr. Robert H. Bishop.
- [15] LabVIEW Digital Signal Processing - Cory Clark.
- [16] Electronics and Instrumentation for Scientists-Howard V. Malmstadt
Christie G. Enke, Stanley R. Crouch, Benjamin-Cummings Pub
Co,CA,USA