

**KADI SARVA VISHWA VIDYALAYA  
GANDHINAGAR**

**Ph.D. Course Work**

**In**

**ELECTRONICS**

**&**

**COMMUNICATION**

# Electronics & Communication Engineering

## Introduction:

The course work for the doctoral research has been made mandatory by the UGC. Kadi Sarva Vishwavidyalaya has decided to implement this aspect on the immediate basis for the benefit of the students pursuing Ph.D. The course work is designed in such a way as to support, motivate and encourage quality research. By undergoing this course work, the student will get equipped with fundamentals of research methodology, scientific communication and also recent developments in the field of specialization. The course work has to be completed by the student in a satisfactory way before submission of his/her dissertation thesis.

## Course Structure:

Paper	Title	University Examination		Total Marks
		Section-A	Section-B	
Paper-1	Research Methodology	60	40	100
Paper-2	Scientific Communication	60	40	100
Paper-3	Specialization paper (Recent trends in Electronics and communication Engineering)	100		100

- **Duration of examination for all three papers: 3 Hours**
- **Schedule of examinations may be every six months. Student should complete course work in a year (Two chances)**
- **Specialization paper does not have separate sections**

## **Paper-I: Research Methodology**

### **Section-A (Common to all faculties)**

- 1) Introduction to Research Methodology: Meaning of Research, Objectives of Research, Motivations in Research, Types of Research, Research Approaches, Significance of Research, Research Methods v/s Methodology, Research and Scientific Methods, Research Process, Criteria of Good Research – **3**
- 2) Defining the Research Problem: What is Research Problem?, Selecting the Problem, Necessity of and Techniques in defining the problem – **6**
- 3) Research Design: Meaning, Need, Features of Good Design, Concepts, Types. Basic Principles of Experimental Design, Developing a Research Plan – **6**
- 4) Sample Design: Implication, Steps. Criteria for selecting a sample procedure, Characteristics of Good sampling Procedure, Types of Sample Design, Selecting Random Samples, Complex random sampling Design – **7**
- 5) Measurement and Scaling Techniques: Measurement in Research, Measurement Scales, Sources of Errors in measurement, Tests of Second measurement, Technique of developing Measurement Tools, Meaning of Scaling, Scale Classification Bases, Important Scaling Techniques, Scale Construction Techniques – **10**
- 6) Methods of Data Collection: Collection of Primary Data, Observation Method, Interview method, Collection of Data through questionnaire and Schedules, Other methods. Collection of Secondary Data, Selection of appropriate method for data collection, Case Study Method, Guidelines for developing questionnaire, successful interviewing. Survey v/s experiment – **10**
- 7) Processing and analysis of Data: Processing Operations (Meaning, Problems), Data Analysis (Elements), Statistics in Research, Measures of Central Tendency, Dispersion, Asymmetry, Relationship. Regression Analysis, Multiple correlation and Regression, Partial Correlation, Association in case of Attributes – **10**
- 8) Sampling Fundamentals: Definition, Need, Important sampling Distribution, Central limit theorem Sampling Theory, Sandler's A-test, Concept of Standard Error, Estimation, Estimating population

mean, proportion. Sample size and its determination, Determination of sample size Based on i) Precision Rate and Confidence level ii) Bayesian Statistics – **12**

- 9) Testing of Hypothesis: Meaning, Basic concepts, Flow diagram, Power of a hypothesis test, Important parametric tests, Hypothesis Testing of Means, Differences between Means, Comparing Two related samples, Testing of Proportion, Difference between proportions, Comparing variance to hypothesized population variance, Equality of variances of two normal populations, hypothesis testing of Correlation coefficients, Limitations of Tests of hypothesis – **12**
- 10) Chi- square test: Applications, Steps, characteristics, limitations – **3**
- 11) Analysis of Variance and Covariance: Basic Principles, techniques, applications, Assumptions, limitations – **7**
- 12) Analysis of Non-parametric or distribution-free Tests: Sign Test, Fisher-Irwin Test, McNemer Test, Wilcoxon Matched pair Test (Signed Rank Test), Rank - **7**
- 13) Sum Tests: a) Wilcoxon-Mann-Whitney Test b)Kruskal-Wallis Test, One sample Runs Test, Spearman's Rank Correlation, Kendall's Coefficient of Concordance, Multivariate Analysis Techniques: Characteristics, Application, Classification, Variables, Techniques, Factor Analysis (Methods, Rotation), Path Analysis - **7**

**Reference Books: Latest Editions of following Books**

- 1) Kothari, C.R., Research Methodology (Methods and Techniques), New Age Publisher
- 2) Fundamentals of modern statistical methods By *Rand R. Wilcox*
- 3) Power Analysis for Experimental Research A Practical Guide for the Biological, Medical and Social Sciences by *R. Barker Bausell, Yu-Fang Li* Cambridge University Press
- 4) Design of Experiments: Statistical Principles of Research Design and Analysis, by *Robert O. Kuehl* Brooks/Cole

## **Section-B (Faculty of Electronics & Communication)**

### **Research Areas:**

Microelectronics, Wireless Communication, Data communication and Networking, Wavelets, VLSI design and technology, Speech Processing, Image Processing, Electronics Systems, Fiber optic, Signal Processing, Biomedical Electronics and Related areas of Electronics and Communication

### **Exercise:**

- Select the area of research.
- Define a problem.
- Outline the Title
- Survey of Literature and its documentation
- Formulation of Research hypothesis with expected outcomes
- Research Plan
- Requirements Engineering
- Research Design: Model, Architecture, Prototyping
- Implementation of Prototype and data collection
- Data Analysis: Use of Software Tools like MATLAB, SPSS, etc.
- Testing
- Evaluation
- Future scope of research

### **Evaluation:**

[Based on university examination, 100 marks paper of 3hrs]

**Section A** will be having a weightage of 60 marks. Questions will be of objective types.

**Section-B** marks will be having a weightage of 40 marks.

## **Paper-II: Scientific Communication**

### **Section-A (Common for all faculties)**

1. Basics of Communication skill.
2. English Grammar
  - a) Word Choice, Sentence Structure, paragraph structure
3. Types of Scientific Communication.
4. Importance of publishing research paper
5. Publishing paper
  - a) Preliminaries, Format, Choosing Journal
  - b) Title, Running Title
  - c) Authors: Single and Multi authorship
  - d) Writing Abstract
  - e) Selecting Keywords
  - f) Introduction section
  - g) Materials and Methods Section
  - h) Result Section
  - i) Figures : Design Principles, Legends, Table components, Graphs: Types, Style, Tables v/s Graph
  - j) Discussion Section: Format, Grammar Style, Content.
  - k) Acknowledgements
  - l) References : Different Styles
  - m) Communication with the Editor, Handling Referees' Comments, Galey Proofs
6. Writing Review Articles
7. Preparing Posters for Scientific Presentation
8. Preparing and Delivering of Oral Presentation
9. Writing Practical Reports.
10. Avoiding Plagiarism
11. Research Grant funding Agencies, Preparing for application to grant providing Agencies.
12. Patent drafting and submission
13. IUPAC symbols and Terminology for physicochemical quantities and Units, SI prefixes, Fundamental Constants, Standard Abbreviations and Symbols
14. Preparing documents for Technology Transfers, MoUs, Confidentiality Agreements

### **Reference Books:**

- 1) Study and Communication Skills for the Biosciences by *Stuart Johnson and Jon Scott*, Oxford University Press
- 2) Write and Publish a Scientific Paper by *Robert A. Day* Oryx Press
- 3) Scientific Easy when you know how by *Jennifer Peat* BMJ Books

4) Research Projects and Research Proposals A Guide for Scientists Seeking Funding by *Paul G. Chapin* Cambridge University Press

**Section – B (Faculty of Electronics & Communication)**

**Exposure on**

- Study of general guidelines for authors in journals
- Study of research papers in the area of interest
- Analysis of studied research papers
- Planning for research paper
- Components of the planned research paper
- Critical parameters of each component
- Compilation of manuscript
- Preparation of Hardcopy and Softcopy version of manuscript
- Selection of Journal
- Submission of manuscript
- Final Submission of paper after review comments
- Select an area from emerging technologies
- Plan for an innovative project
- Plan for project proposal
- Compilation of proposal with data
- Selection of funding agency (UGC, AICTE, GUJCOST, DST, IT Ministry, CSIR, etc.
- Submission proposal to the agency.
- Use of MATLAB for scientific visualization of data.

**Evaluation:**

[Based on university examination, 100 marks paper of 3hrs]

**Section A** will be having a weightage of 60 marks. Questions will be of objective types.

**Section-B** marks will be having a weightage of 40 marks.

## **PAPER III: (Faculty of Electronics & Communication Engg.)**

### **RECENT TRENDS IN ELECTRONICS & COMMUNICATION**

#### **[1] Data and Communication Networks**

- Introduction to computer communication networks and layered architecture overview. Packet switching.
- Point to Point Protocols and links: ARQ retransmission strategies. Selective repeat ARQ. Framing and standard Data Link Control protocol-HDLC, SDLC, LAPD. Queuing models in communication networks.
- Multi access Communication and multiple access protocols:
- ALOHA, slotted ALOHA, CSMA, CSMA/CD. Performance modeling and analysis.
- Local Area Networks: Ethernet, Token Ring and FDDI.
- Internetworking issues: Bridges, Routers and Switched networks. Routing and Flow Control algorithms in data networks.
- IP addressing, subnetting, supernetting
- Internet Protocol
- IGMP, ICMP, ARP, RARP, DNS,
- UDP, TCP/IP Congestion and Flow Control in Internet-Throughput analysis of TCP congestion control. TCP for high bandwidth delay networks. Fairness issues in TCP.
- Broadband Networks: ATM, Frame relay and Gigabit Ethernet. Traffic Management in ATM networks.

#### **Texts/References**

1. TCP/IP protocol suite – 2<sup>nd</sup> Edition, Behrouz A. Forouzan
2. R G Gallager and D Bertsekas, Data Networks, Prentice Hall of India, 1992.
3. J F Hayes, Modeling and Analysis of Computer Communication Networks, Plenum Publishing Corporation, New York, 1984.
4. W Stallings, Data and Computer Communications, Prentice Hall of India, 1997.
5. R Rom and M Sidi, Multiple Access Protocols, Springer Verlag, 1990.
6. M DePrycker, ATM-solutions for Broadband ISDN, Prentice Hall of USA, 1995.
7. Jean Wairand and Pravin Varaiya, High Performance Communications Networks, Second Edition, 2000
8. Jean Le Boudec and Patrick Thiran, Network Calculus A Theory of Deterministic Queueing Systems for the Internet, Springer Verlag, 2001.
9. Zhang Wang, Internet QoS, Morgan Kaufman 2001



10. George Kesidis, ATM Network Performance, Kluwer Academic, 2000
5. Research Papers.

## **[2] Wavelets and its applications**

- Introduction to time frequency analysis; the how, what and why about wavelets.
- Short-time Fourier transforms, Wigner-Ville transform.
- Continuous time wavelet transform, discrete wavelet transform, tiling of the time-frequency plane and wave packet analysis.
- Orthogonal & orthonormal vectors suggested by SNS, Construction of wavelets. Multiresolution analysis. Introduction to frames and biorthogonal wavelets.
- Multirate signal processing and filter bank theory.
- Application of wavelet theory to signal denoising, image and video compression, multi-tone digital communication (do not know how it is related to wavelet may be omitted), transient detection.

## **Texts/References**

1. Y.T. Chan, Wavelet Basics, Kluwer Publishers, Boston, 1993.
- Daubechies, Ten Lectures on Wavelets, Society for Industrial and Applied Mathematics, Philadelphia, PA, 1992.
2. C. K. Chui, An Introduction to Wavelets, Academic Press Inc., New York, 1992.
3. Gerald Kaiser, A Friendly Guide to Wavelets, Birkhauser, New York, 1995.
4. P. P. Vaidyanathan, Multirate Systems and Filter Banks, Prentice Hall, New Jersey, 1993.
5. A.N. Akansu and R.A. Haddad, Multiresolution signal Decomposition: Transforms, Sub bands and Wavelets, Academic Press, Oranld, Florida, 1992.
6. B.Boashash, Time-Frequency signal analysis, In S.Haykin, (editor), Advanced Spectral Analysis, pages 418--517. Prentice Hall, New Jersey, 1991.

### **[3] VLSI design and technology**

- Basics of VLSI Design, Review of MOS transistor models. CMOS logic families including static, dynamic and dual rail logic. Integrated Circuit Layout: Design Rules, Parasitics. Building blocks: ALU's, FIFO's, counters. VLSI system design: data and control path design, floor planning, Design methodology: Introduction to hardware description languages (VHDL), logic, circuit and layout verification. Design examples.
- VLSI in Communication circuits
- RF Design using VLSI circuits
- Environment for VLSI Technology: Clean room and safety requirements. Wafer cleaning processes and wet chemical etching techniques.

#### **Texts/References**

1. N. Weste and K. Eshraghian, Principles of CMOS VLSI Design, Addison Wesley, 1985
2. L. Glaser and D. Dobberpuhl, The Design and Analysis of VLSI Circuits, Addison Wesley, 1985
3. C. Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979.
4. J. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, 1997.
5. D. Perry, VHDL, 2nd Ed., McGraw Hill International, 1995.
6. C.Y. Chang and S.M.Sze (Ed), ULSI Technology, McGraw Hill Companies Inc, 1996.
7. S.K. Ghandhi, VLSI Fabrication Principles, John Wiley Inc., New York, 1983.
8. S.M. Sze (Ed), VLSI Technology, 2nd Edition, McGraw Hill, 1988.

#### **Digital Speech and Image Processing:**

- Discrete time signal and system, Classification of signals, The concept of frequency in continuous time and discrete time signals
- Transform representation of signals and systems,
- The speech signal, Digital speech processing, Speech synthesis systems
- Speaker verification and Identification, Speech recognition systems, Aids-to-the – Handicapped, Enhancement of signal quality.
- Introduction to image processing, Elements of digital image processing, Image enhancement techniques

#### **exts/References**

1. Digital Image Processing by Rafael C. Gonzalez, Richard E. Woods, Prentice Hall Publication
2. Digital Processing of Speech Signals by L.R.Rabiner and R.W.Schafer, Pearson Education