# SNDT Women's University

Shreemati Nathibai Damodar Thackersey Women's University



**NAAC -SSR**

**CRITERION III**

**Supporting Documents**

**for**

**3.4.1.1: Copy of the syllabus of the research methodology course work to indicate if research ethics is included**

# SNDT Women's University

## Research Methodology

## Detailed Course Syllabus

Credits: 4

Marks: 100

Delivery mode: online

Prerequisites: Basics of research methodology and ICT Skills

Faculty/Instructor: Pl refer to detailed course plan below

## Overview

Research is an essential part of Higher education today. University, an abode of knowledge is expected to conduct genuine and high quality research which has impact on the society. Teaching and Research should be synthesized so as to bring in relevance to the academic activity in the university. Linkages with Industry as well as other Government and Non-Government organizations also have very valuable influence on the research conducted in the Universities. SNDT Women's University places great importance on research. Faculty research, sponsored research as well as Departmental/ Institutional research are important research activities in the University.

Ph. D. Programme in SNDT Women's University is one such research activity which aims at enhancing, sharpening research skills of future researchers. In order to provide basic understanding about research in specific area, each Master programme has introduced a course (at least 4-credit) on Research methodology. This is true of all Universities in India as it is a mandatory requirement of Ph. D. Scholars.

This online course is planned to provide knowledge and skills in research methodology to Ph.D. Scholar (newly registered) as well as others who are interested in keeping up with new trends in research methodology in their respective discipline.

## Course Objectives

After completing this course you will be able to:

- ❖ Understand framework for scientific enquiry.
- ❖ Use electronic resources to conduct literature review
- ❖ Examine trends and patterns in the use of various research methods
- ❖ Select appropriate research method for conducting empirical research
- ❖ Use /develop/select appropriate tools for data collection
- ❖ Select statistical tools for data analysis
- ❖ Use appropriate software for data analysis
- ❖ Use appropriate style of preparing bibliography
- ❖ Prepare a research proposal
- ❖ Appreciate the benefits of various types of research

## Prerequisites

- ❖ For Ph. D. Scholars: Admission to Ph.D. Programme in SNDT Women's University

### Knowledge and skills

- ❖ Basic knowledge of research process
- ❖ Readings of suggested articles/papers

### ICT Related Skills

- ❖ Use of computer and internet
- ❖ Use of email
- ❖ Knowledge of web 2.0 tools (like use of Blog, Group, Google document/Google Drive, etc. ) is desirable.

**Course Outline**

The course Modules and units for Research Methodology (RM) include the following:

# Module 1: Research

**Objectives:** After completing this module you will be able to:

1. Understand framework for scientific enquiry.
2. Differentiate between 'Basic', 'Applied' and 'Action' Research
3. Select and define appropriate research problem and parameters

**Content**

1.1 What is research?
1.2 Types of research, some contemporary thoughts on Research
1.3 Basic, Applied, Action, Evaluation research

# Module 2: Literature Review

**Objectives:** After completing this module you will be able to:

1. Understand importance of electronic databases
2. Know various techniques of literature review
3. Prepare a review on a selected topic of study.
4. Differentiate between literature search and literature review

**Content**

2.1 Use of Electronic Databases
2.2 Use of Online Journals

# Module 3: Research Process

**Objectives:** After completing this module you will be able to:

1. Identify Research problem
2. Propose higher order objectives / Research Questions
3. State Hypotheses
4. Identify measures to test hypotheses

**Content**

4.1   Objectives, Research Questions
4.2   Hypothesis
4.3   Assumptions

# Module 4:  Research Methods

**Objectives:** After completing this module you will be able to:

1.   Understand various methods of research
2.   State characteristics of research methods
3.   Understand various qualitative research methods
4.   Explain importance of qualitative research methods
5.   Compare Ethnographic study and Case Study methods.
6.   State types of Survey method
7.   Compare various Survey designs
8.   Use appropriate survey design
9.   Explain various Experimental designs
10.  Describe types of Action Research
11.  Understand process of conducting action research
12.  Explain need for using mixed methods.
13.  Select appropriate research design
14.  Select the most appropriate design for the research study

**Content**

4.1   Qualitative Research
       4.1.1   Ethnographic
       4.1.2   Naturalist
       4.1.3   Case Study
       4.1.4   Oral History

4.2   Quantitative Research
       4.2.1   Survey
                Descriptive, correlational, causal-comparative
       4.2.2   Experimental
                Experimental Designs

4.3   Action Research (AR)
       4.3.1   Philosophy of AR
       4.3.2   Types of AR

4.4   Mixed Methods
    4.4.1   Need for use of Mixed methods
    4.4.2   Triangulation

## Module 5: Tools and Techniques of Research

**Objectives:** After completing this module you will be able to:

1. State characteristics of tools of data collection
2. State characteristics of techniques of data collection
3. Understand strength of various tools of data collection
4. Develop tool for data collection
5. Select appropriate tool for data collection
6. Understand the coding requirements of the analysis process
7. Review atleast 1 tool and 1 test used for data collection
8. State the procedure for data collection
9. Prepare a plan for data analysis

**Contents**

5.1   Qualitative Research

    5.1.1   Focussed Group Interviews
    5.1.2   In-Depth Interviews
    5.1.3   Participative Observation
    5.1.4   Content Analysis
    5.1.5   Corroboration
    5.1.6   Triangulation

5.2   Quantitative Research

    5.2.1   Questionnaire
    5.2.2   Interview Schedule
    5.2.3   Observation Schedule

## Module 6: Sampling

**Objectives:** After completing this module you will be able to:

1. Understand concept of population and sample
2. Understand the process of sampling and generalizability of research
3. State characteristics of different sampling procedures

4.  Identify various techniques of sampling
5.  Select appropriate sampling technique

**Content**

6.1  Types of Sampling
    6.1.1  Sampling Design/Types of samples
    6.1.2  Procedure/Techniques of sampling
    6.1.3  Sampling and Generalisability of results

6.2  Sampling for Quantitative & Qualitative Studies

# Module 7: Data Analysis

**Objectives:** After completing this module you will be able to:

1.  Understand various types of data
2.  Identify statistical tools for Descriptive analysis and inferential analysis
3.  Select appropriate statistical tool for data analysis
4.  State statistical significance of the tools used.
5.  Test hypothesis using appropriate statistical tool.
6.  Use software for data analysis (SPSS)

**Content**

7.1  Type of Data and need for Analysis
7.2  Statistical Tools
    7.2.1  Descriptive Statistics
           Measures of Central Tendency, Variability, Association
    7.2.2  Inferential statistics
           t-ratio, F-Ratio, Analysis of Co-Variance
           chi-square

7.3  Use of Software for Data Analysis
    7.3.1  SPSS (Quantitative)

## Module 8:  Bibliography

**Objectives:** After completing this module you will be able to:
1. Understand importance of preparing bibliography
2. Identify different styles of preparing bibliography
3. Select appropriate style of bibliography for your research study
4. Differentiate between citation and bibliography

**Content**

14.1 Bibliography and Citation
14.2 Styles of preparing Bibliography

      14.2.1 APA (American Psychological Association) Style

      14.2.2 MLA (Modern Language Association) Style

      14.2.3 AMA (American Medical Association) Style

      14.2.4 Other styles (discipline specific)

14.3 Selection of appropriate style of Bibliography

## Module 9:  Research Ethics

**Objectives:** After completing this module you will be able to:
1. Understand importance of ethical research
2. Suggest ways for observing ethics in research

**Content**

9.1 Ethics in Research

## Module 10: Preparation of Research Proposal

**Objectives:** After completing this module you will be able to:
1. Understand process of preparing research proposal
2. Assess a given research proposal
3. Prepare a research proposal

**Content**

10.1 Process of preparation of research proposal,
10.2 Objectives, Research Questions, hypothesis, assumptions

## Evaluation/Assessment Scheme

| | | |
|---|---|---|
| 1. | Quizzes on Modules (Multiple Choice Questions) | 15 % |
| | These will be 7 quizzes of 6-10 marks. | |
| 2. | Final End of Course Test (30 MCQs) | 15 % |
| 3. | Assignments (4 in number) | 25 % |
| | 3 Individual and 1 group assignment | |
| 4. | Posts on Discussion Forum (6 Forum questions) | 10 % |
| 5. | Participation in Synchronous Sessions | 05 % |
| | (Minimum 10 sessions should be attended) | |
| 6. | Preparation of a research proposal | 30 % |

**Grade:**

| | | | | |
|---|---|---|---|---|
| O+ | 86+ | O | 80-85 |
| A | 70-79 | B | 60-69 |
| C | 50-59 | D | 40-49 |
| F | below 40 | | |

## Additional Course Readings

Additional readings are provided for all modules as downloadable PDF files on Moodle classroom website or as links to readings located on the Internet. Check the readings and presentations for each module.

## Access Moodle classroom

Access Moodle Classroom for more readings (in pdf format) and presentations by the faculty/Instructor. This classroom is created especially for your batch and all faculty members will use it to upload their SLM and presentations week-wise.  Access to the Learning Management System (LMS), Moodle, will be provided from June 20, 2015.

## Pre-Course Activities

1. Register yourself for the Online Course by sending email to rmonline@sndt.ac.in with an attachment of Registration Form.
2. On submission of the Registration form, you will get an invitation from the Course teacher/Admin to log in to your Moodle Account, specially created for this Online Course. Please log in and explore Moodle Learning Management System (LMS).
3. You will also receive an invitation from Admin of this course for WizIQ. We shall be conducting many activities including synchronous interactive sessions using WizIQ.

4.  A blog (Research Methodology 2015) is created for this Online Course; all participants are required to visit this blog regularly.
5.  Please create your own blog for this course using blogger.com. Please invite the teachers/ instructors of this course to your blog. All these blogs will be connected to the Course blog. Participants are expected to write on their blog regularly (including some assignments). You will be posting on this blog your thoughts, reflections as well as some assignments (which need to use blog specifically).
6.  Resources will be posted on the Moodle Course website as well as WizIQ so that all participants get access to all the learning resources.
7.  There will be one Synchronous Interactive session of One Hour each per week (11 am to 12 noon).

## Course methodology

It is an online course conducted using Moodle as Learning Management System (LMS). The learning Modules will be posted on Course website on Moodle. Detailed course schedule is posted on the course website which will give you an idea of all the activities/ assignments/ project work etc. expected of you. There will be group work as well. Active participation of all the participants is very essential.

A blog is specially created for this Course (http://sndtwu-rm615.blogspot.in/). There will be a weekly posting on this blog. All participants are expected to create their own blog or use their existing blog and post their comments on the Professor's blog regularly. Research Methodology blog will be a restricted blog for the participants by invitation only.

Quizzes on each unit (and subunits) will be available on Moodle Course site at a date and time announced in the class at least 3 days in advance.

## Post Course Activities

The Course aims at facilitating the process of understanding concepts and trends in Research methodology. The participants are expected to prepare a research proposal after going through this 4-credit course. This proposal should be submitted within one week of the course closure (Sept. 27). The HOD and Guide will arrange for a Presentation of proposal after giving feedback on the same.

A Certificate (Hard copy as well as a pdf file) of successful participation will be issued by the Director, BCUD on successful completion of all tasks/assignments.

## Readings:

### (मराठी आणि हिन्दी ग्रंथसूची)

आवलगावकर, अ. (संपादक). (2006). *मराठी साहित्यसंशोधन नव्या दिशा.* पुणे: प्रतिमा प्रकाशन.

कार्लेकर, श्री., आणि काळे, मो. (2007). *भूगोल शास्त्रातील संशोधन पध्दती.* पुणे: डायमंड पब्लिकेशन्स्.

जैन, गो. (2009). *आधुनिक शोध प्रणाली.* जयपुर: श्रीनिवास पब्लिकेशन्स्, (H)

ताटके, नी. (2008). *संशोधन करताना....* पुणे: डायमंड. (M)

धुरी, नी. (2008). *संशोधन पध्दती.* कोल्हापुर: फडके प्रकाशन.(M)

पाटकर, वि. (2007). *संशोधन-मार्गावरील प्रवास.* मुंबई: डॉ विवेक पाटकर. (M)

पाण्डेय, ग. आणि पाण्डेय, अ.(2005). *शोध प्रविधि नई.* दिल्ली: राधा पब्लिकेशन्स. (H)

बोरूडे, रा. (2005). *संशोधन पध्दतीशास्त्र.* पुणे: पुणे विद्यार्थी गृह प्रकाशन. (M)

मालशे, मिलिंद (2011). *प्रयोगकलांसाठी संशोधनपद्धती.* मुंबई: लोकवाङ्मय गृह. (M)

मालशे, स.गं आणि मिलिंद (2007). (संपादक). *शोधनिबंधाची लेखनपद्धती.* मुंबई: लोकवाङ्मय गृह. (M)

## In English

Adams, J., Khan, H. T. A., Raeside, R. & White, D. (2007). *Research methods for graduate business and social science students.* New Delhi: Response Books.

Alston, M. & Bowles, W. (2003*). Research for social workers: an introduction to methods* (2nd ed.). New Delhi: Rawat.

Angrosino, M. (2007). *Doing ethnographic and observational research.* Los Angeles: Sage.

Banks, M. (2007). *Using visual data in qualitative research.* Los Angeles: Sage.

Barbour, R. (2007). *Doing focus groups.* Los Angeles: Sage.

Bond, A. (2007). *Your master's thesis: How to plan, draft, write and revise* (2nd ed.).  New  Delhi:  Viva  Books. (J)

Boeije, H. (2010). *Analysis in qualitative research*. New  Delhi: Sage.

Chaudhary, C. M. (2009).  *Research methodology*. Jaipur: RBSA publishers. (J)

Clark, P., Vicky, L. & Creswell, J. W. (2008). *The Mixed methods reader*. Los Angeles: Sage Publ. (J)

Cohen, L., Manion, L. & Morrison, K. (2007). *Research methods in education*  (6th ed.).  Oxon:  Routledge.

Coppin, J. & Nelson, E. (2005). *The art of inquiry: A depth psychological perspective* (2nd ed.). Connecticut:  Spring Publ.

Creswell, J. W.(2007). *Qualitative inquiry & research design : Choosing among five approaches* 2nd ed.).  Thousand Oaks:  Sage.

Creswell, J. W. (2009). *Research design [qualitative, quantitative, and mixed method approaches].* (3rd ed.).  London: Sage. (J)

Czaja, R. & Blair, J. (2005). *Designing surveys[ a guide to decisions and procedures].*  (2nd ed.).  Thousand Oaks: Pine Forge Press.

Dane, F. C. (2011). *Evaluating research.  [methodology for people who need to read research].* Los Angeles: Sage. (J)

Das, D. K. (2004). *Practice of social research social work perspective*.  Jaipur:  Rawat.

Engel, R. J. & Schutt, R. K. (2009). *The practice of research in social work* (2nd ed.).  Los Angeles:  Sage.

Flick, U. (2009).  *An introduction to qualitative research*  (4th ed.). Los Angeles: Sage. (J)

Flick, U. (2007). *Managing quality in qualitative research*.  Los Angeles:  Sage.

Flick, U. (2007). *Designing qualitative research*.  Los Angeles:  Sage.

Fowler, F. J. (2009). *Survey research methods* (4th ed.).  Los Angeles:  Sage.

Gibbs, G. R. (2007). *Analyzing qualitative data*.  Los Angeles:  Sage.

Glenn, J. C. (2010). *Handbook of research methods*.  New Delhi:  Oxford Book Company. (J)

James, E. A., Milenkiewicz, M. T. & Bucknam, A.(2008).  *Participatory action research for educational leadership : Using data-driven decision making to improve schools*. Los Angeles: Sage.

Kamath, R. & Udipi, S.(2010). *Thesis and scientific writing: Process form and content*. Udaipur: Agrotech Publishing Academy.(J)

Kitchin, R. & Duncan F. (2005). *The Academic's guide to publishing*. New Delhi: Vistaar.

Kothari, C. R. (2008). *Research methodology : Methods and techniques* (2nd rev ed.). New Delhi: New Age International.

Kumar, A. (2011). *Methods in psychological research.* New Delhi: Anmol Publ.

Kvale, S. (2007). *Doing interviews*. Los Angeles: Sage. (J)

Lenburg, J. (2007). *Viva facts on file: Guide to research*.  New Delhi: Viva Books.

Locke, L. F., Silverman, S. J. & Spirduso, W. W.(2010). *Reading and understanding research* (3rd ed.).
     Los Angeles: Sage Publication.(J)

Madan, P., Paliwal, V. & Bhardwaj, R. (2010). *Research methodology* . New Delhi: Global Vision Publishing House. (J)

McBride, D. M. (2010).  *The Process of research in Psychology*. Los Angeles: Sage.

McBride, D. M. & Cutting, J C.(2010). *Lab manual for psychological research* (2nd ed.).  Los Angeles: Sage.

Nadkarni, M. V. & Deshpande, R. S. (eds.) (2011).  *Social science research in India [institutions and structure]*. New Delhi: Academic foundation.(J)

Nestor, P. G. & Schutt, R. K. (2012). *Research methods in psychology: Investigating human behavior*. Los Angeles: Sage.

Oates, B. J. (2006). *Researching information systems and computing.* New Delhi: Sage.

Pathak, R. P. (2008). *Methodology of educational research*. New Delhi: Atlantic Publ.

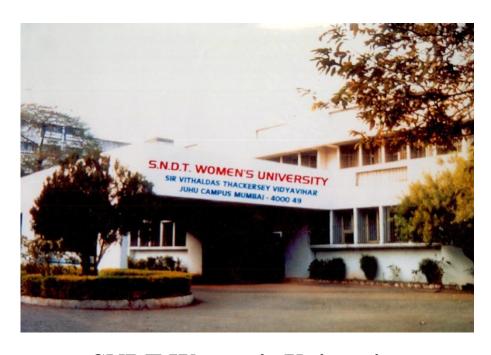Pandya, S. R. (2010). *Educational research*. New Delhi: A P H Publ.

Phophalia, A. K. (2010). *Modern research methodology [new trends and techniques].* Jaipur: Paradise Publisher.(J)

Polonsky, M. J. & Waller, D. S. (2009). *Designing and managing a research project [a business student's guide].* New Delhi: Response Books. (J)

*Publication manual of the American Psychological  Association.* (2010).(6th ed.). Washington: American Psychological Association.

Rapley, T. (2007). *Doing conversation discourse and document analysis.*  Los Angeles: Sage.

Ruane, J. M. (2005).  *Essentials of research methods : A guide to social science research*. Malden: Blackwell.

Rubin, A. & Babbie, E. R. (2011). *Methodology for social work research*.  New Delhi: Cengage Learning India.

Salkind, N. J. (ed.) (2010).  *Encyclopedia of research design vols.1-3.* Los Angeles:  Sage.

Sarantakos, S. (2005). *Social research* (3rd ed.).New York: Palgrave Macmillan.

Sharma, J. N.(2007). *Research methodolog : The discipline and its dimensions.* New Delhi: Deep & Deep.

Shenoy, G. V. & Pant, M. (2006). *Statistical methods in business and social sciences.* Delhi: Macmillan India Ltd. (J)

Smith, J. A. (ed.) (2008). *Qualitative psychology : A practical guide to research methods* (2nd ed.).  Los Angeles: Sage.

Taylor, B., Sinha, G. & Ghoshal, T. (2006).  *Research methodology : A guide for researchers in   management & social sciences*. New Delhi: Prentice Hall of India.

Vijaylakshmi, G & Sivaporagasam (2008). *Research methods [tips and techniques]* . Chennai: MJP Publishers. (J)

Whittaker, A. (2009). *Research skills for social work*. Exeter: Learning Matters.

Wimmer, R. D. & Dominick, J. R. (2006). *Mass media research: Process, approaches, and applications.*  New Delhi: Cengage Learning.(J)

# SNDT Women's University

**(sndt.digitaluniversity.ac)**

## Syllabus M.Tech.

## in

## Electronics and Communication



## SNDT Women's University

**1, Nathibai Thackersey Road,**

**Mumbai 400 020 Revised – 2013**

| | SNDT Women's University |
|---|---|
| | 1, Nathibai Thackersey Road, Mumbai 400020 |

**SNDT Women's University**

**SCHEME OF INSTRUCTION AND EVALUATION**

**Programme: M.Tech (Electronics and Communication)**

<u>**Scheme for Semester I**</u>

| Sr. No | Subjects | No. of Periods per week (60 minutes each) | | | Credits | Duration of Theory papers (Hours) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Lecture | Practical | Tutorial | | | Theory (%) | Term-work(%) | Oral | Total (100%) |
| 1 | Statistical Signal Analysis | 3 | | 2 | 4 | 3 | 50 | 50 | | 100 |
| 2 | Research Methodology | 3 | | - | 4 | 3 | 50 | 50 | | 100 |
| 3 | Error correcting code | 3 | | 2 | 4 | 3 | 50 | 50 | | 100 |
| 4 | Advance Computer Network | 3 | | | 4 | 3 | 50 | 50 | | 100 |
| 5 | Elective-I | 3 | | - | 4 | 3 | 50 | 50 | | 100 |
| 6 | Seminar | | 4 | | 2 | | | 50 | 50 | 100 |
| Total…. | | 15 | 14 | 04 | 24 | - | 250 | 300 | 50 | 600 |

## Scheme for Semester II

| Sr. No | Subjects | No. of Periods per week (60 minutes each) | | | Credits | Duration of Theory papers (Hours) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Lecture | Practical | Tutorial | | | Theory | Term-work | Oral | Total |
| 1 | Optical Network | 3 | | - | 4 | 3 | 50 | 50 | | 100 |
| 2 | Electronic Warfare system | 3 | | 2 | 4 | 3 | 50 | 50 | | 100 |
| 3 | Advance Wireless communication | 3 | | - | 4 | 3 | 50 | 50 | | 100 |
| 4 | R&D Project | - | 4 | - | 2 | - | - | 50 | 50 | 100 |
| 5 | Network Planning , Design and Management | 3 | | 2 | 4 | 3 | 50 | 50 | | 100 |
| 6 | Elective -II | 3 | | 2 | 4 | 3 | 50 | 50 | | 100 |
| Total…. | | 15 | 4 | 6 | 24 | - | 250 | 300 | 50 | 600 |

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## Scheme for Semester III

| Sr. No | Subjects | No. of Periods per week (60 minutes each) | | | Credits | Duration of Theory papers (Hours) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Lecture | Practical | Tutorial | | | Theory | Term-work | Oral | Total |
| 1 | Adaptive signal processing | 3 | | 2 | 4 | 3 | 50 | 50 | | 100 |
| 2 | Digital Message Transmission | 3 | | 2 | 4 | 3 | 50 | 50 | | 100 |
| 3 | Elective-III | 3 | | 2 | 4 | 3 | 50 | 50 | | 100 |
| 4 | Stage-I Project | | 8 | | 8 | | | 100 | 100 | 200 |
| 5 | Seminar/Project | | | | 4 | | | 50 | 50 | 100 |
| | **Total….** | **9** | **8** | **6** | **24** | **-** | **150** | **300** | **150** | **600** |

## Scheme for Semester IV

| Sr. No | Subjects | No. of Periods per week (60 minutes each) | | | Credits | Duration of Theory papers (Hours) | Marks | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Lecture | Practi-cal | Tuto-rial | | | Theory | Term-work | Oral | Total |
| 1 | Project–II Dissertation Report | | 2 | - | 12 | | | 150 | 150 | 300 |
| 2 | Project-II Dissertation Viva | | 2 | - | 12 | | | 150 | 150 | 300 |
| Total…. | | | 6 | | 24 | - | | 150 | 150 | 600 |

**Elective List for M.Tech Electronics and Communications**

**Students are required to select any one group. Once the group is selected it will be maintained for three semesters**

| Group Number | Group Name | Elective-I | Elective-II | Elective-III |
|---|---|---|---|---|
| Group-I | VLSI | VLSI Design | Mix Design using VLSI | VLSI Signal Processing |
| Group-II | HF Communication System | RF Circuit | RADAR and Navigations | Satellite Communication |
| Group-III | Signal Processing | Image Processing | Computer Vision | Speech Processing |

**Semester I**

**E501 Statistical Signal Analysis**

| | Objective :- To understand and study the statistical nature of signals and behavior of the systems. | | |
|---|---|---|---|
| **Sr. No** | **Topics and Details** | **No. of Hours** | **Weightage in %** |
| 1 | Review of probability theory and random variables: Transformation (function) of random variables Conditional expectation | 06 | 10 |
| 2 | Sequences of random variables: convergence of sequences of random variables. | 04 | 10 |
| 3 | Stochastic processes: wide sense stationary processes, orthogonal increment processes, Wiener process, and the Poisson process, KL expansion. | 08 | 20 |
| 4 | Ergodicity, Mean square continuity, mean square derivative and mean square integral of stochastic processes. | 08 | 20 |
| 5 | Stochastic systems: response of linear dynamic systems (e.g. state space or ARMA systems) to stochastic inputs; Lyapunov equations; correlational function; power spectral density function; introduction to linear least square estimation, Wiener filtering and Kalman filtering. | 14 | 40 |
| | | 40 | 100 |

**Text and Reference Books:**

1. A. Papoulis, Probability, Random Variables and stochastic processes, 2nd Ed., McGraw Hill, 1983.

2 . A. Larson and B.O. Schubert, Stochastic Processes, Vol.I and II, Holden-Day, 1979.

3.. Gardener, "Stochastic Processes", McGraw Hill, 1986

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**E502 Research Methodology**

**Research Methodology for Technology**

| | **Objective:-** To understand the basic process and steps of research in engineering, and study various presentation models of research. | |
|---|---|---|
| **Sr. No** | **Topics and Details** | **Weightage in %** |
| 1 | Research Basic:<br><br>What is research, Importance of Research, Role of research in society, aims and Objective of Research, Literature Survey, purpose and use of literature survey, various resources for literature survey, presentation of compiled literature reviews of various models and methods in literature survey. Identification of thrust areas, formulation of Problems, research objectives. | 25% |
| 2 | Design of research:-Problem Definition, Data collection, steps in design process, Introduction to various statistical tools for data analysis, modeling, simulation packages and tools, characterization of Experimental process. | 25% |
| 3 | Research Presentation:- Research paper writing, paper presentation, Introduction to presentation tools, thesis writing, introduction to tools for writing thesis and graphics for presentation of thesis. Introductions to patents, process of filing patents etc. | 25% |
| 4 | Ethics and Morals in Research:-Issues related to Plagiarism, acknowledgements, intellectual property rights, copy rights etc<br><br>Project proposal suggested by BOS | 25% |

**Text and Reference Books:**

1. Kothari  C K, "Research Methodology  Research and Techniques"
   second Ed,  Vishwa Prakashan,  New Delhi, 2009.

2. Montgomery, Douglus C, "Design and Analysis of Experiment" 5$^{th}$ Edition,
   Wiley India, 2007.

3. Murry R, "How to write Thesis" 2ed  Tata Mc Graw Hill, 2010.

**E602 Error Correcting Codes**

| | Objective :- To study and understand various error correcting codes, in discrete , wireless and optical communications, with its various properties and analysis. | | |
|---|---|---|---|
| **Sr. No** | **Topics and Details** | **No. of Hours** | **Weightage in %** |
| 1 | Linear block codes : Systematic linear codes and optimum decoding for the binary symmetric channel; | 08 | 15 |
| 2 | Generator and Parity Check matrices, Syndrome decoding on symmetric channels; Hamming codes; Weight enumerators and the MacWilliams identities; Perfect codes. | 08 | 20 |
| 3 | Introduction to finite fields and finite rings; factorization of $(X^{n-1})$ over a finite field; Cyclic Codes. | 04 | 15 |
| 4 | BCH codes; Idempotent and Mattson-Solomon polynomials; Reed-Solomon codes, Justeen codes, MDS codes, Alterant, Goppa and generalized BCH codes; Spectral properties of cyclic codes. | 06 | 15 |
| 5 | Decoding of BCH codes: Berlekamp's decoding algorithm, Massey's minimum shift register synthesis technique and its relation to Berlekamp's algorithm. A fast Berlekamp - Massey algorithm. | 06 | 15 |
| 6 | Convolution codes; Wozencraft's sequential decoding algorithm, Fann's algorithm and other sequential decoding algorithms; Viterbi decoding algorithm. | 08 | 20 |

**Texts and Reference Books**

1.F.J. MacWilliams and N.J.A. Slone, The theory of error correcting codes,

 North Holland, 1977.


2.R.E. Balahut, Theory and practice of error control codes, Addison Wesley, 1983.

10

**Advance Communication Network**

| | Objective:- To study the latest trends in networking, characterization of networks, its models, traffic analysis. | | |
|---|---|---|---|
| **Sr. No** | **Topics and Details** | **No. of Hours** | **Weightage in %** |
| 1 | Overview of Internet-Concepts, challenges and history. Overview of high speed networks-ATM. TCP/IP Congestion and Flow Control in Internet-Throughput analysis of TCP congestion control. TCP for high bandwidth delay networks. Fairness issues in TCP. | 06 | 15 |
| 2 | Real Time Communications over Internet. Adaptive applications. Latency and throughput issues. Integrated Services Model (intServ). Resource reservation in Internet. RSVP. | 06 | 15 |
| 3 | Characterization of Traffic by Linearly Bounded arrival Processes (LBAP). Concept of (o,, p) regulator. Leaky bucket algorithm and its properties. | 04 | 10 |
| 4 | Packet Scheduling Algorithms-requirements and choices. Scheduling guaranteed service connections. GPS, WFQ and Rate proportional algorithms. High speed scheduler design. | 04 | 10 |
| 5 | Active Queue Management - RED, WRED and Virtual clock. Control theoretic analysis of active queue management. | 04 | 10 |
| 6 | IP address lookup-challenges. Packet classification algorithms and Flow Identification- Grid of Tries, Cross producting and controlled prefix expansion algorithms. | 04 | 10 |
| 7 | Admission control in Internet. Concept of Effective bandwidth. Measurement based admission control. Differentiated Services in Internet (DiffServ). DiffServ architecture and framework. | 06 | 15 |

| 8 | IP switching and MPLS-Overview of IP over ATM and its evolution to IP switching. MPLS architecture and framework. MPLS Protocols. Traffic engineering issues in MPLS. [P control of Optical Routers. Lamda Switching, DWDM Networks | 06 | 15 |
|---|---|---|---|

**Text and Reference Books:**

1. Jean Wairand and Pravin Varaiya, High Performance Communications Networks,

   Second  Edition, 2000

2. Jean Le Boudec and Patrick Thiran, Network Calculus A Theory of Deterministic Queueing

   Systems for the Internet, Springer Veriag, 2001.

3. Zhang Wang, Internet Qo,5, Morgan Kaufman 2001

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

**Semster –II**

**E510  Optical Network**

| | Objective:- To study and understand the advancements in optical components and architectures from the view of the networks for access and backbone networks. | | |
|---|---|---|---|
| **Sr. No** | **Topics and Details** | **No. of Hours** | **Weightage in %** |
| 1 | Introduction to Optical Networks: Multiplexing technique, Optical Packet switching, Network evolution | 04 | 20 |
| 2 | Propagation of signal in Optical fiber : Chromatic Dispersion, Nonlinear Effects | 06 | 15 |
| 3 | Components: Couplers, Multiplexers, Isolators, Switches, Wavelength converters, Modulation, Subcarrier Modulation, Spectrum Efficiency, Optical Duobinary Modulation, Demodulation | 04 | 15 |
| 4 | Client layers of Optical layer, Storage area network, Gigabit and 10Gigabit Network, WDM Network elements, Optical ADD/DROP Mux, Optical Cross connects | 06 | 15 |
| 5 | WDM Network Design, LTD and RWA problem, Dimensioning wavelength Routing | 10 | 15 |
| 6 | Access Network , PON evolution, Photonic packet switching, Optical TDM, Synchronization, Buffering and burst switching | 10 | 20 |
| | | 40 | 100 |

**Text and Reference Books:**

1. Rajiv Ramaswami, Kumar N Sivarajan, Optical Networks: A Practical Prespecctive, Morgan Kauffman

13

2. Siva Ram Murthy and Mohan Guruswamy, WDM optical Networks, Prentice Hall India, 2002

3  J.E.  Midwinter,  Optical  fibers  for  transmission,  John Wiley, 1979.

4. J.Gowar, Optical communication systems, Prentice Hall  India, 1987.

5. S.E.  Miller  and  A.G. Chynoweth,  eds., Optical fibres telecommunications,

   Academic Press, 1979.

6. G.Agrawal,  Nonlinear fibre optics, Academic Press,  2nd  Ed. 1994.

7. G. Agrawal, Fiber optic Communication Systems, John Wiley  and sons, New York, 1992

8. F.C.  Allard,  Fiber  Optics  Handbook  for  engineers and scientists, McGraw Hill,

   New York (1990).

## E503 Electronics Warefare System

| | Objective:- To understand the architecture, design and analysis of various electronics systems in warfare with latest trends. | | |
|---|---|---|---|
| **Sr. No** | **Topics and Details** | **No. of Hours** | **Weightage in %** |
| | Objective :- Know electronics Warfare Principles, Design principles of EW receivers and transmitters subsystem and Modules. | | |
| 1 | Introduction:- Electronics Warfare, ELINT, SIGINT, ESM and ECM definitions, RADARS and EW mutual interaction. | 04 | 10 |
| 2 | Passive Systems:- Purpose, defense Chaff, Decoys, Advantages, Disadvantages, ECCM aspects, Surveillance (ESM) Characteristic such as Noise Figure, Noise skirt, Noise floor, sensitivity, Dynamic Range ECCM aspects.<br><br>Active Systems:- Defense Characteristics, Noise floor, Modulation, power output, Dynamic range, Advantages, Disadvantages, ECCM aspects. | 04 | 10 |
| 3 | Surveillance (ESM):- Direct receivers  Advantages/disadvantages, ECM aspects database EPL, Parameter list, ECM aspects, Super heterodyne (indirect) receivers:- scanning receivers advantages, disadvantages, wide open receivers advantages disadvantages, frequency scanning and space scanning. | 04 | 10 |
| 4 | Wide Open Receiver:- Segmentation frequency, IFM,DFD, Space, IDF, Array receivers frequency and Space:- Space coverage, Frequency Coverage, Advantages, Disadvantages. | 04 | 10 |

15

| 5 | Active Systems:- Defense, Data integration and receivers, on board systems, off board systems, dispensable, reusable, ECCM aspects. | 04 | 10 |
|---|---|---|---|
| 6 | Low Power Units:- Avoidance- Jammers, CW, FM, Noise Modulation, Spot, SSN, pulse Wobulation, staggers, Deception FML Pulse, CW, DRFM AM< FM, PM, Pulse CW, Rage Deception RGPO, RGPI, Hooks, Angular Deception, Radar Scan types, Related Deception Techniques. | 08 | 20 |
| 7 | High Power Units:- Real beam transmitter, MBAT, Phased arrays | 08 | 20 |

**Text and Reference Books:**

1. Rechard Poissel, "Introduction to Communication Electronics Warefare Systems" 2nd Edition, Artech House Intelligence and Information Operations, 2012.

2. Rechard Poissel, " Target Acquisition in Electronics Warefare Systems", 2nd Artech House Intelligence and Information Operations, 2012

3. D Curties Schleher, " Electronics Warfare, in information age" Artech House Radar Library, 2012.

**E512  Advance Wireless  Communication**

| | Objective:- To understand and study the latest trends and standards in wireless Communication for voice/ data/multimedia and other applications | | |
|---|---|---|---|
| **Sr. No** | **Topics and Details** | **No. of Hours** | **Weightage in %** |
| 1 | **Basics of Communication Engineering:**<br><br>Analog and Digital signal formats, RF fundamentals, Information capacity. | 04 | 10 |
| 2 | **RF Engineering and Signal Processing:**<br><br>Introduction to  mobile communication systems; GSM, CDMA 2000, UMTS and UTRAN technologies.<br><br>Transmission, reception, propagation, channel modeling, and signal processing; system performance and reliability; path loss; effects of different fading and empirical path loss models; antennas & antenna arrays; coverage and interference prediction maps; optimize the coverage of a radio; RF system measurements. | 10 | 25 |
| 3 | **Wireless Access Technologies:**<br><br>Wireless access networks, physical, MAC, and link layers. Building blocks, multiple access, mobility management, and spectrum implications in wireless access system design; design considerations to optimize capacity/coverage; bandwidth for a wireless system and tradeoffs; wireless access technology standards, their features, and evolution.<br><br>**Multiple access technologies:**<br><br>MIMO channels, uplink & downlink with multiple receive antennas, space division multiple access (SDMA) , capacity region, SDMA with multiple transmit antennas, OFDM systems. | 10 | 25 |

| 4 | **Network and Service Architecture:**<br><br>Network infrastructure, including core networks; service frameworks such as IMS; and application architectures such as voice, video streaming, and messaging. All-IP services architecture as in 3GPP Rel 6 and beyond, including Enhanced Packet Services (EPS) as in 3GPP Rel 8 LTE (Long Term Evolution) and EPC (Enhanced Packet Core). Service platforms, IP addressing schemes for various technologies; Quality of service (QoS); Load-balancing scheme; IP routing and ad hoc routing and mesh protocols; Capacity planning, error tracking, and trace analysis; evolution of mobile networks to enable IP multimedia. | 10 | 25 |
|---|---|---|---|
| 5 | **Network Management and Security:**<br><br>Fault, configuration, account, performance, maintenance, security management, management availability, and operation support systems. Fault monitoring system and performance monitoring system; types and methods of alarm reporting; availability and reliability metrics; potential impacts of known security attacks.<br><br>**Analytical methods:**<br><br>Probability theory in signal processing, Linear Algebra. | 06 | 15 |
| | | 40 | 100 |

**Texts and Reference Books:**

1 Wireless & Mobile Systems by Dharma Prakash Agarwal & Qing Ann Zeng

2. Mobile Cellular Telecommunications Systems by WCY Lee.

3. Mobile Radio Communications by Raymond Steele.

4. CDMA: Principles of Spread Spectrum Communications by A.J Veterbi.

5. VK Garg and JE Wilkes, Wireless and personal Communication Systems,

   Prentice Hall, 1996.

**Network and Service Management**

| | Objective:- To understand the various architectures, tools and standards in network and service management. | | |
|---|---|---|---|
| **Sr. No** | **Topics and Details** | **No. of Hours** | **Weightage in %** |
| 1 | Introduction to network management | 02 | 05 |
| 2 | Network management architectures and application, Functions. SNMP version 2 and 3 | 06 | 15 |
| 3 | Remote network monitoring statics collections, alarms, filters, traffic monitoring etc. Network management tools, systems and applications | 08 | 20 |
| 4 | Traffic sizing, Traffic Characteristics, Traffic Engineering and capacity planning | 08 | 20 |
| 5 | Technology Comparisions, Choosing the service provider | 08 | 20 |
| 6 | Access Network Design, Backbone Network Design | 08 | 20 |
| | | 40 | 100 |

**Text and Reference Book:**

1. Becker, Hal B., Functional Analysis of Information Networks: A Structured

2. Approach to the Data Communications Environment, John Wiley and Sons, New York,l973.
3. Flood, J. E. (ed.), Telecommunications Networks, International Scholarly Book

4. Services,ForestGrove,Oregon,l976. Kuehn, Richard A., Cost-Effective

   Telecommunications,AmericanManagementAssociation,NewYork,l975.
5. Martin, James Future Developments in Telecommunications, Prentice-Hall,

6. Martin, James, Telecommunications and the Computer, Prentice-Hall, Englewood Cliffs,

   NewJersey,1976.
7. Martin, James, Teleprocessing Network Organization, Prentice-Hall, Englewood

8. Darren L SPOHN, "Data Network Design, 3rd Edition , Tata Mcgraw Hill Edition,2002

**Semster-III**


**E601 Adaptive Signal processing**


| | Objection:- To understand and study various tool and algorithm for signal to have least error and BERs. | | |
|---|---|---|---|
| Sr. No | Topics and Details | No. of Hours | Weightage in % |
| 1 | Review of linear and non-linear estimation theory. Signal modelling. Optimal filtering | 08 | 20 |
| 2 | Adaptive filtering as an extension of the optimal least mean square error case | 08 | 20 |
| 3 | Adaptive algorithms: adaptive equalization and echo cancellation; adaptive lattice filters. | 08 | 20 |
| 4 | Application to radar, sonar, geophysics and hydrology, economic processes | 08 | 20 |
| 5 | Least Mean square, RMS Algorithm | 08 | 20 |
| | | 40 | 100 |


**Text and Reference Book:**


1. S. Haykin, Adaptive filter theory, Prentice Hall, 1986.


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2. B. Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall, 1984.

**E503 Digital Message Transmission**

| Sr. No | Topics and Details | No. of Hours | Weightage in % |
|---|---|---|---|
| | **Objective:- To study the statistical analysis of various digital communication messages from signal and system design aspect.** | | |
| 1 | Examples of analog pulse and digital transmission systems | 04 | 10 |
| 2 | Performance analysis of analog and pulse modulation systems. | 04 | 10 |
| 3 | Role and review of probability theory and stochastic processes in digital message transmission. | 04 | 10 |
| 4 | Principles of detection theory: Binary and m-ary hypothesis testing. Bayes' likelihood ratio test. | 04 | 10 |
| 5 | Principles of detection theory: Performance analysis of digital communication systems. | 04 | 10 |
| 6 | Spectrum of digital signals: Spectral efficiency of digital communication systems; Nyquist pulse shaping. Correlative coding schemes. | 08 | 20 |
| 7 | Equalization techniques | 08 | 20 |
| 8 | Synchronization techniques. Carrier, bit and frame synchronization schemes | 04 | 10 |
| | | 40 | 100 |

**Text and Reference Books:**

1.Wozencraft J.M. and Jacobs I.M., Principles of Communication Engineering,

   John Wiley, 1965.

2.Carlson A., Communication Systems, 3rd ed., McGraw Hill, 1986.

3.Van Trees H.L., Detection Estimation and Modulation Theory, Vol. 1., Wiley, 1968.

4.Proakis J.J., Digital Communications, 2nd Ed., McGraw Hill, 1989.

5.Blahut R.F., Digital transmission of Information, Addison Wesley 1990.

6.Benedetto S., Biglieri E. and Castellari V., Digital Transmission Theory, Prentice Hall, 1987.

**Electives**

**Group I :**

**VLSI Design**

| | **Objective :- To study the process and steps in VLSI design.** | | |
|---|---|---|---|
| **Sr. No** | **Topics and Details** | **No. of Hours** | **Weightage in %** |
| 1 | Review of Microelectronics and Introduction to MOS Technologies: MOS, CMOS, BiCMOS Technology, Trends And Projections. Basic Electrical Properties of MOS, CMOS & BiCMOS Circuits: Ids-Vds Relationships,Thereshols voltage Vt, Gm, Gds and ωo, Pass Transistor, MOS, CMOS & Bi CMOS Inverters, Zpu/Zpd, MOS Transistor circuit model, Latch-up in CMOS circuits. | 08 | 20 |
| 2 | LAYOUT DESIGN AND TOOLS: Transistor structures, Wires and Vias, Scalable Design rules, Layout Design tools. LOGIC GATES & LAYOUTS: Static Complementary Gates, Switch Logic, Alternative Gate circuits, Low power gates, Resistive and Inductive interconnect delays. | 08 | 20 |
| 3 | COMBINATIONAL LOGIC NETWORKS: Layouts, Simulation, Network delay, Interconnect design, Power optimization, Switch logic networks, Gate and Network testing. | 08 | 20 |

| 4 | SEQUENTIAL SYSTEMS: Memory cells and Arrays, Clocking disciplines, Design, Power optimization, Design<br><br>validation and testing. | 08 | 20 |
|---|---|---|---|
| 5 | FLOOR PLANNING & ARCHITECTURE DESIGN: Floor planning methods, off-chip connections, High-level<br><br>synthesis, Architecture for low power, SOCs and Embedded CPUs, Architecture testing. | 08 | 20 |
| | | 40 | 100 |

**Texts and Reference Books**

1. Essentials of VLSI Circuits and Systems, K. Eshraghian Eshraghian.

   D, A.Pucknell, 2005, PHI.

2. Modern VLSI Design - Wayne Wolf, 3rd ed., 1997, Pearson Education.

3 Principals of CMOS VLSI Design – N.H.E Weste, K.Eshraghian, 2 ed., Adisson Wesley.

**MIXDESIGN VLSI**

| Sr. No | Topics and Details | No. of Hours | Weightage in % |
|---|---|---|---|
| | **Objective :- To study and understand the mixed signal approach, its necessary and implementation with VLSI design.** | | |
| 1 | Introduction to Mixed-signal design; Advanced data converters: Working principle and architecture of a folding-and-interpolation ADC, Design of sample and hold amplifier, Design of folding amplifier and interpolation network, Design of decimation filter, Working principle and architecture of a Sigma-delta ADC, Design of basic and multistage sigma-delta converters, Working principle and architecture of a pipeline ADC. | 10 | 25 |
| 2 | Design of one-and-half-bit converter, Working principle and various architectures of high speed DAC, Working principle and architecture of a high resolution DAC; Clock and timing: Block diagram of a PLL, PLL based frequency synthesizer, Application and block diagram of a DLL, Design of a multiphase generator; Implementation of system on a chip and the associated issue: Precautionary measure for integrating analog and digital modules within an IC, Signal integrity, floor planning and physical design of mixed signal IC design. | 10 | 25 |
| 3 | Overview of RF system: Introduction to RF Transceiver architectures, Multiple access techniques, Different wireless standards, Various modulation techniques used in RF system. | 10 | 25 |
| 4 | Aspects and considerations of RF design: Low voltage and low power design, RF-models of devices; Building blocks of RF: Design of oscillator and mixer, Frequency synthesizer, Design of low noise amplifiers, Design of narrowband and wideband amplifiers, Design of high efficiency power amplifier, Matching network design; RF system design and testing: Design of RF system, Noise and distortion measures and mitigation methods. | 10 | 25 |
| | | 40 | 100 |

**Texts and Reference Books:**

1. CMOS mixed-signal circuit design by R. Jacob Baker, Wiley India, IEEE press, reprint 2008.
2. CMOS circuit design, layout and simulation by R. Jacob Baker Revised second edition, IEEE press, 2008.
3. Design of analog CMOS integrated circuits by Behad RazaviMcGraw-Hill, 2003.
4. Y.P. Tsividis Mixed  Analog and Digital VLSI Devices and Technology, McGraw Hill,1996

**VLSI for Signal Processing**

| | Objective :- To study and understand the need for VLSI design for signal processing, its requirements and various process. | | |
|---|---|---|---|
| **Sr. No** | **Topics and Details** | **No. of Hours** | **Weightage in %** |
| 1 | **UNIT I INTRODUCTION TO DSP SYSTEMS**<br><br>Introduction To DSP Systems -Typical DSP algorithms; Iteration Bound – data flow graph representations, loop bound and iteration bound, Longest path Matrix algorithm; Pipelining and parallel processing – Pipelining of FIR digital filters, parallel processing, pipelining and parallel processing for low power. | 10 | 25 |
| 2 | **UNIT II RETIMING**<br><br>Retiming - definitions and properties; Unfolding – algorithm for Unfolding, properties of unfolding, sample period reduction and parallel processing application; Algorithmic strength reduction in filters and transforms – 2-parallel FIR filter, 2-parallel fast FIR filter, DCT algorithm architecture transformation, parallel architectures for rank-order filters, Odd- Even Merge- Sort architecture, parallel rank-order filters | 10 | 25 |
| 3 | **UNIT III FAST CONVOLUTION**<br><br>Fast convolution – Cook-Toom algorithm, modified Cook-Took algorithm; Pipelined and parallel recursive and adaptive filters – inefficient/efficient single channel interleaving, Look- Ahead pipelining in first- order IIR filters, Look-Ahead pipelining with power-of-two decomposition, Clustered Look-Ahead pipelining, parallel processing of IIR filters, combined pipelining and parallel processing of IIR filters, pipelined adaptive digital filters, relaxed look-ahead, pipelined LMS adaptive filter. | 10 | 25 |
| 4 | **UNIT IV BIT-LEVEL ARITHMETIC ARCHITECTURES** Scaling and roundoff noise- scaling operation, roundoff noise, state variable description of digital filters, scaling and roundoff noise computation, roundoff noise in pipelined first-order filters; Bit-Level Arithmetic Architectures- parallel multipliers with sign extension, parallel carry-ripple array multipliers, parallel carry-save multiplier, 4x 4 bit Baugh-Wooley carry-save multiplication tabular form and implementation, design of Lyon"s bit-serial multipliers using Horner"s rule, bit-serial FIR filter, CSD representation, CSD multiplication using Horner"s rule for precision improvement. | 10 | 25 |

| 5 | **UNIT V PROGRAMMING DIGITAL SIGNAL PROCESSORS 9** <br> Numerical Strength Reduction – subexpression elimination, multiple constant multiplications, iterative matching. Linear transformations; Synchronous, Wave and asynchronous pipelining-synchronous pipelining and clocking styles, clock skew in edge-triggered single-phase clocking, two-phase clocking, wave pipelining, asynchronous pipelining bundled data versus dual rail protocol; Programming Digital Signal Processors – general architecture with important features; Low power Design – needs for low power VLSI chips, charging and discharging capacitance, short-circuit current of an inverter, CMOS leakage current, basic principles of low power design. | | |
| --- | --- | --- | --- |
| | | 40 | 100 |

**Texts and Reference Books**

1. Keshab K.Parhi, "VLSI Digital Signal Processing systems, Design and implementation",

   Wiley Inter Science, 1999.

2. Gary Yeap, "Practical Low Power Digital VLSI Design", Kluwer Academic Publishers, 1998.

3. Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing",

   Mc Graw-Hill, 1994.

**Group-II High Frequency Communication**


**E511 RF Circuit Design**


| | Objectve :- To study, understand and design various RF circuits. | | |
|---|---|---|---|
| **Sr. No** | **Topics and Details** | **No. of Hours** | **Weightage in %** |
| 1 | Introduction: Importance of RF design, RF behavior of Passive Components | 04 | 10 |
| 2 | RF Filter Design, Basic Resonator and Filter configuration, Filter types and parameters, Special Filter Realizations Butterworth type Filters, Chebyshev type filters, Coupled Filters | 06 | 20 |
| 3 | RF component modeling, Diode models, Transistor Models, Measurement of Active Devices<br><br>RF Transistor Amplifier Design<br><br>Characterstics of Amplifiers, amplifier Power relations, Stability Considerations, Broad band , high power and multistage amplifiers | 12 | 25 |
| 4 | Oscillator and mixers, Basic Oscillator Model, High frequency Oscillator Configuration, Fixed Frequency oscillator, Dielectric Resonator Model, Voltage controlled Oscillator, Gunn Element Oscillator, Basic characterstics of Mixers, Frequency Domain Considerations, Single ended Mixer design, Single balanced mixer | 12 | 25 |
| 5 | Introduction  to Microstrip Lines | 06 | 25 |
| | | 40 | 100 |

**Text and Reference Books**

1. Reinhold Ludwig, Pavel  Bretchko, " RF circuit Design."Pearsons 2001

2. R. Collin "Foundation of Microwave Engineering". 2nd Edition, Mc Graw Hill

3 Samuel Liao, "Microwave circuits and devices", 2nd ed. PHI, 1987

**RADAR and Navigations**

| Sr. No | Topics and Details | No. of Hours | Weightage in % |
|--------|--------------------|--------------|----------------|
| 1 | Radar and systems :- Overview, EW overview, ELINT, SIGINT, ESM and ECM definitions | 7 | 15 |
| 2 | Radar:- Principles, cross sections, equations, parameters such as frequency, PRI/PRF PW | 7 | 15 |
| 3 | Types of Radars:- Bistable, Pulse, FM/CM, CW Doppler, pulse Doppler, Pulse compression | 10 | 20 |
| 4 | Search Radars:- Range and direction detection, space coverage search radars | 7 | 15 |
| 5 | Tracking and locking Radars:- search phase, Track phase, Lock Phase, scanning type search radars, CS COSRO, LS, LORO, TWS, Mono Pulse | 10 | 20 |
| 6 | Application of RADARs in defense, navigation and other applications | 7 | 15 |
|  |  |  |  |

**Text and Reference Books:**

1.M.I.Skolnik, Introduction to Radar Systems, McGraw Hill, 1980.

2.D.K.Barton, Modern radar systems analysis, Artech House, 1988.

3.B,Edde, Radar: Principles, Technology, Applications, Prentice Hall, 1993.

**Satellite Communication**

| Sr. No | Topics and Details | No. of Hours | Weightage in % |
|---|---|---|---|
| 1 | **Introduction :**<br><br>• Origin of Satellite Communication.<br>• Development, Space Segment, Ground Segment<br>• Types of Orbit<br>• Evolution of Satellite Communications, Development of Service | | |
| 2 | **Link Analysis :**<br><br>• Characteristic parameters of an antenna, Received Signal Power at receiver input.<br>• Carrier to noise ratio fat the receiving input, Influence of the propagation medium.<br>• Compensation for the effects of the propagation medium constraints, Signal to noise ratio for a station-to-station link. | | |
| 3 | **Regenerative Satellite Networks :**<br><br>• Transparent and regenerative repeaters.<br>• Comparison of link budgets on board processing, Impact to the earth segment.<br>Orbits<br>• Keplerian Orbits, Useful orbits for Satellite Communication.<br>• Perturbations of the Orbits. | | |
| 4 | **Earth Stations :**<br><br>• Station Organisation, Radio Frequency Characteristics, Antenna subsystems.<br><br>• Radio Frequncy subsystem Communication subsystem | | |

| 5 | **Communication Payload :** | | |
|---|---|---|---|
| | • Mission and Characteristics of the payload. | | |
| | • Transparent repeaters, Multibeam Satellite repeaters, Regenerative repeater | | |
| | • Antenna Coverage, Antenna Characteristics. | | |
| | Platform | | |
| | • Subsystems, Attitude Control, Propulsion Subsystem, Electric Power supply, Telemetry, Tracking and Command, Thermal Control and Structure | | |
| 6 | **Satellite Installation and Space Environment** | | |
| | • Installation in orbit. Vaccum Mechanical Environment, Radiation flux of high energy particles, Environment during Installation, Satellite System availability. Component reliability. | | |

**Text and Reference Books:**

1. Satellite Communication Systems Techniques and Technology (3$^{rd}$ edition, Maral and

   M. Bousquet. John Wiley and sons.

2. VASAT Networks G. Maral, John Wiley and Sons.

3. Satellite Communication, Firs quarter century of Service David W.E. Rees John Wiley & Sons

4. Satellite Communications Systems Design Principles – Richard M. McGraw Hill.

5. CDMA, Principles of Spread Spectrum Communication – Andrew J. Virebi, Addition – Wiley 1995.

**Group-III: Signal Processing Group**

**Image Processing**

<table>
<tr><td colspan="2"><strong>Objectives:</strong><br><br>1. Identify, formulate and solve digital signal and image processing problems in a multidisciplinary environment, individually or as a member of a team.<br><br>2. Analyze, design and make use of systems, procedures and algorithms in order to achieve the proposed goals in a specific digital signal processing problem, making use of simulation, analysis and application development tools in this area (MATLAB), and to analyze and understand the given results.</td><td></td><td></td></tr>
<tr><td><strong>Sr. No</strong></td><td><strong>Topics and Details</strong></td><td><strong>No. of Hours</strong></td><td><strong>Weightage in %</strong></td></tr>
<tr><td>1</td><td>Image representation-Gray scale and colour Images, image sampling and quantization.</td><td>04</td><td>10</td></tr>
<tr><td>2</td><td>Two dimensional orthogonal transforms-DFT, FFT, WHT, Haar transform, KLT, DCT.</td><td>08</td><td>20</td></tr>
<tr><td>3</td><td>Image enhancement - filters in spatial and frequency domains, histogram-based processing, homomorphic filtering.</td><td>04</td><td>10</td></tr>
<tr><td>4</td><td>Edge detection - non parametric and model based approaches, LOG filters, localisation problem.</td><td>03</td><td>05</td></tr>
<tr><td>5</td><td>Image Restoration - PSF, circulant and block - circulant matrices, deconvolution, restoration using inverse filtering, Wiener filtering and maximum entropy-based methods.</td><td>04</td><td>10</td></tr>
<tr><td>6</td><td>Mathematical morphology - binary morphology, dilation, erosion, opening and closing, duality relations, gray scale morphology, applications such as hit-and-miss transform, thinning and shape decomposition.</td><td>04</td><td>10</td></tr>
<tr><td>7</td><td>Computer tomography - parallel beam projection, Radon transform, and its inverse, Back-projection operator, Fourier-slice theorem, CBP and FBP methods, ART, Fan beam projection</td><td>04</td><td>10</td></tr>
</table>

| 8 | Image communication - JPEG, MPEGs and H.26x standards, packet video, error concealment. Image texture analysis - co-occurence matrix, measures of textures, statistical models for textures. | 06 | 20 |
|---|---|---|---|
| 9 | Hough Transform, boundary detection, chain coding | 03 | 05 |
| | | 40 | 100 |

**Texts and Reference Books**

1.A. K. Jain, Fundamentals of digital image processing, Prentice Hall of India, 1989.

2.R.M. Haralick, and L.G. Shapiro, Computer and Robot Vision, Vol-1, Addison Wesley, Reading, MA, 1992.

3.R.Jain, R.Kasturi and B.G. Schunck,Machine Vision,McGraw-Hill International Edition, 1995.

4. W. K. Pratt, Digital image processing, Prentice Hall, 1989.

5. A. Rosenfold and A. C. Kak, Digital image processing, Vols. 1 and 2, Prentice Hall, 1986.

6. H. C. Andrew and B. R. Hunt, Digital image restoration, Prentice Hall, 1977

**Computer Vision**

| Sr. No | Topics and Details | No. of Hours | Weightage in % |
|---|---|---|---|
| 1 | Imaging model and geometry: scene radiance and image irradiance, reflectance model of a surface, Lambertian and specular reflectance, photometric stereo. | 08 | 20 |
| 2 | Ill-posedness of vision problems: regularization theory. | 06 | 15 |
| 3 | Shape from shading, structured light and texture. Optical flow, structure from motion and recursive motion analysis. Stereo vision and correspondence problem. | 08 | 20 |
| 4 | Depth analysis using real-aperture camera: depth from defocused images. | 04 | 10 |
| 5 | MRF approach to early vision problems: (shape from shading, matching, stereo and motion), Image texture analysis | 06 | 15 |
| 6 | Introduction to image understanding. | 04 | 10 |
| 7 | Integrated vision, sensor fusion. | 04 | 10 |

Suggestion by the BOS IEEE Biometric certification

**Texts and Reference Books:**

39

1 B. K. P. Horn, Robot Vision, MIT Press, 1986.

2.D. Marr, Vision, Freeman and Co., San Francisco, 1982

**Speech Processing**

| Sr. No | Topics and Details | No. of Hours | Weightage in % |
|--------|--------------------|--------------|----------------|
| 1 | Speech production and acoustic phonetics, speech perception. | 04 | 10 |
| 2 | Speech analysis: time and frequency domain techniques for pitch and formant estimation, cepstral and LPC analysis. | 08 | 20 |
| 3 | Speech synthesis: articulatory, formant, and LPC synthesis, voice response and text-to-speech systems. | 08 | 20 |
| 4 | Applications: data compression, vocoders, speech enhancement, speech recognition, speaker recognition, aids for the speech and hearing impairments. | 20 | 40 |

**Texts and Reference Books:**

1.D O'Shaughnessy, Speech Communication: Human and Machine, Addison Wesley, 1987.

2.L R Rabiner and RW Schafer, Digital Processing of Speech Signals, Prentice Hall, 1978.

3.JL Flanagan, Speech Analysis, Synthesis, and Perception, Springer Verlag, 1972.