

# E.G.S. PILLAY ENGINEERING COLLEGE

(Autonomous)

NAGAPATTINAM- 611 002.

(Affiliated to Anna University, Chennai | Accredited by NAAC with 'A++' Grade

Accredited by NBA | Approved by AICTE, New Delhi)



## REGULATIONS-R2024 M.E. COMMUNICATION SYSTEMS First Year – First Semester Curriculum

| Sl. No | Course Code | Course Title  | Category | Periods per week |   |   | Credits | Total contact periods |
|--------|-------------|---|----------|------------------|---|---|---------|-----------------------|
|        |             |   |          | L                | T | P |         |                       |
| 1      | 2401CO101   | Applied Engineering Mathematics for Communication systems | FC       | 3                | 2 | 0 | 4       | 5                     |
| 2      | 2401RMX01   | Research Methodology and IPR                              | RMC      | 3                | 0 | 0 | 3       | 3                     |
| 3      | 2402CO102   | Radiating Systems   | PCC      | 3                | 0 | 0 | 3       | 3                     |
| 4      | 2402CO103   | Advanced Digital Communication systems                    | PCC      | 3                | 0 | 0 | 3       | 3                     |
| 5      | 2402CO104   | Digital Image and Video processing                        | PCC      | 3                | 0 | 0 | 3       | 3                     |
| 6      |             | Professional Elective - I                                 | PEC      | 3                | 0 | 0 | 3       | 3                     |
| 7      |             | Audit Course -I   | AC       | 2                | 0 | 0 | 0       | 2                     |
| 8      | 2402CO105   | Advanced Communication Laboratory                         | PCC      | 0                | 0 | 3 | 1.5     | 3                     |
| 9      | 2402CO106   | Digital Image and Video processing Laboratory             | PCC      | 0                | 0 | 3 | 1.5     | 3                     |
|        |             |   |          | 20               | 2 | 6 | 22      | 28                    |

## PROGRAM ELECTIVE COURSES (PEC) SEMESTER- I, ELECTIVE – I

| SL. NO | COURSE CODE | COURSE TITLE  | CATEGORY | PERIODS PER WEEK |   |   | TOTAL CONTACT PERIODS | CREDITS |
|--------|-------------|---|----------|------------------|---|---|-----------------------|---------|
|        |             |   |          | L                | T | P |                       |         |
| 1.     | 2403CO001   | Electromagnetic Interference and Compatibility in System Design | PEC      | 3                | 0 | 0 | 3                     | 3       |
| 2.     | 2403CO002   | Information Retrieval Techniques                                | PEC      | 3                | 0 | 0 | 3                     | 3       |
| 3.     | 2403CO003   | Multimedia Compression Techniques                               | PEC      | 3                | 0 | 0 | 3                     | 3       |

M.E. Communication systems | E.G.S. Pillay Engineering College | Regulations 2024 Approved in XI  
Academic Council Meeting held on 04-02-2024

|    |           |   |     |   |   |   |   |   |
|----|-----------|---|-----|---|---|---|---|---|
| 4. | 2403CO004 | Advanced Satellite Communication and Navigation systems | PEC | 3 | 0 | 0 | 3 | 3 |
| 5. | 2403CO005 | FPGA Based Communication System                         | PEC | 3 | 0 | 0 | 3 | 3 |

|  |   |             |             |            |            |            |            |                |            |            |             |             |             |
|--|---|-------------|-------------|------------|------------|------------|------------|----------------|------------|------------|-------------|-------------|-------------|
| <b>2401CO101</b>   | <b>APPLIED ENGINEERING MATHEMATICS FOR COMMUNICATION SYSTEMS</b>                              |             |             |            | <b>L</b>   | <b>T</b>   | <b>P</b>   | <b>C</b>       |            |            |             |             |             |
|  |   | <b>3</b>    | <b>0</b>    | <b>0</b>   | <b>3</b>   |            |            |                |            |            |             |             |             |
| <b>PREREQUISITE:</b>   |   |             |             |            |            |            |            |                |            |            |             |             |             |
|  | Probability and Random Process  |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>COURSE OBJECTIVES:</b>  |   |             |             |            |            |            |            |                |            |            |             |             |             |
|  | 1. To expose the students to solve ordinary differential equations by various techniques.     |             |             |            |            |            |            |                |            |            |             |             |             |
|  | 2. To understand basic concepts of Advanced techniques in Matrix operations, linearequations. |             |             |            |            |            |            |                |            |            |             |             |             |
|  | 3. To acquire the knowledge of interest in Special functions                                  |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>COURSE OUTCOMES:</b>  |   |             |             |            |            |            |            |                |            |            |             |             |             |
| On the successful completion of the course, students will be able to   |   |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>CO1:</b>  | Explain the linear algebra and linear programming   |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>CO2:</b>  | Compute the problems with advance matrix theory   |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>CO3:</b>  | Classify the ordinary differential equations.   |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>CO4:</b>  | Derive the random process for various applications.   |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>CO5:</b>  | Distinguish the special functions.  |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>COs Vs POs MAPPING:</b>   |   |             |             |            |            |            |            |                |            |            |             |             |             |
|  | <b>COs</b>  | <b>PO1</b>  | <b>PO2</b>  | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b>     | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> |
| <b>1</b>   | 3   | 3           | 2           | 1          |            |            |            |                |            |            |             |             | 3           |
| <b>2</b>   | 3   | 3           | 2           | 1          |            |            |            |                |            |            |             |             | 3           |
| <b>3</b>   | 3   | 3           | 2           | 1          |            |            |            |                |            |            |             |             | 3           |
| <b>4</b>   | 3   | 3           | 2           | 1          |            |            |            |                |            |            |             |             | 3           |
| <b>5</b>   | 3   | 3           | 2           | 1          |            |            |            |                |            |            |             |             | 3           |
| <b>COs VsPSOs MAPPING:</b>   |   |             |             |            |            |            |            |                |            |            |             |             |             |
|  | <b>COs</b>  | <b>PSO1</b> | <b>PSO2</b> |            |            |            |            |                |            |            |             |             |             |
|  | <b>CO1</b>  | 3           | 2           |            |            |            |            |                |            |            |             |             |             |
|  | <b>CO2</b>  | 3           | 2           |            |            |            |            |                |            |            |             |             |             |
|  | <b>CO3</b>  | 3           | 2           |            |            |            |            |                |            |            |             |             |             |
|  | <b>CO4</b>  | 3           | 2           |            |            |            |            |                |            |            |             |             |             |
|  | <b>CO5</b>  | 3           | 2           |            |            |            |            |                |            |            |             |             |             |
| <b>COURSE CONTENTS:</b>  |   |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>MODULE I</b>  | <b>LINEAR PROGRAMMING</b>   |             |             |            |            |            |            | <b>9 Hours</b> |            |            |             |             |             |
| Formulation – Graphical solution – Simplex method – Two phase method - Transportation and Assignment Models  |   |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>MODULE II</b>   | <b>ADVANCE MATRIX THEORY</b>  |             |             |            |            |            |            | <b>9 Hours</b> |            |            |             |             |             |
| Diagonalization of symmetric matrices - Quadratic forms - Singular values decomposition - Change of basis, Cramer's rule, Matrix factorizations  |   |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>MODULE III</b>  | <b>ORDINARY DIFFERENTIAL EQUATIONS</b>  |             |             |            |            |            |            | <b>9 Hours</b> |            |            |             |             |             |
| Runge-Kutta Methods for system of IVPs, numerical stability, Adams-Bash forth multistep method, solution of stiff ODEs, shooting method, BVP: Finite difference method, orthogonal collocation method, orthogonal collocation with finite element method, Galerkin in finite element method. |   |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>MODULE IV</b>   | <b>RANDOM PROCESSES</b>   |             |             |            |            |            |            | <b>9 Hours</b> |            |            |             |             |             |

|   |  |
|---|--|
| Classification – Auto Correlation – Cross Correlation – Stationary random process – Markov process – Markov Chain – Poisson process – Gaussian process  |  |
| <b>MODULE V</b>   | <b>SPECIAL FUNCTIONS</b> <span style="float: right;"><b>9 Hours</b></span> |
| Bessel’s equation – Bessel functions – Legendre’s equation – Legendre’s polynomials – Rodrigue’s formula – Recurrence relations – Generating functions and orthogonal property for Bessel’s functions– Strum-Liouville problem – Error functions. |  |
| <b>TOTAL: 45 HOURS</b>  |  |
| <b>REFERENCES:</b>  |  |
| 1. Elsgolts.L, <i>Differential Equation and Calculus of variations</i> , MIR Publishers, 1996   |  |
| 2. Grewal B S, <i>Higher Engineering Mathematics</i> , Fortieth Edition, Khanna Publications, New Delhi 2014.   |  |
| 3. HowardA.Anton, “ <i>ElementaryLinearAlgebra</i> ”, JohnWiley&Sons, NinthEdition,2008.  |  |
| 4. David C.Lay, Steven R Lay and Judy J McDonald “ <i>Linear Algebra and itApplications</i> ”, GlobalEditionPearsonEducation Ltd,2015   |  |
| 5. Raisinghanian. M. D, <i>Ordinary and partial differential equations</i> , S. Chand & Co, New Delhi, 2006.  |  |
| 6. SeymourLipschutz, MarcLipson, “ <i>Schaum'sOutlineofLinearAlgebra</i> ”, McGrawHill, FifthEdition, 2013  |  |
| 7. Taha H.A. — <i>Operations Research: An introduction</i> Ninth Edition, Pearson Education, Asia, New Delhi 2012   |  |

|                  |                                     |          |          |          |          |
|------------------|-------------------------------------|----------|----------|----------|----------|
| <b>2401RMX01</b> | <b>RESEARCH METHODOLOGY AND IPR</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                  |                                     | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**COURSE OBJECTIVES:**

1. To Understand the knowledge on basics of research and its types.
2. To learn the concept of Literature Review, Technical Reading, Attributions and Citations
3. To discuss the concepts of IPR and Patents

**COURSE OUTCOMES:**

On the successful completion of the course, students will be able to

|             |   |
|-------------|---|
| <b>CO1:</b> | Apply ethical principles throughout engineering research, addressing misconduct and authorship issues.  |
| <b>CO2:</b> | Illustrate the literature review techniques, technical reading strategies, and citation practices using bibliographic databases to analyze and synthesize knowledge in research |
| <b>CO3:</b> | Explain proposal writing, research reporting, and communication skills for presenting research to funding agencies and academic audiences                                       |
| <b>CO4:</b> | Articulate the importance of IPR and protect their intellectual property  |
| <b>CO5:</b> | Differentiate the patents and their filing mechanism  |

**COs Vs POs MAPPING:**

| COs        | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| <b>CO1</b> | 3   | 3   |     |     | 3   |     |     | 3   |     |      |      | 3    |
| <b>CO2</b> | 3   | 3   | 2   |     | 3   |     |     | 3   |     |      |      | 3    |
| <b>CO3</b> | 3   | 3   | 2   |     | 3   |     |     | 3   |     |      |      | 3    |
| <b>CO4</b> | 3   | 3   |     |     | 3   |     |     | 3   |     |      |      | 3    |
| <b>CO5</b> | 3   | 3   | 3   |     | 3   |     |     | 3   |     |      |      | 3    |

**COs Vs PSOs MAPPING:**

| COs        | PSO1 | PSO2 | PSO3 |
|------------|------|------|------|
| <b>CO1</b> |      |      |      |
| <b>CO2</b> |      |      |      |
| <b>CO3</b> |      |      |      |
| <b>CO4</b> |      |      |      |
| <b>CO5</b> |      |      |      |

**COURSE CONTENTS:**

**MODULE I INTRODUCTION 9 Hours**

Meaning of Research, Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research, Finding and Solving a Worthwhile Problem. Ethics in Engineering Research, Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship.

**MODULE II LITERATURE REVIEW AND CITATION 9 Hours**

Literature Review and Technical Reading, New and Existing Knowledge, Analysis and Synthesis of Prior Art Bibliographic Databases, Web of Science, Google and Google Scholar, Effective Search: The Way Forward Introduction to Technical Reading Conceptualizing Research, Critical and Creative Reading, Citations: Giving Credit Wherever Due, Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge Flow through Citation, Citing Datasets, Styles for Citations, Acknowledgments and Attributions,

|  |  |                |
|--|--|----------------|
| <b>MODULE III</b>  | <b>ACADEMIC WRITING &amp; PRESENTATION</b>   | <b>9 Hours</b> |
| Proposal submission for funding agencies, Elements of Style. Organization of proposals, Basic knowledge of funding agencies, Research report writing, Communication skills, Tailoring the presentation to the target audience – Oral presentations, Poster preparations, Submission of research articles for Publication to Reputed journals, Thesis writing, and Research report writing. Elements of excellent presentation: Preparation, Visual and Delivery. Oral Communication skills and Oral defence.                   |  |                |
| <b>MODULE IV</b>   | <b>INTRODUCTION TO IPR</b>                   | <b>9 Hours</b> |
| Introduction to intellectual property; types of IP: patents, trademarks, copyright & related rights, industrial design, traditional knowledge, geographical indications, protection of new GMOs; IP as a factor in R&D; IPs of relevance to biotechnology and few case studies; plant variety protection and farmers rights.   |  |                |
| <b>MODULE V</b>  | <b>INTRODUCTION TO PATENTS AND ITS TYPES</b> | <b>9 Hours</b> |
| Basics of patents: types of patents; Indian Patent Act 1970; recent amendments; WIPO Treaties; Budapest Treaty; Patent Cooperation Treaty (PCT) and implications; filing of a patent application; role of a Country Patent Office; precautions before patenting-disclosure/non-disclosure - patent application- forms and guidelines including those of National Bio-diversity Authority (NBA) and other regulatory bodies, fee structure, time frames; types of patent applications: provisional and complete specifications. |  |                |
| <b>TOTAL: 45 HOURS</b>   |  |                |
| <b>REFERENCES:</b>   |  |                |
| 1. Kothari, C. R. <i>Research Methodology - Methods and Techniques</i> , New Age International publishers, New Delhi, 2004.  |  |                |
| 2. Robert P. Merges, Peter S. Menell and Mark A. Lemley, “ <i>Intellectual Property in New Technological Age</i> ”, Aspen Publishers, 2016   |  |                |
| 3. Ranjit Kumar, <i>Research Methodology- A step by step guide for beginners</i> , Pearson Education, Australia, 2005.   |  |                |
| 4. Ann M. Korner, <i>Guide to Publishing a Scientific paper</i> , Bioscript Press 2004.  |  |                |
| 5. <a href="https://nptel.ac.in/courses/106/105/106105077/">https://nptel.ac.in/courses/106/105/106105077/</a>   |  |                |

| <b>2402CO102</b>  | <b>RADIATING SYSTEMS</b>  |      |     |     |     |     | <b>L</b> | <b>T</b> | <b>P</b>       | <b>C</b> |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
|---|---|------|-----|-----|-----|-----|----------|----------|----------------|----------|------|------|------|-----|-----|-----|-----|-----|-----|-----|------|------|------|-----|---|-----|---|---|---|---|--|--|--|--|--|--|-----|---|--|---|---|---|---|--|--|--|--|--|--|-----|---|--|---|---|---|---|--|--|--|--|--|--|-----|---|--|---|---|---|---|--|--|--|--|--|--|-----|---|--|---|---|---|---|--|--|--|--|--|--|
|   |   |      |     |     |     |     | <b>3</b> | <b>0</b> | <b>0</b>       | <b>3</b> |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| <b>PREREQUISITE:</b>  |   |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
|   |   |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
|   | 1. Electromagnetic fields   |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
|   | 2. Transmission lines and Waveguides  |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
|   | 3. Antenna and Waveguide Propagation  |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
|   | 4. Microwave Engineering  |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| <b>COURSE OBJECTIVES:</b>   |   |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
|   |   |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
|   | 1. To enhance the students knowledge in the area of various antenna design and to make them understand their radiation mechanism. |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
|   | 2. To learn about Antenna arrays and their characteristics.   |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
|   | 3. To study about aperture Antennas.  |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
|   | 4. To familiarize with modern Antennas and Measurement Techniques.  |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
|   | 5. To learn about recent trends in Antenna Design.  |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| <b>COURSE OUTCOMES:</b>   |   |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
|   |   |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| On the successful completion of the course, students will be able to  |   |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| <b>CO1:</b>   | Explain the fundamentals behind the different techniques in antenna technology.   |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| <b>CO2:</b>   | Elaborate the challenges associated in designing antennas based on different technologies   |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| <b>CO3:</b>   | Describe the capability and assess the performance of various antennas.   |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| <b>CO4:</b>   | Compare the antennas specific to the applications, design and characterize.   |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| <b>CO5:</b>   | Discuss the need for optimizing in antenna design and the methodologies for the same.   |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| <b>COs Vs POs MAPPING:</b>  |   |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| <table border="1"> <thead> <tr> <th>COs</th> <th>PO1</th> <th>PO2</th> <th>PO3</th> <th>PO4</th> <th>PO5</th> <th>PO6</th> <th>PO7</th> <th>PO8</th> <th>PO9</th> <th>PO10</th> <th>PO11</th> <th>PO12</th> </tr> </thead> <tbody> <tr> <td>CO1</td> <td>1</td> <td></td> <td>3</td> <td>2</td> <td>2</td> <td>2</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>CO2</td> <td>1</td> <td></td> <td>3</td> <td>2</td> <td>2</td> <td>2</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>CO3</td> <td>3</td> <td></td> <td>3</td> <td>2</td> <td>2</td> <td>2</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>CO4</td> <td>3</td> <td></td> <td>3</td> <td>3</td> <td>2</td> <td>2</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>CO5</td> <td>3</td> <td></td> <td>3</td> <td>3</td> <td>2</td> <td>2</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> |   |      |     |     |     |     |          |          |                |          | COs  | PO1  | PO2  | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | CO1 | 1 |     | 3 | 2 | 2 | 2 |  |  |  |  |  |  | CO2 | 1 |  | 3 | 2 | 2 | 2 |  |  |  |  |  |  | CO3 | 3 |  | 3 | 2 | 2 | 2 |  |  |  |  |  |  | CO4 | 3 |  | 3 | 3 | 2 | 2 |  |  |  |  |  |  | CO5 | 3 |  | 3 | 3 | 2 | 2 |  |  |  |  |  |  |
| COs   | PO1   | PO2  | PO3 | PO4 | PO5 | PO6 | PO7      | PO8      | PO9            | PO10     | PO11 | PO12 |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| CO1   | 1   |      | 3   | 2   | 2   | 2   |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| CO2   | 1   |      | 3   | 2   | 2   | 2   |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| CO3   | 3   |      | 3   | 2   | 2   | 2   |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| CO4   | 3   |      | 3   | 3   | 2   | 2   |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| CO5   | 3   |      | 3   | 3   | 2   | 2   |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| <b>COs VsPSOs MAPPING:</b>  |   |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| <table border="1"> <thead> <tr> <th>COs</th> <th>PSO1</th> <th>PSO2</th> </tr> </thead> <tbody> <tr> <td>CO1</td> <td>1</td> <td>3</td> </tr> <tr> <td>CO2</td> <td>1</td> <td>3</td> </tr> <tr> <td>CO3</td> <td>1</td> <td>3</td> </tr> <tr> <td>CO4</td> <td>1</td> <td>3</td> </tr> <tr> <td>CO5</td> <td>1</td> <td>2</td> </tr> </tbody> </table>   |   |      |     |     |     |     |          |          |                |          | COs  | PSO1 | PSO2 | CO1 | 1   | 3   | CO2 | 1   | 3   | CO3 | 1    | 3    | CO4  | 1   | 3 | CO5 | 1 | 2 |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| COs   | PSO1  | PSO2 |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| CO1   | 1   | 3    |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| CO2   | 1   | 3    |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| CO3   | 1   | 3    |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| CO4   | 1   | 3    |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| CO5   | 1   | 2    |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| <b>COURSE CONTENTS:</b>   |   |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
|   |   |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| <b>MODULE I</b>   | <b>ANTENNA FUNDAMENTALS &amp; WIRE ANTENNAS</b>   |      |     |     |     |     |          |          | <b>9 Hours</b> |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| Introduction –Types of Antennas – Radiation Mechanism – Current distribution on wire antennas – Maxwell’s equations – Antenna fundamental parameters – Radiation integrals – Radiation from surface and line current distributions – dipole, monopole, loop antenna.  |   |      |     |     |     |     |          |          |                |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |
| <b>MODULE II</b>  | <b>ANTENNA ARRAYS</b>   |      |     |     |     |     |          |          | <b>9 Hours</b> |          |      |      |      |     |     |     |     |     |     |     |      |      |      |     |   |     |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |     |   |  |   |   |   |   |  |  |  |  |  |  |

|   |   |
|---|---|
| Linear array –uniform array, end fire and broad side array, gain, beam width, side lobe level; Linear array synthesis techniques — Binomial and Chebyshev distributions; Two dimensional uniform arrays; phased array antennas, smart antennas, switched beam and adaptive arrays, Mutual Coupling in Finite Arrays.  |   |
| <b>MODULE III</b>   | <b>APERTURE ANTENNAS</b> <span style="float: right;"><b>9 Hours</b></span>                            |
| Field equivalence principle, Radiation from Rectangular and Circular apertures, Babinet's principle, Slot antenna; Horn antenna; Reflector antenna, aperture blockage, and design consideration. Radiation Mechanism and Excitation techniques, Microstrip dipole; Patch, Rectangular patch, Circular patch – Microstrip array and feed network; Lens Antennas. |   |
| <b>MODULE IV</b>  | <b>MODERN ANTENNAS &amp; MEASUREMENT TECHNIQUES</b> <span style="float: right;"><b>9 Hours</b></span> |
| Base station antennas, PIFA – Antennas for WBAN – RFID Antennas – Automotive antennas, MIMO Antennas, Diversity techniques – Antenna impedance and radiation pattern measurements.  |   |
| <b>MODULE V</b>   | <b>RECENT TRENDS IN ANTENNA DESIGN</b> <span style="float: right;"><b>9 Hours</b></span>              |
| UWB antenna arrays – Vivaldi antenna arrays – Artificial magnetic conductors/High impedance surfaces – Antennas in medicine – Plasma antennas – Antennas for millimeter wave communication - optimization techniques – Numerical methods.   |   |
| <b>TOTAL: 45 HOURS</b>  |   |
| <b>REFERENCES:</b>  |   |
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| 4. Krauss.J.D, "Antennas", John Wiley and sons, New York, 2nd Edition, 1997.  |   |
| 5. I.J. Bahl and P. Bhartia, "Microstrip Antennas", Artech House, Inc., 1980  |   |
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| 7. Jim R.James, P.S.Hall, "Handbook of Microstrip Antennas" IEE Electromagnetic waves series 28, Volume 2, 1989   |   |
| 8. <a href="https://www.electronicdesign.com/technologies/passives/article/21769333/w">https://www.electronicdesign.com/technologies/passives/article/21769333/w</a>  |   |
| 9. <a href="#">elcome-to- antennas 101</a>  |   |
| 10. <a href="https://www.tutorialspoint.com/antenna_theory/antenna_theory_fundamentals.htm">https://www.tutorialspoint.com/antenna_theory/antenna_theory_fundamentals.htm</a>   |   |
| 11. <a href="https://www.microwavejournal.com/articles/29437-antenna-design-analysis-and-simulation">https://www.microwavejournal.com/articles/29437-antenna-design-analysis-and-simulation</a>   |   |
| 12. <a href="https://www.microwaves101.com/encyclopedias/antenna-design">https://www.microwaves101.com/encyclopedias/antenna-design</a>   |   |
| 13. <a href="https://www.udemy.com/courses/search/?src=ukw&amp;q=Antennas+for+Wireless+Communications">https://www.udemy.com/courses/search/?src=ukw&amp;q=Antennas+for+Wireless+Communications</a>   |   |
| 14. <a href="https://www.coursera.org/learn/microwave-antenna">https://www.coursera.org/learn/microwave-antenna</a>   |   |
| 15. <a href="https://engineering.purdue.edu/online/courses/antennas-design-application">https://engineering.purdue.edu/online/courses/antennas-design-application</a>   |   |



|                  |   |          |          |          |          |
|------------------|---|----------|----------|----------|----------|
| <b>2402CO103</b> | <b>ADVANCED DIGITAL COMMUNICATION SYSTEMS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                  |   | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**PREREQUISITE:**

|  |                       |
|--|-----------------------|
|  | Analog Communication  |
|  | Digital Communication |

**COURSE OBJECTIVES:**

|  |   |
|--|---|
|  | 1. To understand the coherent and non coherent receivers and their performance under AWGN channel conditions            |
|  | 2. To understand the effect of signaling through band limited channels and Equalization techniques used to overcome ISI |
|  | 3. To understand different channel models, channel capacity and different block coding techniques                       |
|  | 4. To understand the principle of convolutional coding and different decoding techniques                                |
|  | 5. To understand the basics of OFDM as a multicarrier communication and CDMA as a multiuser communication technique.    |

**COURSE OUTCOMES:**

|  |   |
|--|---|
| On the successful completion of the course, students will be able to |   |
| <b>CO1:</b>  | Differentiate coherent and non coherent receivers and analyze their performance under AWGN channel conditions     |
| <b>CO2:</b>  | Illustrate the effect of signaling through band limited channels and Equalization techniques used to overcome ISI |
| <b>CO3:</b>  | Determine the channel capacity and design various block coding techniques to techniques combat channel errors     |
| <b>CO4:</b>  | Construct convolutional coders and analyze the performance of different decoding techniques.                      |
| <b>CO5:</b>  | Describe the basics of OFDM as a multicarrier communication and CDMA as a Multiuser communication technique.      |

**COs Vs POs MAPPING:**

| COs        | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| <b>CO1</b> | 3   | 3   |     |     |     |     |     |     |     |      |      | 1    |
| <b>CO2</b> | 3   | 3   | 2   |     |     |     | 1   |     |     |      |      | 1    |
| <b>CO3</b> | 3   | 3   | 2   |     |     |     | 1   |     |     |      |      | 1    |
| <b>CO4</b> | 3   | 3   |     |     |     |     | 1   |     |     |      |      | 1    |
| <b>CO5</b> | 3   | 3   | 3   |     |     |     | 1   |     |     |      |      | 1    |

**COs Vs PSOs MAPPING:**

| COs        | PSO1 | PSO2 | PSO3 |
|------------|------|------|------|
| <b>CO1</b> | 3    |      |      |
| <b>CO2</b> | 3    | 3    |      |
| <b>CO3</b> | 3    | 3    |      |
| <b>CO4</b> | 3    | 3    |      |
| <b>CO5</b> | 3    | 3    |      |

**COURSE CONTENTS:**

|                 |  |                |
|-----------------|--|----------------|
| <b>MODULE I</b> | <b>COHERENT AND NON-COHERENT COMMUNICATION</b> | <b>9 Hours</b> |
|-----------------|--|----------------|

|   |   |
|---|---|
| Coherent receivers – Optimum receivers in WGN – IQ modulation & demodulation – QAM modulation and demodulation Noncoherent receivers in random phase channels; MFSK receivers – Rayleigh and Rician channels – Partially coherent receivers – DPSK; M-PSK; M- DPSK-BER Performance Analysis. Carrier Synchronization Bit synchronization.   |   |
| <b>MODULE II</b>  | <b>EQUALIZATIONTECHNIQUES</b> <span style="float: right;"><b>9 Hours</b></span>                 |
| Band Limited Channels- ISI – Nyquist Criterion- Controlled ISI-Partial Response signals-Equalization algorithms– Linear equalizer – Decision feedback equalization – Adaptive Equalization algorithms.  |   |
| <b>MODULE III</b>   | <b>BLOCKCODEDDIGITALCOMMUNICATION</b> <span style="float: right;"><b>9 Hours</b></span>         |
| Architecture and performance – Binary block codes; – Shannon’s channel coding theorem; Channel capacity; Matched filter; Concepts of Spread spectrum communication – Coded BPSK and DPSK demodulators– Linear block codes; Hamming; Golay; Cyclic; BCH ; Reed – Solomon codes. Space time block codes.  |   |
| <b>MODULE IV</b>  | <b>CONVOLUTIONALCODEDDIGITALCOMMUNICATION</b> <span style="float: right;"><b>9 Hours</b></span> |
| Representation of codes using Polynomial, State diagram, Tree diagram, and Trellis diagram – Decoding techniques using Maximum likelihood, Viterbi algorithm, Sequential and Threshold methods – Error probability performance for BPSK and Viterbi algorithm, Turbo Coding.  |   |
| <b>MODULE V</b>   | <b>MULTICARRIERANDMULTIUSERCOMMUNICATIONS</b> <span style="float: right;"><b>9 Hours</b></span> |
| Single Vs multicarrier modulation, orthogonal frequency division multiplexing (OFDM), Modulation and demodulation in an OFDM system, An FFT algorithmic implementation of an OFDM system, Bit and power allocation in multicarrier modulation, Peak-to-average ratio in multicarrier modulation. Introduction to CDMA systems, multiuser detection in CDMA systems – optimum multiuser receiver, sub-optimum detectors, successive interference cancellation. |   |
| <b>TOTAL: 45 HOURS</b>  |   |
| <b>REFERENCES:</b>  |   |
| 1. John G. Proakis and Masoud Salehi “Digital Communication”, Fifth Edition, McGraw Hill Publication, 2014.   |   |
| 2. Simon Haykin, “Digital communication Systems”, John Wiley and sons, 2014.  |   |
| 3. Bernard Sklar and Pabitra Kumar Ray, “Digital Communications Fundamentals & Applications ”, second edition, Pearson Education, 2009.   |   |
| 4. Lathi B P and Zhi Ding, “Modern Digital and Analog communication Systems”, Oxford University Press, 2011.  |   |
| 5. Richard Van Nee & Ramjee Prasad, “OFDM for Multimedia Communications” Artech House Publication, 2001.  |   |
| 6. Theodore S.Rappaport, “Wireless Communications”, 2nd edition, Pearson Education, 2002.   |   |

|  |   |             |             |            |            |            |            |                |            |            |             |             |             |
|--|---|-------------|-------------|------------|------------|------------|------------|----------------|------------|------------|-------------|-------------|-------------|
| <b>2402CO104</b>   | <b>DIGITAL IMAGE AND VIDEO PROCESSING</b>   |             |             |            | <b>L</b>   | <b>T</b>   | <b>P</b>   | <b>C</b>       |            |            |             |             |             |
|  |   | <b>3</b>    | <b>0</b>    | <b>0</b>   | <b>3</b>   |            |            |                |            |            |             |             |             |
| <b>PREREQUISITE:</b>   |   |             |             |            |            |            |            |                |            |            |             |             |             |
|  | Signal & Systems, Digital Image Processing  |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>COURSE OBJECTIVES:</b>  |   |             |             |            |            |            |            |                |            |            |             |             |             |
|  | 1.To understand the basic fundamentals of digital image processing and Image Transforms                         |             |             |            |            |            |            |                |            |            |             |             |             |
|  | 2.To Master the Image Processing Techniques in Spatial Domain and Frequency Domain.                             |             |             |            |            |            |            |                |            |            |             |             |             |
|  | 3.To learn the fundamentals of various Image compression models.  |             |             |            |            |            |            |                |            |            |             |             |             |
|  | 4.To understand the Basic Steps of Video Processing   |             |             |            |            |            |            |                |            |            |             |             |             |
|  | 5.To learn the Mathematical and computational skills needed to understand the principal of 2-DMotion Estimation |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>COURSE OUTCOMES:</b>  |   |             |             |            |            |            |            |                |            |            |             |             |             |
| Upon completion of this course, the students will be able to:  |   |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>CO1:</b>  | Understand the basic fundamentals of digital image processing and Image Transforms.                             |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>CO2:</b>  | Master the Image Processing Techniques in Spatial Domain and Frequency Domain.                                  |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>CO3:</b>  | Learn the fundamentals of various Image compression models.   |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>CO4:</b>  | Understand the Basic Steps of Video Processing.   |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>CO5:</b>  | Learn the Mathematical and computational skills needed to understand the principle of 2- D Motion Estimation    |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>COs Vs POs MAPPING:</b>   |   |             |             |            |            |            |            |                |            |            |             |             |             |
|  | <b>COs</b>  | <b>PO1</b>  | <b>PO2</b>  | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b>     | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> |
|  | <b>CO1</b>  | 3           | 3           | 1          | -          | -          | -          | -              | -          | -          | -           | -           | 3           |
|  | <b>CO2</b>  | 3           | 3           | 1          | -          | -          | -          | -              | -          | -          | -           | -           | 3           |
|  | <b>CO3</b>  | 3           | 3           | 1          | -          | -          | -          | -              | -          | -          | -           | -           | 3           |
|  | <b>CO4</b>  | 3           | 3           | 1          | -          | -          | -          | -              | -          | -          | -           | -           | 3           |
|  | <b>CO5</b>  | 3           | 3           | 1          | -          | -          | -          | -              | -          | -          | -           | -           | 3           |
| <b>COs Vs PSOs MAPPING:</b>  |   |             |             |            |            |            |            |                |            |            |             |             |             |
|  | <b>COs</b>  | <b>PSO1</b> | <b>PSO2</b> |            |            |            |            |                |            |            |             |             |             |
|  | <b>CO1</b>  | -           | 3           |            |            |            |            |                |            |            |             |             |             |
|  | <b>CO2</b>  | -           | 3           |            |            |            |            |                |            |            |             |             |             |
|  | <b>CO3</b>  | -           | 3           |            |            |            |            |                |            |            |             |             |             |
|  | <b>CO4</b>  | -           | 3           |            |            |            |            |                |            |            |             |             |             |
|  | <b>CO5</b>  | -           | 3           |            |            |            |            |                |            |            |             |             |             |
| <b>COURSE CONTENTS:</b>  |   |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>MODULE I</b>  | <b>FUNDAMENTALS OF IMAGE PROCESSING AND IMAGE TRANSFORMS</b>  |             |             |            |            |            |            | <b>8 Hours</b> |            |            |             |             |             |
| Digital Image fundamentals, Sampling and quantization of an Image, Relationship between pixels.<br><b>Image Transforms:</b> 2-D Discrete Fourier Transform, Properties, Discrete cosine Transform, Hadamard Transform. |   |             |             |            |            |            |            |                |            |            |             |             |             |

|   |  |                |
|---|--|----------------|
| <b>MODULE II</b>  | <b>IMAGE PROCESSING TECHNIQUES</b>     | <b>9 Hours</b> |
| Image Enhancement : Spatial Domain methods: Histogram Processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening Spatial filters. Frequency Domain methods : Basics of filtering in frequency domain, image smoothing, image sharpening. <b>Image Restoration:</b> Degradation Model, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration |  |                |
| <b>MODULE III</b>   | <b>Image Compression</b>               | <b>9 Hours</b> |
| Image compression fundamentals – coding Redundancy, spatial and temporal redundancy. Compression models : Lossy and Lossless, Huffmann coding, Arithmetic coding, run length coding, transform coding, predictive coding , JPEG standards   |  |                |
| <b>MODULE IV</b>  | <b>Basic steps of video processing</b> | <b>9 Hours</b> |
| Analog video, Digital video, Time varying image formation model, Geometric image formation, formation, sampling of video signal.  |  |                |
| <b>MODULE V</b>   | <b>2D Motion Estimation</b>            | <b>9 Hours</b> |
| Optical flow, Pixel based motion estimation, Region based Motion estimation, Multi resolution motion estimation, Application of motion estimation in video coding   |  |                |
| <b>TOTAL: 45 HOURS</b>  |  |                |
| <b>REFERENCES:</b>  |  |                |
| 1. <i>Gonzaleze and Woods ,”Digital Image Processing “, 3rd edition , Pearson</i>   |  |                |
| 2. <i>Yao wang, Joem Ostarmann and Ya – quin Zhang, ”Video processing and communication “,1<sup>st</sup> edition , PHI</i>  |  |                |
| 3. <i>M. Tekalp ,”Digital video Processing”, Prentice Hall International</i>  |  |                |

**SEMESTER – I, ELECTIVE - I**

|   |   |             |             |            |            |            |            |            |                |            |             |             |             |
|---|---|-------------|-------------|------------|------------|------------|------------|------------|----------------|------------|-------------|-------------|-------------|
| <b>2403CO001</b>  | <b>ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY IN SYSTEM DESIGN</b>      |             |             |            |            | <b>L</b>   | <b>T</b>   | <b>P</b>   | <b>C</b>       |            |             |             |             |
|   |   |             |             |            |            | <b>3</b>   | <b>0</b>   | <b>0</b>   | <b>3</b>       |            |             |             |             |
| <b>PREREQUISITE:</b>  |   |             |             |            |            |            |            |            |                |            |             |             |             |
|   | Electromagnetic Fields  |             |             |            |            |            |            |            |                |            |             |             |             |
|   | Transmission lines and waveguides   |             |             |            |            |            |            |            |                |            |             |             |             |
|   | Wireless Communication  |             |             |            |            |            |            |            |                |            |             |             |             |
| <b>Course Objectives:</b>   |   |             |             |            |            |            |            |            |                |            |             |             |             |
|   | 1. To explore the concepts of EMI Environment and EMI Coupling Principles   |             |             |            |            |            |            |            |                |            |             |             |             |
|   | 2. To focus on popular EMI/EMC Standards and Measurements                   |             |             |            |            |            |            |            |                |            |             |             |             |
|   | 3. To study the control techniques involved in Electromagnetic Interference |             |             |            |            |            |            |            |                |            |             |             |             |
| <b>COURSE OUTCOMES:</b>   |   |             |             |            |            |            |            |            |                |            |             |             |             |
| After completion of the course, Student will be able to   |   |             |             |            |            |            |            |            |                |            |             |             |             |
| <b>CO1:</b>   | Recall electromagnetic concepts and its measuring parameters                |             |             |            |            |            |            |            |                |            |             |             |             |
| <b>CO2:</b>   | understand the EMI coupling principle and its types                         |             |             |            |            |            |            |            |                |            |             |             |             |
| <b>CO3:</b>   | know the design and architecture of Micro machined Antennas                 |             |             |            |            |            |            |            |                |            |             |             |             |
| <b>CO4:</b>   | Explain Mems phase shifters and its applications                            |             |             |            |            |            |            |            |                |            |             |             |             |
| <b>CO5:</b>   | Demonstrate Designing of PCBs   |             |             |            |            |            |            |            |                |            |             |             |             |
| <b>COs Vs POs MAPPING:</b>  |   |             |             |            |            |            |            |            |                |            |             |             |             |
|   | <b>COs</b>  | <b>PO1</b>  | <b>PO2</b>  | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b>     | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> |
|   | <b>CO1</b>  | 3           | 3           | 2          |            |            |            |            | 2              |            |             |             | 3           |
|   | <b>CO2</b>  | 3           | 3           | 2          |            |            |            |            | 2              |            |             |             | 3           |
|   | <b>CO3</b>  | 3           | 3           | 2          |            |            |            |            | 2              |            |             |             | 3           |
|   | <b>CO4</b>  | 3           | 3           | 2          |            |            |            |            | 2              |            |             |             | 3           |
|   | <b>CO5</b>  | 3           | 3           | 2          |            |            |            |            | 2              |            |             |             | 3           |
| <b>COs VsPSOs MAPPING:</b>  |   |             |             |            |            |            |            |            |                |            |             |             |             |
|   | <b>COs</b>  | <b>PSO1</b> | <b>PSO2</b> |            |            |            |            |            |                |            |             |             |             |
|   | <b>CO1</b>  | 1           | 3           |            |            |            |            |            |                |            |             |             |             |
|   | <b>CO2</b>  | 1           | 3           |            |            |            |            |            |                |            |             |             |             |
|   | <b>CO3</b>  | 1           | 3           |            |            |            |            |            |                |            |             |             |             |
|   | <b>CO4</b>  | 1           | 3           |            |            |            |            |            |                |            |             |             |             |
|   | <b>CO5</b>  | 1           | 3           |            |            |            |            |            |                |            |             |             |             |
| <b>Course Outcomes:</b>   |   |             |             |            |            |            |            |            |                |            |             |             |             |
| <b>MODULE I</b>   | <b>EMI ENVIRONMENT</b>  |             |             |            |            |            |            |            | <b>9 Hours</b> |            |             |             |             |
| EMI/EMC concepts and definitions, Sources of EMI, conducted and radiated EMI, Transient EMI, Time domain Vs Frequency domain EMI, Units of measurement parameters, Emission and immunity concepts, ESD. |   |             |             |            |            |            |            |            |                |            |             |             |             |
| <b>MODULE II</b>  | <b>EMI COUPLING PRINCIPLES</b>  |             |             |            |            |            |            |            | <b>9 Hours</b> |            |             |             |             |

|  |   |                        |
|--|---|------------------------|
| Conducted, Radiated and Transient Coupling, Common Impedance Ground Coupling, Radiated Common Mode and Ground Loop Coupling, Radiated Differential Mode Coupling, Near Field Cable to Cable Coupling, Power Mains and Power Supply coupling. |   |                        |
| <b>MODULE III</b>  | <b>EMI/EMC STANDARDS AND MEASUREMENTS</b> | <b>8 Hours</b>         |
| Civilian standards - FCC, CISPR, IEC, EN, Military standards - MIL STD 461D/462, EMI Test Instruments /Systems, EMI Shielded Chamber, Open Area Test Site, , Military Test Method and Procedures (462).                                      |   |                        |
| <b>MODULE IV</b>   | <b>EMI CONTROL TECHNIQUES</b>             | <b>12 Hours</b>        |
| Shielding, Filtering, Grounding, Bonding, Isolation Transformer, Transient Suppressors, Cable Routing, Signal Control, Component Selection and Mounting  |   |                        |
| <b>MODULE V</b>  | <b>EMC DESIGN OF PCBs</b>                 | <b>8 Hours</b>         |
| PCB Traces Cross Talk, Impedance Control, Power Distribution Decoupling, Zoning, Motherboard Designs and Propagation Delay Performance Models, Electrical, Magnetic and Thermal analysis of circuits for EMC                                 |   |                        |
|  |   | <b>TOTAL: 45 HOURS</b> |
| <b>REFERENCES:</b>   |   |                        |
| 1. Henry W.Ott, <i>Noise Reduction Techniques in Electronic System</i> , John Wiley and Sons, 2008   |   |                        |
| 2. C.R. Paul, <i>Introduction to Electromagnetic Compatibility</i> , John Wiley and Sons, Inc, 2005  |   |                        |
| 3. V.P.Kodali., <i>Engineering EMC Principles, Measurements and Technologies</i> , IEEE Press, 1996  |   |                        |
| 4. Bernhard Keiser, <i>Principles of Electromagnetic Compatibility</i> , Artech house, 1986  |   |                        |

|                  |   |          |          |          |          |
|------------------|---|----------|----------|----------|----------|
| <b>2403CO002</b> | <b>INFORMATION RETRIEVAL TECHNIQUES</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                  |   | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**PREREQUISITE:**

|  |                                      |
|--|--------------------------------------|
|  | Digital principles and system design |
|--|--------------------------------------|

**Course Objectives:**

|  |  |
|--|--|
|  | 1.To understand the basics of Information Retrieval with pertinence to modeling, query operations and indexing |
|  | 2. To get an understanding of machine learning techniques for text classification and clustering               |
|  | 3.To understand the various applications of Information Retrieval giving emphasis to Multimedia IR             |
|  | 4. To understand the concepts of digital libraries   |
|  | 5. To get the knowledge of XMLWeb Search and Ranking   |

**COURSE OUTCOMES:**

After completion of the course, Student will be able to

|             |   |
|-------------|---|
| <b>CO1:</b> | Build an Information Retrieval system using the available tools   |
| <b>CO2:</b> | Identify and design the various components of an Information Retrieval system   |
| <b>CO3:</b> | Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval |
| <b>CO4:</b> | Apply appropriate method of classification and clustering   |
| <b>CO5:</b> | Design an efficient search engine for web search.   |

**COs Vs POs MAPPING:**

| COs        | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| <b>CO1</b> | 3   | 3   | 2   |     |     |     |     |     |     |      |      | 3    |
| <b>CO2</b> | 3   | 3   | 2   |     |     |     |     |     |     |      |      | 3    |
| <b>CO3</b> | 3   | 3   | 2   |     |     |     |     |     |     |      |      | 3    |
| <b>CO4</b> | 3   | 3   | 2   |     |     |     |     |     |     |      |      | 3    |
| <b>CO5</b> | 3   | 3   | 2   |     |     |     |     |     |     |      |      | 3    |

**COs VsPSOs MAPPING:**

| COs        | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> |      | 3    |
| <b>CO2</b> |      | 3    |
| <b>CO3</b> |      | 3    |
| <b>CO4</b> |      | 3    |
| <b>CO5</b> |      | 3    |

**COURSE OUTCOMES:**

**MODULE I | INTRODUCTION** **9 Hours**

Motivation – Basic Concepts – Practical Issues - Retrieval Process – Architecture – Boolean Retrieval – Retrieval Evaluation – Open Source IR Systems–History of Web Search – Web Characteristics–The impact of the web on IR —IR Versus Web Search–Components of a Search engine.

**MODULE II | MODELING** **9 Hours**

|  |   |
|--|---|
| Taxonomy and Characterization of IR Models – Boolean Model – Vector Model – Term Weighting – Scoring and Ranking – Language Models – Set Theoretic Models – Probabilistic Models – Algebraic Models – Structured Text Retrieval Models – Models for Browsing.  |   |
| <b>MODULE III</b>  | <b>METRICS</b> <span style="float: right;"><b>8 Hours</b></span>                        |
| Experimental Evaluation of IR - Performance Metrics – Recall - Precision and F Measure - Evaluations on Benchmark Text Collections - Text Representation - Word Statistics - Zipf's Law - Porter Stemmer – Morphology - Index Term Selection - Using Thesauri - Metadata and Markup Languages - Web Search - Search Engines – Spidering – Metacrawlers - Directed Spidering – Link Analysis Shopping Agents. |   |
| <b>MODULE IV</b>   | <b>CLASSIFICATION AND CLUSTERING</b> <span style="float: right;"><b>12 Hours</b></span> |
| Text Classification and Naïve Bayes – Vector Space Classification – Support vector machines and Machine learning on documents. Flat Clustering – Hierarchical Clustering – Matrix decompositions and latent semantic indexing – Fusion and Meta learning.  |   |
| <b>MODULE V</b>  | <b>SEARCHING AND RANKING</b> <span style="float: right;"><b>8 Hours</b></span>          |
| Searching the Web – Structure of the Web – IR and web search – Static and Dynamic Ranking - Web Crawling and Indexing – Link Analysis - XML Retrieval Multimedia IR: Models and Languages – Indexing and Searching Parallel and Distributed IR – Semantic Web - Collecting and Integrating Specialized Information on the Web.   |   |
| <b>TOTAL: 45 HOURS</b>   |   |
| <b>REFERENCES:</b>   |   |
| 1. Ricardo Baeza – Yates, Berthier Ribeiro – Neto, <i>Modern Information Retrieval: The concepts and Technology behind Search (ACM Press Books), Second Edition 2011.</i>  |   |
| 2. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, <i>Introduction to Information Retrieval, Cambridge University Press, First South Asian Edition 2012.</i>  |   |
| 3. Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, <i>Information Retrieval Implementing and Evaluating Search Engines, The MIT Press, Cambridge, Massachusetts London, England, 2010</i>  |   |
| 4. Mark Levene, <i>An Introduction to Search Engines and Web Navigation, 2 nd Edition Wiley, 2010.</i>   |   |
| 5. Ophir Frieder “ <i>Information Retrieval: Algorithms and Heuristics: Information Retrieval Series</i> “, 2nd Edition, Springer, 2004.   |   |



|                  |  |          |          |          |          |
|------------------|--|----------|----------|----------|----------|
| <b>2403CO003</b> | <b>MULTIMEDIA COMPRESSION TECHNIQUES</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                  |  | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**PREREQUISITE:**

|  |                   |
|--|-------------------|
|  | Signal Processing |
|  | Image Processing  |

**Course Objectives:**

1. Data Compression
2. Text and Audio Compression
3. Image and Video Compression

**COURSE OUTCOMES:**

|             |   |
|-------------|---|
| <b>CO1:</b> | Explain the fundamental concept of multimedia compression techniques.   |
| <b>CO2:</b> | Choose a efficient text compression techniques.                         |
| <b>CO3:</b> | Examine the different audio compression methods.                        |
| <b>CO4:</b> | Compare an image compression technique based on the quality parameters. |
| <b>CO5:</b> | Explain the video compression techniques.                               |

**COs Vs POs MAPPING:**

| COs        | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| <b>CO1</b> | 3   | 3   | 2   |     |     |     |     |     |     |      |      | 3    |
| <b>CO2</b> | 3   | 3   | 2   |     |     |     |     |     |     |      |      | 3    |
| <b>CO3</b> | 3   | 3   | 2   |     |     |     |     |     |     |      |      | 3    |
| <b>CO4</b> | 3   | 3   | 2   |     |     |     |     |     |     |      |      | 3    |
| <b>CO5</b> | 3   | 3   | 2   |     |     |     |     |     |     |      |      | 3    |

**COs VsPSOs MAPPING:**

| COs        | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> |      | 3    |
| <b>CO2</b> |      | 3    |
| <b>CO3</b> |      | 3    |
| <b>CO4</b> |      | 3    |
| <b>CO5</b> |      | 3    |

**Course Outcomes:**

**MODULE I | INTRODUCTION | 9 Hours**

Special features of Multimedia – Graphics and Image Data Representations -Fundamental Concepts in Video and Digital Audio – Storage requirements for multimedia applications -Need for Compression - Taxonomy of compression techniques – Overview of source coding, source models, scalar and vector quantization theory – Evaluation techniques – Error analysis and methodologies

**MODULE II | TEXT COMPRESSION | 9 Hours**

Compaction techniques – Huffman coding – Adaptive Huffman Coding – Arithmetic coding – Shannon-Fano coding – Dictionary techniques – LZW family algorithms.

**MODULE III | AUDIO COMPRESSION | 8 Hours**

Audio compression techniques -  $\mu$ - Law and A- Law companding. Speech compression- waveform codecs-source codec's- hybrid codec's-Shorten compressor, Frequency domain and filtering – Basic sub-band coding – Application to speech coding – G.722 –Application to audio coding – MPEG audio, progressive

|   |   |
|---|---|
| encoding for audio – Silence compression, speech compression techniques – Formant and CELP Vocoders.  |   |
| <b>MODULE IV</b>  | <b>IMAGE COMPRESSION</b> <span style="float: right;"><b>12 Hours</b></span> |
| Predictive techniques – DM, PCM, DPCM: Optimal Predictors and Optimal Quantization– Contour based compression – Transform Coding – JPEG Standard – Sub-band coding algorithms: Design of Filter banks – Wavelet based compression: Implementation using filters – EZW, SPIHT coders – JPEG 2000 standards – JBIG, JBIG2 Standards |   |
| <b>MODULE V</b>   | <b>VIDEO COMPRESSION</b> <span style="float: right;"><b>8 Hours</b></span>  |
| Video compression techniques and standards – MPEG Video Coding I: MPEG – 1 and 2 MPEG Video Coding II: MPEG – 4 and 7 – Motion estimation and compensation techniques – H.261 Standard – DVI technology – PLV performance – DVI real time compression – Packet Video.   |   |
| <b>TOTAL: 45 HOURS</b>  |   |
| <b>REFERENCES:</b>  |   |
| 1. Khalid Sayood : <i>Introduction to Data Compression, Morgan Kauffman Harcourt India, 2nd Edition, 2000.</i>  |   |
| 2. David Salomon : <i>Data Compression – The Complete Reference, Springer Verlag New York Inc., 2nd Edition, 2001.</i>  |   |
| 3. Yun Q.Shi, Huifang Sun : <i>Image and Video Compression for Multimedia Engineering - Fundamentals, Algorithms &amp; Standards, CRC press, 2003.</i>  |   |
| 4. Peter Symes : <i>Digital Video Compression, McGraw Hill Pub., 2004.</i>  |   |
| 5. Mark Nelson : <i>Data compression, BPB Publishers, New Delhi, 1998.</i>  |   |

|  |   |             |             |            |            |            |            |                |            |            |             |             |             |
|--|---|-------------|-------------|------------|------------|------------|------------|----------------|------------|------------|-------------|-------------|-------------|
| <b>2403CO004</b>   | <b>ADVANCED SATELLITE COMMUNICATION AND NAVIGATION SYSTEMS</b>  |             |             |            | <b>L</b>   | <b>T</b>   | <b>P</b>   | <b>C</b>       |            |            |             |             |             |
|  |   | <b>3</b>    | <b>0</b>    | <b>0</b>   | <b>3</b>   |            |            |                |            |            |             |             |             |
| <b>PREREQUISITE:</b>   |   |             |             |            |            |            |            |                |            |            |             |             |             |
| Basics of satellite and digital communication.   |   |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>COURSE OBJECTIVES:</b>  |   |             |             |            |            |            |            |                |            |            |             |             |             |
| 1.Learn M2M developments and satellite applications  |   |             |             |            |            |            |            |                |            |            |             |             |             |
| 2.Understand Satellite Communication in Ipv6 Environment   |   |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>COURSE OUTCOMES:</b>  |   |             |             |            |            |            |            |                |            |            |             |             |             |
| Upon completion of this course, the students will be able to:  |   |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>CO1:</b>  | Discuss Satellite navigation and global positioning system  |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>CO2:</b>  | Understand deep space networks and inter planetary missions.  |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>CO3:</b>  | Demonstrate an understanding of the different interferences and attenuation mechanisms affecting the satellite link design. |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>CO4:</b>  | Demonstrate an understanding of the different communication, sensing and navigational applications of satellite.            |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>CO5:</b>  | Understand RADAR systems and its concepts   |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>COs Vs POs MAPPING:</b>   |   |             |             |            |            |            |            |                |            |            |             |             |             |
|  | <b>COs</b>  | <b>PO1</b>  | <b>PO2</b>  | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b>     | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> |
|  | <b>CO1</b>  | 3           | 3           | 1          | -          | -          | -          | -              | -          | -          | -           | -           | 1           |
|  | <b>CO2</b>  | 3           | 3           | 1          | -          | -          | -          | -              | -          | -          | -           | -           | 1           |
|  | <b>CO3</b>  | 3           | 3           | 1          | -          | -          | -          | -              | -          | -          | -           | -           | 1           |
|  | <b>CO4</b>  | 3           | 3           | 1          | -          | -          | -          | -              | -          | -          | -           | -           | 1           |
|  | <b>CO5</b>  | 3           | 3           | 1          | -          | -          | -          | -              | -          | -          | -           | -           | 1           |
| <b>COs Vs PSOs MAPPING:</b>  |   |             |             |            |            |            |            |                |            |            |             |             |             |
|  | <b>COs</b>  | <b>PSO1</b> | <b>PSO2</b> |            |            |            |            |                |            |            |             |             |             |
|  | <b>CO1</b>  | -           | 1           |            |            |            |            |                |            |            |             |             |             |
|  | <b>CO2</b>  | -           | 2           |            |            |            |            |                |            |            |             |             |             |
|  | <b>CO3</b>  | -           | 3           |            |            |            |            |                |            |            |             |             |             |
|  | <b>CO4</b>  | -           | 3           |            |            |            |            |                |            |            |             |             |             |
|  | <b>CO5</b>  | -           | 3           |            |            |            |            |                |            |            |             |             |             |
| <b>COURSE CONTENTS:</b>  |   |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>MODULE I</b>  | <b>OVERVIEW OF SATELLITE COMMUNICATION</b>  |             |             |            |            |            |            | <b>8 Hours</b> |            |            |             |             |             |
| Overview of satellite communication and orbital mechanics Link budget Parameters, Link budget calculations, Auxiliary Equations, Performance Calculations. |   |             |             |            |            |            |            |                |            |            |             |             |             |
| <b>MODULE II</b>   | <b>M2M DEVELOPMENTS AND SATELLITE APPLICATIONS</b>  |             |             |            |            |            |            | <b>9 Hours</b> |            |            |             |             |             |

|  |   |                 |
|--|---|-----------------|
| Overview of the Internet of Things and M2M- M2M Applications Examples and Satellite Support Satellite Roles Context and Applications- Antennas for Satellite M2M Applications- M2M Market Opportunities for Satellite Operators-Ultra HD Video/TV and Satellite Implications-High Throughput Satellites (HTS) and Ka/Ku Spot Beam Technologies-Aeronautical, Maritime and other Mobility Services. |   |                 |
| <b>MODULE III</b>  | <b>SATELLITE COMMUNICATION IN IPV6 ENVIRONMENT</b>        | <b>8 Hours</b>  |
| Overview of IPv6 and its benefits for Satellite Networks - Migration and Coexistence-- Implementation scenarios and support- Preparations for IPv6 in Satellite communication- Satellite specific Protocol issues in IPv6 – Impact of IPv6 on Satellite Network architecture and services - Detailed transitional plan - IPv6 demonstration over satellites - Key results and recommendations.     |   |                 |
| <b>MODULE IV</b>   | <b>SATELLITE NAVIGATION AND GLOBAL POSITIONING SYSTEM</b> | <b>12 Hours</b> |
| Overview of Radio and Satellite Navigation, GPS Principles, Signal model and Codes, Satellite Signal Acquisition, Mathematical model of GPS observables, Methods of processing GPS data , GPS Receiver Operation and Differential GPS. IRNSS, GAGAN, GLONASS and Galileo.  |   |                 |
| <b>MODULE V</b>  | <b>RADAR System and Concepts</b>                          | <b>8 Hours</b>  |
| <b>RADAR:</b> Block diagram - types of RADAR - CW - Doppler - MTI - FMCW - pulsed - tracking RADAR; DSP in RADAR: False alarm and missed detection - RADAR cross section - TR - ATR; Waveform matched filter - matched filtering of moving targets - ambiguity function - pulse burst waveform - COSTAS frequency codes.   |   |                 |
| <b>TOTAL: 45 HOURS</b>   |   |                 |
| <b>REFERENCES:</b>   |   |                 |
| 1. Anil K. Maini, Varsha Agrawal, “Satellite Technology: Principles and Applications”, Third Edition, Wiley, 2014.   |   |                 |
| 2. Daniel Minoli, “Innovations in Satellite Communication and Satellite Technology” Wiley, 2015.   |   |                 |
| 3. Daniel Minoli, “Satellite Systems Engineering in an IPv6 Environment”, CRC Press, First Edition, 2009.  |   |                 |
| 4. Hofmann-Wellenhof B., Lichtenegger H., and Elmar Wasle, “Global Navigational Satellite Systems” Springer-Verlag, 2008.  |   |                 |
| 5. Louis J. Ippolito, Jr. “Satellite Communications Systems Engineering: Atmospheric Effects, Satellite Link Design and System Performance”, Second Edition, 2017.   |   |                 |
| 6. B.N.Agarwal, “Design of Geosynchronous Spacecraft”, Prentice Hall, 1993.  |   |                 |
| 7. Brian Ackroyd, “World Satellite Communication and Earth Station Design”, BSP Professional Books, 1990.  |   |                 |
| 8. M.I. Skolnik, “Radar Handbook”, 2nd Edition, McGraw Hill, 1991.   |   |                 |
| 9. Fred E. Nathanson, “Radar Design Principles – Signal Processing and the Environment”, 2 nd Edition, PHI, 1999.  |   |                 |
| 10. M. I. Skolnik, “Introduction to Radar Systems”, 3rd Edition, TMH, 2001.  |   |                 |
| 11. Peyton Z. Peebles, “Radar Principles”, John Wiley, 2004.   |   |                 |
| 12. R. Nitzberg, “Radar Signal Processing and Adaptive Systems”, Artech House, 1999.   |   |                 |

|  |   |             |             |            |            |            |            |            |                |            |             |             |             |
|--|---|-------------|-------------|------------|------------|------------|------------|------------|----------------|------------|-------------|-------------|-------------|
| <b>2403CO005</b>   | <b>FPGA BASED COMMUNICATION SYSTEM DESIGN</b> |             |             |            |            | <b>L</b>   | <b>T</b>   | <b>P</b>   | <b>C</b>       |            |             |             |             |
|  |   |             |             |            |            | <b>3</b>   | <b>0</b>   | <b>0</b>   | <b>3</b>       |            |             |             |             |
| <b>PREREQUISITE:</b>   |   |             |             |            |            |            |            |            |                |            |             |             |             |
| VLSI Dseign  |   |             |             |            |            |            |            |            |                |            |             |             |             |
| <b>Course Objectives:</b>  |   |             |             |            |            |            |            |            |                |            |             |             |             |
| 1. To understand the basics of wireless communication  |   |             |             |            |            |            |            |            |                |            |             |             |             |
| 2. To understand the concepts of transceiver architectures   |   |             |             |            |            |            |            |            |                |            |             |             |             |
| 3. To introduce to the students the low power design techniques of VLSI circuits   |   |             |             |            |            |            |            |            |                |            |             |             |             |
| 4. To learn the design and implementation of various VLSI circuits for wireless communication systems  |   |             |             |            |            |            |            |            |                |            |             |             |             |
| <b>COURSE OUTCOMES:</b>  |   |             |             |            |            |            |            |            |                |            |             |             |             |
| CO1: Understanding of application of VLSI circuits in wireless communication   |   |             |             |            |            |            |            |            |                |            |             |             |             |
| CO2: Knowledge of various architectures used in implementing wireless systems  |   |             |             |            |            |            |            |            |                |            |             |             |             |
| CO3: Discussion about design and simulation of low power techniques using software   |   |             |             |            |            |            |            |            |                |            |             |             |             |
| CO4: Learn the VLSI design of wireless circuits  |   |             |             |            |            |            |            |            |                |            |             |             |             |
| <b>COs Vs POs MAPPING:</b>   |   |             |             |            |            |            |            |            |                |            |             |             |             |
|  | <b>COs</b>                                    | <b>PO1</b>  | <b>PO2</b>  | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b>     | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> |
|  | <b>CO1</b>                                    | 3           | 3           | 2          | -          | -          | -          | -          | -              | -          | -           | -           | 3           |
|  | <b>CO2</b>                                    | 3           | 3           | 2          | -          | -          | -          | -          | -              | -          | -           | -           | 3           |
|  | <b>CO3</b>                                    | 3           | 3           | 2          | -          | -          | -          | -          | -              | -          | -           | -           | 3           |
|  | <b>CO4</b>                                    | 3           | 3           | 2          | -          | -          | -          | -          | -              | -          | -           | -           | 3           |
| <b>COs VsPSOs MAPPING:</b>   |   |             |             |            |            |            |            |            |                |            |             |             |             |
|  | <b>COs</b>                                    | <b>PSO1</b> | <b>PSO2</b> |            |            |            |            |            |                |            |             |             |             |
|  | <b>CO1</b>                                    |             | 3           |            |            |            |            |            |                |            |             |             |             |
|  | <b>CO2</b>                                    |             | 3           |            |            |            |            |            |                |            |             |             |             |
|  | <b>CO3</b>                                    |             | 3           |            |            |            |            |            |                |            |             |             |             |
|  | <b>CO4</b>                                    |             | 3           |            |            |            |            |            |                |            |             |             |             |
|  | <b>CO5</b>                                    |             | 3           |            |            |            |            |            |                |            |             |             |             |
| <b>Course Outcomes:</b>  |   |             |             |            |            |            |            |            |                |            |             |             |             |
| <b>MODULE I</b>  | <b>WIRELESS COMMUNICATION BASICS</b>          |             |             |            |            |            |            |            | <b>9 Hours</b> |            |             |             |             |
| Digital communication systems- minimum bandwidth requirement, the Shanon limit- overview of modulation schemes- classical channel- wireless channel description- path loss- multipath fading basics of spread spectrum and spread spectrum techniques- PN sequence           |   |             |             |            |            |            |            |            |                |            |             |             |             |
| <b>MODULE II</b>   | <b>TRANSCEIVER ARCHITECTURE</b>               |             |             |            |            |            |            |            | <b>9 Hours</b> |            |             |             |             |
| Transceiver design constraints- baseband subsystem design- RF subsystem design- Super heterodyne receiver and direct conversion receiver- Receiver front-end- filter design- non-idealities and design parameters- derivation of noise figure and IP3 of receiver front end. |   |             |             |            |            |            |            |            |                |            |             |             |             |
| <b>MODULE III</b>  | <b>LOW POWERDESIGN TECHNIQUES</b>             |             |             |            |            |            |            |            | <b>8 Hours</b> |            |             |             |             |
| Source of power dissipation- estimation of power dissipation- reducing power dissipation at device and circuit levels- low voltage and low power operation- reducing power dissipation at architecture and   |   |             |             |            |            |            |            |            |                |            |             |             |             |

|  |  |
|--|--|
| algorithm levels   |  |
| <b>MODULE IV</b>   | <b>WIRELESS CIRCUITS</b> <span style="float: right;"><b>12 Hours</b></span>          |
| VLSI Design of LNA-wideband and narrow band-impedance matching. Automatic Gain Control (AGC) amplifier-power amplifier- Active mixer- analysis, conversion gain, distortion analysis- low frequency and high frequency case, noise. Passive mixer- sampling mixer and switching mixer analysis of distortion, conversion gain and noise in these mixers. |  |
| <b>MODULE V</b>  | <b>VLSI DESIGN OF SYNTHESIZERS</b> <span style="float: right;"><b>8 Hours</b></span> |
| VLSI design of Frequency Synthesizers (FS) – Parameters of FS - VCO- LC oscillators- ring oscillator- phase noise- loop filter description, design approaches, PLL based frequency synthesizer, phase detector/charge pump- dividers.  |  |
| <b>TOTAL: 45 HOURS</b>   |  |
| <b>REFERENCES:</b>   |  |
| 1. <i>Bosco Leung, VLSI for Wireless Communication, Springer, 2011.</i>  |  |
| 2. <i>Elmad N Farag and Mohamed I Elmasry, Mixed Signal VLSI Wireless Design-Circuits and Systems, Kluwer Academic Publishers, 2002</i>  |  |

## Audit Course

|  |   |            |             |             |                |            |            |            |            |            |             |             |             |
|--|---|------------|-------------|-------------|----------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| <b>2401AU001</b>   | <b>ENGLISH FOR RESEARCH PAPER WRITING</b>                                   | <b>L</b>   | <b>T</b>    | <b>P</b>    | <b>C</b>       |            |            |            |            |            |             |             |             |
|  |   | <b>3</b>   | <b>0</b>    | <b>0</b>    | <b>3</b>       |            |            |            |            |            |             |             |             |
| <b>PREREQUISITE:</b>   |   |            |             |             |                |            |            |            |            |            |             |             |             |
| NIL  |   |            |             |             |                |            |            |            |            |            |             |             |             |
| <b>COURSE OBJECTIVES:</b>  |   |            |             |             |                |            |            |            |            |            |             |             |             |
| <ul style="list-style-type: none"> <li>• Teach how to improve writing skills and level of readability</li> <li>• Tell about what to write in each section</li> <li>• Summarize the skills needed when writing a Title</li> <li>• Infer the skills needed when writing the Conclusion</li> <li>• Ensure the quality of paper at very first-time submission</li> </ul> |   |            |             |             |                |            |            |            |            |            |             |             |             |
| <b>COURSE OUTCOMES:</b>  |   |            |             |             |                |            |            |            |            |            |             |             |             |
| On the successful completion of the course, students will be able to   |   |            |             |             |                |            |            |            |            |            |             |             |             |
| <b>CO1:</b>  | Understand that how to improve your writing skills and level of readability |            |             |             |                |            |            |            |            |            |             |             |             |
| <b>CO2:</b>  | Learn about what to write in each section                                   |            |             |             |                |            |            |            |            |            |             |             |             |
| <b>CO3:</b>  | Understand the skills needed when writing a Title                           |            |             |             |                |            |            |            |            |            |             |             |             |
| <b>CO4:</b>  | Understand the skills needed when writing the Conclusion                    |            |             |             |                |            |            |            |            |            |             |             |             |
| <b>CO5:</b>  | Ensure the good quality of paper at very first-time submission              |            |             |             |                |            |            |            |            |            |             |             |             |
| <b>COs Vs POs MAPPING:</b>   |   |            |             |             |                |            |            |            |            |            |             |             |             |
|  | <b>COs</b>  | <b>PO1</b> | <b>PO2</b>  | <b>PO3</b>  | <b>PO4</b>     | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> |
|  | <b>CO1</b>  |            |             |             |                |            |            |            |            |            | 3           |             | 3           |
|  | <b>CO2</b>  |            |             |             |                |            |            |            |            |            | 3           |             | 3           |
|  | <b>CO3</b>  |            |             |             |                |            |            |            |            |            | 3           |             | 3           |
|  | <b>CO4</b>  |            |             |             |                |            |            |            |            |            | 3           |             | 3           |
|  | <b>CO5</b>  |            |             |             |                |            |            |            |            |            | 3           |             | 3           |
| <b>COs Vs PSOs MAPPING:</b>  |   |            |             |             |                |            |            |            |            |            |             |             |             |
|  |   | <b>COs</b> | <b>PSO1</b> | <b>PSO2</b> |                |            |            |            |            |            |             |             |             |
|  |   | <b>CO1</b> |             |             |                |            |            |            |            |            |             |             |             |
|  |   | <b>CO2</b> |             |             |                |            |            |            |            |            |             |             |             |
|  |   | <b>CO3</b> |             |             |                |            |            |            |            |            |             |             |             |
|  |   | <b>CO4</b> |             |             |                |            |            |            |            |            |             |             |             |
|  |   | <b>CO5</b> |             |             |                |            |            |            |            |            |             |             |             |
| <b>COURSE CONTENTS:</b>  |   |            |             |             |                |            |            |            |            |            |             |             |             |
| <b>MODULE I</b>  | <b>INTRODUCTION TO RESEARCH PAPER WRITING</b>                               |            |             |             | <b>8 Hours</b> |            |            |            |            |            |             |             |             |
| Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness  |   |            |             |             |                |            |            |            |            |            |             |             |             |
| <b>MODULE II</b>   | <b>PRESENTATION SKILLS</b>  |            |             |             | <b>9 Hours</b> |            |            |            |            |            |             |             |             |
| Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction  |   |            |             |             |                |            |            |            |            |            |             |             |             |

|   |                              |                 |
|---|------------------------------|-----------------|
| <b>MODULE III</b>   | <b>TITLE WRITING SKILLS</b>  | <b>8 Hours</b>  |
| Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check |                              |                 |
| <b>MODULE IV</b>  | <b>RESULT WRITING SKILLS</b> | <b>12 Hours</b> |
| Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions   |                              |                 |
| <b>MODULE V</b>   | <b>VERIFICATION SKILLS</b>   | <b>8 Hours</b>  |
| Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first- time submission  |                              |                 |
| <b>TOTAL: 45 HOURS</b>  |                              |                 |
| <b>REFERENCES:</b>  |                              |                 |
| 1. Adrian Wallwork, <i>English for Writing Research Papers</i> , Springer New York Dordrecht Heidelberg London, 2011  |                              |                 |
| 2. Day R <i>How to Write and Publish a Scientific Paper</i> , Cambridge University Press 2006   |                              |                 |
| 3. Goldbort R <i>Writing for Science</i> , Yale University Press (available on Google Books) 2006   |                              |                 |
| 4. Highman N, <i>Handbook of Writing for the Mathematical Sciences</i> , SIAM. Highman's book 1998  |                              |                 |
| 5. Adrian Wallwork, <i>English for Writing Research Papers</i> , Springer New York Dordrecht Heidelberg London, 2011  |                              |                 |
| 6. Day R <i>How to Write and Publish a Scientific Paper</i> , Cambridge University Press 2006   |                              |                 |



|   |  |             |             |             |            |            |            |            |                |            |             |             |             |
|---|--|-------------|-------------|-------------|------------|------------|------------|------------|----------------|------------|-------------|-------------|-------------|
| <b>2401AU002</b>  | <b>DISASTER MANAGEMENT</b>   |             |             |             |            | <b>L</b>   | <b>T</b>   | <b>P</b>   | <b>C</b>       |            |             |             |             |
|   |  | <b>3</b>    | <b>0</b>    | <b>0</b>    | <b>3</b>   |            |            |            |                |            |             |             |             |
| <b>PREREQUISITE:</b>  |  |             |             |             |            |            |            |            |                |            |             |             |             |
| NIL   |  |             |             |             |            |            |            |            |                |            |             |             |             |
| <b>COURSE OBJECTIVES:</b>   |  |             |             |             |            |            |            |            |                |            |             |             |             |
|   | 1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.   |             |             |             |            |            |            |            |                |            |             |             |             |
|   | 2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.   |             |             |             |            |            |            |            |                |            |             |             |             |
|   | 3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.  |             |             |             |            |            |            |            |                |            |             |             |             |
|   | 4. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries |             |             |             |            |            |            |            |                |            |             |             |             |
|   | 5. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.   |             |             |             |            |            |            |            |                |            |             |             |             |
| <b>COURSE OUTCOMES:</b>   |  |             |             |             |            |            |            |            |                |            |             |             |             |
| On the successful completion of the course, students will be able to  |  |             |             |             |            |            |            |            |                |            |             |             |             |
| <b>CO1:</b>   | Explain about the disaster and hazards in the environment.   |             |             |             |            |            |            |            |                |            |             |             |             |
| <b>CO2:</b>   | Discuss about the repercussions of disasters and hazards.  |             |             |             |            |            |            |            |                |            |             |             |             |
| <b>CO3:</b>   | Evaluate the disaster prone areas in India.  |             |             |             |            |            |            |            |                |            |             |             |             |
| <b>CO4:</b>   | Classify the disaster preparedness and management.   |             |             |             |            |            |            |            |                |            |             |             |             |
| <b>CO5:</b>   | Audit the risk assessment.   |             |             |             |            |            |            |            |                |            |             |             |             |
| <b>COs Vs POs MAPPING:</b>  |  |             |             |             |            |            |            |            |                |            |             |             |             |
|   | <b>COs</b>   | <b>PO1</b>  | <b>PO2</b>  | <b>PO3</b>  | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b>     | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> |
|   | <b>CO1</b>   | 3           |             |             |            |            |            |            |                |            |             |             |             |
|   | <b>CO2</b>   | 3           |             |             |            |            |            |            |                |            |             |             |             |
|   | <b>CO3</b>   | 3           | 3           | 3           |            |            |            |            |                |            |             |             |             |
|   | <b>CO4</b>   | 3           | 3           | 3           |            |            |            |            |                |            |             |             |             |
|   | <b>CO5</b>   | 3           | 3           | 3           |            |            |            |            |                |            |             |             |             |
| <b>COs Vs PSOs MAPPING:</b>   |  |             |             |             |            |            |            |            |                |            |             |             |             |
|   | <b>COs</b>   | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |            |            |            |            |                |            |             |             |             |
|   | <b>CO1</b>   | 3           |             |             |            |            |            |            |                |            |             |             |             |
|   | <b>CO2</b>   | 3           |             |             |            |            |            |            |                |            |             |             |             |
|   | <b>CO3</b>   | 3           | 3           | 3           |            |            |            |            |                |            |             |             |             |
|   | <b>CO4</b>   | 3           | 3           | 3           |            |            |            |            |                |            |             |             |             |
|   | <b>CO5</b>   | 3           | 3           | 3           |            |            |            |            |                |            |             |             |             |
| <b>COURSE CONTENTS:</b>   |  |             |             |             |            |            |            |            |                |            |             |             |             |
| <b>MODULE I</b>   | <b>INTRODUCTION</b>  |             |             |             |            |            |            |            | <b>8 Hours</b> |            |             |             |             |
| Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude. |  |             |             |             |            |            |            |            |                |            |             |             |             |

|   |   |                        |
|---|---|------------------------|
| <b>MODULE II</b>  | <b>REPERCUSSIONS OF DISASTERS AND HAZARDS</b> | <b>9 Hours</b>         |
| Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.   |   |                        |
| <b>MODULE III</b>   | <b>DISASTER PRONE AREAS IN INDIA</b>          | <b>8 Hours</b>         |
| Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics  |   |                        |
| <b>MODULE IV</b>  | <b>DISASTER PREPAREDNESS AND MANAGEMENT</b>   | <b>12 Hours</b>        |
| Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.  |   |                        |
| <b>MODULE V</b>   | <b>RISK ASSESSMENT</b>                        | <b>8 Hours</b>         |
| Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival. Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India. |   |                        |
|   |   | <b>TOTAL: 45 HOURS</b> |
| <b>REFERENCES:</b>  |   |                        |
| 1. Goel S.L., <i>Disaster Administration And Management Text And Case Studies</i> , Deep & Deep Publication Pvt. Ltd., New Delhi, 2009.   |   |                        |
| 2. Nishitha Rai, Singh AK, <i>Disaster Management In India: Perspectives, Issues And Strategies</i> "New Royal Book Company, 2007.  |   |                        |
| 3. Sahni, Pardeep Et. Al., <i>Disaster Mitigation Experiences And Reflections</i> , Prentice Hall Of India, New Delhi, 2001.  |   |                        |

|                  |   |          |          |          |          |
|------------------|---|----------|----------|----------|----------|
| <b>2401AU003</b> | <b>SANSKRIT FOR TECHNICAL KNOWLEDGE</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                  |   | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**PREREQUISITE:**

|  |     |
|--|-----|
|  | NIL |
|--|-----|

**COURSE OBJECTIVES:**

|  |  |
|--|--|
|  | <ul style="list-style-type: none"> <li>Illustrate the basic sanskrit language.</li> <li>Recognize sanskrit, the scientific language in the world.</li> <li>Appraise learning of sanskrit to improve brain functioning.</li> <li>Relate sanskrit to develop the logic in mathematics, science &amp; other subjects enhancing thememory power.</li> <li>Extract huge knowledge from ancient literature.</li> </ul> |
|--|--|

**COURSE OUTCOMES:**

|  |   |
|--|---|
| On the successful completion of the course, students will be able to |   |
| <b>CO1:</b>  | Understanding basic Sanskrit language.                      |
| <b>CO2:</b>  | Write sentences.  |
| <b>CO3:</b>  | Know the order and roots of Sanskrit.                       |
| <b>CO4:</b>  | Know about technical information about Sanskrit literature. |
| <b>CO5:</b>  | Understand the technical concepts of Engineering.           |

**COs Vs POs MAPPING:**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 |     |     |     |     |     |     |     |     |     | 3    |      | 3    |
| CO2 |     |     |     |     |     |     |     |     |     | 3    |      | 3    |
| CO3 |     |     |     |     |     |     |     |     |     |      |      | 3    |
| CO4 |     |     |     |     |     |     |     |     |     |      |      | 3    |
| CO5 |     |     |     |     |     |     |     |     |     |      |      | 3    |

**COs Vs PSOs MAPPING:**

| COs | PSO1 | PSO2 |
|-----|------|------|
| CO1 |      |      |
| CO2 |      |      |
| CO3 |      |      |
| CO4 |      |      |
| CO5 |      |      |

**COURSE CONTENTS:**

|   |  |                 |
|---|--|-----------------|
| <b>MODULE I</b>                                 | <b>ALPHABETS</b>                         | <b>8 Hours</b>  |
| Alphabets in Sanskrit                           |  |                 |
| <b>MODULE II</b>                                | <b>TENSES AND SENTENCES</b>              | <b>9 Hours</b>  |
| Past/Present/Future Tense - Simple Sentences    |  |                 |
| <b>MODULE III</b>                               | <b>ORDER AND ROOTS</b>                   | <b>8 Hours</b>  |
| Order - Introduction of roots                   |  |                 |
| <b>MODULE IV</b>                                | <b>SANSKRIT LITERATURE</b>               | <b>12 Hours</b> |
| Technical information about Sanskrit Literature |  |                 |
| <b>MODULE V</b>                                 | <b>TECHNICAL CONCEPTS OF ENGINEERING</b> | <b>8 Hours</b>  |

|  |
|--|
| Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics  |
| <b>TOTAL: 45 HOURS</b>   |
| <b>REFERENCES:</b>   |
| 1. <i>“Abhyaspustakam” – Dr. Vishwas, Samskrita-Bharti Publication, New Delhi</i>  |
| 2. <i>“Teach Yourself Sanskrit” Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication</i> |
| 3. <i>“India’s Glorious Scientific Tradition” Suresh Soni, Ocean books (P) Ltd., New Delhi, 2017.</i>                            |

|  |                                       |             |             |            |            |            |            |            |            |            |             |             |                |          |
|--|---------------------------------------|-------------|-------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|----------------|----------|
| <b>2401AU004</b>   | <b>VALUE EDUCATION</b>                |             |             |            |            |            |            |            |            |            | <b>L</b>    | <b>T</b>    | <b>P</b>       | <b>C</b> |
|  |                                       |             |             |            |            |            |            |            |            |            | <b>3</b>    | <b>0</b>    | <b>0</b>       | <b>3</b> |
| <b>PREREQUISITE:</b>   |                                       |             |             |            |            |            |            |            |            |            |             |             |                |          |
| NIL  |                                       |             |             |            |            |            |            |            |            |            |             |             |                |          |
| <b>COURSE OBJECTIVES:</b>  |                                       |             |             |            |            |            |            |            |            |            |             |             |                |          |
| 1. Understand value of education and self-development  |                                       |             |             |            |            |            |            |            |            |            |             |             |                |          |
| 2. Imbibe good values in students  |                                       |             |             |            |            |            |            |            |            |            |             |             |                |          |
| 3. Let the should know about the importance of character   |                                       |             |             |            |            |            |            |            |            |            |             |             |                |          |
| <b>COURSE OUTCOMES:</b>  |                                       |             |             |            |            |            |            |            |            |            |             |             |                |          |
| On the successful completion of the course, students will be able to   |                                       |             |             |            |            |            |            |            |            |            |             |             |                |          |
| <b>CO1:</b>  | Knowledge of self-development.        |             |             |            |            |            |            |            |            |            |             |             |                |          |
| <b>CO2:</b>  | Learn the importance of Human values. |             |             |            |            |            |            |            |            |            |             |             |                |          |
| <b>CO3:</b>  | Developing the overall personality.   |             |             |            |            |            |            |            |            |            |             |             |                |          |
| <b>CO4:</b>  | Distinguish between mind and body.    |             |             |            |            |            |            |            |            |            |             |             |                |          |
| <b>COs Vs POs MAPPING:</b>   |                                       |             |             |            |            |            |            |            |            |            |             |             |                |          |
|  | <b>COs</b>                            | <b>PO1</b>  | <b>PO2</b>  | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b>    |          |
|  | <b>CO1</b>                            | 3           | 3           |            |            |            |            |            |            |            |             |             |                |          |
|  | <b>CO2</b>                            | 3           |             | 3          |            |            |            |            |            |            |             |             |                |          |
|  | <b>CO3</b>                            | 3           |             | 3          |            |            |            |            |            |            |             |             |                |          |
|  | <b>CO4</b>                            | 3           |             | 3          |            |            |            |            |            |            |             |             |                |          |
| <b>COs Vs PSOs MAPPING:</b>  |                                       |             |             |            |            |            |            |            |            |            |             |             |                |          |
|  | <b>COs</b>                            | <b>PSO1</b> | <b>PSO2</b> |            |            |            |            |            |            |            |             |             |                |          |
|  | <b>CO1</b>                            |             |             |            |            |            |            |            |            |            |             |             |                |          |
|  | <b>CO2</b>                            |             |             |            |            |            |            |            |            |            |             |             |                |          |
|  | <b>CO3</b>                            |             |             |            |            |            |            |            |            |            |             |             |                |          |
|  | <b>CO4</b>                            |             |             |            |            |            |            |            |            |            |             |             |                |          |
| <b>COURSE CONTENTS:</b>  |                                       |             |             |            |            |            |            |            |            |            |             |             |                |          |
| <b>MODULE I</b>  |                                       |             |             |            |            |            |            |            |            |            |             |             | <b>6 HOURS</b> |          |
| Values and self-development–Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non-moral valuation. Standards and principles. Value judgements  |                                       |             |             |            |            |            |            |            |            |            |             |             |                |          |
| <b>MODULE II</b>   |                                       |             |             |            |            |            |            |            |            |            |             |             | <b>8 HOURS</b> |          |
| Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National MODULEy. Patriotism. Love for nature, Discipline  |                                       |             |             |            |            |            |            |            |            |            |             |             |                |          |
| <b>MODULE III</b>  |                                       |             |             |            |            |            |            |            |            |            |             |             | <b>8 HOURS</b> |          |
| Personality and Behavior Development-Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brother hood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature |                                       |             |             |            |            |            |            |            |            |            |             |             |                |          |
| <b>MODULE IV</b>   |                                       |             |             |            |            |            |            |            |            |            |             |             | <b>8 HOURS</b> |          |
| Character and Competence–Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.  |                                       |             |             |            |            |            |            |            |            |            |             |             |                |          |

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|---|
| <b>TOTAL: 30 PERIODS</b>  |
|   |
| <b>REFERENCES:</b>  |
| 1. Chakroborty, S.K. <i>“Values and Ethics for organizations Theory and practice”</i> , Oxford University Press, New Delhi. |

|                  |                              |          |          |          |          |
|------------------|------------------------------|----------|----------|----------|----------|
| <b>2401AU005</b> | <b>CONSTITUTION OF INDIA</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                  |                              | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**PREREQUISITE:**

|  |     |
|--|-----|
|  | NIL |
|--|-----|

**COURSE OBJECTIVES:**

|  |   |
|--|---|
|  | 1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.  |
|  | 2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism. |
|  | 3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.  |

**COURSE OUTCOMES:**

|  |   |
|--|---|
| On the successful completion of the course, students will be able to |   |
| <b>CO1:</b>  | Explain the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.   |
| <b>CO2:</b>  | Describe the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.  |
| <b>CO3:</b>  | Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution. |
| <b>CO4:</b>  | Examine the passage of the Hindu Code Bill of 1956.   |
| <b>CO5:</b>  | Discuss about the rules and regulations of election commission of India.  |

**COs Vs POs MAPPING:**

| COs        | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| <b>CO1</b> | 3   |     |     |     |     |     |     |     |     |      |      |      |
| <b>CO2</b> | 3   |     | 3   |     |     |     |     |     |     |      |      |      |
| <b>CO3</b> | 3   |     | 3   |     |     |     |     |     |     |      |      |      |
| <b>CO4</b> | 3   | 3   | 3   |     |     |     |     |     |     |      |      |      |
| <b>CO5</b> | 3   | 3   | 3   |     |     |     |     |     |     |      |      |      |

**COs Vs PSOs MAPPING:**

| COs        | PSO1 | PSO2 | PSO3 |
|------------|------|------|------|
| <b>CO1</b> | 3    |      |      |
| <b>CO2</b> | 3    |      | 3    |
| <b>CO3</b> | 3    |      | 3    |
| <b>CO4</b> | 3    | 3    | 3    |
| <b>CO5</b> | 3    | 3    | 3    |

**COURSE CONTENTS:**

|                  |   |                |
|------------------|---|----------------|
| <b>MODULE I</b>  | <b>HISTORY OF MAKING OF THE INDIAN CONSTITUTION AND PHILOSOPHY OF THE INDIAN CONSTITUTION</b> | <b>6 HOURS</b> |
|                  | History Drafting Committee, ( Composition & Working), Preamble Salient Features               |                |
| <b>MODULE II</b> | <b>CONTOURS OF CONSTITUTIONAL RIGHTS &amp; DUTIES</b>   | <b>6 HOURS</b> |

|  |  |
|--|--|
| Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.  |  |
| <b>MODULE III</b>  | <b>ORGANS OF GOVERNANCE</b> <b>6 HOURS</b> |
| Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions   |  |
| <b>MODULE IV</b>   | <b>LOCAL ADMINISTRATION</b> <b>6 HOURS</b> |
| District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy. |  |
| <b>MODULE V</b>  | <b>ELECTION COMMISSION</b> <b>6 HOURS</b>  |
| Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.   |  |
| <b>TOTAL: 30 PERIODS</b>   |  |
| <b>REFERENCES:</b>   |  |
| 1. <i>The Constitution of India, 1950 (Bare Act), Government Publication.</i>  |  |
| 2. <i>Dr. S.N. Busi, Dr. B.R. Ambedkar framing of Indian Constitution, 1<sup>st</sup> Edition, 2015.</i>   |  |
| 3. <i>M.P. Jain, Indian Constitution Law, 7<sup>th</sup> Edn., Lexis Nexis, 2014.</i>  |  |
| 4. <i>D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.</i>   |  |



|  |   |             |             |             |            |            |            |            |            |            |             |             |                |          |          |
|--|---|-------------|-------------|-------------|------------|------------|------------|------------|------------|------------|-------------|-------------|----------------|----------|----------|
| <b>2401AU006</b>   | <b>PEDAGOGY STUDIES</b>   |             |             |             |            |            |            |            |            |            |             | <b>L</b>    | <b>T</b>       | <b>P</b> | <b>C</b> |
|  |   |             |             |             |            |            |            |            |            |            |             | <b>3</b>    | <b>0</b>       | <b>0</b> | <b>3</b> |
| <b>PREREQUISITE:</b>   |   |             |             |             |            |            |            |            |            |            |             |             |                |          |          |
| NIL  |   |             |             |             |            |            |            |            |            |            |             |             |                |          |          |
| <b>COURSE OBJECTIVES:</b>  |   |             |             |             |            |            |            |            |            |            |             |             |                |          |          |
| 1. Review existing evidence on there view topic to inform programme design and policy  |   |             |             |             |            |            |            |            |            |            |             |             |                |          |          |
| 2. Making under taken by the Dfid, other agencies and researchers.   |   |             |             |             |            |            |            |            |            |            |             |             |                |          |          |
| 3. Identify critical evidence gaps to guide the development.   |   |             |             |             |            |            |            |            |            |            |             |             |                |          |          |
| <b>COURSE OUTCOMES:</b>  |   |             |             |             |            |            |            |            |            |            |             |             |                |          |          |
| On the successful completion of the course, students will be able to   |   |             |             |             |            |            |            |            |            |            |             |             |                |          |          |
| <b>CO1:</b>  | Explain about the introduction and methodology of pedagogy studies.   |             |             |             |            |            |            |            |            |            |             |             |                |          |          |
| <b>CO2:</b>  | Describe about the thematic overview.                                 |             |             |             |            |            |            |            |            |            |             |             |                |          |          |
| <b>CO3:</b>  | Summarize the evidence of the effectiveness of pedagogical practices. |             |             |             |            |            |            |            |            |            |             |             |                |          |          |
| <b>CO4:</b>  | Infer the professional development                                    |             |             |             |            |            |            |            |            |            |             |             |                |          |          |
| <b>CO5:</b>  | Analyze the research gaps and future directions.                      |             |             |             |            |            |            |            |            |            |             |             |                |          |          |
| <b>COs Vs POs MAPPING:</b>   |   |             |             |             |            |            |            |            |            |            |             |             |                |          |          |
|  | <b>COs</b>  | <b>PO1</b>  | <b>PO2</b>  | <b>PO3</b>  | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b>    |          |          |
|  | <b>CO1</b>  | 3           |             |             |            |            |            |            |            |            |             |             |                |          |          |
|  | <b>CO2</b>  | 3           |             | 3           |            |            |            |            |            |            |             |             |                |          |          |
|  | <b>CO3</b>  | 3           |             | 3           |            |            |            |            |            |            |             |             |                |          |          |
|  | <b>CO4</b>  |             |             |             |            |            |            |            |            |            |             |             |                |          |          |
|  | <b>CO5</b>  |             |             |             |            |            |            |            |            |            |             |             |                |          |          |
| <b>COs Vs PSOs MAPPING:</b>  |   |             |             |             |            |            |            |            |            |            |             |             |                |          |          |
|  | <b>COs</b>  | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |            |            |            |            |            |            |             |             |                |          |          |
|  | <b>CO1</b>  | 3           |             |             |            |            |            |            |            |            |             |             |                |          |          |
|  | <b>CO2</b>  | 3           |             | 3           |            |            |            |            |            |            |             |             |                |          |          |
|  | <b>CO3</b>  | 3           |             | 3           |            |            |            |            |            |            |             |             |                |          |          |
|  | <b>CO4</b>  |             |             |             |            |            |            |            |            |            |             |             |                |          |          |
|  | <b>CO5</b>  |             |             |             |            |            |            |            |            |            |             |             |                |          |          |
| <b>COURSE CONTENTS:</b>  |   |             |             |             |            |            |            |            |            |            |             |             |                |          |          |
| <b>MODULE I</b>  | <b>INTRODUCTION AND METHODOLOGY:</b>                                  |             |             |             |            |            |            |            |            |            |             |             | <b>6 HOURS</b> |          |          |
| Aims and rationale, Policy background, Conceptual frame work and terminology-Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overviewofmethodologyand Searching.  |   |             |             |             |            |            |            |            |            |            |             |             |                |          |          |
| <b>MODULE II</b>   | <b>THEMATIC OVERVIEW</b>  |             |             |             |            |            |            |            |            |            |             |             | <b>6 HOURS</b> |          |          |
| Pedagogical practices are being used by teachers in formal and informal classrooms in developingcountries-Curriculum,Teachereducation.   |   |             |             |             |            |            |            |            |            |            |             |             |                |          |          |
| <b>MODULE III</b>  | <b>EVIDENCE ON THEEFFECTIVENESS OF PEDAGOGICAL PRACTICES</b>          |             |             |             |            |            |            |            |            |            |             |             | <b>6 HOURS</b> |          |          |
| Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective |   |             |             |             |            |            |            |            |            |            |             |             |                |          |          |

|   |  |
|---|--|
| pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and Pedagogic strategies  |  |
| <b>MODULE IV</b>  | <b>PROFESSIONAL DEVELOPMENT</b> <span style="float: right;"><b>6 HOURS</b></span>            |
| Professional development: alignment with classroom practices and follow up support - Peer support - Support from the head teacher and the comm MODULE y - Curriculum and assessment - Barriers to learning: limited resources and large class sizes |  |
| <b>MODULE V</b>   | <b>RESEARCH GAPS AND FUTURE DIRECTIONS</b> <span style="float: right;"><b>6 HOURS</b></span> |
| Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.  |  |
| <b>TOTAL: 30 PERIODS</b>  |  |
| <b>REFERENCES:</b>  |  |
| 1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, <i>Compare</i> , 31(2): 245-261.   |  |
| 2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, <i>Journal of Curriculum Studies</i> , 36(3):361-379.   |  |
| 3. Akyeampong K (2003) Teacher training in Ghana-does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.  |  |
| 4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? <i>International Journal Educational Development</i> , 33(3): 272–282.                |  |
| 5. Alexander RJ (2001) <i>Culture and pedagogy: International comparisons in primary education</i> . Oxford and Boston: Blackwell.  |  |
| 6. Chavan M (2003) <i>Read India: A mass scale, rapid, 'learning to read' campaign</i> .  |  |
| 7. <a href="http://www.pratham.org/images/resource%20working%20paper%202.pdf">www.pratham.org/images/resource%20working%20paper%202.pdf</a>   |  |

|   |  |             |             |            |            |            |            |            |            |            |             |             |                 |          |          |
|---|--|-------------|-------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-----------------|----------|----------|
| <b>2401AU007</b>  | <b>STRESS MANAGEMENT BY YOGA</b>   |             |             |            |            |            |            |            |            |            |             | <b>L</b>    | <b>T</b>        | <b>P</b> | <b>C</b> |
|   |  |             |             |            |            |            |            |            |            |            |             | <b>3</b>    | <b>0</b>        | <b>0</b> | <b>3</b> |
| <b>PREREQUISITE:</b>  |  |             |             |            |            |            |            |            |            |            |             |             |                 |          |          |
| NIL   |  |             |             |            |            |            |            |            |            |            |             |             |                 |          |          |
| <b>COURSE OBJECTIVES:</b>   |  |             |             |            |            |            |            |            |            |            |             |             |                 |          |          |
| To achieve overall health of body and mind  |  |             |             |            |            |            |            |            |            |            |             |             |                 |          |          |
| To overcome stress  |  |             |             |            |            |            |            |            |            |            |             |             |                 |          |          |
| <b>COURSE OUTCOMES:</b>   |  |             |             |            |            |            |            |            |            |            |             |             |                 |          |          |
| On the successful completion of the course, students will be able to  |  |             |             |            |            |            |            |            |            |            |             |             |                 |          |          |
| <b>CO1:</b>   | Develop healthy mind in a healthy body thus improving social health also |             |             |            |            |            |            |            |            |            |             |             |                 |          |          |
| <b>CO2:</b>   | Improve efficiency   |             |             |            |            |            |            |            |            |            |             |             |                 |          |          |
| <b>CO3:</b>   | Compare good and bad things in mind and body.                            |             |             |            |            |            |            |            |            |            |             |             |                 |          |          |
| <b>COs Vs POs MAPPING:</b>  |  |             |             |            |            |            |            |            |            |            |             |             |                 |          |          |
|   | <b>COs</b>   | <b>PO1</b>  | <b>PO2</b>  | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b>     |          |          |
|   | <b>CO1</b>   | 3           | 3           | 3          |            |            |            |            |            |            |             |             |                 |          |          |
|   | <b>CO2</b>   |             | 3           | 3          |            |            |            |            |            |            |             |             |                 |          |          |
|   | <b>CO3</b>   |             | 3           | 3          |            |            |            |            |            |            |             |             |                 |          |          |
| <b>COs Vs PSOs MAPPING:</b>   |  |             |             |            |            |            |            |            |            |            |             |             |                 |          |          |
|   | <b>COs</b>   | <b>PSO1</b> | <b>PSO2</b> |            |            |            |            |            |            |            |             |             |                 |          |          |
|   | <b>CO1</b>   |             |             |            |            |            |            |            |            |            |             |             |                 |          |          |
|   | <b>CO2</b>   |             |             |            |            |            |            |            |            |            |             |             |                 |          |          |
|   | <b>CO3</b>   |             |             |            |            |            |            |            |            |            |             |             |                 |          |          |
| <b>COURSE CONTENTS:</b>   |  |             |             |            |            |            |            |            |            |            |             |             |                 |          |          |
| <b>MODULE I</b>   |  |             |             |            |            |            |            |            |            |            |             |             | <b>10 HOURS</b> |          |          |
| Definitions of Eight parts of yoga.(Ashtanga)   |  |             |             |            |            |            |            |            |            |            |             |             |                 |          |          |
| <b>MODULE II</b>  |  |             |             |            |            |            |            |            |            |            |             |             | <b>10 HOURS</b> |          |          |
| Yam and Niyam - Do`s and Don`t`s in life - i) Ahinsa, satya, astheya, bramhacharya and aparigraha,ii)Ahinsa, satya, astheya, bramhacharya and aparigraha. |  |             |             |            |            |            |            |            |            |            |             |             |                 |          |          |
| <b>MODULE III</b>   |  |             |             |            |            |            |            |            |            |            |             |             | <b>10 HOURS</b> |          |          |
| Asan and Pranayam - Various yog poses and their benefits for mind & body - Regularization of breathing techniques and its effects-Types of pranayam       |  |             |             |            |            |            |            |            |            |            |             |             |                 |          |          |
| <b>TOTAL: 30 PERIODS</b>  |  |             |             |            |            |            |            |            |            |            |             |             |                 |          |          |
| <b>REFERENCES:</b>  |  |             |             |            |            |            |            |            |            |            |             |             |                 |          |          |
| 1. <i>Yogic Asanas for Group Training-Part-I</i> :Janardan Swami Yoga bhyasi Mandal, Nagpur   |  |             |             |            |            |            |            |            |            |            |             |             |                 |          |          |
| 2. <i>“Rajayoga or conquering the Internal Nature”</i> by Swami Vivekananda, Advaita Ashrama(Publication Department), Kolkata                             |  |             |             |            |            |            |            |            |            |            |             |             |                 |          |          |

### Laboratory

|                  |  |          |          |          |          |
|------------------|--|----------|----------|----------|----------|
| <b>2402CO106</b> | <b>DIGITAL IMAGE AND VIDEO PROCESSING LABORATORY</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|                  |  | <b>0</b> | <b>0</b> | <b>4</b> | <b>2</b> |

**PREREQUISITE:**

|  |                                  |
|--|----------------------------------|
|  | 1. Digital Signal Processing Lab |
|  | 2. Digital Image Processing Lab  |

**COURSE OBJECTIVES:**

|  |   |
|--|---|
|  | 1. To make the students to understand the digital image fundamentals.   |
|  | 2. To demonstrate the digital image using different transforms.   |
|  | 3. To apply the concepts and basic knowledge in filters, image enhancement, image restoration and compression techniques. |

**COURSE OUTCOMES:**

|  |   |
|--|---|
| On the successful completion of the course, students will be able to |   |
| <b>CO1:</b>  | Apply the Fundamentals of Digital image processing and its applications.                                  |
| <b>CO2:</b>  | Perform the image enhancement technique for the improvement of pictorial information for human perception |
| <b>CO3:</b>  | Apply the concepts of image segmentation and compression  |
| <b>CO4:</b>  | Demonstrate object detection and recognition technique learning   |
| <b>CO5:</b>  | Demonstrate video object tracking and detection.  |
| <b>CO6:</b>  | Showcase the video inpainting technique.  |

**COs Vs POs MAPPING:**

| COs        | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| <b>CO1</b> | 3   | 3   | 3   | 3   | 3   |     |     | 3   | 3   |      | 3    | 3    |
| <b>CO2</b> | 3   | 3   | 3   | 3   | 3   |     |     | 3   | 3   |      | 3    | 3    |
| <b>CO3</b> | 3   | 3   | 3   | 3   | 3   |     |     | 3   | 3   |      | 3    | 3    |
| <b>CO4</b> | 3   | 3   | 3   | 3   | 3   |     |     | 3   | 3   |      | 3    | 3    |
| <b>CO5</b> | 3   | 3   | 3   | 3   | 3   |     |     | 3   | 3   |      | 3    | 3    |
| <b>CO6</b> | 3   | 3   | 3   | 3   | 3   |     |     | 3   | 3   |      | 3    | 3    |

**COs Vs PSOs MAPPING:**

| COs        | PSO1 | PSO2 |
|------------|------|------|
| <b>CO1</b> |      | 3    |
| <b>CO2</b> |      | 3    |
| <b>CO3</b> |      | 3    |
| <b>CO4</b> |      | 3    |
| <b>CO5</b> |      | 3    |
| <b>CO6</b> |      | 3    |

**LIST OF EXPERIMENTS:**

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| 1. Write a program to read an image, apply the Sobel filter for edge detection, and display the resulting image.     |
| 2. Write a MATLAB program to resize an image.  |
| 3. Write a MATLAB program to perform image segmentation.   |
| 4. Write a MATLAB program to perform histogram equalization on an image.   |
| 5. Write a MATLAB program to perform image compression.  |
| 6. Write a MATLAB program to read a video file and display it frame by frame   |
| 7. Write a MATLAB program to read a video file, apply a Sobel filter, and display the processed frames one by one.   |
| 8. Write a MATLAB program to read a video file, sample the video signal, and display the sampled frames.             |
| 9. Write a simple MATLAB program to read a video file, perform video enhancement, and display the frames one by one. |
| 10. Write a MATLAB program to read a video file, perform motion estimation on the video signal, and display it.      |
| <b>TOTAL: 45 HOURS</b>   |

**REFERENCES:**

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|---|
| 1. <i>C.Rafeal Gonzalez and E.Richard Woods, Digital Image Processing, Third Edition, Pearson Education 2008.</i>       |
| 2. <i>Anil K.Jain, Fundamentals of Digital Image Processing, PHI, 2010.</i>   |
| 3. <i>S Jayaraman, S Esakkirajan T Veerakumar, Digital Image Processing , Mc Graw- Hill, 2010</i>                       |
| 4. <i>K.William Pratt, Digital Image Processing, John Wiley, 1997.</i>  |
| 5. <i>M.A.Sid Ahmed, Image Processing Theory, Algorithm and Architectures, McGraw - Hill, 1995.</i>                     |
| 6. <i>C.Rafeal Gonzalez and E.Richard Woods, Digital Image Processing, Third Edition, Pearson Education 2008.</i>       |
| 7. <i>Anil K.Jain, Fundamentals of Digital Image Processing, PHI, 2010.</i>   |
| 8. <i>S Jayaraman, S Esakkirajan T Veerakumar, Digital Image Processing , Mc Graw- Hill, 2010</i>                       |
| 9. <i>Yao wang, JoemOstarmannand Ya- quin Zhang, "Video processing and communication", 1<sup>st</sup> edition , PHI</i> |
| 10. <i>M.Tekalp, "DigitalvideoProcessing", PrenticeHallInternational</i>  |

|  |  |             |             |            |            |            |            |            |            |            |             |             |             |
|--|--|-------------|-------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| <b>2402CO105</b>   | <b>ADVANCED COMMUNICATION LABORATORY</b>   |             |             |            | <b>L</b>   | <b>T</b>   | <b>P</b>   | <b>C</b>   |            |            |             |             |             |
|  |  | <b>0</b>    | <b>0</b>    | <b>4</b>   | <b>2</b>   |            |            |            |            |            |             |             |             |
| <b>PREREQUISITE:</b>   |  |             |             |            |            |            |            |            |            |            |             |             |             |
| NIL  |  |             |             |            |            |            |            |            |            |            |             |             |             |
| <b>COURSE OBJECTIVES:</b>  |  |             |             |            |            |            |            |            |            |            |             |             |             |
| 1. To study & measure the performance of digital communication systems.                          |  |             |             |            |            |            |            |            |            |            |             |             |             |
| 2. To provide a comprehensive knowledge of Wireless Communication.                               |  |             |             |            |            |            |            |            |            |            |             |             |             |
| 3. To learn about the design of digital filter and its adaptive filtering algorithms.            |  |             |             |            |            |            |            |            |            |            |             |             |             |
| <b>COURSE OUTCOMES:</b>  |  |             |             |            |            |            |            |            |            |            |             |             |             |
| On the successful completion of the course, students will be able to                             |  |             |             |            |            |            |            |            |            |            |             |             |             |
| <b>CO1:</b>  | Implement the adaptive filtering algorithms  |             |             |            |            |            |            |            |            |            |             |             |             |
| <b>CO2:</b>  | Generate and detect digital communication signals of various modulation techniques using MATLAB.                           |             |             |            |            |            |            |            |            |            |             |             |             |
| <b>CO3:</b>  | Evaluate cellular mobile communication technology and propagation model.   |             |             |            |            |            |            |            |            |            |             |             |             |
| <b>CO4:</b>  | Apply mathematical formulation to analyze spectrum estimation of a signal and bitrate determination of a transmission link |             |             |            |            |            |            |            |            |            |             |             |             |
| <b>CO5:</b>  | Analyze the performance of optimization algorithms for equalizing the channel or noise /echo cancellation                  |             |             |            |            |            |            |            |            |            |             |             |             |
| <b>CO6:</b>  | Able to design synchronization algorithm for Digital Communication systems.  |             |             |            |            |            |            |            |            |            |             |             |             |
| <b>COs Vs POs MAPPING:</b>   |  |             |             |            |            |            |            |            |            |            |             |             |             |
|  | <b>COs</b>   | <b>PO1</b>  | <b>PO2</b>  | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> |
|  | <b>CO1</b>   | 3           | 3           | 3          | 3          | 3          |            |            | 3          | 3          |             | 3           | 3           |
|  | <b>CO2</b>   | 3           | 3           | 3          | 3          | 3          |            |            | 3          | 3          |             | 3           | 3           |
|  | <b>CO3</b>   | 3           | 3           | 3          | 3          | 3          |            |            | 3          | 3          |             | 3           | 3           |
|  | <b>CO4</b>   | 3           | 3           | 3          | 3          | 3          |            |            | 3          | 3          |             | 3           | 3           |
|  | <b>CO5</b>   | 3           | 3           | 3          | 3          | 3          |            |            | 3          | 3          |             | 3           | 3           |
|  | <b>CO6</b>   | 3           | 3           | 3          | 3          | 3          |            |            | 3          | 3          |             | 3           | 3           |
| <b>COs Vs PSOs MAPPING:</b>  |  |             |             |            |            |            |            |            |            |            |             |             |             |
|  | <b>COs</b>   | <b>PSO1</b> | <b>PSO2</b> |            |            |            |            |            |            |            |             |             |             |
|  | <b>CO1</b>   |             | 3           |            |            |            |            |            |            |            |             |             |             |
|  | <b>CO2</b>   |             | 3           |            |            |            |            |            |            |            |             |             |             |
|  | <b>CO3</b>   |             | 3           |            |            |            |            |            |            |            |             |             |             |
|  | <b>CO4</b>   |             | 3           |            |            |            |            |            |            |            |             |             |             |
|  | <b>CO5</b>   |             | 3           |            |            |            |            |            |            |            |             |             |             |
|  | <b>CO6</b>   |             | 3           |            |            |            |            |            |            |            |             |             |             |
| <b>LIST OF EXPERIMENTS:</b>  |  |             |             |            |            |            |            |            |            |            |             |             |             |
| 1. Generation & detection of binary digital modulation techniques using SDR                      |  |             |             |            |            |            |            |            |            |            |             |             |             |
| 2. Spread Spectrum communication system-Pseudo random binary sequence generation-Base band DSSS. |  |             |             |            |            |            |            |            |            |            |             |             |             |

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|--|
| 3. MIMO system transceiver design using MATLAB/SCILAB/LABVIEW  |
| 4. Performance evaluation of simulated CDMA system   |
| 5. Channel Coder/decoder design (block codes / convolutional codes/ turbo codes)   |
| 6. OFDM transceiver design using MATLAB /SCILAB/LABVIEW  |
| 7. Channel equalizer design using MATLAB (LMS, RLS algorithms)   |
| 8. Design and Analysis of Spectrum Estimators (Bartlett, Welch) using MATLAB   |
| 9. BER performance Analysis of M-ary digital Modulation Techniques (coherent & non coherent) in AWGN Environment using MATLAB/SCILAB/LABVIEW |
| 10. Design and performance analysis of Lossless Coding Techniques - Huffman Coding and Lempel Ziv Algorithm using MATLAB/SCILAB/LABVIEW      |
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