| | **K.S.R. COLLEGE OF ENGINEERING (Autonomous)**<br>(Approved by AICTE, Accredited by NAAC with A grade & Affiliated to Anna University) **K.S.R. Kalvi Nagar, Tiruchengode – 637 215** | **CURRICULUM PG**<br>**R - 2018** |
|---|---|---|
| Department | Department of Electronics and Communication Engineering | |
| Programme | M.E - Communication Systems | |

### SEMESTER - I

| Sl.No. | Course Code | Course Name | L | T | P | C | CA | ES | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | | **Hours/ Week** | | | **Credit** | **Maximum Marks** | | |
| **THEORY** | | | | | | | | | |
| 1. | CU18111 | Advanced Radiation Systems | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2. | CU18112 | Wireless and Mobile Communication | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3. | CU18113 | Advanced Communication Network | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4. | | Elective - I | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5. | CU18114 | Research Methodology and IPR | 2 | 0 | 0 | 2 | 30 | 70 | 100 |
| 6. | | Audit Course 1 | 2 | 0 | 0 | 0 | 50 | 50 | 100 |
| **PRACTICAL** | | | | | | | | | |
| 7. | CU18121 | Antennas and Radiating Systems Laboratory | 0 | 0 | 3 | 2 | 50 | 50 | 100 |
| 8. | CU18122 | Advanced Communication Networks Laboratory | 0 | 0 | 3 | 2 | 50 | 50 | 100 |
| | | Total | 16 | 0 | 6 | 18 | | 700 | |

### SEMESTER - II

| Sl.No. | Course Code | Course Name | L | T | P | C | CA | ES | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | | **Hours/ Week** | | | **Credit** | **Maximum Marks** | | |
| **THEORY** | | | | | | | | | |
| 1. | MA18241 | Applied Mathematics | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2. | CU18212 | Modern Digital Communication Techniques | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3. | CU18213 | Advanced Digital Signal Processing | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4. | | Elective - 2 | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5. | | Elective - 3 | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6. | | Audit Course 2 | 2 | 0 | 0 | 0 | 50 | 50 | 100 |
| **PRACTICAL** | | | | | | | | | |
| 7. | CU18221 | Advanced Digital Signal Processing Lab | 0 | 0 | 3 | 2 | 50 | 50 | 100 |
| 8. | CU18222 | Mini Project | 0 | 0 | 3 | 2 | 50 | 50 | 100 |
| | | Total | 18 | 0 | 6 | 20 | | 700 | |

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|---|---|---|
| Department | Department of Electronics and Communication Engineering | |
| Programme | M.E - Communication Systems | |

### SEMESTER - III

| SI.No. | Course Code | Course Name | Hours/ Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | CA | ES | Total |
| **THEORY** | | | | | | | | | |
| 1. | | Elective -4 | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2. | | Elective - 5 | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3. | | Open Elective | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| **PRACTICAL** | | | | | | | | | |
| 4. | CU18321 | Project Phase - I | 0 | 0 | 12 | 8 | 50 | 50 | 100 |
| | | Total | 9 | 0 | 12 | 14 | | 400 | |

### SEMESTER – IV

| SI.No. | Course Code | Course Name | Hours/ Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | CA | ES | Total |
| **PRACTICAL** | | | | | | | | | |
| 1. | CU18421 | Project Phase - II | 0 | 0 | 24 | 16 | 50 | 50 | 100 |
| | | Total | 0 | 0 | 24 | 16 | | 100 | |

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|---|---|---|
| Department | Department of Electronics and Communication Engineering | |
| Programme | M.E - Communication Systems | |
| **List of Electives** | | |

| | | ELECTIVES 1(SEMESTER – I) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **SI.No.** | **Course Code** | **Course Name** | **Hours/ Week** | | | **Credit** | **Maximum Marks** | | |
| | | | **L** | **T** | **P** | **C** | **CA** | **ES** | **Total** |
| 1. | CU18161 | DSP Processor Architecture and Programming | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2. | CU18162 | Cognitive Radio | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3. | CU18163 | Optical Communication Networks | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4. | CU18164 | Wireless Sensor Networks | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5. | CU18165 | RF and Microwave Circuit Design | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6. | CU18166 | Microstrip Patch Antenna Design | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 7. | CU18167 | Digital Communication Receivers | 3 | 0 | 0 | 3 | 30 | 70 | 100 |

| | | ELECTIVES 2 & 3 (SEMESTER – II) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **SI.No.** | **Course Code** | **Course Name** | **Hours/ Week** | | | **Credit** | **Maximum Marks** | | |
| | | | **L** | **T** | **P** | **C** | **CA** | **ES** | **Total** |
| 1. | CU18261 | Communication Protocol Engineering | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2. | CU18262 | Internet of Things | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3. | CU18263 | Voice and Data Networks | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4. | CU18264 | MIMO Systems | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5. | CU18265 | Satellite Communication | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6. | CU18266 | EM Modeling and Analysis for Planar Antenna | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 7. | CU18267 | Communication Network Security | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 8. | CU18268 | RF MEMS for Wireless Communication | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 9. | CU18269 | Multimedia Compression Techniques | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 10. | PE18201 | Soft Computing Techniques (Common to PE & CS) | 3 | 0 | 0 | 3 | 30 | 70 | 100 |

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|---|---|---|
| Department | Department of Electronics and Communication Engineering | |
| Programme | M.E - Communication Systems | |
| **List of Electives** | | |

| **ELECTIVES 4&5**(SEMESTER – III) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SI.No. | Course Code | Course Name | Hours/ Week | | | Credit | Maximum Marks | | |
| | | | L | T | P | C | CA | ES | Total |
| 1. | CU18361 | High Performance Computer Networks | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 2. | CU18362 | Pattern Recognition and Machine Learning | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 3. | CU18363 | Remote sensing | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 4. | CU18364 | High Speed Switching Architecture | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 5. | CU18365 | Spread Spectrum Communication | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 6. | CU18366 | Speech and Audio Processing | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 7. | CU18367 | Signal Detection and Estimation | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 8. | CU18368 | Internetworking Multimedia | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 9. | CU18369 | Wavelet transforms and its applications | 3 | 0 | 0 | 3 | 30 | 70 | 100 |
| 10. | CU18371 | Microwave Integrated Circuits | 3 | 0 | 0 | 3 | 30 | 70 | 100 |

| **Audit Courses** (SEMESTER – I& II) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| S.No. | Course Code | Course Name | Hours/ Week | | | Credit | Maximum Marks | | |
| | | | L | T | P | C | CA | ES | Total |
| 1. | CUAC01 | English for Research Paper Writing | 2 | 0 | 0 | 0 | - | - | - |
| 2. | CUAC02 | Disaster Management | 2 | 0 | 0 | 0 | - | - | - |
| 3. | CUAC03 | Sanskrit for Technical Knowledge | 2 | 0 | 0 | 0 | - | - | - |
| 4. | CUAC04 | Value Education | 2 | 0 | 0 | 0 | - | - | - |
| 5. | CUAC05 | Constitution of India | 2 | 0 | 0 | 0 | - | - | - |
| 6. | CUAC06 | Pedagogy Studies | 2 | 0 | 0 | 0 | - | - | - |
| 7. | CUAC07 | Stress Management by Yoga | 2 | 0 | 0 | 0 | - | - | - |
| 8. | CUAC08 | Personality Development through life Enlightenment skills | 2 | 0 | 0 | 0 | - | - | - |

**K.S.R. COLLEGE OF ENGINEERING (Autonomous)**     **R 2018**

<u>**SEMESTER - I**</u>

| | | L | T | P | C |
|---|---|---|---|---|---|
| **CU18111** | **ADVANCED RADIATION SYSTEMS** | 3 | 0 | 0 | 3 |

*Objectives: Students will be able*
- *To learn the fundamental parameters of antennas*
- *To familiarize the fundamental concepts of array antennas*
- *To understand about the radiation from apertures with the field equivalence principles*
- *To know design various array antenna structures and micro strip patch antenna*
- *To know analyze EMC measurements of antennas*

**UNIT - I     ANTENNA FUNDAMENTALS**                    **[9 Periods]**

Antenna fundamental parameters, Radiation integrals, Radiation from surface and line current distributions –dipole, monopole, loop antenna; Mobile phone antenna – base station, handset antenna: Image; Induction, reciprocity theorem, Broadband antennas and Matching techniques, Balance to unbalance transformer, Introduction to numerical techniques.

**UNIT - II     ARRAY ANTENNA**                    **[9 Periods]**

Linear array – uniform array, end fire and broad side array, gain, beam width, side lobe level, Two dimensional uniform array, Phased array, beam scanning, grating lobe, feed network. Three dimensional characteristics, binomial array and Dolph-Tchebycheff arrays, Circular array**.**

**UNIT - III     RADIATION FROM APERTURES**                    **[9 Periods]**

Field equivalence principle, Radiation from Rectangular and Circular apertures, Uniform aperture distribution on an infinite ground plane, Slot antenna, Horn antenna, Reflector antenna, aperture blockage and design consideration**.**

**UNIT - IV     ANALYSIS AND DESIGN OF MICROSTRIP PATCH ANTENNAS**                    **[9 Periods]**

Configurations – Excitations and radiation mechanism of microstrip patch antennas – radiation resistance – Power and input impedance. Modeling of Rectangular and Circular microstrip patch antennas–Transmission line model and cavity model method. Circular polarization and bandwidth of micro strip patch antennas. Simulation of microstrip antennas using HFSS.

**UNIT - V     EMC ANTENNA AND ANTENNA MEASUREMENTS**                    **[9 Periods]**

Concept of EMC measuring antenna; Tx and Rx antenna factors, Log periodic dipole, Bi-conical, Ridge guide, Multiturn loop, Antenna measurement and instrumentation - Gain, Impedance and antenna factor measurement, Antenna test range Design.

                                                                        **Total =45 Periods**

*Course Outcomes:*
*Upon Completion of the course, the students will be able to:*
*CO1: Understand the basic parameters of Antenna.*
*CO2: Analyze the different characteristics of arrays.*
*CO3: Understand the working principles of aperture antennas.*
*CO4: Design of micro strip Patch antenna.*
*CO5: Perform different antenna measurement techniques.*

**Reference Books :**
1    K.Balanis.A,"Antenna Theory Analysis and Design", 3/e,John Wiley and Sons, NewYork. (2011).
2    Krauss.J.D, "Antennas", 2/e, John Wiley and sons, NewYork (2011).
3    I.J. Bahl and P. Bhartia," Microstrip Antennas", Artech House, Inc(1980).
4    W.L.Stutzman and G.A.Thiele, "Antenna Theory and Design",3/e, John Wiley & Sons Inc.,(2012).
5    JordanE.C. "Electromagnetic Waves and Radiating Systems", Prentice Hall India, NewDelhi, (2003).

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## SEMESTER - I

| | | L | T | P | C |
|---|---|---|---|---|---|
| **CU18112** | **WIRELESS AND MOBILE COMMUNICATION** | 3 | 0 | 0 | 3 |

*Objectives: Students will be able*
- *To learn the fundamental of cellular concepts*
- *To familiarize the fundamental concepts Multiple access techniques*
- *To understand about the propagation Models*
- *To know design various diversity techniques and CDMA*
- *To know analyze various systems and standards*

### UNIT - I    CELLULAR FUNDAMENTALS                                    [9 Periods]

Cellular Communication Fundamentals: Cellular system design, Frequency reuse, cell splitting, handover concepts, Co channel and adjacent channel interference, interference reduction techniques and methods to improve cell coverage, Frequency management and channel assignment, GSM architecture and interfaces, GSM Logical Channels, Data Encryption in GSM, Mobility Management, Call Flows in GSM.2.5G Standards: General Packet Radio Service (GPRS), 2.75 G Standards: EDGE.

### UNIT - II    MULTIPLE ACCESS TECHNIQUES                              [9 Periods]

Spectral efficiency analysis based on calculations for Multiple access technologies: TDMA, FDMA and CDMA, Comparisons, advantages, disadvantages and application areas. Wireless network planning: Link budget and power spectrum calculations.

### UNIT - III    PROPAGATION MODELS                                     [9 Periods]

Mobile Radio Propagation: Large Scale Path Loss, Free Space Propagation Model, Ground Reflection (Two-Ray) Model, Reflection, Diffraction, Scattering, Link Budget Design using Path Loss Models, Outdoor Propagation Models, Indoor Propagation Models, Signal Penetration into Buildings. Small Scale Fading and Multipath Propagation, Impulse Response Model, Multipath Measurements, Parameters of Multipath channels, Types of Small Scale Fading: Time Delay Spread; Flat, Frequency selective, Doppler Spread; Fast and Slow fading.

### UNIT - IV    DIVERSITY TECHNIQUES AND CDMA                          [9 Periods]

Equalization, Diversity: Equalizers in a communications receiver, Algorithms for adaptive equalization, Diversity techniques: space, polarization, frequency diversity. Interleaving, Code Division Multiple Access: Introduction to CDMA technology, IS 95 system Architecture, Air Interface, Physical and logical channels of IS 95, Forward Link and Reverse link operation, Physical and Logical channels of IS 95 CDMA, IS 95 CDMA Call Processing, Evolution of IS 95 (CDMA One) to CDMA 2000, CDMA 2000 layering structure and channels.

### UNIT - V    SYSTEMS AND STANDARDS                                    [9 Periods]

Higher Generation Cellular Standards: 3G Standards: EDGE, enhancements in 4G standard, Architecture and representative protocols, call flow for LTE, VoLTE, UMTS, Introduction to 5G.

**Total =45 Periods**

*Course Outcomes:*

*Upon Completion of the course, the students will be able to:*
*CO1: Design appropriate mobile communication systems.*
*CO2: Apply frequency-reuse concept in mobile communications, and to analyze its effects on interference, system capacity, handoff techniques*
*CO3: Distinguish various multiple-access techniques for mobile communications e.g. FDMA, TDMA, CDMA, and their advantages and disadvantages.*
*CO4: Analyze path loss and interference for wireless telephony and their influences on a mobile communication system's performance.*
*CO5: Understanding upcoming technologies like 3G, 4G etc.*

**Reference Books :**

1. V.K.Garg, J.E.Wilkes, "Principle and Application of GSM", Pearson Education, 5th edition, 2008.
2. V.K.Garg, "IS-95 CDMA & CDMA 2000", Pearson Education, 4th edition, 2009.
3. T.S.Rappaport, "Wireless Communications Principles and Practice", 2nd edition, PHI,2002.
4. William C.Y.Lee, "Mobile Cellular Telecommunications Analog and Digital Systems", 2nd edition, TMH, 1995.
5. AshaMehrotra, "A GSM system Engineering" Artech House Publishers Bosten, London, 1997.

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<u>SEMESTER - I</u>

| **CU18113** | **ADVANCED COMMUNICATION NETWORK** | L<br>3 | T<br>0 | P<br>0 | C<br>3 |

*Objectives: Students will be able*
- *To understand the TCP and RSVP Protocol.*
- *To know the traffic scheduling and queue management.*
- *To analyze the packet classification algorithm.*
- *To gain the knowledge on differentiated services.*
- *To learn the features IP switching and traffic engineering.*

### UNIT – I    TCP AND RSVP    [9 Periods]

Overview of Internet – Concepts and challenges. Overview of ATM, TCP/IP Congestion and Flow Control. Throughput analysis of TCP - TCP for high bandwidth delay networks- Fairness issues in TCP. Real Time Communications over Internet - Latency and throughput issues - Resource reservation in Internet. RSVP - Leaky bucket algorithm and its properties.

### UNIT - II    TRAFFIC SCHEDULING AND QUEUE MANAGEMENT    [9 Periods]

Packet Scheduling Algorithms-requirement - Scheduling guaranteed service connections - GPS, WFQ and Rate proportional algorithms - High speed scheduler design - Characterization of Traffic by Linearly Bounded Arrival Processes (LBAP) -  Theory of Latency Rate servers and delay bounds in packet switched networks for LBAP traffic- Active Queue Management - RED, WRED and Virtual clock - Control theoretic analysis of active queue management.

### UNIT - III    PACKET CLASSIFICATION ALGORITHM    [9 Periods]

IP address lookup-challenges. Packet classification algorithms and Flow Identification- Grid of Tries, Cross producting and controlled prefix expansion algorithms.

### UNIT - IV    DIFFERENTIATED SERVICES    [9 Periods]

Admission control in Internet - Concept of Effective bandwidth. Measurement based admission control - Differentiated Services in Internet (DiffServ) - DiffServ architecture and framework.

### UNIT - V    IP SWITCHING AND TRAFFIC ENGINEERING    [9 Periods]

IPV4, IPV6, IP tunneling – IP switching and MPLS - Overview of IP over ATM and its evolution to IP switching - MPLS architecture and framework. MPLS Protocols – Traffic engineering issues in MPLS.

**Total =45 Periods**

*Course Outcomes:*
*Upon Completion of the course, the students will be able to:*
*CO1: Understand internet challenges and TCP congestion control*
*CO2: Understand advanced concepts in Communication Networking.*
*CO3: Design and develop protocols for Communication Networks.*
*CO4: Understand the mechanisms in Quality of Service in networking.*
*CO5: Optimize the Network Design.*

**Reference Books :**

1    Jean Wairand and PravinVaraiya, "High Performance Communications Networks", 2ndedition, 2000.
2    Jean Le Boudec and Patrick Thiran, "Network Calculus A Theory of Deterministic Queuing Systems for the Internet", Springer Veriag, 2001.
3    Zhang Wang, "Internet QoS", Morgan Kaufman, 2001.
4    Anurag Kumar, D. Manjunath and Joy Kuri, "Communication Networking: An Analytical Approach", Morgan Kaufman Publishers, 2004.
5    George Kesidis, "ATM Network Performance", Kluwer Academic, Research Papers, 2005.

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**SEMESTER - I**

| CU18114 | RESEARCH METHODOLOGY AND IPR | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 0 |

*Objectives: Students will be able*
- *To understand the characteristics of wireless medium and wireless network fundamentals.*
- *To know the various digital modulation and detection techniques.*
- *To analyze the different conditions for diversity concepts.*
- *To gain the knowledge for spread spectrum analysis.*
- *To learn the features of wireless ADHOC networks.*

**UNIT - I     RESEARCH METHODOLOGY                                    [9 Periods]**

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

**UNIT - II     RESEARCH PAPER WRITING                                 [9 Periods]**

Effective literature studies approaches, analysis Plagiarism , Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

**UNIT - III     INTELLECTUAL PROPERTY RIGHTS                        [9 Periods]**

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

**UNIT - IV     PATENT RIGHTS                                          [9 Periods]**

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

**UNIT - V     RECENT ADVANCEMENTS IN IPR                            [9 Periods]**

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

**Total =45 Periods**

*Course Outcomes:*
*Upon Completion of the course, the students will be able to:*
*CO1: Understand research problem formulation.*
*CO2: Analyze research related information  and follow research ethics*
*Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.*
*CO3: Understanding that when IPR would take such important place in growth of individuals &nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.*
*Understand that IPR protection provides an incentive to inventors for further research work and investment in R & CO4: D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.*

**Reference Books :**

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'.
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction".
3. Ranjit Kumar, 2ndEdition, "Research Methodology: A Step by Step Guide for beginners".
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov, "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.

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<u>**SEMESTER - I**</u>

|  |  | L | T | P | C |
|---|---|---|---|---|---|
| **CU18121** | **ANTENNAS AND RADIATING SYSTEMS LABORATORY** | 0 | 0 | 3 | 2 |

*Objectives: Students will be able*
- *To simulate dipole antennas.*
- *To simulate quarter wave and monopole antenna*
- *To understand the effect on height and its characteristics.*
- *To analyze the concept of antenna arrays.*
- *To understand the phase difference on antenna arrays.*

**List of Experiments:**
1. Simulation of half wave dipole antenna.
2. Simulation of change of the radius and length of dipole wire on frequency of resonance of antenna.
3. Simulation of quarter wave, full wave antenna and comparison of their parameters.
4. Simulation of monopole antenna with and without ground plane.
5. Study the effect of the height of the monopole antenna on the radiation characteristics of the   antenna.
6. Simulation of a half wave dipole antenna array.
7. Study the effect of change in distance between elements of array on radiation pattern of dipole array.
8. Study the effect of the variation of phase difference 'beta' between the elements of the array on the radiation pattern of the dipole array.
9. Case study.

**Total = 45 Periods**

*Course Outcomes:*
*At the end of the course, the student should be able to:*
*CO1: Perform Designing and simulating the dipole antennas.*

*CO2: Know the Simulate quarter wave and monopole antenna*

*CO3: Understood the effect on height and its characteristics.*

*CO4: Analyze the concept of antenna arrays.*

*CO5: Understand the phase difference on antenna arrays.*

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**SEMESTER - I**

| | L | T | P | C |
|---|---|---|---|---|
| **CU18122**    **ADVANCED COMMUNICATION NETWORKS LABORATORY** | 0 | 0 | 3 | 2 |

***Objectives:*** *Students will be able*
- *To learn simulation of network in static and dynamic environment.*
- *To simulate the various concepts of LAN and wired, wireless networks.*
- *To understand Ad hoc routing protocols and wireless MAC protocols.*
- *To realize the concepts of various protocols and models in* GLOMOSIM/NS2.
- *To evaluate the performance of entity models, GSM*

**List of Experiments:**

1. Study of Networking Commands (Ping, Tracert, TELNET, nslookup, netstat, ARP, RARP) and Network Configuration Files.

2. Linux Network Configuration.
   a. Configuring NIC's IP Address.
   b. Determining IP Address and MAC Address using if-config command.
   c. Changing IP Address using if-config.
   d. Static IP Address and Configuration by Editing.
   e. Determining IP Address using DHCP.
   f. Configuring Hostname in /etc/hosts file.

3. Design TCP iterative Client and Server application to reverse the given input sentence.

4. Design a TCP concurrent Server to convert a given text into upper case using multiplexing system call "select".

5. Design UDP Client Server to transfer a file.

6. Configure a mail server for IMAP/POP protocols and write a simple SMTP client in C/C++/Java Client to send and receive mails.

7. Configure FTP Server on a Linux/Windows machine using a FTP client/SFTP client characterize file transfer rate for a cluster of small files 100k each and a video file of 700mb. Use a TFTP client and repeat the experiment.

8. Signaling and QoS of labeled paths using RSVP in MPLS.

9. Find shortest paths through provider network for RSVP and BGP.

**Total = 45 Periods**

***Course Outcomes:***
***At the end of the course, the student should be able to:***
*CO1: Identify the different types of network devices and their functions within a network.*
*CO2: Understand and build the skills of sub-netting and routing mechanisms.*
*CO3: Understand basic protocols of computer networks.*
*CO4: How they can be used to assist in network design and implementation.*

**K.S.R. COLLEGE OF ENGINEERING (Autonomous)**

**SEMESTER - II**

| | | L | T | P | C |
|---|---|---|---|---|---|
| **MA18241** | **APPLIED MATHEMATICS**<br>( M.E – Communication Systems) | 3 | 0 | 0 | 3 |

*Objectives: Students will be able*
- *On the completion of the course, the students are expected to apply advanced matrix theory and its applications.*
- *To familiarize with the basics and applications of Random Variables and to extend the knowledge in two dimensional random variables*
- *To improve ability in solving Queuing Models and to acquire knowledge in Bessel's function and its applications.*

**UNIT - I     MATRIX THEORY**                                    **[9 Periods]**

Matrix factorizations - The Cholesky decomposition - QR factorization - Least squares method - Singular value decomposition - Toeplitz matrices and some applications.

**UNIT - II     ONE DIMENSIONAL RANDOM VARIABLES**              **[9 Periods]**

One dimensional random variables - Probability function – moments – moment generating functions and their properties – Binomial, Poisson, Geometric,Uniform, Exponential, Gamma and Normal distributions – Function of a Random Variable

**UNIT - III     TWO DIMENSIONAL RANDOM PROCESS**              **[9 Periods]**

Joint distributions- Marginal and Conditional distributions – Functions of two dimensional random variables – regression curve – correlation.

**UNIT - IV     QUEUEING MODELS**                                **[9 Periods]**

Poission process - Markovian queues – Applications of Queuing Models – characteristics of Queuing Models – Kendall's notation - Model I – (M/M/1) : ($\infty$ /FIFO) Single Server with infinite capacity, – Little's formula - Model II – (M/M/C) : ($\infty$ /FIFO) Multi  Server with infinite capacity, - Model III – (M/M/1) : ($N$ /FIFO) Single Server with finite capacity, - Model IV – (M/M/C) : ($N$ /FIFO) multi server with finite capacity – Machine interference model – steady state analysis.

**UNIT - V     SPECIAL FUNCTIONS**                                **[9 Periods]**

Bessel's equation - Bessel function – Recurrence relations - Generating function and orthogonal property for Bessel functions of first kind – Fourier - Bessel expansion.

**Total (L: 45 ) = 45 Periods**

*Course Outcomes:*
*CO1: Interpret the basics of Eigen values and vectors of symmetric matrices, by  factorization and decomposition of matrices*
*CO2: Understanding the concepts of one dimensional random variables and apply in the field of engineering.*
*CO3: Develop their skills in solving the two dimensional random variables.*
*CO4: Enable to find the waiting time by applying various queuing models.*
*CO5: Ability to  evaluate Bessel function using orthogonal property*

**Reference Books :**

1   Grewal, B.S.Numerical methods in engineering and science, 42nd edition, khanna publishers, 2013.
2   Moon, T.K., Sterling, W.C., Mathematical methods and algorithms for signal processing, Pearson Education, 2014.
3   Richard Johnson, Miller & Freund, Probability and Statistics for Engineers, 7th Edition, Prentice Hall of India, Private Ltd., New Delhi (2013).
4   Taha, H.A., Operations Research, An introduction, 7thedition, Pearson education, Asia, New Delhi, 2014
5   Donald Gross and Carl M. Harris, Fundamentals of Queuing theory, 10thedition, John Wiley and Sons, New York (2013).

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<u>**SEMESTER - II**</u>

| **CU18212** | **MODERN DIGITAL COMMUNICATION TECHNIQUES** | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

***Objectives:*** *Students will be able*
- *To understand basic digital modulation schemes*
- *To learn about OFDM and coding logics for OFDM*
- *To understand the architecture of block codes*
- *To familiarize on Viterbi algorithm and convolutional codes*
- *To know about equalization techniques and algorithms*

### UNIT - I      DIGITAL MODULATION TECHNIQUES      [9 Periods]

Advantages of constant envelope modulation; Binary frequency shift keying– Coherent and Non-coherent detection of BFSK; Minimum shift keying – Gaussian minimum shift keying; M-ary phase shift keying; M-ary quadrature amplitude modulation; M-ary frequency shift keying.

### UNIT - II      OFDM      [9 Periods]

Generation of sub-carriers using the IFFT; Guard time and cyclic extension; Windowing; OFDM signal processing; Peak power problem: PAP reduction schemes - Clipping, filtering, coding and scrambling.

### UNIT - III      BLOCK CODED DIGITAL COMMUNICATION      [9 Periods]

Architecture and performance – Binary block codes; Orthogonal; Bi orthogonal; Trans orthogonal – 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.

### UNIT - IV      CONVOLUTIONAL CODED DIGITAL COMMUNICATION      [9 Periods]

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.

### UNIT - V      EQUALIZATION TECHNIQUES      [9 Periods]

Band limited channels – ISI – Nyquist criterion – Controlled ISI – Partial response signals– Equalization algorithms– Viterbi algorithm – Linear equalizer–Decision feedback equalization – Adaptive equalization algorithms.

**Total =45 Periods**

***Course Outcomes:***
***Upon Completion of the course, the students will be able to:***
*CO1: Familiarize on fundamental digital modulation mechanisms.*
*CO2: Understand OFDM concepts and applications*
*CO3: Analyze and apply different block codes*
*CO4: Design convolutional codes with error probability*
*CO5: Apply equalization techniques in communication systems*

**Reference Books :**

1. M.K.Simon,S.M.Hinedi and W.C.Lindsey," Digital communication techniques; Signaling and detection", Prentice Hall India, New Delhi.1995.Reprint Edition2003.
2. Simon Haykin,"Digital communications", John Wiley and sons,1998.
3. John G. Proakis.,"Digital Communication", 2/e, McGraw Hill Publication2001.
4. Theodore S.Rappaport., "Wireless Communications", 2/e, PearsonEducation,2002.
5. StephenG.Wilson.,"DigitalModulationandCoding",FirstIndianReprint,PearsonEducation2003.
6. Richard VanNee & Ramjee Prasad, "OFDM for Multimedia Communications"Artech House Publication 2001.

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**SEMESTER - II**

| | | L | T | P | C |
|---|---|---|---|---|---|
| **CU18213** | **ADVANCED DIGITAL SIGNAL PROCESSING** | 3 | 0 | 0 | 3 |

*Objectives: Students will be able*
- *To introduce the concept of discrete random signal processing.*
- *To learn fundamental concepts on signal processing in power spectrum estimation.*
- *To study about the linear estimation and prediction for various filter.*
- *To study the adaptive filters and its applications.*
- *To explore the concepts of multi rate signal processing and multi rate filters.*

### UNIT - I    DISCRETE RANDOM SIGNAL PROCESSING    [9 Periods]

Discrete random processes – Ensemble averages – Stationary processes: Bias and Estimation, Auto covariance, Autocorrelation - Parseval's theorem - Wiener-Khintchine relation – White noise - Power spectral density, Spectral factorization – Filtering random processes – Low pass filtering of white noise.

### UNIT - II    SPECTRUM ESTIMATION    [9 Periods]

Estimation of spectra from finite duration signals -Non-Parametric methods – Correlation method – Periodogram estimator – Performance analysis of estimators - Unbiased, Consistent estimators – Modified periodogram –Bartlett and Welch methods – Blackman – Tukey method - Parametric methods: AR, MA, ARMA model based spectral estimation, Yule-Walker equations-Solutions using Durbin's algorithm.

### UNIT - III    LINEAR ESTIMATION AND PREDICTION    [9 Periods]

Linear prediction – Forward and backward predictions, Solutions of the normal equations - Levinson recursion algorithms – Least mean squared error criterion – Wiener filter for filtering and prediction – FIR Wiener filter and IIR Wiener filters – Discrete kalman filter.

### UNIT - IV    ADAPTIVE FILTERS    [9 Periods]

FIR adaptive filters – Adaptive filter based on steepest descent method – Widrow – Hoff LMS adaptive algorithm – Normalized LMS – Adaptive channel equalization – Adaptive echo cancellation–Adaptive noise cancellation –Adaptive recursive filters – RLS adaptive filters – Exponentially weighted RLS sliding window RLS.

### UNIT - V    MULTIRATE DIGITAL SIGNAL PROCESSING    [9 Periods]

Mathematical description of change of sampling rate – Interpolation and decimation – Decimation by an integer factor – Interpolation by an integer factor – Sampling rate conversion by a rational factor–Filter implementation for sampling rate conversion – Direct form FIR structures – Polyphase filter structures-Time-variant structures –Multistage implementation of multirate system – Application to sub band coding -Wavelet transform and filter bank implementation of wavelet expansion of signals.

**Total =45 Periods**

*Course Outcomes:*
*Upon Completion of the course, the students will be able to:*
*CO1: Gain the knowledge about discrete random signal processing.*
*CO2: Understanding different spectral estimation techniques.*
*CO3: Analyze the concept about linear prediction.*
*CO4: Ability to design LMS and RLS adaptive filters for signal enhancement, channel equalization.*
*CO5: Acquiring knowledge of how a multi rate system works.*

**Reference Books :**
1. Monson H. Hayes, 'Statistical Digital Signal Processing and Modeling", John Wiley and Sons,Inc., Singapore (2008)
2. JohnJ. Proakis, Dimitris G.Manolakis, : Digital Signal Processing', Pearson Education(2007).
3. DimitrisGManolakis,"StatisticalandAdaptiveSignalProcessing",McGrawHill,New York, (2005).
4. Rafael Gonzalez.C. Richard Woods E."DigitalImageProcessing",2/e, Pearson Education, Inc. (2004). (For Wavelet Transform Topic)
5. John Proakis.G. "Algorithms for Statistical Signal Processing", Pearson Education (2002)

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<u>**SEMESTER - I**</u>

| | | L | T | P | C |
|---|---|---|---|---|---|
| **CU18221** | **ADVANCED DIGITAL SIGNAL PROCESSING LAB** | 0 | 0 | 3 | 2 |

***Prerequisites:***

***Objectives:***
*Students are able to perform*
- *To design and implement the various signal representation*
- *To analyze Routh Hurwitz and FFT techniques.*
- *To simulate various filters using MATLAB.*
- *To simulate different codes in communication.*
- *To simulate and analyze PSD and Z transform.*

**List of Experiments:**
1. Basic Signal Representation
2. Correlation Auto And Cross
3. Stability Using Hurwitz Routh Criteria
4. Sampling FFT Of Input Sequence
5. Butterworth Lowp ass And High pass Filter Design
6. Chebychev Type I,II Filter
7. State Space Matrix from Differential Equation
8. Normal Equation Using Levinson Durbin
9. Decimation And Interpolation Using Rationale Factors
10. Maximally Decimated Analysis DFT Filter
11. Cascade Digital IIR Filter Realization
12. Convolution And M Fold Decimation &PSD Estimator
13. Estimation Of PSD
14. Inverse Z Transform

**Total = 45 Periods**

***Course Outcomes:***
***At the end of the course, the student should be able to:***
*CO1: Understand the design and implement the various signal representation*
*CO2: Analyze Routh - Hurwitz and FFT techniques.*
*CO3: Knows about simulate various filters using MATLAB.*
*CO4: Simulate different codes in communication.*
*CO5: Simulate and analyze PSD and Z transform.*

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### SEMESTER - I

| | | L | T | P | C |
|---|---|---|---|---|---|
| **CU18161** | **DSP PROCESSOR ARCHITECTURE AND PROGRAMMING (ELECTIVE)** | 3 | 0 | 0 | 3 |

***Objectives:*** *Students will be able*
- *To understand the architectural features of various DSP processor.*
- *To implement the DSP algorithms using the fixed DSP Processor.*
- *To implement the DSP algorithms using the floating DSP Processor.*
- *To develop the ADSP processor.*
- *To learn about advanced processors.*

#### UNIT - I    FUNDAMENTALS OF PROGRAMMABLE DSPs    [9 Periods]

Multiplier and multiplier accumulator – Modified bus structures and memory access in PDSPs– Multiple access memory – Multi-port memory – VLIW architecture- Pipelining –Special addressing modes in P-DSPs – On chip peripherals.

#### UNIT - II    TMS320C5X PROCESSOR -Fixed    [9 Periods]

Architecture – Assembly language syntax - Addressing modes – Assembly language Instructions - Pipeline structure, Operation – Block diagram of DSP starter kit – Application programs for processing real time signals.

#### UNIT - III    TMS320C3X PROCESSOR -Floating    [9 Periods]

Architecture – Data formats - Addressing modes – Groups of addressing modes- Instruction sets - Operation – Block diagram of DSP starter kit – Application programs for processing real time signals – Generating and finding the sum of series, Convolution of two sequences, Filter design.

#### UNIT - IV    ADSP PROCESSORS    [9 Periods]

Architecture of ADSP-21XX and ADSP-210XX series of DSP processors- Addressing modes and assembly language instructions – Application programs –Filter design, FFT calculation.

#### UNIT - V    ADVANCED PROCESSORS    [9 Periods]

Architecture of TMS320C54X: Pipe line operation, Code composer studio – Architecture of TMS320C6X - Architecture of Motorola DSP563XX – Comparison of the features of DSP family processors.

**Total =45 Periods**

***Course Outcomes:***
*Upon Completion of the course, the students will be able to:*
*CO1: Analyze the concept about fundamentals of Programmable DSP.*
*CO2: Ability to design a DSP Algorithm using fixed processor.*
*CO3: Ability to design a DSP Algorithm using floating processor.*
*CO4: Gain the knowledge about various parameters considered in ADSP processor.*
*CO5: Develop the concepts of advanced processors.*

**Reference Books :**
1. Venkataramani B. and Bhaskar M., "Digital Signal Processors – Architecture, Programming and Applications" ,Tata McGraw – Hill Publishing Company Limited. New Delhi, 2nd Edition, 2011.
2. User guides Texas Instrumentation, Analog Devices, Motorola.
3. Sen.M.Kuo, Woon–Seng S.Gan, "Digital Signal Processors: Architecture, Implementation and Applications", Pearson, 2012.
4. www.analogdevices.com
5. www.adi.com

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<u>**SEMESTER - I**</u>

| | | L | T | P | C |
|---|---|---|---|---|---|
| **CU18162** | **COGNITIVE RADIO** | 3 | 0 | 0 | 3 |

***Objectives:*** *Students will be able*
- *To understand the Introduction to cognitive radio.*
- *To study the concepts of Spectrum Sensing*
- *To understand the concept of optimization techniques.*
- *To determine the principles dynamic spectrum.*
- *To analyze the* spectrum trading and research challenges.

### UNIT - I     INTRODUCTION TO COGNITIVE RADIO      **[9 Periods]**

Introduction to Cognitive Radios: Digital dividend, cognitive radio (CR) architecture, functions of cognitive radio, dynamic spectrum access (DSA), components of cognitive radio, spectrum sensing, spectrum analysis and decision, potential applications of cognitive radio.

### UNIT - II     SPECTRUM SENSING      **[9 Periods]**

Spectrum Sensing: Spectrum sensing, detection of spectrum holes (TVWS), collaborative sensing, geo-location database and spectrum sharing business models.

### UNIT - III     OPTIMIZATION TECHNIQUES      **[9 Periods]**

Optimization Techniques of Dynamic Spectrum Allocation: Linear programming, convex programming, non-linear programming, integer programming, dynamic programming, stochastic programming.

### UNIT - IV     DYNAMIC SPECTRUM      **[9 Periods]**

Dynamic Spectrum Access and Management: Spectrum broker, cognitive radio architectures, centralized dynamic spectrum access, distributed dynamic spectrum access, learning algorithms and protocols.

### UNIT - V     SPECTRUM TRADING AND RESEARCH CHALLENGES      **[9 Periods]**

Spectrum Trading: Introduction to spectrum trading, classification to spectrum trading, radio resource pricing, brief discussion on economics theories in DSA (utility, auction theory), classification of auctions (single auctions, double auctions, concurrent, sequential). Research Challenges in Cognitive Radio: Network layer and transport layer issues, cross layer design for cognitive radio networks.

                                                                       **Total =45 Periods**

***Course Outcomes:***
**Upon Completion of the course, the students will be able to:**
*CO1: Understand the fundamental concepts of cognitive radio networks.*
*CO2: Develop the cognitive radio, as well as techniques for spectrum holes detection that cognitive radio takes advantages in order to exploit it.*
*CO3: Understand technologies to allow an efficient use of TVWS for radio communications based on two spectrum sharing business models/policies.*
*CO4: Understand fundamental issues regarding dynamic spectrum access, the radio-resource management and trading, as well as a number of optimization techniques for better spectrum exploitation.*

**Reference Books :**

1. Ekram Hossain, Dusit Niyato, Zhu Han, "Dynamic Spectrum Access and Management in Cognitive Radio Networks", Cambridge University Press, 2009.
2. Kwang-Cheng Chen, Ramjee Prasad, "Cognitive radio networks", John Wiley & Sons Ltd., 2009.
3. Bruce Fette, "Cognitive radio technology", Elsevier, 2nd edition, 2009.
4. Huseyin Arslan, "Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems", Springer, 2007.
5. Francisco Rodrigo Porto Cavalcanti, Soren Andersson, "Optimizing Wireless Communication Systems" Springer, 2009.

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**SEMESTER - I**

| | | L | T | P | C |
|---|---|---|---|---|---|
| CU18163 | **OPTICAL COMMUNICATION NETWORKS** | 3 | 0 | 0 | 3 |

***Objectives:*** *Students will be able*
- *To learn the basics of optical devices.*
- *To study the concept of Network Architectures*
- *To understand the various wavelength routing networks.*
- *To study about the different methods of packet switching network.*
- *To know the concept of fault management.*

### UNIT - I     OPTICAL SYSTEM COMPONENTSAND NETWORK DESIGN     [9 Periods]

Optical system components:  Couplers, Isolators and Circulators, Multiplexers and Filters, Optical amplifiers, Switches, Wavelength converters – Transmission system engineering – System model, Power penalty-Transmitter, Receiver, Optical amplifiers, crosstalk, dispersion, wavelength stabilization; Overall design considerations.

### UNIT - II     OPTICAL NETWORK ARCHITECTURES     [9 Periods]

Introduction to optical networks; SONET/SDH, Metropolitan Area Networks, Layered architecture; Broad cast and select Networks– Topologies, Media Access Control protocols and test beds.

### UNIT - III     WAVELENGTH ROUTING NETWORKS     [9 Periods]

WDM network elements: WDM network design – Cost tradeoffs, Routing and wavelength assignment, Virtual topology design, Wavelength routing test beds, Architectural variations.

### UNIT - IV     PACKET SWITCHING AND ACCESS NETWORKS     [9 Periods]

Photonic packet switching:    OTDM, Multiplexing and Demultiplexing, Synchronization, Broadcast OTDM networks, Switch based networks – Access Networks – Network architecture overview, Future access networks, Optical access network architectures and OTDM networks.

### UNIT - V     NETWORK MANAGEMENT AND SURVIVABILITY     [9 Periods]

Control and Management:  Network management functions, Configuration management, Performance management, Fault management, Optical safety, Service interface.

**Total =45 Periods**

***Course Outcomes:***
***Upon Completion of the course, the students will be able to:***
*CO1: Understand  optical system components and network design*
*CO2: Analyze different optical networks.*
*CO3: Perform different multiplexing techniques in optical networks*
*CO4: Understand the different accessing techniques.*
*CO5: Know about network management techniques.*

**Reference Books :**
1. Rajiv Ramaswami and Kumar N.Sivarajan,"Optical Networks: A Practical Perspective" Harcourt Asia Pvt.Ltd.,2/e (2006).
2. C.Siva Ram Moorthy and Mohan Gurusamy,"WDM Optical Networks : Concept, Design and Algorithms", Prentice HallofIndia,1/e (2002).
3. P.E. Green, Jr., "Fiber Optic Networks", Prentice Hall, NJ (1993).
4. Biswanath Mukherjee, "Optical WDM Networks", Springer (2006).

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## SEMESTER - I

| | | L | T | P | C |
|---|---|---|---|---|---|
| CU18164 | WIRELESS SENSOR NETWORKS (ELECTIVE) | 3 | 0 | 0 | 3 |

***Objectives:** Students will be able*
- *To know the fundamentals of wireless sensor networks.*
- *To analyze the architecture and optimization goals.*
- *To gain the knowledge about various types of sensors in networking.*
- *To understand the infrastructure establishment.*
- *To understand the concept about network platform tools.*

### UNIT - I     OVERVIEW OF WIRELESS SENSOR NETWORKS     [9 Periods]

Challenges for wireless sensor networks – Characteristics requirements –Required mechanisms, Difference between mobile ad-hoc and sensor networks, Applications of sensor networks –Enabling technologies for wireless sensor networks.

### UNIT - II     ARCHITECTURES     [9 Periods]

Single – node Architecture – Hardware components, Energy consumption of sensor nodes, Operating systems and execution environments, Network architecture – Sensor network scenarios, Optimization goals and figures of merit, Gate way concepts.

### UNIT - III     NETWORKING OF SENSORS     [9 Periods]

Physical layer and transceiver design considerations, MAC protocols for wireless sensor networks, Low duty cycle protocols and wakeup concepts- S-MAC, The mediation device protocol, Wakeup radio concepts, Address and name management, Assignment of MAC addresses, Routing protocols – Energy – efficient routing, Geographic routing.

### UNIT - IV     INFRASTRUCTURE ESTABLISHMENT     [9 Periods]

Topology control, Clustering, Time synchronization, Localization and localization services, Sensor tasking and control – Information based joint routing and information aggregation.

### UNIT - V     SENSOR NETWORK PLATFORMS AND TOOLS     [9 Periods]

Operating systems for wireless sensor networks, Sensor node hardware – Berkeley motes, Programming challenges, Node- level software platforms, Node – level simulators, State-centric programming

**Total =45 Periods**

***Course Outcomes:***
***Upon Completion of the course, the students will be able to:***
*CO1: Understand the concept of basics of wireless sensor networks.*
*CO2: Gain knowledge about of various architectures in WSN.*
*CO3: Analyze the different sensors in networking.*
*CO4: Understand the concept of Infrastructure establishment in WSN.*
*CO5: Learn about various tools used in sensor network platform.*

**Reference Books :**
1. Holger Karl & Andreas Willig,"Protocols And Architectures for Wireless Sensor Networks", John Wiley,2011.
2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks – An Information Processing Approach", Elsevier, Reprint 2012
3. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks -Technology, Protocols, And Applications", John Wiley, 2007.Reprint2012.
4. AnnaHac, "Wireless Sensor Network Designs", John Wiley, 2009.
5. Bhaskar Krishnamachari,"Networking Wireless Sensors", Cambridge Press, 2005.
6. Mohammad Ilyas and Imad Mahgaob, "Handbook Of Sensor Networks: Compact Wireless And Wired Sensing Systems", CRC Press, 2005.
7. Wayne Tomasi, "Introduction To Data Communication And Networking", PE, 2010.

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### SEMESTER - I

| | | L | T | P | C |
|---|---|---|---|---|---|
| **CU18165** | **RF AND MICROWAVE CIRCUIT DESIGN (ELECTIVE)** | 3 | 0 | 0 | 3 |

***Objectives:*** *Students will be able*
- *To understand the importance of RF Passive Components*
- *To learn about impedance matching components in amplifiers.*
- *To know the role of feedback in RF power amplifiers.*
- *To analyze the various models in PLL and frequency synthesizers.*
- *To learn the concept about mixers and oscillators.*

**UNIT - I**      **TRANSMISSION LINE THEORY**          **[9 Periods]**

Transmission Line Theory: Lumped element circuit model for transmission line, field analysis, Smith chart, quarter wave transformer, generator and load mismatch, impedance matching and tuning.

**UNIT - II**      **MICROWAVE COMPONENTS**          **[9 Periods]**

Microwave Network Analysis: Impedance and equivalent voltage and current, Impedance and admittance matrix, The scattering matrix, transmission matrix, Signal flow graph. Microwave Components: Microwave resonators, Microwave filters, power dividers and directional couplers, Ferromagnetic devices and components

**UNIT - III**      **RANDOM PROCESS**          **[9 Periods]**

Nonlinearity And Time Variance Inter-symbol interference, random process & noise, definition of sensitivity and dynamic range, conversion gain and distortion.

**UNIT - IV**      **MICROWAVE SEMICONDUCTOR DEVICES**          **[9 Periods]**

Microwave Semiconductor Devices And Modeling: PIN diode, Tunnel diodes, Varactor diode, Schottky diode, IMPATT and TRAPATT devices, transferred electron devices, Microwave BJTs, GaAs FETs, low noise and power GaAs FETs, MESFET, MOSFET, HEMT.

**UNIT - V**      **RF CIRCUITS DESIGN**          **[9 Periods]**

Amplifiers Design: Power gain equations, stability, impedance matching, constant gain and noise figure circles, small signal, low noise, high power and broadband amplifier, oscillators, Mixers design.

                 **Total =45 Periods**

**Course Outcomes:**
**Upon Completion of the course, the students will be able to:**
*CO1: Understand the behavior of RF passive components and model active components.*
*CO2: Perform transmission line analysis.*
*CO3: Demonstrate use of Smith Chart for high frequency circuit design.*
*CO4: Justify the choice/selection of components from the design aspects.*
*CO5: Contribute in the areas of RF circuit design.*

**Reference Books :**

1. K.T.Lee, "Design of CMOS RF Integrated Circuits", Cambridge, 2004.
2. B.Razavi, "RF Microelectronics", Pearson Education, 1997.
3. JanCrols, Michiel Steyaert, "CMOS Wireless Transceiver Design", Kluwer Academic Publishers, 1997.
4. B.Razavi, "Design of Analog CMOS Integrated Circuits", Mc Graw Hill,2001.

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<u>**SEMESTER - I**</u>

| | | L | T | P | C |
|---|---|---|---|---|---|
| **CU18166** | **MICROSTRIP PATCH ANTENNA DESIGN(ELECTIVE)** | 3 | 0 | 0 | 3 |

***Objectives:*** *Students will be able*
- *To learn about basics of microstrip antennas.*
- *To study various broadband techniques*
- *To learn planar and compact broadband antennas*
- *To understand the polarization concepts in antenna radiations*
- *To study about antenna arrays theory*

**UNIT - I        BASICS OF  MICROSTRIP PATCH ANTENNA**                    **[9 Periods]**

Introduction – Radiation mechanism of micro strip antenna – Feeding techniques – Printed slot antennas - Design considerations of rectangular patch – Substrate selection – Radiation pattern and radiation resistance – Characteristics of patch antennas – Circular disc and ring antennas.

**UNIT - II        BROADBAND MICROSTRIP ANTENNAS**                    **[9 Periods]**

Introduction – Effects on substrate parameters on Bandwidth – Selection of feeding techniques – Multimoding techniques – Tunable and dual frequency microstrip antennas – Broadband circularly polarized microstrip antennas.

**UNIT - III    PLANAR MULTIRESONATORS AND COMPACT BROADBAND MICROSTRIP ANTENNAS**                    **[9 Periods]**

Introduction – Mechanism of parasitic coupling – Gap coupled MSA – radiating and non-radiating edge coupled MSAs – Compact shorted RMSAs – slot loaded RMSAs – U slot RMSAs.

**UNIT - IV        CIRCULARLY POLARIZED MICROSTRIP ANTENNAS AND TECHNIQUES**        **[9 Periods]**

Introduction – Linear elliptical and circularly polarized antennas – Dual feed circularly polarized antennas - various types of circularly polarized microstrip antennas – Design Procedure for Single-Feed Circularly Polarized MSAs - Bandwidth enhancement techniques.

**UNIT - V        DESIGN AND ANALYSIS OF MICROSTRIP ANTENNA ARRAYS**            **[9 Periods]**

Parallel and series feed systems – Mutual coupling – design of linear arrays – Design of planar arrays – Monolithic integrated phased arrays and its design considerations

**Total =45 Periods**

***Course Outcomes:***
***Upon Completion of the course, the students will be able to:***
*CO1: Understand the fundamentals microstrip antennas*
*CO2: Understand various broadband techniques*
*CO3: Design planar and compact broadband antennas*
*CO4: Analyze the polarization concepts in antenna radiations*
*CO5: Understand about antenna array theory*

**Reference Books :**
1. J.R James & P.S.Hall, "Handbook of Microstrip Antennas", IEEE Electromagnetic Waves Series, London 1989.
2. Ramesh Garg and Prakash Bhartia "Microstrip Antenna Design Hand Book "Artech house, London, 2001.
3. G.Kumar and K.P.Ray "Broad band Microstrip Antennas "Artech house, London 2003.

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<u>**SEMESTER - I**</u>

| | | L | T | P | C |
|---|---|---|---|---|---|
| **CU18167** | **DIGITAL COMMUNICATION RECEIVERS (ELECTIVE)** | 3 | 0 | 0 | 3 |

*Objectives: Students will be able*
- *To understand the concepts of digital communication techniques.*
- *To understand various receiver architectures used in digital communication.*
- *To learn the performance of receivers for different channels.*
- *Tounderstandthesynchronizationandvariousequalizationtechniquesusedin communication systems.*
- *To analyze the concept of algorithm used for adaptive equalization.*

**UNIT - I　　REVIEW OF DIGITAL COMMUNICATION TECHNIQUES**　　　　**[9 Periods]**

Baseband and band pass communication; Signal space representation, linear and nonlinear modulation techniques, and spectral characteristics of digital modulation.

**UNIT - II　　OPTIMUM RECEIVERS FOR AWGN CHANNEL**　　　　**[9 Periods]**

Correlation demodulator matched filter, maximum likelihood sequence detector, optimum receiver for CPM signals, M-ary orthogonal signals, envelope detectors for M-ary and correlated binary signals.

**UNIT - III　　RECEIVERS FOR FADING CHANNELS**　　　　**[9 Periods]**

Characterization of fading multiple channels, statistical models, slow fading, frequency selective fading, diversity technique, RAKE demodulator, coded waveform for fading channel.

**UNIT - IV　　SYNCHRONIZATION TECHNIQUES**　　　　**[9 Periods]**

Carrier and signal synchronization, carrier phase estimation – PLL, Decision directed loops, symbol timing estimation, maximum likelihood and non-decision directed timing estimation, joint estimation.

**UNIT - V　　ADAPTIVE EQUALIZATION**　　　　**[9 Periods]**

Zero forcing algorithm, LMS algorithm, adaptive decision – feedback equalizer and Equalization of Trellis –coded signals. Kalman algorithm, blind equalizers and stochastic gradient algorithm.

**Total =45 Periods**

*Course Outcomes:*
**Upon Completion of the course, the students will be able to:**
*CO1: Gain the knowledge about overview of digital communication.*
*CO2: Analyze the concept of optimization process in receivers.*
*CO3: Understand the fading channels in receiving side.*
*CO4: Develop the various techniques used in synchronization process.*
*CO5: Discuss the various algorithms in adaptive equalization.*

**Reference Books :**

1. K.Hein rich Meyer, Mare Moeneclacy, Stefan.A.Fechtel,"Digital communication receivers", VolI & VolII, John Wiley, NewYork1997.
2. John.G.Proakis, "Digital communication "4/e, McGraw-Hill, NewYork2001.
3. E.A.LeeandD.G.Messerschmitt,"Digitalcommunication",2/e,AlliedPublishers,NewDelhi 1994.
4. SimonMarvin,"Digitalcommunicationoverfadingchannel;Anunifiedapproachtoperformance Analysis ", John Wiley, NewYork2000.
5. N.Benuveruto & G.Cherubini, Algorithms for Communication Systems and their Applications, Wiley 2002.

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**SEMESTER - II**

| | | L | T | P | C |
|---|---|---|---|---|---|
| **CU18261** | **COMMUNICATION PROTOCOL ENGINEERING(ELECTIVE)** | 3 | 0 | 0 | 3 |

***Objectives:*** *Students will be able*
- *To demonstrate the basic network reference model.*
- *To learn about the protocols specifications.*
- *To analyze the concept of protocol verification/validation.*
- *To develop the protocol for testing performance.*
- *To understand the testing, synthesis and implementation of protocol*

**UNIT - I　　　NETWORK REFERENCE MODEL**　　　　　　　　　　**[9 Periods]**

Communication model-software, subsystems, protocol, protocol development methods, Protocol engineering process, Layered architecture, Network services and Interfaces, Protocol functions, OSI model, TCP/IP protocol suite.

**UNIT - II　　　PROTOCOL SPECIFICATIONS**　　　　　　　　　　**[9 Periods]**

Components of protocol, Specifications of communication service, Protocol entity, Interface, Interactions, Multimedia protocol, Internet protocol, SDL, SDL based protocol other protocol specification languages.

**UNIT - III　　　PROTOCOL VERIFICATION / VALIDATION**　　　　　**[9 Periods]**

Protocol verification, Verification of a protocol using finite state machines, Protocol validation, protocol design errors, Protocol validation approaches, SDL based protocol verification and validation.

**UNIT - IV　　　PROTOCOL CONFORMANCE / PERFORMANCE TESTING**　　**[9 Periods]**

Conformance testing methodology and framework, Conformance test architectures, Test sequence generation methods, Distributed architecture by local methods, Conformance testing with TTCN, systems with semi controllable interfaces-RIP, SDL based tools for conformance testing, SDL based conformance testing of MPLS Performance testing, SDL based performance testing of TCP and OSPF, Interoperability testing, SDL based interoperability testing of CSMA/CD and CSMA/CA protocol using Bridge, Scalability testing

**UNIT - V　　　PROTOCOL SYNTHESISAND IMPLEMENTATION**　　　**[9 Periods]**

Protocol synthesis, Interactive synthesis algorithm, Automatic synthesis algorithm, Automatic synthesis of SDL from MSC, Protocol re-synthesis; Requirements of protocol implementation, Object based approach to protocol implementation, Protocol compilers, Tool for protocol engineering.

　　　　　　　　　　　　　　　　　　　　　　　　　　　**Total =45 Periods**

***Course Outcomes:***
***Upon Completion of the course, the students will be able to:***
*CO1: Understand the concept of network reference models.*
*CO2: Analyze the different types of specification in communication protocol.*
*CO3: Gain the knowledge about protocol verification and validation.*
*CO4: Develop the testing methodology used for protocol conformance.*
*CO5: Implement the various protocol synthesis techniques for communication networks.*

**Reference Books :**
1. Pallapa Venkataram and Sunil kumar S.Manvi,"Communication protocol Engineering", Eastern Economy edition, (2004).
2. RichardLai and Jirachief pattana, "Communication Protocol Specification and Verification", Kluwer Publishers, Boston (1998).
3. Tarnay, K., "Protocol Specification and Testing", Plenum, New York (1991).
4. MohamedG.Gouda, "Elements of Network Protocol Design", John Wiley & Sons,Inc. NewYork, USA (1998).
5. G.J.Holtzmann, "Design and validation of Computer protocols", Prentice Hall, New York (1991).

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<u>**SEMESTER - II**</u>

| CU18262 | INTERNET OF THINGS (ELECTIVE) | L 3 | T 0 | P 0 | C 3 |

*Objectives:* Students will be able
- To understand the basic concepts of IoT.
- To learn about the data base and networking.
- To understand the concept of Networking in IoT.
- To develop the protocol for IoT.
- To understand the operating systems and applications.

**UNIT - I        INTRODUCTION TO IOT**                                    **[9 Periods]**

Smart cities and IoT revolution, Fractal cities, From IT to IoT, M2M and peer networking concepts, Ipv4 and IPV6.

**UNIT - II       CLOUD AND NETWORKING**                                **[9 Periods]**

Software Defined Networks SDN, From Cloud to Fog and MIST networking for IoT communications, Principles of Edge/P2P networking, Protocols to support IoT communications, modular design and abstraction, security and privacy in fog – Scaling.

**UNIT - III      IOT NETWORKS**                                        **[9 Periods]**

Wireless sensor networks: introduction, IOT networks (PAN, LAN and WAN), Edge resource pooling and caching, client side control and configuration.

**UNIT - IV      HARDWARE PROGRAMMING**                                **[9 Periods]**

Smart objects as building blocks for IoT, Open source hardware and Embedded systems platforms for IoT, Edge/gateway, IO drivers, Battery Operated Devices, C Programming, multithreading concepts - Accelerometer sensor.

**UNIT - V       OPERATING SYSTEMS AND APPLICATIONS**                 **[9 Periods]**

Operating systems requirement of IoT environment, study of Embed, RIoT, and Contiki operating systems, Introductory concepts of big data for IoT applications. Applications of IoT, Connected cars IoT Transportation, Smart Grid and Healthcare sectors using IoT, Security and legal considerations, IT Act 2000 and scope for IoT legislation.

**Total =45 Periods**

*Course Outcomes:*
*Upon Completion of the course, the students will be able to:*
- CO1.  Understand what IoT technologies are used for today, and what is required in certain scenarios.
- CO2.  Understand the types of technologies that are available and in use today and can be utilized to implement IoT solutions.
- CO3.  Apply these technologies to tackle scenarios in teams of using an experimental platform for implementing prototypes and testing them as running applications.

**Reference Books :**
1. A Bahaga, V. Madisetti, "Internet of Things- Hands on approach", VPT publisher, 2014.
2. A. McEwen, H. Cassimally, "Designing the Internet of Things", Wiley, 2013.
3. Cuno Pfister, "Getting started with Internet of Things", Maker Media, 1st edition, 2011.
4. Samuel Green guard, "Internet of things", MIT Press, 2015.
5. http://www.datamation.com/open-source/35-open-source-tools-for-the-internet-of-things-1.html
6. https://developer.mbed.org/handbook/AnalogIn
7. http://www.libelium.com/50_sensor_applications

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## SEMESTER - II

| CU18263 | VOICE AND DATA NETWORKS (ELECTIVE) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

*Objectives: Students will be able*
- *To understand the basics of voice networks*
- *To learn about the data link layer*
- *To understand the queuing models and multiple access*
- *To develop concepts of the network layer*
- *To understand the quality of service in networks*

### UNIT - I　　NETWORK BASICS AND SWITCHING　　　　　[9 Periods]

Network Design Issues, Network Performance Issues, Network Terminology, centralized and distributed approaches for networks design, Issues in design of voice and data networks. Layered and Layer less Communication, Cross layer design of Networks, Voice Networks (wired and wireless) and Switching, Circuit Switching and Packet Switching, Statistical Multiplexing.

### UNIT - II　　DATA LINK LAYER　　　　　[9 Periods]

Data Networks and their Design, Link layer design- Link adaptation, Link Layer Protocols, Retransmission. Mechanisms (ARQ), Hybrid ARQ (HARQ), Go Back N, Selective Repeat protocols and their analysis.

### UNIT - III　　QUEUING AND MULTIPLE ACCESS TECHNIQUES　　　　　[9 Periods]

Queuing Models of Networks, Traffic Models, Little's Theorem, Markov chains, M/M/1and other Markov systems, Multiple Access Protocols, Aloha System, Carrier Sensing, Examples of Local area networks,

### UNIT - IV　　NETWORK LAYER　　　　　[9 Periods]

Inter-networking, Bridging, Global Internet, IP protocol and addressing, Sub netting, Classless Inter domain Routing (CIDR), IP address lookup, Routing in Internet. End to End Protocols, TCP and UDP. Congestion Control , Additive Increase/Multiplicative Decrease , Slow Start, Fast Retransmit/ Fast Recovery,

### UNIT - V　　QoS IN NETWOKS　　　　　[9 Periods]

Congestion avoidance, RED TCP Throughput Analysis, Quality of Service in Packet Networks. Network Calculus, Packet Scheduling Algorithms – DPI Packet inspection.

**Total =45 Periods**

*Course Outcomes:*
*Upon Completion of the course, the students will be able to:*
　　*CO1. Know about the basics of voice networks*
　　*CO2. Analyze  about the data link layer*
　　*CO3. Configure queuing models and multiple access*
　　*CO4. Develop concepts of the network layer*
　　*CO5. Understand the quality of service in networks*

**Reference Books :**

1. D. Bertsekas and R. Gallager, "Data Networks", 2nd Edition, Prentice Hall, 1992.
2. L. Peterson and B. S. Davie, "Computer Networks: A Systems Approach",5th Edition, Morgan Kaufman, 2011.
3. Kumar, D. Manjunath and J. Kuri, "Communication Networking: An analytical approach",1st Edition, Morgan Kaufman, 2004.
4. Walrand, "Communications Network: A First Course", 2nd Edition, McGraw Hill, 2002.
5. Leonard Kleinrock, "Queuing Systems, Volume I: Theory", 1st Edition, John Wiley and Sons, 1975.
6. Aaron Kershenbaum, "Telecommunication Network Design Algorithms", McGraw Hill,1993.
7. Vijay Ahuja, "Design and Analysis of Computer Communication Networks", McGraw Hill, 1987

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<u>SEMESTER - II</u>

| | | L | T | P | C |
|---|---|---|---|---|---|
| **CU18264** | **MIMO SYSTEMS (ELECTIVE)** | 3 | 0 | 0 | 3 |

*Objectives: Students will be able*
- *To understand the basics of MIMO techniques.*
- *To learn about the MIMO techniques and equalization techniques.*
- *To understand the beam forming techniques.*
- *To develop the MIMO channel model and code words*
- *To understand the MIMO estimation techniques.*

### UNIT - I   OVERVIEW OF MIMO                                            [9 Periods]

Introduction to Multi-antenna Systems, Motivation, Types of multi-antenna systems, MIMO vs. multi-antenna systems. Diversity, Exploiting multipath diversity, Transmit diversity, Space-time codes, The Alamouti scheme, Delay diversity, Cyclic delay diversity, Space-frequency codes, Receive diversity, The rake receiver, Combining techniques, Spatial Multiplexing, Spectral efficiency and capacity, Transmitting independent streams in parallel, Mathematical notation.

### UNIT - II   MIMO FUNCTIONS AND EQUALIZATION TECHNIQUES                 [9 Periods]

The generic MIMO problem, Singular Value Decomposition, Eigenvalues and eigen vectors, Equalising MIMO systems, Disadvantages of equalizing MIMO systems, Pre distortion in MIMO systems, Disadvantages of pre-distortion in MIMO systems, Pre-coding and combining in MIMO systems, Advantages of pre-coding and combining, Disadvantages of pre coding and combining, Channel state information.

### UNIT - III   BEAMFORMING TECHNIQUES IN MIMO                           [9 Periods]

Codebooks for MIMO, Beam forming, Beam forming principles, Increased spectrum efficiency, Interference cancellation, Switched beam former, Adaptive beam former, Narrow band beam former, Wideband beam former.

### UNIT - IV   MIMO CHANNEL MODEL AND CODE WORDS                          [9 Periods]

Case study: MIMO in LTE, Code words to layers mapping, Pre-coding for spatial multiplexing, Pre-coding for transmit diversity, Beam forming in LTE, Cyclic delay diversity based pre-coding, Pre-coding codebooks, Propagation Channels, Time & frequency channel dispersion, AWGN and multipath propagation channels, Delay spread values and time variations, Fast and slow fading environments, Complex baseband multipath channels, Narrowband and wideband channels, MIMO channel models.

### UNIT - V   MIMO ESTIMATION TECHNIQUES                                 [9 Periods]

Channel Estimation, Channel estimation techniques, Estimation and tracking, Training based channel estimation, Blind channel estimation, Channel estimation architectures, Iterative channel estimation, MMSE channel estimation, Correlative channel sounding, Channel estimation in single carrier systems, Channel estimation for CDMA, Channel estimation for OFDM.

**Total =45 Periods**

*Course Outcomes:*
*Upon Completion of the course, the students will be able to:*
   CO1.  *Understand the basics of MIMO techniques*
   CO2.  *Learn about the MIMO techniques and equalization techniques*
   CO3.  Analyze *beam forming techniques*
   CO4.  *Know about the MIMO channel model and code words*
   CO5.  Understand the MIMO estimation techniques

**Reference Books :**
   1. Claude Oestges, Bruno Clerckx, "MIMO Wireless Communications: From Real-world Propagation to Space-time Code Design", Academic Press, 1st edition, 2010.
   2. Mohinder Janakiraman, "Space - Time Codes and MIMO Systems", Artech House Publishers, 2004.

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<u>SEMESTER - II</u>

| **CU18265** | **SATELLITE COMMUNICATION (ELECTIVE)** | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

*Objectives: Students will be able*
- *To understand the basic elements of satellite communication.*
- *To study the concepts of different techniques for modulation.*
- *To understand the concept about satellite link design.*
- *To determine the principles of global positioning systems.*
- *To analyze the different applications for satellite communication.*

**UNIT - I          ELEMENTS OF SATELLITE COMMUNICATION**          **[9 Periods]**

Satellite systems, Orbital description and Orbital mechanics of LEO, MEO and GSO – Placement of a satellite in a GSO - Satellite-description of different communication subsystems - Bandwidth allocation.

**UNIT - II     TRANSMISSION, MULTIPLEXING, MODULATION, MULTIPLE ACCESS AND CODING**          **[9 Periods]**

Different Modulation and Multiplexing Schemes – Multiple access techniques:  FDMA, TDMA, CDMA and DAMA – Coding schemes.

**UNIT - III          SATELLITE LINKDESIGN**          **[9 Periods]**

Basic link analysis – Interference analysis – Rain induced attenuation and interference, Ionospheric characteristics – Link design with and without frequency reuse**.**

**UNIT - IV          SATELLITE NAVIGATIONAND GLOBAL POSITIONING SYSTEM**          **[9 Periods]**

 Radio and Satellite navigation – GPS: Position location, principles, GPS receivers and codes - Satellite signal acquisition - GPS receiver operation and differential GPS**.**

**UNIT - V          APPLICATIONS**          **[9 Periods]**

Satellite packet communications, INTELSAT series – INSAT series–VSAT, Mobile satellite services – INMARSAT - Satellite and Cable Television - DBS (DTH), Satellite phones.

**Total =45 Periods**

*Course Outcomes:*
*Upon Completion of the course, the students will be able to:*
- *CO1.  Understand the elements of satellite communication.*
- *CO2. Perform the different multiple accessing techniques.*
- *CO3. Design  satellite link systems*
- *CO4. Understand the basics of navigation using satellite systems*
- CO5. *Understand the various applications of satellite systems.*

**Reference Books :**
1. Wilbur.L.Pritchard, H.G. Suyderhoud, Robert A.Nelson, Satellite Communication Systems Engineering, Prentice Hall, New Jersey2006.
2. Timothy Pratt and Charles W.Bostain, Satellite Communications, John Wiley and Sons 2003.
3. D.Roddy, Satellite Communication, McGraw Hill, 2006.
4. Tri T Ha, Digital Satellite Communication, McGraw Hill1990.
5. B.N.Agarwal, Design of Geo synchronous Spacecraft, Prentice Hall 1993.

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<u>SEMESTER - II</u>

| CU18266 | EM MODELLING AND ANALYSIS FOR PLANAR ANTENNAS(ELECTIVE) | L<br>3 | T<br>0 | P<br>0 | C<br>3 |
|---|---|---|---|---|---|

*Objectives: Students will be able*
- *Understand the numerical analysis method*
- *Know about transmission line model approach*
- *Understand about multiport network approach*
- *Understand about full wave analysis method*
- *Know about cavity model and computer aided design*

**UNIT - I       NUMERICAL ANALYSIS METHOD**                                   **[9 Periods]**

Introduction – Model based on the electric surface current – Horizontal electric dipole in microstrip – Numerical techniques for sommerfield integrals – Method of moments – Excitation and loading – Single rectangular patch antenna – Microstrip arrays.

**UNIT - II      TRANSMISSION LINE MODEL APPROACH**                          **[9 Periods]**

Simple transmission line model – Improved transmission line model – Application of the improved transmission line model – Transmission line model for mutual coupling.

**UNIT - III     MULTIPORT NETWORK APPROACH**                                 **[9 Periods]**

Models for microstrip antennas – Z- matrix characterization of planar segments – Edge- Admittance and mutual coupling networks – Analysis of multiport network model – Examples

**UNIT - IV      FULLWAVE ANALYSIS OF MICROSTRIP ANTENNAS**                   **[9 Periods]**

Spectral domain Fullwave analysis – Input impedance and Radiation analysis – Radiation patters – Numerical Evaluation – Basis functions – Mathematical model of excitation – Applications of spectral domain techniques – Integral equations – Potential in green function – FDTD method – Numerical dispersion – Excitation and source modeling

**UNIT - V       CAVITY MODEL  AND COMPUTER AIDED DESIGN**                    **[9 Periods]**

Cavity Models for analyzing Microstrip patch antennas – Generalized cavity model – Cavity model analysis for rectangular and circular MSAs – Computer aided design of microstrip antennas.

**Total =45 Periods**

*Course Outcomes:*
*Upon Completion of the course, the students will be able to:*
   CO1.  *Apply numerical analysis method of planar structure*
   CO2.  *Understand transmission line model approach*
   CO3.  *Analyze multiport network approach*
   CO4.  *Apply full wave analysis method*
   CO5.  *Perform  cavity model and computer aided design*

**Reference Books :**
1. J.R James &P.S.Hall "Handbook of Microstrip Antennas "IEE Electromagnetic Waves Series, London 1989.

2. Ramesh Garg and Prakash Bhartia "Microstrip Antenna Design Hand Book "Artech house, London, 2001.

3. G.Kumar and K.P.Ray "Broad band Microstrip Antennas "Artech house, London 2003.

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<u>**SEMESTER - II**</u>

| | | L | T | P | C |
|---|---|---|---|---|---|
| **CU18267** | **COMMUNICATION NETWORK SECURITY(ELECTIVE)** | 3 | 0 | 0 | 3 |

*Objectives: Students will be able*
- *To learn about the provision of security in wireless networks.*
- *To learn about the different types of algorithm in wireless networks.*
- *To acquire skills on data encryption and decryption, authentication, Key management.*
- *To gain knowledge about network and web security.*
- *To analyze the concept wireless network security.*

### UNIT - I    INTRODUCTION ON SECURITY                         [9 Periods]

Security goals, Types of attacks: Passive attack, Active attack, Attacks on confidentiality, Attacks on Integrity and Availability. Security services and mechanisms, Techniques: Cryptography, Steganography, Revision on Mathematics for cryptography.

### UNIT - II    SYMMETRIC & ASYMMETRIC KEY ALGORITHMS          [9 Periods]

Substitutional Ciphers, Transposition ciphers, Stream and block ciphers, Data Encryption Standards (DES), Advanced Encryption Standard (AES), RC4, Principle of asymmetric key algorithms, RSA cryptosystem.

### UNIT - III    INTEGRITY, AUTHENTICATION AND KEY MANAGEMENT   [9 Periods]

Message integrity, Hash functions: SHA, Digital signatures: Digital signature standards. Authentication: Entity authentication, Biometrics, Key management techniques.

### UNIT - IV    NETWORK SECURITY , FIREWALLS AND  WEB SECURITY  [9 Periods]

Introduction on firewalls, Types of firewalls, Firewall configuration and Limitation of firewall. IP security overview, IP security architecture, Authentication header, Security pay load, Security associations, Key management. Web security requirement, Secure sockets layer, Transport layer security, Secure electronic transaction, Dual signature.

### UNIT - V    WIRELESS NETWORK SECURITY                       [9 Periods]

Security attack issues specific to wireless systems: Wormhole, Tunneling, DoS, WEP for Wi-Fi network, Security for 4G networks: Secure adhoc network, Secure sensor network.

**Total =45 Periods**

*Course Outcomes:*
*Upon Completion of the course, the students will be able to:*
   *CO1.  Learn the concept of various types of attacks and security techniques.*
   *CO2.  Gain the knowledge about algorithms in security.*
   *CO3.  Discuss the various techniques used in data securing.*
   *CO4.  Analyze the concept about firewalls and network security.*
   CO5.  *Gain the knowledge about wireless network security.*

**Reference Books :**
1. K. Behrouz A.Fourcuzan," Cryptography and Network security" Tata McGraw Hill(2008).
2. William Stallings," Cryptography and Network security: principles and practice",2/e, Prentice Hall of India, New Delhi (2002)
3. Atul Kahate," Cryptography and Network security", 2/e, Tata McGraw Hill,(2008).
4. H.Yangetal. Security in Mobile AdHoc Networks: Challenges and Solution, IEEE Wireless Communications, Feb.(2004).
5. Securing Ad Hoc Networks," IEEE Network Magazine, vol.13, no. 6, pp24-30, December (1999).
6. Perrig,A., Stankovic,J., Wagner,D.(2004),"Security in Wireless Sensor Networks", Communications of the ACM,47(6),53-57

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<u>**SEMESTER - II**</u>

| | | L | T | P | C |
|---|---|---|---|---|---|
| **CU18268** | **RF MEMS FOR WIRELESS COMMUNICATION (ELECTIVE)** | 3 | 0 | 0 | 3 |

*Objectives: Students will be able*
- *To gain knowledge about the physical aspects of RF circuit design*
- *To know RF MEMS circuit elements such as switches resonators etc.*
- *To design a various RF applications of MEMS.*
- *To understand the fundamentals of phase shifters and filters.*
- *To understand the working and features of RF MEMS circuits in wireless communication systems.*

**UNIT - I      WIRELESS TRANSCEIVER ARCHITECTURES**                    **[9 Periods]**

Introduction, Spheres of wireless activities - The home and office -The ground fixed/mobile platform - The space platform - Wireless standards - Systems and architectures, wireless standards, conceptual wireless systems, wireless transceiver architectures, power and bandwidth-efficient wireless systems & challenges, MEMS based wireless appliances enable ubiquitous connectivity. Physical aspects of RF circuit design, skin effect, transmission lines on thin substrates, self-resonance frequency, quality factor packaging, practical aspects of RF circuit design, dc biasing, and impedance mismatch effect in RF MEMS.

**UNIT - II      MEM SWITCHES AND ITS APPLICATIONS**                    **[9 Periods]**

Enabled circuit elements and models - RF/Microwave substrate properties - Micro machined enhanced elements - Capacitors, inductors, varactors - MEM switches - Shunt MEM switch - Low voltage hinged MEM switch approaches - Push-pull series switch - Folded beam springs suspension series switch - Resonators - Transmission line planar resonators, cavity resonators - Micromechanical resonators - Film bulk acoustic wave resonators - MEMS modeling - Mechanical modeling, electromagnetic modeling.

**UNIT - III      RF APPLICATIONS OF MEMS**                    **[9 Periods]**

Enabled circuits - Reconfigurable circuits - The resonant MEMS switch – Capacitors – Inductors - Tunable CPW resonator - MEMS microswitch arrays - Reconfigurable circuits - Double - Stub tuner, Nth – stub tuner, filters, resonator tuning system -Massively parallel switchable RF front ends -True time-delay digital phase shifters.

**UNIT - IV      PHASE SHIFTERS & FILTERS**                    **[9 Periods]**

Phase shifters –Fundamentals - X-Band RF MEMS phase shifter for phased array applications - Ka- Band RF MEMS Phase shifter for radar systems applications - Film bulk acoustic wave filters – FBAR filter fundamentals, FBAR filter for PCS applications.

**UNIT - V      RF MEMS ANTENNA**                    **[9 Periods]**

Micro machined antenna - Micro electro mechanical system antennas - Reconfigurable Antennas - Tunable dipole antennas - Tunable microstrip patch - Array antenna. Integrates antenna selection - Photonic band gap antennas.

**Total =45 Periods**

*Course Outcomes:*
*Upon Completion of the course, the students will be able to:*
   *CO1.  Understand the different wireless transceiver architectures*
   *CO2.  Understand the Working principle of different MEM switches and its applications*
   *CO3.  Perform RF MEMS applications in various areas i=of communication*
   *CO4.  Know about the RF Phase shifters and filters*
   *CO5.  Understand the RF MEMS antennas.*

**Reference Books :**

1. Hector J. De Los Santos, "RF MEMS Circuit Design for Wireless Communications", Artech House (2002)
2. Vijay K.Varadan, K.J. Vinoy, K.A. Jose., "RF MEMS and their Applications", John Wiley and sons, LTD (2002).
3. Gabriel M. Rebeiz, "RF MEMS Theory, Design & Technology", Wiley Inter science (2002).

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**SEMESTER - II**

| CU18269 | MULTIMEDIA COMPRESSION TECHNIQUES(ELECTIVE) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

*Objectives: Students will be able*
- *To learn the fundamentals of compression method.*
- *Identify the various multimedia networking characteristics.*
- *To understand the techniques of text and audio compression.*
- *To analyze the various concepts of image compression.*
- *To learn the analysis of different coding techniques for video compression.*

### UNIT - I    INTRODUCTION                                    [9 Periods]

Special features of multimedia, Graphics and image data representations – Fundamental concepts in text, images, graphics, video and digital audio – Storage requirements for multimedia applications – Need for compression – Lossy & Lossless compression techniques – Overview of source coding, information theory & source models– Kraft McMillan in equality–Scalar quantization-Uniform and non-uniform quantization - Vector quantization.

### UNIT - II    TEXT  COMPRESSION                              [9 Periods]

Compaction techniques – Run length coding – Huffmann coding–Adaptive Huffmann coding – Arithmetic coding – Shanonfano coding- Dictionary techniques – LZW family algorithms

### UNIT - III    AUDIO COMPRESSION                             [9 Periods]

Audio compression techniques – µLaw and ALaw companding 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.

### UNIT - IV    IMAGE COMPRESSION                             [9 Periods]

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.

### UNIT - V    VIDEO COMPRESSION                              [9 Periods]

Video compression techniques and standards – MPEG Video coding: MPEG–1 and 2 – MPEG Video coding II : MPEG–4and7– Motion estimation and compensation techniques – H.261standard – DVI technology – DVI realtime compression – Packet video.

**Total =45 Periods**

*Course Outcomes:*
*Upon Completion of the course, the students will be able to:*
- *CO1. Explore the special features and representations of different data types of multimedia.*
- *CO2. Analyze different multimedia communication standards for text compression.*
- *CO3. Gain the knowledge about compression techniques in audio signal.*
- *CO4. Analyze the concept about image compression.*
- *CO5. Explore the various standards in video compression.*

**Reference Books :**
1. KhalidSayood," Introduction to Data Compression", Morgan Kauffman Harcourt India,2/e, Reprint 2011.
2. DavidSalomon,"DataCompression–TheCompleteReference",SpringerVerlagNewYork,2/e 2001.
3. YunQ.Shi, Huifang Sun: Image and Video Compression for Multimedia Engineering– Fundamentals Algorithms & Standards", CRC press 2003.
4. Peter Symes,"Digital Video Compression", McGraw HillPub.2004.
5. MarkS.Drew, Ze-NianLi: "Fundamentals of Multimedia", PHI, Ist, 2003.
6. J.Watkinson, "Compression in Video and Audio", Focal press, London 1995.

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<u>**SEMESTER – II**</u>

| | | L | T | P | C |
|---|---|---|---|---|---|
| **PE18201** | **SOFT COMPUTING TECHNIQUES** (Common to CS & PE) | 3 | 0 | 0 | 3 |

**Objective:** *To solve typical control problems by using artificial neural networks, fuzzy logic system and genetic algorithm and the usage of MATLAB tool box to the above intelligent techniques.*

**UNIT - I     ARTIFICIAL NEURAL NETWORK**                                      **[ 9 Periods]**

Motivation for the development of neural networks – biological neural networks – artificial neural networks – Fundamental Concepts – weights – biases and thresholds – common activation functions. McCulloch-pitts neuron: Architecture – Algorithm – Applications – Hebb Net – Architecture – Algorithm – Application – Perceptron – Architecture – Algorithm – Applications – Linear separability – Perceptron learning rule convergence theorem – Delta rule.

**UNIT - II     NEURAL NETWORK ARCHITECTURE AND ALGORITHMS**                  **[ 9 Periods ]**

Back propogation Neural Net: Standard and counter back propogation – architecture – algorithm – number of hidden layers – applications – Hopfield neural net – Discrete and Continuous – architecture – algorithm – applications – Associative Memory Neural Networks – Boltzman Machine.

**UNIT - III     COMPETITIVE NEURAL NETWORKS**                                 **[ 9 Periods ]**

Fixed-weight competitive nets – Maxnet- Mexican Hat Net- Kohonen self-organizing Maps – applications – Adaptive Resonance Theory – Basic architecture and operation – Neuro controllers – Functional diagram – Inverse dynamics – coping control action – Case studies.

**UNIT - IV     FUZZY LOGIC**                                                  **[ 9 Periods ]**

Fuzzy sets – Properties of Classical and Fuzzy sets – Operations on Fuzzy sets – Fuzzy relations – Linguistic variables – Linguistic Hedges – Fuzzy statements – Assignment statements – Conditional statements – unconditional statements – Fuzzy rule base – Canonical rule formation – Decomposition of compound rules.- Fuzzy logic controller: Functional diagram – Fuzzification – Membership value assignments using intuition – Membership functions- Defuzzification: Max – Membership principle - centroid method - weighted average method – Inference Engine – Knowledge Base – Rule base – Case studies.

**UNIT - V     EVOLUTIONARY PROGRAMMING**                                      **[ 9 Periods ]**

Optimization – Traditional optimization methods – Concept of Evolutionary Algorithm – Simulated Annealing – Genetic Algorithm – encoding and decoding of variables – GA operators – reproductions – Cross over – mutation – fitness function – fitness scaling – Real coded GA – Advanced operators – Particle swarm optimization.

**Total  = 45 Periods**

*Course Outcomes:*
CO1.  Infer the concepts of artificial neural network.
CO2.  Apply the knowledge of neural network to develop architecture and algorithms of BPN, Hopfield.
CO3.  Analyze the concept competitive neural networks
CO4.  Discuss the concepts of fuzzy logic system with Classical system, Apply the knowledge of fuzzy logic controller for classical applications.
CO5.  Illustrate the fundamentals of genetic algorithm and its various functionalities.

**Reference Books :**

1   Jacek.M.Zurada, Introduction to Artificial Neural Systems, Jaico Publishing House, 2006.
2   Lawrence Faussett, Fundamental of neural networks, Prentice Hall, 2004.
3   T.J.Ross, Fuzzy Logic with Engineering Applications, McGraw-Hill, Newyork, 2005.
4   H.J. Zimmerman, Fuzzy set theory-and its Applications-Kluwer Academic Publishers, 1994.
5   Driankov, Hellendroon, Introduction to Fuzzy Control, Narosa Publishers, 2001.
6   David .E. Gold berg, Genetic algorithms in search optimization and machine learning, Addison Wesley, Pearson Education, Asia, 2001.

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<u>**SEMESTER – I**</u>

| | | L | T | P | C |
|---|---|---|---|---|---|
| **CUAC01** | **ENGLISH FOR RESEARCH PAPER WRITING (AC)** | 2 | 0 | 0 | - |

***Objectives:*** Students will be able
- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title
- Ensure the good quality of paper at very first-time submission

**UNIT - I**  **[6 Periods]**

Planning and preparation, Word order, Breaking up long sentences, Structuring, Paragraphs and sentences, Being concise and removing redundancy, Avoiding, Ambiguity and vagueness

**UNIT - II**  **[6 Periods]**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and plagiarism, Sections of a paper, abstracts. Introduction. Review of the literature, methods, results, discussion, Conclusions, The final check.

**UNIT - III**  **[6 Periods]**

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

**UNIT - IV**  **[6 Periods]**

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

**UNIT - V**  **[6 Periods]**

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

**Total = 30 Periods**

***Course Outcomes:***
***Upon Completion of the course, the students will be able to:***
*CO1. Know how to improve your writing skills and level of readability*
*CO2. Learn about what to write in each section*
*CO3. Improved skills needed when writing a Title*
*CO4. Ensure the good quality of paper at very first-time submission*

**Reference Books :**
1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM.Highman's book.
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

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**SEMESTER – I**

| | | L | T | P | C |
|---|---|---|---|---|---|
| **CUAC02** | **DISASTER MANAGEMENT (AC)** | 2 | 0 | 0 | - |

**Objectives:** Students will be able to:

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

**UNIT - I        Introduction**                                                              **[4 Periods]**

Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types And Magnitude.

**UNIT - II       Repercussions of Disasters And Hazards**                              **[4 Periods]**

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.

**UNIT - III      Disaster Prone Areas In India**                                          **[4 Periods]**

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

**UNIT - IV      Disaster Preparedness and Management**                              **[4 Periods]**

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.

**UNIT - V       Risk Assessment**                                                        **[4 Periods]**

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.

**UNIT - VI      Disaster Mitigation**                                                    **[4 Periods]**

Meaning, Concept And Strategies of Disaster Mitigation, merging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

**Total = 24 Periods**

*Course Outcomes:*
*Upon Completion of the course, the students will be able to:*
   CO1.  Demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
   CO2.  Critically evaluate disaster risk reduction and humanitarian response policy
   CO3.  Develop the standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
   CO4.  critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

**Reference Books :**

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L., Disaster Administration And Management Text And Case Studies", Deep &Deep Publication Pvt. Ltd., New Delhi.

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**SEMESTER – I**

| | | L | T | P | C |
|---|---|---|---|---|---|
| **CUAC03** | **SANSKRIT FOR TECHNICAL KNOWLEDGE (AC)** | 2 | 0 | 0 | - |

**Objectives:** *Students will be able to:*
- *To get a working knowledge in illustrious Sanskrit, the scientific language in the world*
- *Learning of Sanskrit to improve brain functioning*
- *Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power*
- *The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature*

**UNIT - I          Alphabets**                                        **[8 Periods]**

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

**UNIT - II          Technical Information**                            **[8 Periods]**

Order, Introduction of roots, Technical information about Sanskrit Literature.

**UNIT - III          Technical Concepts**                             **[8 Periods]**

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics.

**Total = 24 Periods**

*Course Outcomes:*
*Upon Completion of the course, the students will be able to:*
   CO1.  *Understanding basic Sanskrit language*
   CO2.  *Ancient Sanskrit literature about science & technology can be understood*
   CO3.  *Being a logical language will help to develop logic in students*

**Reference Books :**
1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

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<u>**SEMESTER – I**</u>

| | | L | T | P | C |
|---|---|---|---|---|---|
| **CUAC04** | **VALUE EDUCATION (AC)** | 2 | 0 | 0 | - |

**Objectives:** *Students will be able to:*
- *Understand value of education and self- development*
- *Imbibe good values in students*
- *Let the should know about the importance of character*

**UNIT - I      Values and self - development**                                 **[4 Periods]**

➢ Social values and individual attitudes.
➢ Work ethics, Indian vision of humanism.
➢ Moral and non- moral valuation. Standards and principles.
➢ Value judgements

**UNIT - II      Importance of cultivation of values.**                        **[6 Periods]**

➢ Sense of duty. Devotion, Self-reliance. Confidence, Concentration.
➢ Truthfulness, Cleanliness.
➢ Honesty, Humanity. Power of faith, National Unity.
➢ Patriotism.Love for nature ,Discipline

**UNIT - III      Personality and Behavior Development**                     **[6 Periods]**

➢ Soul and Scientific attitude.
➢ Positive Thinking. Integrity and discipline.
➢ Punctuality, Love and Kindness.
➢ Avoid fault Thinking.
➢ Free from anger, Dignity of labour.
➢ Universal brotherhood and religious tolerance.
➢ True friendship.
➢ Happiness Vs suffering, love for truth.
➢ Aware of self-destructive habits.
➢ Association and Cooperation.
➢ Doing best for saving nature

**UNIT - IV      Character and Competence**                                  **[6 Periods]**

➢ 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

                                                                        **Total = 22 Periods**

*Course Outcomes:*
*Upon Completion of the course, the students will be able to:*
  CO1. *Knowledge of self-development*
  CO2. *Learn the importance of Human values*
  CO3. *Developing the overall personality*

**Reference Books :**

1. *Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi*

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**SEMESTER – II**

| | | L | T | P | C |
|---|---|---|---|---|---|
| CUAC05 | CONSTITUTION OF INDIA (AC) | 2 | 0 | 0 | - |

**Objectives:** Students will be able to:

- *Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.*
- *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.*
- *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.*

**UNIT - I**  **History of Making of the Indian Constitution**  **[4 Periods]**

History, Drafting Committee, ( Composition & Working)

**UNIT - II**  **Philosophy of the Indian Constitution**  **[4 Periods]**

Preamble, Salient Features

**UNIT - III**  **Contours of Constitutional Rights & Duties**  **[4 Periods]**

- 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

**UNIT - IV**  **Organs of Governance**  **[4 Periods]**

- Parliament
- Composition
- Qualifications and Disqualifications
- Powers and Functions
- Executive
- President
- Governor
- Council of Ministers
- Judiciary, Appointment and Transfer of Judges, Qualifications
- Powers and Functions

**UNIT - V**  **Local Administration**  **[4 Periods]**

- 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 Zila Pachayat: Position and role.
- Block level: Organizational Hierarchy (Different departments),
- Village level: Role of Elected and Appointed officials,
- Importance of grass root democracy

**UNIT - VI**  **Election Commission**  **[4 Periods]**

- 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.

**Total = 24 Periods**

*Course Outcomes:*

*Upon Completion of the course, the students will be able to:*

CO1. *Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.*

CO2. *Discuss the intellectual origins of the framework of argument that informed the Conceptualization of social reforms leading to revolution in India.*

CO3. *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.*

CO4. *Discuss the passage of the Hindu Code Bill of 1956.*

**Reference Books :**

1.  The Constitution of India, 1950 (Bare Act), Government Publication.
2.  Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3.  M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4.  D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

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#### SEMESTER – II

| | | L | T | P | C |
|---|---|---|---|---|---|
| **CUAC06** | **PEDAGOGY STUDIES (AC)** | 2 | 0 | 0 | - |

**Objectives:** Students will be able to:

- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers
- Identify critical evidence gaps to guide the development.

**UNIT - I     Introduction and methodology**                                      **[4 Periods]**

- Aims and rationale, Policy background, Conceptual framework and terminology
- Theories of learning, Curriculum, Teacher education.
- Conceptual framework, Research questions.
- Overview of methodology and Searching.

**UNIT - II     Thematic overview**                                                **[2 Periods]**

- Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.
- Curriculum, Teacher education.

**UNIT - III     Evidence on the effectiveness of Pedagogical Practices**          **[4 Periods]**

- 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.

**UNIT - IV     Professional Development**                                          **[4 Periods]**

- Professional development: alignment with classroom practices and follow-up support
- Peer support
- Support from the head teacher and the community.
- Curriculum and assessment
- Barriers to learning: limited resources and large class sizes

**UNIT - V     Research gaps and future directions**                               **[2 Periods]**

- Research design
- Contexts
- Pedagogy
- Teacher education
- Curriculum and assessment
- Dissemination and research impact.

**Total = 16 Periods**

*Course Outcomes:*
*Upon Completion of the course, the students will be able to:*

CO1. *What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?*

CO2. *What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?*

CO3. *How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?*

**Reference Books :**

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 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? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

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<u>**SEMESTER – II**</u>

| CUAC07 | STRESS MANAGEMENT BY YOGA (AC) | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | - |

**Objectives:** Students will be able to:
- To achieve overall health of body and mind
- To overcome stress

**UNIT - I        Ashtanga**                                                      **[8 Periods]**

Definitions of Eight parts of yog. ( Ashtanga )

**UNIT - II        Yam and Niyam**                                            **[8 Periods]**

Do`s and Don't's in life.
i) Ahinsa, satya, astheya, bramhacharya and aparigraha
ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

**UNIT - III        Asan and Pranayam**                                    **[8 Periods]**

i) Various yog poses and their benefits for mind & body
ii)Regularization of breathing techniques and its effects - Types of pranayam

**Total = 24 Periods**

*Course Outcomes:*
*Upon Completion of the course, the students will be able to:*
1. *Develop healthy mind in a healthy body thus improving social health*
2. *Improve efficiency*

**Reference Books :**

1. "Yogic Asanas for Group Tarining-Part-I" :Janardan Swami Yogabhyasi Mandal, Nagpur.
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata.

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<u>**SEMESTER – II**</u>

| | | L | T | P | C |
|---|---|---|---|---|---|
| **CUAC08** | **PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS (AC)** | 2 | 0 | 0 | - |

**Objectives:** Students will be able to:
* *To learn to achieve the highest goal happily*
* *To become a person with stable mind, pleasing personality and determination*
* *To awaken wisdom in students*

**UNIT - I**                                                                 **[8 Periods]**

Neetisatakam-Holistic development of personality
* Verses- 19,20,21,22 (wisdom)
* Verses- 29,31,32 (pride & heroism)
* Verses- 26,28,63,65 (virtue)
* Verses- 52,53,59 (dont's)
* Verses- 71,73,75,78 (do's)

**UNIT - II**                                                                **[8 Periods]**

* Approach to day to day work and duties.
* Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48,
* Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17,23, 35,
* Chapter 18-Verses 45, 46, 48.

**UNIT - III**                                                               **[8 Periods]**

* Statements of basic knowledge.
* ShrimadBhagwadGeeta: Chapter2-Verses 56, 62, 68
* Chapter 12 -Verses 13, 14, 15, 16,17, 18
* Personality of Role model. ShrimadBhagwadGeeta:
* Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
* Chapter 4-Verses 18, 38,39
* Chapter18 – Verses 37,38,63

**Total = 24 Periods**

*Course Outcomes:*
*Upon Completion of the course, the students will be able to:*

   CO1. *Study of Shrimad - Bhagwad - Geeta will help the student in developing his personality and achieve the highest goal in life*
   CO2. *The person who has studied Geeta will lead the nation and mankind to peace and prosperity*
   CO3. *Study of Neetishatakam will help in developing versatile personality of students.*

**Reference Books :**

   1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata
   2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.