Syllabus for Core Subjects

Course Title: ELE – CT4: ADVANCED COMMUNICATION SYSTEM	Course Credits: 3
Total Contact Hours: 56 Hrs.	Duration of ESA: 4 Hrs.
Formative Assessment Marks: 20 marks	Summative Assessment Marks :80 marks

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research.
2. To acquire experimental skills, analyzing the results and interpret data.
3. Ability to design / develop / manage / operation and maintenance of sophisticated electronic gadgets / systems / processes that conforms to a given specification within ethical and economic constraints.
4. Capacity to identify and implementation of the formulae to solve the electronic related issues and analyze the problems in various sub disciplines of electronics.
5. Capability to use the Modern Tools / Techniques.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with ProgramOutcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**
Aptitude to apply Logic thinking and Basic Science knowledge forproblem solving in various fields of electronics both in industries and research	**x**					
To acquire experimental skills, analyzing the results and interpret data.						
Ability to design / develop / manage / operation and maintenance ofsophisticated electronic gadgets / systems / processes that conforms to a given specification within ethical and economic constraints.						
Capacity to identify and implementation of the formulae to solve the electronic related issues and analyses the problems in various sub disciplines of electronics.						
Capability to understand the working principles of the electronic devicesand their applications.	**x**					

ELE – CT4: **Advanced Communication Systems** 56 Hours.

Unit 1 14 Hrs.

T-lines- Types, Primary and secondary constants, concept of standing waves. Noise and its effects. Block diagram of electronic communication system, **Modulation**-need, types of analog modulation.

Amplitude Modulation – representation, modulation index, instantaneous voltage, frequency spectrum, power relations. Limitations of AM.

Frequency Modulation- representation, modulation index, frequency spectrum, bandwidth requirements, frequency deviation and carrier swing.

Pulse Modulation- Types, PAM, PWM and PPM. Detailed discussion of PCM with its advantages, disadvantages and applications.

Digital Communication: Block diagram of digital communication, Advantage and disadvantages of digital transmission systems.

Characteristics of data transmission circuits–Shannon limit for information capacity. Bit Rate and Baud, bandwidth requirements, data transmission speed, noise, cross talk, echo suppressors, distortion and equalizer.

Digital Modulation – Types (ASK, FSK, PSK, QPSK, 16QAM and 64 QAM), definition and waveforms and applications of each. MODEM– modes.

Unit 2 14 Hrs.

Antenna Systems- Radiation mechanism, resonant and non-resonant antennas, Ungrounded and grounded antenna. Types- Folded dipole, micro strip, dish, helical, horn, and loop antennas.

Satellite Communication-Need, types of orbits, advantages of geostationary satellites. Satellite visibility, Block diagram of satellite transponder, Uplink and downlink systems, Satellite earth station, path loss.

Radar - Microwaves Frequency bands and applications. RADAR principle, maximum unambiguous range, Pulsed RADAR system, RADAR range equation-derivation, factors influencing maximum range, Doppler effect. MTI and FM CW RADAR systems.

Unit 3 14 Hrs.

Optical Fiber Communication- Need for OFC. Block diagram of OFC system. Fiber optic cables, light propagation through fiber – step index fiber, graded index fiber, Snell's law, numerical aperture. Light sources – requirements, LEDs and semiconductor

laser diodes. Photo detectors – PN, PIN and avalanche photodiodes. Losses in optical fibers – Rayleigh scattering, absorption, leaky modes, bending, joint junction losses. Advantages and disadvantages of OFC over metallic cables.

Unit 4 14 Hrs.

Cellular Communication- Mobile communication, cell and cell splitting, frequency bands used in cellular communication, Absolute RF channel numbers (ARFCN), frequency reuse, roaming and hand off, authentication of the SIM card of the subscribers, IMEI number, data encryption, block diagram of cellular mobile communication network, Multiplexing-FDMA, WCDMA, TDMA, OFDMA, GSM. Block diagram of cellular phone handset.

REFERENCES:

1. Kennedy & Davis, “Electronic Communication Systems”, 4th edition, TMH.
2. Wayne Tomasi, “Advanced Electronic Communication Systems”, 6th edition, Prentice Hall.
3. Skolnik, “Introduction to RADAR systems”, McGraw Hill.
4. Roddy and Coolen, “Electronic Communication”, 4th edition, PHI.
5. B.P. Lathi, “Modern Digital and Analog Communication Systems”, 4th Edition, Oxford University Press.
6. Gerd Keiser, “Optical Fibre Communication”, 3rd Edition, McGraw Hill.
7. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press

Course Title: ELE – CP4: ADVANCED COMMUNICATION SYSTEM	Course Credits: 2
Total Contact Hours: 56 Hrs.	Duration of ESA: 4 Hrs.
Formative Assessment Marks: 10 marks	Summative AssessmentMarks: 40 marks

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research.
2. To acquire experimental skills, analyzing the results and interpret data.
3. Ability to design / develop / manage / operation and maintenance of sophisticated electronic gadgets / systems / processes that conforms to a given specification within ethical and economic constraints.
4. Capacity to identify and implementation of the formulae to solve the electronic related issues and analyze the problems in various sub disciplines of electronics.
5. Capability to use the Modern Tools / Techniques.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with ProgramOutcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**
Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research						
To acquire experimental skills, analyzing the results and interpret data.	**x**					
Ability to design / develop / manage / operation and maintenance of sophisticated electronic gadgets / systems / processes that conforms to a given specification within ethical and economic constraints.	**x**					
Capacity to identify and implementation of the formulate to solve the electronic related issues and analyze the problems in various sub disciplines of electronics.						
Capability to use the Modern Tools / Techniques.	**x**					

ELE-CP3: Advanced Communication Systems – LAB

(Minimum **Eight** Experiments)

1. Amplitude modulator and Demodulator
2. FM modulator using IC8038
3. Pre –emphasis and De- emphasis
4. IF amplifier
5. Frequency Multiplier
6. PAM modulator
7. Second order Active low pass /High pass filter
8. Band Elimination Filter
9. Numerical Aperture of OFC
10. Study of ASK generation and Detection
11. Study of FSK generation and Detection
12. Study of PSK generation and Detection
13. QPSK modulator and demodulator
14. Study of SMPS using PWM.

Syllabus for Elective Subjects

ELE – Elective 4.1: **Computer Networks** 26 Hours.

Unit 1: Fundamentals and Internetworking 8 Hrs.

Protocol Layering, The OSI Model, TCP/IP Protocol Suite, Introduction to Physical Layer: Transmission, Impairments, Data Rate Limits, Performance, Introduction to Data-Link- Layer: Link-Layer Addressing,, Error Detection and Correction: Block Coding, Cyclic Codes, Checksum

Unit 2 : Data Link and Network Layer 9 Hrs.

Data Link Control: Data-Link Layer Protocols, HDLC, Point-To-Point (PPP), Media Access Control (MAC): CSMA, CSMA/CD, CSMA/CA, Reservation, Polling, Token Passing, FDMA, TDMA, CDMA, Network-Layer Services, Packet Switching, Network-Layer Performance, IPV4 Addresses, Network Layer Protocols: Internet Protocol (IP), ICMPv4, Mobile IP, Unicast Routing: Routing Algorithms, Unicast Routing Protocols, Next Generation IP: IPv6 Addressing

Unit 3: Transport and Application Layer 9 Hrs.

Introduction to Transport Layer: Introduction, Transport-Layer Protocols, Transport-Layer Protocols: User Datagram Protocol, Transmission Control Protocol: TCP Services, TCP Features, Segment, A TCP Connection, TCP Congestion Control, Flow Control, Error Control, Application Layer: WWW, E-MAIL, Domain Name System (DNS), Quality of Service: Flow Control To Improves QoS, Integrated Services

Computer Network Experiments

1. To study about components and specifications of Laptop and Desktop.
2. Installation and introduction of simulation tools packet tracer
3. Study of different types of network cables.
4. Familiarization with Transmission media and tools: Co-axial cable, UTP cable, Crimping tool, Connectors
5. Study of network IP address configuration (Classification of address, static and dynamic address)
6. Study of network devices (Switch, Router, Bridge)

REFERENCE:

1. A.S Tanenbaum, Computer Networks, 4th Edition, PHI, 2003
2. Behrouz A. Foruzan, Data communication and Networking, 4th Edition,TMH,2004
3. Larry L. Peterson and Bruce S. Davie, “Computer Networks A System Approach”, 5th Edition, MKP, 2012.
4. James F. Kurose , Keith W. Ross, “ Computer Networking, A Top-Down Approach”, 5thEdition, Pearson, 2012.

ELE – Elective 4.2: **Meditronics** 26 Hours.

Unit 1: 8 Hrs.

Foundations of Medical Electronics: Role of electronics in healthcare and diagnostics, Classification of medical electronic devices: diagnostic, therapeutic, assistive, Bioelectric signals overview: ECG, EEG, EMG – characteristics and relevance, Electrode types and signal pickup: ECG, EEG, EMG probes, Signal conditioning essentials: amplifiers, active filters, isolation circuits, Noise sources and mitigation techniques in medical signal processing

Unit 2: 9 Hrs.

Diagnostic and Therapeutic Electronics: Design and working of ECG, EEG, and EMG machines: block-level understanding Electronics in pulse oximeters and blood pressure monitors

Overview of imaging modalities: X-ray, CT, and ultrasound electronic subsystems Pacemakers and defibrillators: basic circuitry and operational principles, Infusion pumps and ventilators: embedded control and monitoring systems, Maintenance, calibration, and reliability in medical equipment

Unit 3: 9 Hrs.

Embedded Systems and Safety in Medical Devices: Biomedical sensors: pressure, temperature, flow, oxygen saturation, Introduction to embedded systems in medical devices: Block diagram, Wireless health monitoring and the Internet of Medical Things (IoMT), Data acquisition systems for remote diagnostics, Electrical safety: leakage currents, patient isolation, fail-safes

Medical device standards: IEC 60601, ISO certifications, regulatory landscape Future trends: AI in diagnostic tools, smart wearables, and real-time analytics

Meditronics Experiments

1. **Heart Rate Monitoring using PPG Sensor**
   Objective: Measure heart rate using a photoplethysmograph sensor (IR LED + photodiode).
   Components: IR LED, photodiode (or pulse sensor), Arduino Uno, 16x2 LCD (optional).