Savitribai Phule Pune University

Minor Course offered by BOS in Electronics Science for all UG Programs under Faculty of Science & Technology except B. Sc. (Electronic Science) and allied Programs or for all UG programs under any Faculty other than Faculty of Science & Technology for SEM III ONLY

ELS – 241 - MN: Data Communications (2024 Pattern)

Teaching Scheme: TH: 02 Hours/Week	Credits 02	Examination Scheme: Continuous Evaluation: 15 Marks End-Semester: 35 Marks

Course Objectives:

- To understand the fundamental concepts of data communication.
- To understand the error detection and signals, transmission impairments and performance.
- To understand different digital modulation and multiplexing.
- To study basics of computer network.

Course Outcomes: After successful completion of this course, learner will be able to-

- Define basic concepts in data communication.
- Understand signal transmission and error detection and correction.
- Understand digital modulation scheme and multiplexing technique.
- Understand the basic concept of computer network.

Course Contents

Unit I	Introduction to Data Communications	8 Hrs

Introduction of data communication: Components of Data communications (message, sender, receiver, transmission medium),

Transmission Media: Guided (twisted pair, coaxial, fiber optic) and unguided media.

Characteristics of Data Communication: Delivery, Accuracy, Timeline, Jitter,

Data Representation: Text, Numbers, Images, Audio, Video

Types of data flow: Simplex, Half duplex, Full duplex,

Types of communication: Baseband and Broadband communication, parallel communication, and Serial communication: asynchronous and synchronous.

Unit II	Signal, Transmission and Error Detection	7 Hrs

Signal type: Analog and Digital data, Analog and Digital signals,

Digital Signals: Bit rate, Bit length, baud rate,

Transmission Impairments: Attenuation, Distortion, Noise

channel capacity, Nyquist theorem, Signal to noise ratio, Noise Figure, Shannon theorem

Line Coding: Characteristics, Line Coding Schemes–Unipolar -NRZ, Polar-NRZ-I, NRZ-L, RZ (Concept level)

Error Detection and Correction: Introduction of ARQ(Automatic repeat request), FEC (Concept and type), Hamming code.

Unit III	Modulation, Multiplexing and MAC	8 Hrs

Digital modulation techniques: ASK, FSK, PSK (concept block diagram waveform)

Multiplexing technique: FDM and TDM (concept block diagram waveform)

Protocols and standards – Definition of a Protocol, Protocol standards: De facto and De jure,

Media access control:

Random Access Protocols: ALOHA (concept), CSMA, CSMA/CD, CSMA/CA;

Controlled Access Protocol: Reservation, Polling and Token Passing;

Channelization Protocol: (Definitions) – FDMA, TDMA and CDMA.

Unit IV	Computer Networks	7 Hrs

Network Topologies - Bus, Star, Ring, Mesh

Network Types- LAN, MAN, WAN, Wireless Networks,

Ethernet: Ethernet protocol, standard Ethernet, 100 MBPS Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet.

Reference Books:

1. Data Communications and Networking by Behrouz Forouzan, Fifth Edition, ISBN 978-0-07-337622-6 McGraw Hill.
2. Computer Networks, ANDREW S. Tanenbaum, Fifth Edition, ISBN-13: 978-0-13 212695-3, Pearson
3. Communication Electronics: Principles and Applications, Frenzel, Tata Mc Graw Hill publication, 5th edition.

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ELS – 242 - MNP: Data Communications Laboratory (2024 Pattern)

Teaching Scheme: TH: 02 Hours/Week	Credits 02	Examination Scheme: Continuous Evaluation: 15 Marks End-Semester: 35 Marks

Course Objectives:

- To familiar with different network devices and cables.
- To understand different digital modulation and multiplexing.
- To understand error detection and correction scheme.
- To understand different modulation scheme.

Course Outcomes: After successful completion of this course, learner will be able to-

- Understand the roll of different network devices and crimping of RJ45.
- Understand modulation and multiplexing scheme.
- Understand error detection and correction scheme.
- Understand the modulation scheme.

Course Contents (Any 13)

1	To Study the different network cables, connectors, and demonstration of crimping of RJ-45

	Connector for practical use.
2	Set up a simple computer network in CISCO Packet Tracer.
3	Study of network devices – Repeater, HUB, Switch, Bridge, Router, Gateway, NIC, Modem etc.
4	To study line coding concept. (Using Circuit board / Simulation software)
5	To study hamming code generation.
6	To study hamming code error detection and correction.
7	To study Frequency shift keying. (Using Circuit board / Simulation software)
8	To study time division multiplexing. (Using Circuit board / Simulation software)
9	To study sample and hold circuit. (Using Circuit board / Simulation software)
10	To study Amplitude modulation. (Using Circuit board / Simulation software)
11	To study Frequency modulation. (Using Circuit board / Simulation software)
12	To study Amplitude Shift Keying (ASK). (Using Circuit board / Simulation software)
13	To study Phase Shift Keying (PSK). (Using Circuit board / Simulation software)
14	Case study on different noises occurs during data (Analog/Digital) transmission and its remedy.
15	Case study on cellular technology used in communication.

Reference Books:

1. Data Communications and Networking by Behrouz Forouzan, Fifth Edition, ISBN 978-0-07-337622-6 McGraw Hill.
2. Computer Networks, ANDREW S. Tanenbaum, Fifth Edition, ISBN-13: 978-0-13 212695-3, Pearson
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ELS – 291 - MN: Communication Networks (2024 Pattern)

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH: 02 Hours/Week	**02**	**Continuous Evaluation: 15 Marks End-Semester: 35 Marks**

Course Objectives:

- To understand the fundamental concepts of network model.
- To understand IP address and routing.
- To understand wireless communication protocol.
- To study wireless sensor network.

Course Outcomes: After successful completion of this course, learner will be able to-

- Define basic concepts in network model.
- Understand IPv4, IPv6 address.
- Understand short range technologies and their applications.
- Understand the wireless sensor network.

Course Contents

Unit I	**Network Models**	**7 Hrs**

Review of basic concepts in Data Communication, network.

Computer network model: OSI Model – layered architecture, peer-to-peer processes, encapsulation; TCP/IP Model – layers and Protocol Suite

Addressing: Physical, Logical, Port addresses, Specific addresses.

Unit II	Address Mapping and Routing	7 Hrs

IPv4 addresses: Address space, Notations, Classful and Classless addressing,

IPv6 addresses: Structure, address space, packet format, Extension headers;

Address mapping – ARP, RARP, BBOTP and DHCP; **Introduction to ICMP;**

Routing: Concept, types, routing protocol: unicast, multicast

Unit III	Wireless Communication Protocol	9 Hrs

Short range Technologies: Infrared (IR): frequency band, range, and applications,

Bluetooth: Bluetooth architecture, Bluetooth frame format; **Zigbee:** Characteristics, System Structure (Coordinator, router, end device), Topology, applications;

Z wave: Components of Z-wave network, characteristics, applications

RFID: Working of RFID system, types of RFID tags, RFID frequencies,

GPS system: Components of GPS system (space segment, control segment, user segment), Applications

Unit IV	Wireless Networks	7 Hrs

Long range wireless technology: Low power local area networking (LPLAN), Low power wide area networking (LPWAN) technologies, comparison of LoRa, Sigfox, NB-IoT, Cat –M.

Wireless Sensor Network: WSN Architecture, WSN topologies, Types of nodes (Coordinator, Router and End Device).

Satellite communication: Basic concept, segments, orbits, applications.

Reference Books:

1. Data Communications and Networking by Behrouz Forouzan, Fifth Edition, ISBN 978-0-07-337622-6 McGraw Hill.
2. Communication Electronics: Principles and Applications, Frenzel, Tata Mc Graw Hill publication, 5th edition.
3. Wireless Sensor Networks Technology: Protocols and Applications - Kazem Sohraby, Daniel Minoli and Taieb Znati, John Wiley and Sons.

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ELS – 292 - MNP: Communication Networks Laboratory (2024 Pattern)

Teaching Scheme: TH: 02 Hours/Week	Credits 02	Examination Scheme: Continuous Evaluation: 15 Marks End-Semester : 35 Marks

Course Objectives:

- To familiar with MAC and IP address
- To understand how to setup LAN.
- To understand wireless sensor node for WSN.
- To understand short- and long-range wireless technology.

Course Outcomes: After successful completion of this course, learner will be able to-

- Understand the concept of MAC and IP address.
- Set up LAN.
- Understand wireless sensor node for WSN.
- Understand practical use of short- and long-range technology.

Course Contents (Any 13)

1	To study Configuration of IP and MAC address.
2	To study Local Area Network setup.
3	To convert the given IP addresses from dotted-decimal notion to binary notation.
4	To convert the given IP addresses from binary to dotted decimal notion.
5	To find NetID and Host ID of the given IP addresses
6	To find class of the given IP addresses.
7	To study Arduino based LED pattern generation.
8	To study of Bluetooth.
9	To study the RFID.
10	Point to point communication using Zig-Bee.
11	Wireless sensor node used for street light control.
12	Wireless sensor node used for environment monitoring.
13	Wireless sensor node used for security system.
14	Wireless sensor node used for Door control.
15	Study of LoRa Communication.

Reference Books:

1. Data Communications and Networking by Behrouz Forouzan, Fifth Edition, ISBN 978-0-07-337622-6 McGraw Hill.
2. Computer Networks, ANDREW S. Tanenbaum, Fifth Edition, ISBN-13: 978-0-13 212695-3, Pearson
3. Wireless Sensor Networks Technology: Protocols and Applications - Kazem Sohraby, Daniel Minoli and Taieb Znati, John Wiley and Sons.
4. Arduino Made Simple with Interactive Projects by Ashwin Pajankar.