Course Code				
Course Category	Program Core			
Course Title	Communication Networks			
Weekly Teaching Hrs and Credits	L	T	Laboratory	Credits
	3	-	2	3 + 0 + 1

Pre-requisites: Basics knowledge of communication systems

Course Objectives:

1. To introduce basics of communication networks, requirements and their architectures.
2. To understand TCP/IP stack and associated protocols for Internet applications.
3. To familiarize with wireless and Internet of Things technologies for sensing and control applications.
4. To understand different protocols that are used in power and energy sector.

Course Outcomes: After completion of this course, students will be able to

1. Configure the nodes and networks in different settings of the network and applications (CL-II).
2. Visualize the actual working of networks and analyze the traffic and performance (CL-III).
3. Choose appropriate wired or wireless technology or protocols for a given application (CL-V).
4. Design a small Internet of Things based application (CL-V).

Course Contents:

Introduction to Communication Networks: Basic blocks, topologies, network parameters and terminologies, multiplexing techniques, transmission media, switching techniques, network types, internet, network components, standardization bodies, OSI reference model, TCP/IP Stack, Physical layer.

Data Link and Network Layers: Data link layer - framing, flow control, error control, multiple access: random access, controlled access, channelization, addressing, IEEE802.3 Ethernet, network layer - IPv4/IPv6 addressing, subneting, NAT, support protocols such as ARP, RARP, ICMP, ICMPv6, NAT, DHCP, DORA, DNS, routing.

Transport/Applications Layers and Applications: Transport layer functionalities: UDP, TCP, three way handshake, TCP reliable transfer and sliding window, TCP flow and congestion control; application layer protocols, http, client-server paradigm, mailing services, ftp.

Wireless Technologies and Internet of Things: Cellular concepts, architecture, various generations introduction of Wi-Fi/IEEE 802.11, features of 4G and 5G, Internet of Things (IoT) - requirements and characteristics, architectures, topologies, different technologies: Bluetooth, ZigBee, IEEE 802.15.4. LPWANs: LoRa.

Communication Networks for Power and Energy Sector: Requirement and challenges, power line carrier communication, MODBUS, serial interfaces, DNP 3.0, CAN; Network security, network attacks, cryptography, and encryption standards.

Laboratory Exercises/Practicals:

1. Study of networking components
2. Basic TCP/IP network configurations, settings and network commands such as ping, ipconfig, tracert, open visual trace route and related tools
3. GNS3 simulator and basic network configurations
4. Advanced network configuration using routers and switches on GNS3 simulator.
5. Configuration web server
6. Network protocol analyzer tools/software such as Wireshark
7. Configuration of Wi-Fi access point
8. Study of LPWAN-IoT based LoRA
9. Implementation of RSA Algorithm
10. Mini Project on any of the technologies studied in the course (Group activity)

Learning Resources:

Text Books:

1. Forouzan Behrouz, *Data Communications and Networking.* New Delhi: Tata McGraw-Hill, 5th edition, 2017.
2. Forster Anna, *Introduction to Wireless Sensor Networks.* NJ: John Wiley & Sons, Inc, 2016.

Supplementary Reading:

1. Stallings Williams., *Data and Computer Communications.* New Delhi: Prentice Hall of India Pvt. Ltd., 10th edition, 2021.
2. Chaudhari Bharat and Zennaro Marco, *LPWAN Technologies for IoT and M2M Applications.* London: Academic Press-Elsevier, 2020.

Web Resources:

1. https://nptel.ac.in/courses/106105183
2. https://nptel.ac.in/courses/106105081
3. https://www.ethercat.org

Pedagogy:

- Power Point Presentations, Videos
- Group Activities
- Active Learning Methods

Assessment Schemes:

Class Continuous Assessment (CCA) (60 Marks)

Assignments	Midterm Exam	Class Test	Students Initiatives
20	20	15	5

Laboratory Continuous Assessment (LCA) (50 Marks)

Understanding the Objectives	Understanding of Procedure and Initiatives	Experimental Skills	Oral
5	10	10	25

Term End Examination:

Term end exam of 40 marks will be based on entire syllabus.