Course code	CSE/PC/B/T/224
Category	Professional Core
Course title	**Data Communication**
Scheme and Credits	L–T–P: 3-0-0; Credits: 3.0; Semester – II
Pre-requisites (if any)	

Syllabus:

Introduction: Overview of Data Communications, Networks and Network models (OSI, TCP/IP), Protocols and standards [1L]

Data and signals: Analog and digital signals, Periodic and nonperiodic signals, Signal analysis, Composite signals, Time and Frequency domains, Bandwidth, Wave symmetry, Linear and non-linear mixing of signals. [2L]

Transmission Impairment: Attenuation, Distortion, Noise - correlated and uncorrelated noises and their categories, Harmonic distortion and intermodulation distortion, Data rate limits for noisy and noiseless channels [2L]

Performance: Bandwidth, Throughput, Latency, Bandwidth-Delay Product, Jitter [1L]

Digital Transmission: Problems with digital transmission, Different line coding schemes, Block coding schemes, Scrambling techniques; Analog to Digital Conversion – Sampling techniques, Sampling theorem, Pulse amplitude modulation, Pulse code modulation, Differential pulse code modulation, Delta modulation (along with advantages and disadvantages of each technique), Transmission modes (serial and parallel). [4L]

Analog Transmission: Concepts of carrier signal, modulating signal and modulated signal; Amplitude modulation – double sideband suppressed carrier, double sideband transmitted carrier, single sideband; Frequency modulation – Narrowband FM and wideband FM; Digital to analog conversion – Amplitude shift keying, Frequency shift keying, Phase shift keying, Quadrature amplitude modulation, Performance. [4L]

Transmission Media: Guided (wired) media – Twisted pair cable, Coaxial cable and Fibre optic cable, Construction, categories and connectors of each type, Performance, Advantages and disadvantages and applications of each type of media, Different propagation modes through fibre optic cable, Unguided (wireless) media – Different propagation modes, Radio waves, Terrestrial microwaves, Infrared, Applications and performances, Satellite communication. [4L]

Multiplexing and Spreading: Concept of multiplexing, Frequency division multiplexing, Time division multiplexing – Synchronous and Statistical time division multiplexing, Handling variable length data, Pulse stuffing, Concept of spreading spectrum, Frequency hopping spread spectrum and Direct sequence spread spectrum. [6L]

Modems and Interfaces: Dial-up modems, modem speed, standards; other modems; Interface standards. [4L]

Error Detection and Correction: Types of errors, Basic concepts of error detection and correction, Redundancy, Hamming distance, Error detection – Simple parity check codes, Two-dimensional parity

check, Cyclic redundancy check, Polynomials and cyclic code analysis, Checksum, Error correction – Hamming code. [6L]

Protocols for Data Communication: Flow control and Error control, Stop and Wait protocol and its efficiency, Sliding window protocols - Go-back-N and Selective repeat, Piggybacking, HDLC, Point-to-point protocol. [6L]

Suggested Readings:
1. Data & Computer Communications, William Stallings, Pearson Education
2. Data Communications and Networking, Behrouz A Forouzan, McGraw Hill
3. Electronic Communications Systems, Tomasi, Pearson Education
4. Digital Communications, Haykin, Wiley

Course Outcomes (CO):
On completion of this course, students should be able to:
- CO1 Understand the fundamentals of network design, characteristics of analog and digital signals, relationship between data and signals, network topologies and devices and the concept of data communication within the network environment. (K2)
- CO2 Understand the basics of transmission medium and explain how impairments (noise, attenuation and distortion) affect signal traveling through a transmission medium (noiseless and noisy channel). (K2, K3)
- CO3 Understand and describe the concepts of digital transmission of analog and digital data, encoding techniques, conversion techniques used to convert digital data and analog signals to digital signals for parallel and serial transmission. (K2)
- CO4 Understand the describe the concepts of analog transmission of digital and analog data, methods, and the procedures involved in converting digital data and analog low-pass to band-pass analog signals. (K2)
- CO5 Understand and illustratively explain errors in communication, error detection and correction mechanisms. (K2, K4, K5)
- CO6 Explain the concepts of logical link control with reference to framing, flow and error control. (K2, K3, K4)

CO-PO mapping Course Articulation Matrix

CO Data Communication	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	2	2							1	2	1	3		
CO2	3	3	3	2	1						1	2	1	3		
CO3	3	2	2	2	1						1	2	1	3		
CO4	3	3	3	3	2	2	1	2	2	2	2	3	1	3		
CO5	3	3	3	2	2	1	1	2	2	2	2	3	3	2		
CO6	3	3	3	2	2	2	1	2	2	2	2	3	3	2		