Item 3

B.Tech. II Semester (Electronics and Telecommunication Engineering)
Data Communication (20251201)

Course objectives: To provide the concepts of data communication and computer networking applications.

Unit I: Introduction to Data Communication: Components, Data representation, and Data flow; Overview of computer networks, their uses, categories (LAN, MAN, WAN), and Basic topologies. Reference models: OSI and TCP/IP layers and comparison. Multiplexing: FDM and TDM. Physical layer media: guided (twisted pair, coaxial, fiber optic) and unguided (radio, microwave, satellite). Interfaces and devices: RS-232 and modems. Switching techniques: circuit, packet, and message switching.

Unit II: Data Link Layer: Framing, Flow control, and Error detection and Correction using parity, CRC, Checksum, and Hamming codes. ARQ protocols: Stop-and-Wait, Sliding Window, and HARQ. Data link protocols: BSC and HDLC. Multiple Access Protocols: pure and slotted ALOHA, CSMA, CSMA/CD, and CSMA/CA. MAC Sublayer Basics and LAN Technologies: Ethernet, Token Bus, and Token Ring. Networking devices: Bridges, Switches, Routers, and Gateways.

Unit III: Network Layer: Routing principles and algorithms including shortest path, flooding, distance vector, and link state routing. Datagram and virtual circuit approaches. Congestion control: leaky bucket, token bucket, and slow start. IP addressing fundamentals: IPv4, subnetting, CIDR, supernetting, and fragmentation. Introduction to IPv6 features and transition methods.

Unit IV: Transport Layer: addressing, connection establishment and release, segmentation, flow and error control. UDP and TCP: service model, segment format, sliding window, and congestion control basics. Session Layer: dialog control and synchronization. Presentation Layer: translation, encryption, and compression. Application Layer: remote login, file transfer, email, and basic client–server communication.

Unit V: IoT Protocols and Architectures: Internet of Things (IoT) architecture, communication models, and device-to-device, device-to-gateway, and device-to-cloud communication patterns. IoT-specific communication protocols: MQTT for lightweight publish–subscribe messaging, CoAP for constrained RESTful communication, AMQP for reliable message queuing, and 6LoWPAN for IPv6 over low-power wireless networks. Short-range IoT technologies: Zigbee for mesh networking and low-power communication. Long-range IoT technologies: LoRaWAN for wide-area low-power communication. Introduction to edge and fog computing for distributed processing and reduced latency in IoT networks. ***[Dynamic Unit, 2025]***

Text Books:

1. B. A. Forouzan, Data Communications and Networking, 5th ed. New York, NY, USA: McGraw-Hill, 2017.
2. W. Stallings, Data and Computer Communications, 10th ed. Upper Saddle River, NJ, USA: Pearson, 2013.

Reference Books:

1. D. E. Comer, Internetworking with TCP/IP, Vol. 1: Principles, Protocols, and Architecture, 6th ed. Upper Saddle River, NJ, USA: Pearson, 2013.
2. W. R. Stevens, TCP/IP Illustrated, Vol. 1: The Protocols, 1st ed. Reading, MA, USA: Addison-Wesley, 1994.

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

- **CO 1. Compare** various switching techniques in a layered network architecture.
- **CO 2. Analyze** data link layer mechanisms for framing, error control, and MAC layer operations.
- **CO 3. Evaluate** routing algorithms, congestion control, and IP addressing schemes.
- **CO 4. Explore** transport, session, presentation, and application layer functions.
- **CO 5. Explore** IoT architectures, protocols, and edge/fog computing concepts.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	3	2	1	2	1	1	1	3	1	2	2
CO2	3	3	2	2	1	1	1	1	2	1	2	1	1
CO3	3	1	1	1	2	2	1	1	1	2	1	1	2
CO4	3	3	2	2	2	1	2	1	2	1	2	0	1
CO5	3	3	1	1	1	1	2	1	2	1	2	1	1

1 - Slightly; 2 - Moderately; 3 – Substantially

B.Tech. II Semester (Electronics and Telecommunication Engineering)
Electronic Circuits (20251202)

Course Objective: To equip students with the knowledge and skills to analyze and design BJT-based biasing circuits, amplifiers, feedback systems, and practical analog building blocks.

Unit I: BJT Biasing and Stability: BJT biasing and bias stabilization, the operating point, stability factor, analysis of fixed base bias, Voltage divider bias, collector to base bias, Emitter resistance bias circuit and Bias compensation techniques.

Unit II: BJT as an Amplifier (Small Signal Analysis): Low frequency BJT amplifiers, equivalent circuit of BJT using h parameter for CB, CE, CC configurations, calculation of transistor parameter for CB, CE, CC using h parameters. High frequency BJT amplifier: Hybrid-pi (π) common emitter transistor model, hybrid – π conductance and capacitance, gain-bandwidth product.

Unit III: BJT as an Amplifier (Large Signal Analysis): Analysis and design of Class A, Class B, Class AB, and Class C BJT power amplifiers; load-line concepts, efficiency, and distortion. Push–pull amplifier operation, crossover distortion, and biasing techniques for improved linearity.

Unit IV: Feedback amplifiers: Introduction to Feedback Amplifiers & their design parameters, comparison of different feedback amplifier configuration viz (gain, input impedance, output impedance, current gain, voltage gain), cascading of BJT amplifier, Darlington Pair.

Unit V: Industrial analog circuit blocks and their applications: Design principles of current mirror stages photodiode sensor bias networks, Cascode and cascade amplifier stages used in industrial instrumentation amplifier front-ends, Darlington and twin-transistor pair configurations used in relay driver interface circuits and buffer stages for PLC inputs. ***[Dynamic Unit, 2025]***

Text Book:
1. Microelectronic Circuits , Sedra & Smith, 7th Edition
2. Electronic Devices & Circuit Theory, Boylestad & Nashelsky, 12th Edition

Reference Books:
1. Analysis and Design of Analog Integrated Circuits, Gray & Meyer, 5th Edition

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

- **CO 1.** **Compare** BJT biasing methods, operating point stability, and compensation techniques.
- **CO 2.** **Apply** small-signal BJT models to evaluate amplifier gain, impedance, and frequency response.
- **CO 3.** **Analyze** Class A, B, AB, and C power amplifiers with focus on efficiency and distortion.
- **CO 4.** **Design** feedback amplifier configurations and multistage BJT structures.
- **CO 5.** **Design** industrial analog building blocks such as current mirrors, cascode stages, and driver circuits.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	1	0	0	0	1	1	1	2	2
CO2	3	3	3	2	2	0	0	0	1	1	1	1	1
CO3	3	3	3	3	2	0	0	0	1	2	1	1	2
CO4	3	3	3	3	3	0	0	0	2	2	1	0	1
CO5	3	3	3	3	3	0	0	0	3	3	2	1	1

1 - Slightly; 2 - Moderately; 3 – Substantially

B.Tech. II Semester (Electronics and Telecommunication Engineering)
Signals & Systems (20251203)

Course objective: Coverage of continuous and discrete-time signals and systems, their properties and representations and methods that are necessary for the analysis of continuous and discrete-time signals and systems.

Unit 1 Introduction to Signals and Systems: Mathematical Description of Continuous & Discrete Time Signals, Elementary Signals, Even and Odd Functions, Periodic and non periodic Functions, Signal Energy and Power, Signal Operations, Classification of Continuous & Discrete LTI systems, Properties of systems.

Unit 2 Fourier Series: Exponential Fourier Series, Properties of Exponential Fourier Series, Trigonometric Fourier Series, Convergence of Fourier Series, Discrete Fourier Series.

Unit 3: Fourier transform: Introduction to Fourier transform, Fourier Transforms of elementary functions. Properties of Fourier Transform, Analysis of signals using Fourier transform.

Unit 4 Continuous and Discrete System analysis: The Convolution Integral, and Convolution Sum, Convolution & its Properties, Stability and Impulse Response, Response of Systems to Standard inputs.

Unit 5 Time-Frequency analysis: Limitation of Fourier Transform, Short-Time Fourier Transform, Fundamentals of Wavelet analysis, Time-Frequency analysis of biomedical and seismic waves, Visualization of time-frequency analysis using pywt and librosa library. ***[Dynamic Unit, 2025]***

Text Books:
1. Digital Signals and Systems, 2nd Edition: Simon Haykin, Barry Van Veen, 2nd Edition, Wiley India Pvt. Ltd.
2. Signals and Systems: Hwei. P. Hsu, Schaum's outlines, 2 nd Edition, Tata Mcgraw Hill Education.

Reference Books:
1. Fundamentals of Signals & Systems: Michael J Roberts, 2 nd Edition, Mc Graw Hill Education.
2. Signal and Systems: Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, 2nd Edition, Pearson Education India.

Course Outcomes

After the completion of this course students will be able to:

- **CO 1.** **Classify** continuous and discrete time signals and LTI Systems.
- **CO 2.** **Analyze** the spectral characteristics of signals.
- **CO 3.** **Apply** z-transform for analysis of discrete time signals.
- **CO 4.** **Apply** the convolution operation to determine the response of the LTI systems.
- **CO 5.** **Analyze** the time-frequency characteristics of continuous and discrete time systems.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	2	-	-	-	-	-	1	2	2
CO2	3	3	3	3	2	-	-	-	-	2	1	3	3
CO3	3	3	2	3	3	-	-	-	-	2	1	3	3
CO4	3	3	3	3	3	3	-	-	-	2	1	3	3
CO5	3	3	2	3	2	3	-	-	-	2	1	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

B.Tech. II Semester (Electronics and Telecommunication Engineering)
Digital Circuits and Systems (20251203)

Course Objective: To analyze and design the combinational and sequential logic circuits using boolean algebra, logic families and finite state machine for real time applications.

Unit I: Boolean algebra and switching functions: Minimization of Boolean functions, Canonical & standard form, concept of prime implicant etc. Karnaugh's map method, Quine-McCluskey's method, Universal gates, NAND/NOR realization of Boolean functions..

Unit II: Combinational Logic Circuits: Half adder, Half subtractor, Full adder, Full subtractor circuits. Serial and parallel adder, BCD adders, look-ahead carry generator, Code Converters, Decoders, Encoders, Multiplexers & demultiplexers.

Unit III: Sequential Circuits: Sequential Circuits, Flip-Flops: RS Flip-flop, D Flip Flop, Edge-triggered D Flip-flop, Edge-triggered JK Flip-flop, JK Master-slave Flip-flop, Registers, Shift Registers, Counters, Ripple Counters, Synchronous Counters.

Unit IV: Logic Families and Memories: Introduction to Logic families, Comparison of various logic families, Design of PAL, PLA. ROM organization- PROM, EPROM, EEPROM, EAPROM, RAM organization- Static RAM, Dynamic RAM..

Unit V: Finite State Machine: Introduction to FSM, Components of FSM, Moore and Mealy machine, Design steps for FSM, FSM based applications: Traffic light controller, Digital Lock system, Automatic water level controller. ***[Dynamic Unit, 2025]***

Text Books:

1. Digital Design: M. Mano,4th Edition, Prentice Hall of India.
2. Logic & Computer Design Fundamental: M.Mano, 5th Edition, Pearson Education India.
3. Digital Circuits and Design: S. Salivahanan,5th Edition, Oxford University Press.

Reference Books:

1.Digital Electronics: W.H. Gothman, Prentice Hall of India., 4th edition
2.Digital System Principles & Applications: R.J. Tocci,11th Edition, Pearson Education India.
3.Pulse, Digital & Switching Waveforms: Millman&Taub, McGraw Hill Education.,3rd edition.

Course Outcomes:

After successful completion of the course, students will be able to:

- **CO 1.** **Implement** the Boolean expression using logic gates.
- **CO 2.** **Design** different combinational circuits like multiplexer, adder, subtractor etc.
- **CO 3.** **Analyze** sequential circuits such as flip flops, counters etc.
- **CO 4.** **Compare** Logic families and memories.
- **CO 5.** **Develop** the concept of FSM and analyze its applications.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	2	1	1	1	1	1	1	2	2	3	3
CO2	2	2	2	2	2	2	1	1	1	1	2	2	3
CO3	3	2	2	3	2	2	1	-	1	2	1	2	3
CO4	2	2	2	2	2	3	2	-	1	1	1	3	3
CO5	2	2	2	2	2	1	1	1	1	1	2	2	3

1 - Slightly; 2 - Moderately; 3 – Substantially

B.Tech. II Semester (Electronics and Telecommunication Engineering)
Sustainability & Environmental Science (20251212)

Course Objective:
To equip students with a comprehensive understanding of environmental science, pollution control, sustainability, and global frameworks, enabling them to analyze environmental challenges and contribute to sustainable solutions through informed decision-making and responsible practices.

Unit I: Introduction to Environmental Science: definition, importance and its components. Ecosystem and its components. Water cycle, carbon cycle, food chain, energy flow in ecosystem. Current state of environment in India and world; Underlying reasons (root causes) of modern environmental degradation (social, psychological, cultural). Introduction to Environmental pollution: air, water, noise, soil, thermal and radioactive.

Unit II: Environmental Pollution and Management: air, water, noise, soil, thermal and radioactive. Causes, impacts, pollution control techniques and mitigation strategies. Solid waste management: Principles of waste management, different components of waste management system and introduction to management of hazardous waste like e-waste, plastic waste. Global environmental Issues: Climate change, global warming, ozone layer depletion, urban heat island

Unit III: Environmental policies and laws in India: Environmental Protection Act, Water Act, Air Act. **Overview of global environmental policies and frameworks:** Kyoto protocol, Montreal protocol, COP summits. Introduction to clean development mechanism, carbon credit, carbon trading. Environmental audit.

Unit IV: Sustainability concepts: definition, importance, pillars of sustainability (economic, environmental, and social). Sustainable development. Overview of UN Sustainable Development Goals (SDGs) and their global relevance. Concept of circular economy, resource efficiency, energy conservation, green buildings and sustainable manufacturing.

Unit V: Sustainable Energy solutions: New energy sources: need of new sources, different types of new energy sources, application of hydrogen energy, ocean energy sources, and tidal energy conversion. Concept, origin and power plant of geothermal energy. Renewable energy sources like water, wind etc. Overview of sustainable materials and construction practices. Introduction to sustainable transportation systems and sustainable water infrastructure. ***[Dynamic Unit, 2025]***

Recommended Books:
1. D. K. Asthana, Meera Asthana, A Text Book of Environmental Studies, S Chand & Co., New Delhi.
2. S. K. Dhameja, Environmental Engineering & Management, S K Kataria & Sons, New Delhi
3. C. S. Rao, Environmental Pollution Control Engineering, C.S. Rao, New Age International Publishers
4. A. K. Gupta, Environmental Sustainability and Green Technologies, PHI Learning.

Course Outcomes:
After completion of the course, a student will be able to

- **CO 1. Explain** the fundamental concepts of environmental science, including ecosystems and the causes of environmental degradation.
- **CO 2. Analyze** the sources, causes, and impacts of air, water, and solid waste pollution and propose appropriate mitigation strategies.
- **CO 3. Evaluate** the effectiveness of environmental policies and global frameworks in addressing environmental challenges.
- **CO 4. Explain** the concepts of sustainability and sustainable development goals.
- **CO 5. Apply** various solutions for achieving sustainable development.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	3	1	-	-	-	1	3	3
CO2	3	3	3	2	1	3	2	-	-	-	-	2	3
CO3	-	2	-	1	-	3	3	-	2	1	2	2	3
CO4	1	3	2	-	-	3	2	-	1	-	2	3	3
CO5	2	3	3	1	1	3	2	1	1	1	3	2	3

1 - Slightly; 2 - Moderately; 3 – Substantially