B.Tech III Sem (Electronics & Telecommunication Engineering)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot		Total Marks	Contact Hr./week			Total Credits
			Minor valuation I	Minor valuation II	Quiz/ Assignment Marks	Major Evaluation	Continuous Evaluation/Lab work & Sessional	Major Evaluation		L	T	P	
20242102	DC	Data Structures	25	25	20	30	-	-	100	3	-	-	3

Data Structures (20242102)

Course Objectives

- To familiarize the students with the use of data structures as the foundational base for computer solutions to problems.
- To understand various techniques of searching and sorting.
- To understand basic concepts about stacks, queues, lists, trees and graphs.

Unit I: Introduction to Data Structures: Algorithms & their Characteristics, Asymptotic Notations and complexity analysis, **Array:** Representations of Array, Index to Address Translation, **Linked List:** Introduction, Implementation of Linked List, Operations, and types.

Unit II: Stack: Concepts and implementation of Stacks, Operations on Stack, Applications of Stack - Conversion of Infix to Postfix Notation, Evaluation of Postfix Expression, Recursion. Queue: Concepts and Implementation, Operations on Queues, Dequeue, Priority Queues, Circular Queues.

Unit III: Trees: Types, Terminology, Binary Tree -Representations, Traversal, Threaded Binary Tree, Binary Search Tree, Height Balanced Tree-AVL Tree.
Graph: Terminologies, Representation of Graphs- Sequential & Linked Representation, Graph Traversals- BFS, DFS, Spanning Trees.

Unit IV: Searching: Linear Search, Binary Search, Hashing and Collision Resolution Techniques; Sorting: Bubble Sort, Selection Sort, Insertion Sort.

Unit V: Introduction to Advanced Data Structures: Real-world Applications (Big Data, AI, Cloud Computing, etc.), Hashing for Large-Scale Systems, Graph-Based Data Structures in Industry, Introduction to Concurrent and Distributed Data Structures etc.

Text Books

1. Data Structures, Algorithms and Applications in C++, Sartaj Sahni, 2nd Edition.
2. An Introduction to Data Structures with Applications, Jean-Paul Tremblay, Mcgraw hill.

Reference Books

1. Data Structures & Algorithms, Aho, Hopcroft & Ullman, original edition, Pearson Publication.

Course Outcomes

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

CO1. **Analyze** algorithms using asymptotic notations & perform operations on arrays and linked lists.
CO2. **Construct** stacks and queues and use them to solve real world problems.
CO3. **Distinguish** between different types of trees and apply graph theory concepts.
CO4. **Compare** various searching, sorting and hashing techniques.
CO5. **Discover** the applications of data structure in emerging areas and real world.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	1	1	1	1	1	1	2	1	1
CO2	3	3	3	3	2	3	2	2	1	1	2	2	1	1
CO3	3	3	3	3	2	2	1	1	1	1	1	2	1	1
CO4	3	3	3	3	2	2	1	1	1	1	1	2	1	1
CO5	3	3	3	3	2	3	2	2	1	1	2	2	1	1

1 - Slightly; 2 - Moderately; 3 – Substantially

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot		Total Marks	Contact Hr./week			Total Credits
			Minor valuation I	Minor valuation II	Quiz/ Assignment Marks	Major Evaluation	Continuous Evaluation/Lab work & Sessional	Major Evaluation		L	T	P	
20242101	BSC	Probability and Random Process	25	25	20	30	-	-	100	3	-	-	3

Probability and Random Processes

Course Objectives

- To learn central tendency, skewness and kurtosis.
- To describe probability theory and distribution
- To familiarize with correlation and regression
- To know about the hypothesis analysis
- To explore the theory of attributes and rules of association

Unit 1: Measure of Central Tendency

Measures of Averages and Standard Deviation, Moments about origin and mean, Moment Generating Function, Skewness and Kurtosis.

Unit 2: Probability & Regression

Definition of Probability: Classical and Axiomatic Approaches, Laws of Total and Compound Probability, Conditional Probability, Curve Fitting, Correlation and Regression.

Unit 3: Probability Distribution

Probability Distribution Function, Probability Density Function, Central Limit Theorem, Binomial Distribution, Poisson Distribution, Normal Distribution, Exponential Distribution, Uniform Distribution.

Unit 4: Testing of Hypothesis

Testing of Hypothesis, Chi-squared test, t-test, F-test, Z-test, Analysis of Variance: One-way and Two-way Classifications.

Unit 5: Random Variables & Processes

Concept of Random Variable, One-Dimensional Random Variable, Two-Dimensional Random Variable, Distribution Function, Joint Probability Distribution Function, Marginal Probability Distribution, Cumulative Probability Distribution, Conditional Distribution Function.

Recommended Books:

1. M Ray and H.S. Sharma: Mathematical Statistics, Ram Prasad Publications, 3rd Edition, 2017.
2. V.K. Kapoor, S.C. Gupta: Statistical Methods, S. Chand& Company, 11th Edition, 2018.
3. T. Veerarajan: Probability, Statistics and Random Processes, McGraw-Hill, 3rd Edition, 2008.
4. S. M. Rose: Introduction to Probability Models, Elsevier, 10th Edition, 2011.

Course Outcomes

After completing this course, the students will be able to:

CO1. **Gain** knowledge of measures of central tendency

CO2. **Evaluate** the skewness, kurtosis, curve fitting, correlation and regression.

CO3. **Interpret** the theory of probability and its distributions

CO4. **Examine** the test of hypothesis.

CO5. **Compute** random variables with random process

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	1	1	1	1	1	1	2	1	1
CO2	3	3	3	3	2	1	1	1	1	1	1	2	1	1
CO3	3	3	3	3	2	1	1	1	1	1	1	2	1	1
CO4	3	3	3	3	2	1	1	1	1	1	1	2	1	1
CO5	3	3	3	3	2	1	1	1	1	1	1	2	1	1

1 - Slightly; 2 - Moderately; 3 – Substantially

B.Tech III Sem (Electronics & Telecommunication Engineering)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot		Total Marks	Contact Hr./week			Total Credits
			Minor valuation I	Minor valuation II	Quiz/ Assignment Marks	Major Evaluation	Continuous Evaluation/Lab work & Sessional	Major Evaluation		L	T	P	
20242103	DC	Communication Systems	25	25	20	30	-	-	100	3	-	-	3

Communication Systems (20242103)

Course objective:

To understand the fundamental principles of communication systems, analyzing various modulation and demodulation techniques, and introduction to advanced communication technologies.

Unit I: Amplitude Modulation: Amplitude modulation and demodulation techniques, Spectral analysis, Power calculation for AM, DSB-SC & SSB-SC.

Unit II: Angle Modulation: Angle modulation and demodulation techniques, Types of FM, Carson's rule, Figure of merit of modulation techniques, Various sources of noise, types of noise, comparison of modulation scheme for noise.

Unit III: Sampling & Quantization Techniques: Sampling theorem, Quantization and Reconstruction of signals, Generation and detection of PAM, PPM, PWM, PCM, Delta and Adaptive delta modulation

Unit IV: Digital Modulation Techniques: GSOP, ASK, FSK, PSK, QPSK Modulation, 16-QAM, Demodulation, Optimum filter, Matched filter and Correlator detector, Comparison of different modulation techniques.

Unit V: Advanced Communication Technologies: Modulation techniques for 5G & 6G Communication, Software Defined Radio (SDR) & Cognitive Radio, Reconfigurable intelligence surface.

Text Books:

1. Communication System: Simon Haykins, Wiley & Sons.
2. Communication Systems - B. P. Lathi, BSP Publication
3. Singh, R.P. & Sapre, S.D, Systems: Analog & Digital Communication, Tata McGraw-Hill, 5th reprint, 2000.

Reference Books:

1. Electronic Communication System: Kennedy-Devis, Tata McGraw-Hill Education.
2. Modern Digital & Analog Communication System: B.P. Lathi ,Oxford University Press.
3. Principles of Communication System: Taub and Schilling McGraw-Hill Education.
4. Fundamentals of 5G mobile networks: Rodriguez: Jonathan, John Wiley & Sons.
5. Software Defined Radio: Architectures Systems and Functions: Markus Dillinger, Kambiz Madani, Nancy Alonistiot, John Wiley & Sons.
6. Reconfigurable Intelligent Surface-Empowered Wireless Communications: From Theory to Practice: Qingqing Wu, Yue Gao, Zhiguo Ding, Yuanwei Liu, IEEE Press/Wiley.

Course Outcomes

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

CO1: **Analyze** amplitude modulation schemes and power spectral characteristics.
CO2: **Evaluate** angle modulation techniques with respect to noise performance.
CO3: **Design** signal sampling and quantization systems for digital conversion.
CO4: **Analyze** digital modulation techniques based on performance criteria.
CO5: **Acquire** knowledge about advanced communication techniques.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	1	1	1	1	1	1	2	3	2
CO2	3	3	2	2	2	1	1	1	1	1	1	2	3	2
CO3	3	2	3	2	3	1	1	1	1	1	1	2	3	3
CO4	3	3	2	2	2	1	1	1	1	1	1	2	3	2
CO5	2	2	2	2	3	1	1	1	1	1	1	3	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

B.Tech III Sem (Electronics & Telecommunication Engineering)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot		Total Marks	Contact Hr./week			Total Credits
			Minor valuation I	Minor valuation II	Quiz/ Assignment Marks	Major Evaluation	Continuous Evaluation/Lab work & Sessional	Major Evaluation		L	T	P	
20242104	DC	Integrated Circuits	25	25	20	30	-	-	100	3	-	-	3

Integrated Circuits (20242104)

Course objective:

Students will be able to learn the basic concepts of differential and operational amplifiers and their applications. Further, they will be acquainted with instrumentation amplifiers for different industrial applications.

Unit I: Operational Amplifiers: Differential amplifier configurations, Block diagram of Op-amp, Features of practical (IC-741) and ideal op-Amp PSRR, CMRR, Slew rate and its Effect, Input and output offset voltages, Open and Closed loop configuration of Op-amp, Inverting and non- inverting amplifier, Summing amplifier, Integrators and differentiators, Logarithmic and anti-logarithmic amplifier, Schmitt Trigger.

Unit II: **Active Filter Design**: Characteristics and classifications of filters, Magnitude and frequency response, 1st and 2nd order Low pass and High pass filters, Band pass filter, and Band reject filter.

Unit III: **Oscillators**: Phase shift oscillator, Clapp oscillator, Wien bridge oscillator, Hartley Oscillator, Colpiit's oscillator, Crystal oscillator using Op-amp.

Unit IV: **Multivibrators**: Introduction to 555 timer IC, Block diagram, Pin diagram, Astable, Monostable and Bistable Multivibrator Circuits using 555 timer IC and their applications.

Unit V: Integrated Circuits for Industrial Applications: Low noise instrumentation amplifier for Signal Processing, Integrated Circuits in AI Edge Devices, EV Electronics.

Text Books:

1. Electronics Devices and Circuits: Boylested & Nashelsky,11th Edition, Pearson Education India
2. Op-Amp and Linear Integrated Circuit: R. A. Gayakwad, 4th Edition, Prentice Hall of India.
3. Behzad Razavi, Design of Analog CMOS integrated circuits, McGraw Hill Co. Inc.

Reference Books:

1. Integrated Electronics: Millman & Halkias, 2nd Edition, McGraw Hill Education
2. Electronics Devices and Circuits: Shalivanan, 2nd Edition, Tata Mcgraw Hill Education.
3. Design with Operational Amplifiers and Analog Integrated Circuits: Sergio Franco, 3rd Edition,Mcgraw Hill Education.
4. Analog Circuit Design: A Tutorial Guide to Applications and Solutions: Bob Dobkin and Jim Williams, 1st Edition, Newnes

Course Outcomes

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

CO1. **Analyze** Op-amp configurations for various applications.
CO2. **Implement** different types of active filters.
CO3. **Design** different oscillators circuits.
CO4. **Design** multivibrator circuits using 555 timer IC.
CO5. **Compare** different integrated circuits with their industrial applications.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	1	1	1	1	2	1	2	3	2
CO2	3	3	3	3	2	2	1	1	2	2	1	2	3	2
CO3	3	2	3	2	3	2	1	1	2	2	1	2	3	2
CO4	3	2	3	2	3	3	1	1	2	2	1	2	3	2
CO5	3	2	2	2	3	3	1	1	2	2	2	2	2	3

1 - Slightly; 2 - Moderately; 3 – Substantially

B.Tech III Sem (Electronics & Telecommunication Engineering)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot		Total Marks	Contact Hr./week			Total Credits
			Minor valuation I	Minor valuation II	Quiz/ Assignment Marks	Major Evaluation	Continuous Evaluation/Lab work & Sessional	Major Evaluation		L	T	P	
20242105	DC	Linear Control Theory	25	25	20	30	-	-	100	3	-	-	3

Linear Control Theory (20242105)

Course Objective:

Students will be able to learn the gain analysis techniques, stability concepts of control systems and their Industrial/real-world applications.

UNIT I: Fundamentals of Control Systems: Basic control system terminology, Open-loop and closed-loop systems, Feedback control and its significance, Modeling of physical mechanical systems, Transfer function of linear systems, Block diagram algebra and signal flow graphs, Effects of negative feedback on system behavior.

UNIT II: Transient and Steady-State Response Analysis: Time response of first-order and second-order systems, Steady-state error analysis, Error constants and their significance (Type 0, 1, and 2 systems), Impact of adding poles and zeros on open and closed-loop responses

UNIT III: System Stability: Concept and importance of system stability, Stability in relation to closed-loop pole locations, Absolute and relative stability concepts, Routh-Hurwitz stability criterion and applications, Root locus plots and analysis

UNIT IV: Frequency Domain Analysis and Controllers: Bode plots, Polar plots, and Nyquist criterion, Introduction to Controllers: Proportional, Integral, Derivative, PD, PI and PID

UNIT V: Industrial Applications: Introduction to PLC, PLA, Ladder programming, SCADA and its applications in industrial Robotics.

Text Books:

1. Control System Engineering- I. J. Nagrath & M. Gopal, New Age International.
2. Modern Control Engineering –K. Ogata, Prentice Hall.
3. Control System Engineering – B.S. Manke, Khanna publications.

Reference Books:

1. Automatic Control System— B. C. Kuo,Wiley.
2. Control System Engineering- Norman Nise, John Wiley & Sons.
3. Programmable logic controllers. Newnes, Bolton, William.
4. Industrial robotics: Theory, modelling and control. Pro Literatur Verlag, Cubero, Sam.

Course Outcomes:

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

CO1. **Analyze** linear systems using Block diagram reduction and signal flow graph.
CO2. **Compute** steady-state errors and time response of linear systems.
CO3. **Examine** the stability of the control system using time and frequency domain methods.
CO4. **Design** proportional, integral, and derivative controller, PD, PI, PID controllers.
CO5. **Acquire** the knowledge of PLC, SCADA and Robotics for industrial applications. .

CO-PO Mapping Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	1	1	1	1	1	1	2	3	2
CO2	3	2	2	1	1	1	1	1	1	1	1	2	3	1
CO3	3	2	2	1	1	1	1	1	1	1	1	2	3	2
CO4	3	2	3	1	2	1	1	1	2	1	1	2	3	2
CO5	2	2	3	2	3	1	2	1	3	2	2	3	2	3

1 - Slightly; 2 - Moderately; 3 – Substantially

B.Tech III Sem (Electronics & Telecommunication Engineering)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot		Total Marks	Contact Hr./week			Total Credits
			Minor valuation I	Minor valuation II	Quiz/ Assignment Marks	Major Evaluation	Continuous Evaluation/Lab work & Sessional	Major Evaluation		L	T	P	
20242111	MAC	Cyber Security	25	25	20	30	-	-	100	2	-	-	GRADE

Cyber Security (20242111)

Course Objectives

- To introduce the basic concepts of cyber security.
- To make students aware of various types of cyber threats, vulnerabilities, security policies and cyber security tools.
- To build basic skills for protecting information systems.

Unit I: Introduction to Cyber Security: Overview of Cyber Security, Goals of Cyber Security (Confidentiality, Integrity, Availability), Types of cyber-attacks: Phishing, Malware, Ransomware, Social Engineering, Malicious Softwares. Hacker and its types. Real-world incidents and their impact, Cyber Ethics and Legal Aspects.

Unit II: Basics of Networking: Internetworking devices, Topologies OSI and TCP/IP models, IP address, DNS, TCP, IP, HTTP, HTTPS, Web Browser, Web Server.

Unit III: Security Mechanisms: Firewalls, Anti-virus, Intrusion Detection Systems (IDS), Intrusion Prevention Systems (IPS), Encryption and Decryption: Symmetric and Asymmetric, Cryptanalysis, Digital Signature, Authentication: Passwords, Biometrics, Multi-Factor Authentication.

Unit IV: System and Application Security: Operating System security basics. Securing mobile devices and apps. Web application vulnerabilities: SQL Injection, XSS, CSRF. Secure coding practices. Cybercrime, Forensics, and Incident Response: Types of cybercrimes: Identity Theft, Financial Fraud, Cyber bullying. Basics of digital forensics. Cyber law and IT Act (India) overview. Incident response lifecycle and reporting.

Unit V: Cyber Security in Embedded systems: Cyber threats in microcontroller-based systems, protecting electronic devices, networks, and data from cyber threats. Hardware security, IoT Security. Jamming.

Recommended Books

1. "Cybersecurity for Beginners" by Raef Meeuwisse – Wiley
2. "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives" by Nina Godbole and Sunit Belapure – Wiley India
3. "Computer Security: Principles and Practice" by William Stallings and Lawrie Brown – Pearson
4. "Introduction to Cyber " by Chwan-Hwa (John) Wu and J. David Irwin – CRC Press
5. "Cyber security Essentials" by Charles J. Brooks, Christopher Grow, Philip Craig, Donald Short – Wiley

Course Outcomes:

After completion of the course students will be able to:

CO1. **Describe** fundamental concepts of cyber security and identify common cyber threats and legal implications.
CO2. **Explain** basic networking concepts.
CO3. **Demonstrate** common security mechanisms used to protect digital data.
CO4. **Analyze** cybercrime scenarios and vulnerabilities in systems, and outline procedures for incident response and digital forensics.
CO5.**Discuss** Cyber Security in Embedded systems to minimize cyber risks.

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	2	1	2	1	3	1	2	1	2
CO2	3	2	1	1	2	1	1	1	1	1	1	1
CO3	3	2	2	1	3	1	1	1	1	1	1	2
CO4	3	3	1	3	3	2	1	2	1	1	1	2
CO5	2	1	1	2	2	3	2	3	2	2	1	3

1 - Slightly; 2 - Moderately; 3 – Substantially