Bharati Vidyapeeth

(Deemed to be University)

Pune, India

College of Engineering, Pune

B. Tech. E & Tc Curriculum

(2023 Course)

Bharati Vidyapeeth (Deemed to be University)

College of Engineering, Pune

Faculty of Engineering and Technology

Department of E & Tc Engineering

B. Tech. (E & Tc) Curriculum (2023 Course)- Structure and Syllabi of Courses of Sem. VII and VIII

BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)

COLLEGE OF ENGINEERING, PUNE

B. Tech. (E & Tc): Semester –VII & VIII (2023 COURSE)

Module-I

S. No.	Category	Course Code	Course	Teaching Scheme Hrs./Week			Examination Scheme-Marks						Credits			
				L	P	T	ESE	IA	TW	PR	OR	Total	Th	Pr/Or	Tut	Total
1.	PE	PE1109701	Program Elective Course-II/III	4	-	-	60	40	-	-	-	100	4	-	-	4
2.	RP	RP1109702	Seminar	-	4	-	-	-	50	-	50	100	-	2	-	2
3.	IN	IN1109703	Internship *	-	-	-	-	-	150	-	100	250	-	14	-	14
			Total	**04**	**04**	**-**	**60**	**40**	**200**	**-**	**150**	**450**	**4**	**16**	**-**	**20**

*Note: The students can opt for either Industry or In-house Internship for one semester (14 Weeks)

Module-II

S. No.	Category	Course Code	Course	Teaching Scheme Hrs./Week			Examination Scheme-Marks						Credits			
				L	P	T	ESE	IA	TW	PR	OR	Total	Th	Pr/Or	Tut	Total
1.	MJ	MJ1109801	Satellite Communication	3	2	-	60	40	25	-	25	150	3	1	-	4
2.	MJ	MJ1109802	Mobile Communication	3	2	-	60	40	25	-	25	150	3	1	-	4
3.	PE	PE1109803	Program Elective Course-II/III	4	-	-	60	40	-	-	-	100	4	-	-	4
4.	RP	RP1109804	Project work	-	16	-			100	-	50	150	-	8	-	8
			Total	10	20	-	180	120	150	-	100	550	10	10	-	20

PROFESSIONAL ELECTIVE COURSES (PEC)

Sr. No.	**PROFESSIONAL ELECTIVE COURSES**	
	PEC- II	**PEC- III**
1	Software Defined Radio	Telecom Network Management
2	Foundations of Machine Learning	FinTech
3	Wireless Sensor Network	Computer Vision
4	Radio Frequency Engineering	Artificial Intelligence

Note: Students shall be permitted to opt for either Module I or Module II at a given time; simultaneous enrolment in both modules shall not be allowed.

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B. Tech. Sem. VII / VIII : Electronics & Telecommunication Engineering **SUBJECT: - PEC II Software Defined Radio**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination: 60 Marks	Credits: 04
Practical: 00	Internal Assessment: 40 Marks	
Tutorial: 00	TW: 00 Marks	Credit: 00
	Oral: 00 Marks	Credit: 00
	Practical: 00 Marks	Credit: 00
	Total Marks : 100	Total Credit:04

Course Pre-requisites:

Analog Communication, Digital Communication

Course Outcomes: After learning this course students will be able to

1	Analyze the need for Software Defined Radio and explain its characteristics, RF front-end challenges, and receiver architectures.
2	Identify different communication profiles and manage profile data for SDR-based communication systems.
3	Analyze radio resource management strategies and joint radio resource management in heterogeneous wireless networks.
4	Evaluate reconfiguration of network elements in Software Defined Radio (SDR) systems using reconfigurable hardware platforms and optimized interconnect architectures.
5	Understand Software Defined Radio architectures for cognitive radio applications.
6	Apply Software Defined Radio concepts to practical applications including smart antenna systems and evaluate their performance.

UNIT – I	**Introduction**	**(08 Hours)**
	Need for Software Radios, Definition of Software Radio and Software Defined Radio, Characteristics and benefits of Software Defined Radio, Design principles of Software Radio, RF implementation issues in SDR, Purpose and role of RF front-end, Dynamic range requirements, Principal challenges of receiver design, RF receiver front-end architectures and topologies.	
UNIT – II	**Communication Profiles and Radio Resource Management**	**(08 Hours)**
	Communication profiles and their role in **Software Defined Radio (SDR)**. Types of profiles: terminal, service, network, and user. Basic profile architecture, XML-based data representation, and profile storage, access, distribution, and updating in SDR systems. Introduction to Radio Resource Management (RRM): dynamic	

	spectrum allocation, channel assignment, power control, interference management, and Quality of Service (QoS).	
UNIT - III	**Radio Resource Management in Heterogeneous Networks**	**(08 Hours)**
	Introduction to Radio Resource Management (RRM), Definition and objectives of RRM, Radio resource units and RRM phases, Challenges and approaches in RRM, RRM modelling and investigation methods, Joint Radio Resource Management (JRRM), Performance gain analysis using JRRM, Architecture, functions, and principles of JRRM.	
UNIT -IV	**Reconfiguration of Network Elements**	**(08 Hours)**
	Introduction to reconfigurable radio systems, Reconfiguration of base stations and mobile terminals, Abstract modelling of reconfigurable devices, Role of local intelligence in reconfiguration, Performance issues in reconfigurable systems, Classification and evaluation of reconfigurable hardware, Processing elements and connection elements, Global and hierarchical interconnect networks.	
UNIT -V	**SDR Architectures for Cognitive Radio**	**(08 Hours)**
	Introduction to cognitive radio, Relationship between SDR and cognitive radio, SDR architectures for cognitive radio systems, Software-tunable analog radio components, Reconfigurable antenna systems, Reconfigurable digital radio technologies, Basic digital radio building blocks.	
UNIT -VI	**Applications of Software Defined Radio**	**(08 Hours)**
	Applications of Software Defined Radio, SDR frameworks and development platforms, 3G and beyond SDR testbeds, Application of SDR principles to smart antenna systems,Different applications of Software Defined Radio.	

Text Books/ Reference Books:

1. M. Dillinger and K. Madani, Software Defined Radio: Architecture, Systems and Functions. New York, USA: Wiley, 2003.
2. W. T. Tuttlebee, Software Defined Radio: Enabling Technologies. New York, USA: Wiley, 2002.
3. J. H. Reed, Software Radio: A Modern Approach to Radio Engineering. Upper Saddle River, NJ, USA: Prentice Hall (PEA), 2002.
4. M. Dillinger, K. Madani, and N. Alonistioti, Software Defined Radio: Architectures, Systems and Functions. New York, USA: Wiley, 2003.
5. J. Bard and V. J. Kovarik Jr., Software Defined Radio: The Software Communications Architecture. Chichester, U.K.: John Wiley & Sons Ltd., 2007.

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B. Tech. Sem. VII / VIII : Electronics & Telecommunication Engineering **SUBJECT: - PEC-II Foundations of Machine Learning**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination: 60 Marks	Credits: 04
Practical: 00	Internal Assessment: 40 Marks	
Tutorial: 00	TW: 00 Marks	Credit: 00
	Oral: 00 Marks	Credit: 00
	Practical: 00 Marks	Credit: 00
	Total Marks : 100	Total Credit: 04

Course Pre-requisites:

Engineering Mathematics-II, Computer Programming-I, Computer Programming-II, Data Structure and Algorithms

Course Outcomes: After learning this course students will be able to

1	Analyze paradigms of Machine Learning concepts and problem formulation
2	Apply mathematical and statistical foundations to formulate ML problems.
3	Implement supervised learning algorithms including artificial neural networks for regression.
4	Implement classification models using artificial neural networks and decision tree techniques.
5	Design and analyze multilayer neural networks and decision tree models.
6	Evaluate machine learning models using appropriate metrics and validation techniques.

UNIT – I	**Introduction To Machine Learning**	**(08 Hours)**
	What is Machine Learning? Relationship between Artificial Intelligence, Machine Learning, and Data Science, Types of Learnings, Supervised Learning, Unsupervised Learning, Semi-Supervised Learning, Reinforcement Learning (conceptual overview only), Machine Learning Pipeline and Data collection, Feature extraction, Model training, Validation and testing, Applications of Machine Learning in engineering and healthcare.	
UNIT – II	**Mathematical Foundations for Machine Learning**	**(08 Hours)**
	Vectors, matrices, norms, and eigenvalues (review), Probability fundamentals, Random variables, Probability distributions, Expectation and variance, Optimization basics, Cost functions, Gradient descent, convex vs non-convex optimization, Loss functions, Mean Squared Error, Mean Absolute Error, Cross-entropy loss	

UNIT - III	**Artificial Neural Networks: Fundamentals**	**(08 Hours)**
	Biological vs artificial neuron, McCulloch–Pitts neuron model, Bias, threshold, activation functions, Single-layer perceptron, Perceptron learning rule, Limitations of single-layer networks, ADALINE (Adaptive Linear Neuron) and LMS rule, Mean Squared Error, Receiver Operating Characteristic ROC, F1 Score, and confusion matrix	
UNIT -IV	**Multilayer Neural Networks & Learning Decision Tree Learning**	**(08 Hours)**
	Multilayer Perceptron (MLP) architecture, Backpropagation algorithm, Error backpropagation derivation, Vanishing gradient ANN for classification, ANN for regression, Comparison of ANN vs Decision Trees vs Logistic Regression	
UNIT -V	**Decision Tree Learning**	**(08 Hours)**
	Introduction to Decision Trees, Tree structure, Root node, Decision node, Leaf node, splitting criteria, Information Gain, Entropy, Gini Index, Decision Trees for classification, Decision Trees for regression, overfitting in trees, Tree pruning techniques, Advantages and limitations of Decision Trees, Random Forest algorithm	
UNIT -VI	**Unsupervised Learning and Model Evaluation**	**(08 Hours)**
	Clustering concepts, k-Means clustering, Algorithm, Initialization, Convergence issues, Self-Organizing Maps (SOM), Hierarchical clustering, Dimensionality reduction, Multilinear Principal Component Analysis (MPCA), Cross-validation techniques, Hold-out, k-Fold cross-validation, Model selection and comparison	

Text Books/ Reference Books:

1. K. P. Murphy, Probabilistic Machine Learning: An Introduction, Cambridge, MA, USA: MIT Press, 2022.
2. T. M. Mitchell, Machine Learning, revised and updated ed., Cambridge, MA, USA: MIT Press, 2021.
3. E. Alpaydin, Introduction to Machine Learning, 3rd ed., Cambridge, MA, USA: The MIT Press, 2014.
4. C. M. Bishop, Pattern Recognition and Machine Learning, 1st ed., New York, NY, USA: Springer, 2006.
5. A. Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, 3rd ed., Sebastopol, CA, USA: O’Reilly Media, 2022.

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B. Tech. Sem. VII / VIII : Electronics & Telecommunication Engineering SUBJECT : - PEC II Wireless Sensor Network		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination: 60 Marks	Credits: 04
Practical: 00	Internal Assessment: 40 Marks	
Tutorial: 00	TW: 00 Marks	Credit: 00
	Oral: 00 Marks	Credit: 00
	Practical: 00 Marks	Credit: 00
	Total Marks : 100	Total Credit: 04

Course Pre-requisites:

Control System, Embedded Systems, Internet of Things

Course Outcomes:	**After learning this course students will be able to**
1	Identify hardware components and performance requirements of wireless sensor networks.
2	Evaluate system design trade-offs using appropriate performance metrics.
3	Compare communication protocols and standards based on industrial requirements.
4	Analyze routing and optimization strategies for wireless sensor networks.
5	Analyze topology control, synchronization, and localization techniques for energy-efficient operation.
6	Use simulation and software tools to evaluate network performance and study practical application scenarios.

UNIT – I	**Fundamentals of Wireless Sensor Network**	**(08 Hours)**
	Introduction and comparison between wireless sensor networks and industrial wireless sensor networks; sensor node architecture; sensing unit, processing unit, communication unit, and power unit; hardware components of sensor nodes; network characteristics and performance requirements such as reliability, latency, determinism, scalability, and fault tolerance; constraints and challenges in industrial environments; enabling technologies for industrial deployment; types and applications of wireless sensor networks in monitoring, control, and automation.	
UNIT – II	**Architectures and System Design**	**(08 Hours)**
	Network architectures such as star, tree, mesh, and hybrid topologies; industrial deployment scenarios and use cases; design principles for robust network planning; physical layer design considerations; transceiver selection and link budget considerations; optimization goals and performance metrics; gateway concepts and edge devices;	

	integration with the Internet of Things ecosystem; interoperability considerations and system-level design trade-offs.	
UNIT - III	**Communication Protocols and Standards**	**(08 Hours)**
	Medium access control protocols for wireless sensor networks; low-duty-cycle communication and wake-up concepts; classical medium access control protocols such as Sensor-Medium Access Control and Berkeley-Medium Access Control; Institute of Electrical and Electronics Engineers 802.15.4 standard; Zigbee protocol stack; industrial wireless standards including WirelessHART, ISA100.11a, and IPv6 over the Time-Slotted Channel Hopping mode; low-power wide-area network technologies including Long Range Wide Area Network and Narrowband Internet of Things (architecture, channel bandwidth, deployment modes, coverage enhancement, power efficiency, latency considerations, and industrial use cases); comparative study of industrial communication protocols and standards.	
UNIT -IV	**Routing and Optimization Techniques**	**(08 Hours)**
	Routing challenges in wireless sensor networks; addressing and name management; energy-efficient routing techniques; geographic and location-based routing; quality-of-service-aware routing; trust-aware and link-quality-aware routing concepts; optimization-based routing methods; particle swarm optimization for route selection; multi-objective optimization for energy, delay, and reliability; case studies on energy-efficient routing in industrial sensing applications.	
UNIT -V	**Topology Control, Time Synchronization, and Localization**	**(08 Hours)**
	Topology control mechanisms; clustering techniques for scalable operation; energy-efficient cluster-head selection methods; time synchronization techniques and clock drift management; localization and positioning methods; range-based and range-free localization approaches; energy-efficient reference node selection; sensor tasking, scheduling, and network control strategies; impact of synchronization and localization on monitoring and control performance.	
UNIT -VI	**Sensor Network Platforms, Programming, and Tools**	**(08 Hours)**
	Sensor node platforms, including Berkeley motes and contemporary development boards; programming challenges in resource-constrained nodes; node-level software platforms; Tiny Operating System architecture; nesC programming model; simulation and emulation tools for wireless sensor networks; Network Simulator 2 and Network Simulator 3 (architecture, simulation workflow, topology creation, protocol modeling, traffic generation, trace analysis, and performance	

	evaluation); Cooja simulator and practical experimentation; state-centric programming concepts; experimental performance metrics; application-based and case study-oriented study in industrial monitoring, smart energy metering, predictive maintenance, environmental monitoring, and process automation, including model setup, parameter selection, and result interpretation.	

Text Books/ Reference Books:

1. S. R. Nayak, B. M. Sahoo, M. Malarvel, and J. Mishra, Smart Sensor Networks Using AI for Industry 4.0: Applications and New Opportunities. Boca Raton, FL, USA: CRC Press, 2021.
2. H. Karl and A. Willig, Protocols and Architectures for Wireless Sensor Networks, 3rd ed. Hoboken, NJ, USA: John Wiley & Sons, 2005.
3. F. Zhao and L. J. Guibas, Wireless Sensor Networks: An Information Processing Approach, 4th ed. Amsterdam, The Netherlands: Elsevier, 2007.
4. W. Dargie and C. Poellabauer, Fundamentals of Wireless Sensor Networks: Theory and Practice, 6th ed. Hoboken, NJ, USA: John Wiley & Sons, 2019.

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B. Tech. Sem. VII / VIII : Electronics & Telecommunication Engineering SUBJECT: - PEC-II Radio Frequency Engineering		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination: 60 Marks	Credits: 04
Practical: 00	Internal Assessment: 40 Marks	
Tutorial: 00	TW: 00 Marks	Credit: 00
	Oral: 00 Marks	Credit: 00
	Practical: 00 Marks	Credit: 00
	Total Marks : 100	Total Credit: 04

Course Pre-requisites:

Electromagnetics & Transmission Lines, Microwave Theory & Antenna

Course Outcomes: After learning this course students will be able to

1	Specify RF system-level budgets (NF, IP3, P1dB, gain, phase noise) and allocate them to blocks.
2	Use S-parameters to evaluate matching, stability (K, μ), and power/available gain; synthesize L/π/T and stub-based matches with Smith-chart.
3	Design and bias RF transistor stages (Si BJT, SiGe HBT, CMOS, GaN/GaAs FET) for LNA, driver, and PA roles with manufacturable stability and bias networks.
4	Engineer mixers (diode & active) and oscillators/PLL synthesizers meeting conversion gain/loss, LO drive, spur, and phase-noise targets.
5	Design lumped and microstrip filters/resonators (Butterworth/Chebyshev, coupled-line, interdigital/combline) meeting passband/stopband and Q constraints.
6	Produce fabrication-ready PCB/layout guidelines for RF front-ends and define a measurement & calibration plan (VNA, SA, power meter) for conformance.

UNIT – I	**RF Systems, Specifications & S-Parameters**	**(08 Hours)**
	RF system blocks and performance metrics: NF, SNR, SFDR, P1dB, IP3, ACPR, EVM, Cascaded system analysis: Friis NF, cascaded IP3, gain budget Power-wave concepts, dBm/dBc, 50-Ω environment Two-port S-parameters, return loss, VSWR; practical interpretation Stability: Rollett K, μ, stability circles Workflow: system specs → behavioral budget → S-parameter analysis	
UNIT – II	**Passive RF Networks & Impedance Matching**	**(08 Hours)**
	Lumped matching (L, π, T networks); narrowband vs broadband trade-offs	

	Smith-chart-based matching synthesis Stub matching, λ/4 transformers, distributed-line realizations Wilkinson splitters, couplers (design application only) Sensitivity analysis: component tolerances, solder/PCB parasitics	
UNIT - III	**RF Transistors & Amplifier Design**	**(08 Hours)**
	RF transistor models (BJT/SiGe/MOSFET/GaN) from datasheets Bias networks, decoupling strategy Stability engineering (feedback, RC/RL networks, resistive loading) Noise match vs power/linearity match LNA design examples (2.4/5.8 GHz), driver/PA fundamentals Load-pull concept and design flow (simulation-based, no wave physics derivations)	
UNIT -IV	**Nonlinearity, Mixers & Frequency Generation**	**(08 Hours)**
	Nonlinearity: P1dB, IP2/IP3, IM products, blocking Mixer design: diode ring, active mixers, conversion gain/loss, isolation LO planning, spur charts, IF chain considerations Oscillators: practical Colpitts/Clapp, phase noise (design perspective) PLL synthesizers: PFD, CP, loop filters, VCO, divider; lock time vs spur vs noise trade-offs	
UNIT -V	**RF Filters & Resonators**	**(08 Hours)**
	Lumped filters: Butterworth/Chebyshev, order selection, insertion-loss method Band-pass transformations, impedance/frequency scaling Planar filters: coupled-line, interdigital, combline, hairpin (implementation view) Resonators: lumped vs microstrip; Q factors; thermal drift & packaging effects	
UNIT -VI	**Applications & Case Studies (Design-Driven)**	**(08 Hours)**
	Part A: System-Level Applications 1. Wireless Communication Front ends (Sub-6 GHz & mmWave overview) Wi-Fi 6/6E/7, Bluetooth, LTE/5G NR RF chains Case: LNA → Mixer → IF → PA → filter → antenna interface 2. IoT / Low-Power RF Design Narrowband protocols (BLE, ZigBee, LoRa) Power budget, low-cost matching networks, PCB antenna integration **Part B: Component-Level Case Studies**	

	1. Case Study 1: Wi-Fi / BLE LNA Design Path Spec interpretation → Noise/gain target → Matching → Stability → Layout concerns 2. Case Study 4: 1–2 W RF Power Amplifier Module Efficiency vs linearity trade-off, Harmonic terminations & load-pull interpretation	

Text Books/ Reference Books:

1. C. A. Balanis, Antenna Theory: Analysis and Design, 4th ed. Hoboken, NJ, USA: Wiley, 2016.
2. M. Dong, RF Circuits and Applications for Practicing Engineers. Norwood, MA, USA: Artech House, 2021.
3. B. Razavi, RF Microelectronics, 2nd ed. Upper Saddle River, NJ, USA: Pearson, 2012.
4. D. M. Pozar, Microwave Engineering, 4th ed. Hoboken, NJ, USA: Wiley, 2011.
5. R. E. Collin, Foundations for Microwave Engineering, 2nd ed. New York, NY, USA: McGraw-Hill, 2001.

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B. Tech. Sem. VII / VIII : Electronics & Telecommunication Engineering **SUBJECT: - PEC-II Telecom Network Management**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination: 60 Marks	Credits: 04
Practical: 00	Internal Assessment: 40 Marks	
Tutorial: 00	TW: 00 Marks	Credit: 00
	Oral: 00 Marks	Credit: 00
	Practical: 00 Marks	Credit: 00
	Total Marks : 100	Total Credit: 04

Course Pre-requisites:

	Data Communication and Networking

Course Outcomes: After learning this course students will be able to

1	Introduce telecom network architectures and protocols across circuit-switched, packet-switched, and mobile core networks..
2	Analyze communication mechanisms for broadband telecommunication networks using Integrated Services Digital Network, Asynchronous Transfer Mode, and Synchronous Optical Network concepts.
3	Develop broadband access technologies and management tools for telecommunication networks.
4	Analyze cables modems and broadband telecom network routing methods for different telecommunication applications.
5	Assess the Quality of Service and reliability issues in telecommunication networks and recommend suitable protection mechanisms.
6	Demonstrate telecommunication network management functions using open-source and freely available network monitoring and analysis tools.

UNIT – I	**Introduction to Switching and Telecom Networks**	**(08 Hours)**
	Introduction to telecommunication networks; classification of telecommunication networks; network design issues and planning considerations; switching fundamentals; crossbar switching; electronic exchange systems; circuit switching and packet switching; network performance requirements in telecommunication systems; design tools for switching and telecommunication network planning; comparison of switching approaches for voice and data services.	

UNIT – II	**Broadband Telecom Networks**	**(08 Hours)**
	Integrated Services Digital Network architecture and interfaces; narrowband and broadband Integrated Services Digital Network concepts; Frame Relay fundamentals and protocol architecture; Asynchronous Transfer Mode principles and cell structure; Asynchronous Transfer Mode adaptation layers; public broadband telecommunication networks; Synchronous Optical Network and Synchronous Digital Hierarchy fundamentals; role of broadband transport technologies in telecommunication infrastructure; comparative analysis of broadband telecommunication technologies.	
UNIT - III	**Frame Relay and Asynchronous Transfer Mode**	**(08 Hours)**
	Frame Relay: introduction, protocol architecture, frame mode call control, Link Access Procedure for Frame Mode core protocol, and Frame Relay congestion control. Asynchronous Transfer Mode: Asynchronous Transfer Mode protocols, public Asynchronous Transfer Mode networks, Asynchronous Transfer Mode cells, cell details and transmission, Asynchronous Transfer Mode Adaptation Layer, traffic congestion, and traffic control.	
UNIT -IV	**Broadband Access and Routing Technologies**	**(08 Hours)**
	Digital Subscriber Line and Asymmetric Digital Subscriber Line technologies; cable modem systems; wireless local loop; optical wireless access; leased line services; broadband access network design considerations; centralized and distributed routing approaches; static and dynamic routing methods; shortest path routing concepts; routing selection criteria for telecommunication services; routing design issues in broadband and multiservice networks.	
UNIT -V	**Quality of Service and Reliability Issues of Telecommunication**	**(08 Hours)**
	Quality of Service parameters in telecommunication networks; delay, jitter, throughput, and bandwidth analysis; interference and crosstalk issues; service availability and network reliability; survivability concepts in carrier networks; redundancy and protection mechanisms; restoration and recovery strategies; traffic engineering considerations for service assurance; reliability evaluation and service continuity planning in telecommunication systems.	
UNIT -VI	**Telecommunication Network Management**	**(08 Hours)**

	Telecommunication network operation and maintenance, traffic management, management of transport network, configuration management, fault management, security network planning support, and network management using Simple Network Management Protocol: object management, Management Information Base, and traps.	

Text Books/ Reference Books:

1. TeleManagement Forum, GB921 Business Process Framework (Enhanced Telecom Operations Map) Suite Version 25.0. Morristown, New Jersey, United States: TeleManagement Forum, 2025.
2. K. Misra, OSS for Telecom Networks: An Introduction to Network Management. London, United Kingdom: Springer, 2004.
3. J. E. Flood, Telecommunication Switching, Traffic and Networks. Noida, India: Pearson Education, 2008.
4. Kershenbaum, Telecommunications Network Design Algorithms. New York, New York, United States: McGraw-Hill, 1993.
5. M. Schwartz, Telecommunication Networks: Protocols, Modeling, and Analysis. Reading, Massachusetts, United States: Addison-Wesley, 1988.
6. M. Cole, Introduction to Telecommunications: Voice, Data, and the Internet, 2nd ed. Noida, India: Pearson Education, 2002.
7. J. E. Flood, Telecommunication Switching, Traffic and Networks. Noida, India: Pearson Education, 2008.
8. K. Misra, OSS for Telecom Networks: An Introduction to Network Management. London, United Kingdom: Springer, 2004.
9. L. G. Raman, Fundamentals of Telecommunications Network Management. New York, New York, United States: IEEE Press, 1999.

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B. Tech. Sem. VII / VIII : Electronics & Telecommunication Engineering SUBJECT: - PEC III FinTech		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination: 60 Marks	Credits: 04
Practical: 00	Internal Assessment: 40 Marks	
Tutorial: 00	TW: 00 Marks	Credit: 00
	Oral: 00 Marks	Credit: 00
	Practical: 00 Marks	Credit: 00
	Total Marks : 100	Total Credit:04

Course Pre-requisites:

	Data Communication and Networking

Course Outcomes: After learning this course students will be able to

1	Describe the evolution of financial systems from traditional to digital platforms and interpret the scope, importance, and ecosystem structure of Financial Technology.
2	Understand architecture and operation of digital payment systems, including Unified Payments Interface, payment gateways, and mobile wallet transactions.
3	Analyze digital banking service models and their integration with open banking platforms for secure financial transactions.
4	Evaluate blockchain-based financial solutions with reference to functionality, limitations, and implementation challenges.
5	Evaluate Financial Technology use cases that employ analytics and intelligent models for automation and customer-centric financial services.
6	Assess Financial Technology systems from the perspective of cybersecurity readiness, regulatory compliance, and operational risk control.

UNIT – I	**Introduction to FinTech**	**(08 Hours)**
	Evolution of financial systems (Traditional → Digital), Definition, scope and importance of FinTech, FinTech ecosystem & stakeholders, FinTech business models Global and Indian FinTech landscape, Role of telecom & internet in FinTech growth	
UNIT – II	**Digital Payment Systems**	**(08 Hours)**
	Overview of digital payment systems, UPI architecture and working, E-wallets and mobile payments, Payment gateways & transaction flow, NEFT, RTGS, IMPS concepts, POS systems and contactless payments	

UNIT - III	**Digital Banking & Open Banking**	**(08 Hours)**
	Digital banking architecture, Core banking solutions Mobile and internet banking technologies, Open banking concepts, APIs in banking systems, Case studies of digital banks	
UNIT -IV	**Blockchain & Cryptocurrencies in Finance**	**(08 Hours)**
	Blockchain fundamentals in finance, Smart contracts in financial services, Cryptocurrencies and stablecoins, Central Bank Digital Currency (CBDC) concept, Cross-border payments using blockchain, Limitations and challenges	
UNIT -V	**AI & Data Analytics in FinTech**	**(08 Hours)**
	Role of AI in FinTech, AI-based credit scoring, Fraud detection systems, Big data analytics in finance, Algorithmic trading basics, Robo-advisors & predictive analytics	
UNIT -VI	**Security, Regulation & Risk Management**	**(08 Hours)**
	Cybersecurity challenges in FinTech, Data privacy & encryption, Regulatory frameworks overview, KYC and AML concepts, Risk management in digital finance, Ethical issues & future trends.	

Text Books/ Reference Books:

1. Chishti, Susanne, and Janos Barberis. The Fintech book: The financial technology handbook for investors, entrepreneurs and visionaries. John Wiley & Sons, 2016.
2. Skinner, Chris. Digital bank: Strategies to launch or become a digital bank. Marshall Cavendish International Asia Pte Ltd, 2014.
3. Bashir, Imran. Mastering blockchain. Packt Publishing Ltd, 2017.
4. Patel, Shreya Rajnikant, and Rishabh Patil. "An Analysis of the Fintech Regulations in India." Part 2 Indian J. Integrated Rsch. L. 2 (2022): 1.
5. Kou, Gang. "Introduction to the special issue on FinTech." Financial Innovation 5.1 (2019): 45.

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B. Tech. Sem. VII / VIII : Electronics & Telecommunication Engineering SUBJECT: - PEC III Computer Vision		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination: 60 Marks	Credits: 04
Practical: 00	Internal Assessment: 40 Marks	
Tutorial: 00	TW: 00 Marks	Credit: 00
	Oral: 00 Marks	Credit: 00
	Practical: 00 Marks	Credit: 00
	Total Marks : 100	Total Credit:04

Course Pre-requisites:

	Computer Programming-II, Engineering Mathematics- II, Signals and Systems, Information Theory and Coding

Course Outcomes: After learning this course students will be able to

1	Explain camera models, imaging geometry, and calibration.
2	Demonstrate feature detection, extraction, and segmentation methods.
3	Analyze depth capture using stereo and multi-view systems.
4	Apply computer vision algorithms for motion estimation and object tracking.
5	Implement machine-learning driven vision applications.
6	Analyze and design modern computer vision solutions for domains such as autonomous driving, biometrics, medical imaging and gesture recognition.

UNIT – I	**Introduction to Computer Vision**	**(08 Hours)**
	Image Basics, Computer Vision concepts, history & applications; Imaging pipeline; Charge-Coupled Device (CCD) / CMOS sensors; Projective geometry and transformations; Camera parameters & calibration; Bayer pattern and demosaicing; Smart cameras and embedded vision.	
UNIT – II	**Feature Extraction and Image Representation**	**(08 Hours)**
	Points, edges, corners; Contours and segmentation; Histogram-based models; Texture descriptors; Scale-Invariant Feature Transform (SIFT), Oriented FAST and Rotated BRIEF (ORB), Harris & FAST; Level-set based segmentation; Region-based partitioning.	
UNIT - III	**Stereo Imaging and 3-D Reconstruction**	**(08 Hours)**
	Binocular stereo systems; Epipolar geometry; Depth estimation and triangulation; Rectification; Structure-from-silhouettes; Multi-view	

	depth reconstruction; Panorama generation; Registration and volumetric mapping.	
UNIT -IV	**Motion Analysis and Object Tracking**	**(08 Hours)**
	Motion estimation; Optical flow: Lucas-Kanade and Farneback; Kalman filtering & particle filtering; Mean-shift and Continuously Adaptive Mean-Shift **(**CAM-shift) tracking; Multi-target tracking; Structure-from-Motion; Robustness challenges.	
UNIT -V	**Pattern Recognition in Vision**	**(08 Hours)**
	Foundations of learning for Computer Vision; Artificial Neural Network (ANN) & Convolutional Neural Network (CNN) architectures; Convolutional feature maps; Autoencoders; Classical Machine Learning (Support Vector Machine (SVM), K-means, Random Forests) for classification and segmentation; Transfer learning basics.	
UNIT -VI	**Applications of Computer Vision (06 Hours)**	**(08 Hours)**
	Autonomous vehicles: lane marking, pedestrian detection, obstacle avoidance; Industrial machine vision; Biometric security; Medical imaging (MRI/CT fusion); Gesture recognition and Human-Computer Interaction (HCI); Ethics and privacy in vision-based systems.	

Text Books/ Reference Books:

1. A.Torralba, P. Isola, and W. T. Freeman, Foundations of Computer Vision. Cambridge, Massachusetts, United States of America: The MIT Press, 2024
2. R. Szeliski, Computer Vision: Algorithms and Applications, 2nd ed. Cham, Switzerland: Springer, 2022.
3. M. Sonka, V. Hlavac, and R. Boyle, Image Processing, Analysis, and Machine Vision, 4th ed. Cengage Learning, 2015.
4. R. Hartley and A. Zisserman, Multiple View Geometry in Computer Vision, 2nd ed. Cambridge, United Kingdom: Cambridge University Press, 2004.
5. D. A. Forsyth and J. Ponce, Computer Vision: A Modern Approach, 2nd ed. Pearson, 2011.
6. S. J. D. Prince, Computer Vision: Models, Learning, and Inference. Cambridge, United Kingdom: Cambridge University Press, 2012.

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B. Tech. Sem. VII / VIII : Electronics & Telecommunication Engineering
SUBJECT: - PEC III Artificial Intelligence

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04	End Semester Examination: 60 Marks	Credits: 04
Practical: 00	Internal Assessment: 40 Marks	
Tutorial: 00	TW: 00 Marks	Credit: 00
	Oral: 00 Marks	Credit: 00
	Practical: 00 Marks	Credit: 00
	Total Marks : 100	Total Credit:04

Course Pre-requisites:

Database management system , Computer Programming II ,Introduction to data Science, Data Structure and algorithms

Course Outcomes: After learning this course students will be able to

1	Analyze core concepts and evolution of Artificial Intelligence and Deep Learning.
2	Analyze and implement convolutional and recurrent neural network architectures.
3	Apply transformers and large language models for natural language processing tasks.
4	Design generative models including GANs for data synthesis and representation learning.
5	Develop agent-based and agentic AI systems for decision making and autonomous tasks.
6	Evaluate AI models considering performance, robustness, and ethical implications.

UNIT – I	**Introduction to Artificial Intelligence**	**(08 Hours)**
	Definition and scope of Artificial Intelligence, Evolution of AI: Symbolic AI to Data-driven AI, Relationship between AI, Machine Learning, and Deep Learning AI problem formulation and task environments, Types of AI systems: Reactive, Limited Memory, Generative AI (overview),Applications of AI in engineering, healthcare, and industry	
UNIT – II	**Deep Learning Foundations**	**(08 Hours)**
	Review of Artificial Neural Networks, Deep neural networks and representation learning, Activation functions and initialization strategies, Regularization techniques: Dropout Batch normalization, Optimization methods: Stochastic Gradient Descent Adaptive optimizers (Adam – conceptual)	
UNIT - III	**Convolutional Neural Networks (CNN)**	**(08 Hours)**
	Motivation for CNNs , Convolution operation and feature maps,	

	Pooling layers and padding, CNN architectures :LeNet Alex Net (conceptual),CNNs for image classification and object recognition, Limitations of CNNs.	
UNIT -IV	**Sequence Modeling: RNN, LSTM, and Transformers**	**(08 Hours)**
	Sequential data and time-series modeling ,Recurrent Neural Networks (RNN): Architecture and limitations, Long Short-Term Memory (LSTM): Gates and memory cell, Applications of LSTM in speech and signal processing Introduction to Transformers: Self-attention mechanism Encoder–decoder architecture, Comparison: RNN/LSTM vs Transformers	
UNIT -V	**Generative and Large Language Models**	**(08 Hours)**
	Generative modeling concepts, Generative Adversarial Networks (GAN): Generator and discriminator Training dynamics and challenges Variants of GANs (overview)Large Language Models (LLMs): Pre-training and fine-tuning concepts Prompting and in-context learning Applications of LLMs in engineering and automation.	
UNIT -VI	**Agentic AI and Responsible AI**	**(08 Hours)**
	Introduction to intelligent agents Agent architectures: Reactive agents Goal-based and utility-based agents, Agentic AI: Autonomous decision-making Tool-using and planning agents (conceptual), Multi-agent systems (overview) Ethical and responsible AI: Bias and fairness Explain Ability Deployment challenges	

Text Books/ Reference Books:

1. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 3rd ed. Upper Saddle River, NJ, USA: Pearson, 2010.
2. I. Goodfellow, Y. Bengio, and A. Courville, Deep Learning. Cambridge, MA, USA: MIT Press, 2016.
3. C. M. Bishop, Pattern Recognition and Machine Learning. New York, NY, USA: Springer, 2006.
4. S. Raschka, Y. Liu, and V. Mirjalili, Machine Learning with PyTorch and Scikit-Learn: Develop Machine Learning and Deep Learning Models with Python, 2nd ed. Birmingham, U.K.: Packt Publishing, 2022.
5. A. Géron, Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, 2nd ed. Sebastopol, CA, USA: O’Reilly Media, 2019.

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B. Tech. Sem. VII / VIII : Electronics & Telecommunication Engineering
SUBJECT: - Seminar

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 00	End Semester Examination: 00 Marks	Credits: 00
Practical: 04	Internal Assessment: 00 Marks	
Tutorial: 00	TW: 50 Marks	Credits: 01
	Oral: 50 Marks	Credits: 01
	Practical: 00 Marks	Credits: 00
	Total Marks : 100 Marks	Total Credit: 02

Course Outcomes: After learning this course students will be able to

1	Identify and select a relevant seminar topic in Electronics & Telecommunication Engineering.
2	Conduct an effective literature survey using research databases and journals.
3	Analyze and interpret technical content from research papers.
4	Prepare a well-structured technical report following standard formats.
5	Deliver an effective seminar presentation using appropriate tools and techniques.
6	Respond confidently to questions and participate in technical discussions.

Guidelines for Students

1) Each student must select an individual topic
2) Minimum 5–10 research papers must be referred
3) Submit a report of 15–25 pages
4) Follow IEEE referencing style
5) Plagiarism must be strictly avoided
6) Seminar topic must be approved by internal supervisor/guide.

1: Introduction to Seminar and Topic Selection

- Identification of thrust areas in E & Tc Engineering
- Objectives and importance of seminar
- Criteria for selecting seminar topics
- Overview of emerging trends in E &Tc
- Identification of problem statements

2: Literature Survey Techniques

- Sources of information: journals, conferences, patents
- Use of digital libraries (IEEE, Springer, etc.)
- Reading and understanding research papers
- Note-making and summarization

3: Technical Analysis and Content Development

- Interpretation of data, graphs, and results
- Comparative analysis of existing techniques
- Structuring seminar content logically

- Avoiding plagiarism and maintaining ethics

4: Technical Report Writing

- Format of seminar report
- Writing abstract, introduction, methodology, results, conclusion
- Referencing styles (IEEE format)
- Use of tools (Word/LaTeX)

5: Presentation Skills

- Designing effective presentations (PPT)
- Communication skills and body language
- Use of visual aids, diagrams, and simulations
- Time management during seminar

6: Delivery and Evaluation of Seminar

- Seminar presentation (20–30 minutes per student)
- Handling question-answer sessions
- Peer review and feedback
- Self-assessment and improvement

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B. Tech. Sem. VII / VIII : Electronics & Telecommunication Engineering SUBJECT: - Internship		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 00	End Semester Examination: 00 Marks	Credits: 00
Practical: 00	Internal Assessment: 00 Marks	
Tutorial: 00	TW: 150 Marks	
	Oral: 100 Marks	
Duration: 06 Months	Practical: 00 Marks	Credits: 00
	Total Marks : 250 Marks	Total Credit: 14

Course Outcomes:	**After learning this course students will be able to**
1	Apply fundamental knowledge of Electronics and telecommunication Engineering to solve real-world industrial problems.
2	Analyze industrial processes, systems, or operations and identify opportunities for performance improvement, safety enhancement, or cost optimization.
3	Utilize modern engineering tools, software, hardware platforms, and industry practices for design, testing, implementation, and validation.
4	Demonstrate professional ethics, workplace discipline, safety standards, and effective teamwork in a multidisciplinary industrial environment.
5	Communicate technical work effectively through reports, presentations, logbooks, and interaction with industry mentors and faculty supervisors.
6	Evaluate real-time constraints, project management aspects, and organizational practices in industry settings.

Internship: During the six-month industrial internship, the student should actively participate in real-time industrial operations related to E&TC Engineering, such as understanding plant processes, assisting in design, testing, installation, operation, and maintenance of electronic systems, control systems, embedded platforms, power systems, automation setups, or IT infrastructure etc.

The student should study technical drawings, specifications, standard operating procedures, and safety protocols, and contribute to ongoing projects through data collection, analysis, simulation, troubleshooting, performance evaluation, and documentation.

Students are also expected to use modern engineering tools and software relevant to the industry, maintain a detailed logbook of daily activities, interact professionally with supervisors and multidisciplinary teams, follow ethical and safety standards, and prepare a comprehensive technical report and presentation summarizing the work carried out, learning outcomes achieved, and improvements suggested.

This internship can be taken either online or at the actual industry site.

During the in-house internship, students shall undergo hands-on training and technical work in advanced domains such as Communication, VLSI, Embedded Systems and IoT, Artificial Intelligence, Image Processing and Computer Vision, and relevant simulation tools.
Each student or group shall undertake and complete a structured technical assignment, mini-project, experimental study, or simulation-based investigation using real-time laboratory data, case studies, or experimental results generated within the institute. The students are required to maintain a detailed internship logbook recording daily activities, learning outcomes, tools used, experimental observations, and progress of the assigned work, and submit the same at the completion of the internship for evaluation.

This inhouse internship can be taken either online or at the institute laboratories.

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B. Tech. Sem. VII / VIII : Electronics & Telecommunication Engineering **SUBJECT: - Satellite Communication**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 02	Internal Assessment: 40 Marks	
Tutorial: 00	TW: 25 Marks	
	Oral: 25 Marks	Credit: 01
	Practical: 00 Marks	Credit: 00
	Total Marks : 150 Marks	Total Credit: 04

Course Pre-requisites:

	Analog Communication, Digital Communication

Course Outcomes: After learning this course students will be able to

1	Explain the basic concepts of satellite communication, launch vehicles, orbital parameters, and look angle determination for communication applications.
2	Describe major satellite subsystems and their roles in reliable operation of a satellite communication system.
3	Analyze satellite communication links by applying transmission theory, noise temperature, and carrier-to-noise design parameters for uplink and downlink design.
4	Analyze the functional elements of satellite networks and onboard processing methods for communication service delivery.
5	Evaluate Low Earth Orbit and Non-Geostationary satellite system parameters for communication performance and constellation planning, including Iridium applications.
6	Evaluate satellite communication applications in broadcasting, navigation, and modern broadband systems with case-based study of Starlink-enabled services.

UNIT – I	**Fundamentals of Satellite Communication**	**(06 Hours)**
	Introduction, basic concept of satellite communication, Orbital Mechanics, look angle determination, Orbital perturbation, Orbital determination, Launchers and Launch vehicles, Orbital effects in communication system performance.	
UNIT – II	**Satellite Subsystems**	**(06 Hours)**
	Satellite subsystems: Attitude and Orbit Control System; Telemetry, Tracking, Command, and Monitoring; power systems; communication subsystem; satellite antennas; equipment reliability and space qualification.	

UNIT - III	**Satellite Link Design**	**(06 Hours)**
	Basic transmission theory; system noise temperature; gain-to-system-noise-temperature ratio; downlink design; satellite systems using small earth stations; uplink design; design of specified carrier-to-noise ratio; combining carrier-to-noise ratio and carrier-to-interference ratio in satellite links.	
UNIT -IV	**Satellite Networks**	**(06 Hours)**
	Reference architecture for satellite networks; basic characteristics of satellite networks; onboard connectivity with transparent processing; analog transparent switching; frame organization; window organization; onboard connectivity with beam scanning.	
UNIT -V	**Low Earth Orbit and Non-Geostationary Satellite Systems**	**(06 Hours)**
	Introduction to Low Earth Orbit and Non-Geostationary satellite systems; orbit considerations; coverage and frequency considerations; delay and throughput considerations; operational Non-Geostationary constellation design; Iridium satellite communication system.	
UNIT -VI	**Satellite Broadcasting, Navigation, and Advanced Applications**	**(06 Hours)**
	C-Band and Ku-Band home satellite television; digital direct broadcast satellite television; satellite radio broadcasting; radio and satellite navigation; Global Positioning System position location principles; Global Positioning System receivers and codes; Starlink broadband satellite system; case studies and application-based content in sectors such as hospitality, administration, disaster management, remote connectivity, and rural communication services.	

List of experiments:

1. Understanding the basic concepts of satellite communication.
2. To set up a communication link between uplink transmitter and downlink receiver using Satellite.
3. To set up an Active satellite communication link and demonstrate link fail operation
4. To communicate voice & Video signal through satellite link
5. Observe the effect of Different combinations of uplink and downlink frequencies on satellite link.
6. To transmit and receive three separate signals (Audio, Video, Tone) simultaneously through satellite link
7. To transmit and receive function generator signals through satellite link.
8. To measure the signal parameters in an analog FM/FDM TV satellite link
9. To transmit digital waveforms through a satellite communication link.
10. To Calculate Bit Error Rate in a satellite communication link.

Text Books/ Reference Books:

1. M. Höyhtyä, Satellite Communications and Networks. Cham, Switzerland: Springer, 2025.

2. G. Maral, M. Bousquet, and Z. Sun, Satellite Communications Systems: Systems, Techniques and Technology, 6th ed. Hoboken, NJ, USA: John Wiley and Sons, 2020
3. T. Pratt, C. W. Bostian, and J. E. Allnutt, Satellite Communications, 2nd ed. Hoboken, NJ, USA: John Wiley and Sons, 2003.
4. A.K. Maini and V. Agrawal, Satellite Communications. Hoboken, NJ, USA: John Wiley and Sons, 2011.
5. D. Roddy, Satellite Communications, 4th ed. New York, NY, USA: McGraw-Hill, 2006.
6. W. L. Pritchard, H. G. Suyderhoud, and R. A. Nelson, Satellite Communication Systems Engineering, 2nd ed. Upper Saddle River, NJ, USA: Prentice Hall, 1993.
7. G. Maral and M. Bousquet, Satellite Communications Systems: Systems, Techniques and Technology, 5th ed. Chichester, United Kingdom: John Wiley and Sons, 2009.

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B. Tech. Sem. VII / VIII : Electronics & Telecommunication Engineering
SUBJECT: - Mobile Communication

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 02	Internal Assessment: 40 Marks	
Tutorial: 00	TW: 25 Marks	
	Oral: 25 Marks	Credit: 01
	Total Marks : 150	Total Credit:04

Course Pre-requisites:

Analog Communication, Digital Communication, Information Theory & Coding

Course Outcomes: After learning this course students will be able to

1	Introduce the fundamentals and evolution of mobile communication systems from 1G to 5G and familiarize students with various wireless services and applications.
2	Develop an understanding of radio wave propagation mechanisms and enable analysis of path loss, fading, and link budget in wireless channels.
3	Provide knowledge of multiple access techniques and their role in efficient utilization of wireless communication resources.
4	Study the GSM architecture, protocols, and services, including call handling, security, and mobile data communication.
5	Understand the principles and operation of CDMA-based systems and 3G technologies, including resource management and mobility handling.
6	Introduce the concepts and architecture of LTE (4G), including air interface, channels, and system components.

UNIT – I	**Introduction to Mobile Communication**	**(06 Hours)**
	History and evolution of mobile radio systems, the evolution of Mobile Communication from 1G to 5G and LTE Types of mobile wireless services/systems – Cellular, WLL, Paging, Satellite systems, Future trends in personal wireless systems	
UNIT – II	**Mobile Radio Propagation**	**(06 Hours)**
	Large-scale path loss, Free space propagation model, ground reflection model, diffraction, Practical Link Budget using path loss model, Small-scale fading and multipath small-scale propagation, parameters of multipath channels, types of small-scale fading.	
UNIT - III	**Multiple Access Technique in Wireless Communications**	**(06 Hours)**
	Frequency Division Multiple Access (FDMA), Time Division Multiple	

	Access (TDMA), Spread Spectrum Multiple Access (SSMA), Space Division Multiple Access (SDMA), Orthogonal Frequency Division Multiple Access (OFDMA).	
UNIT -IV	**GSM**	**(06 Hours)**
	GSM Network architecture, signaling protocol architecture, identifiers, channels, Frame structure, speech coding, authentication and security, call procedure, handoff procedure, services and features. Mobile data networks, GPRS and higher data rates, SMS in GSM.	
UNIT -V	**CDMA Digital Cellular Standard (IS-95) & IMT – 2000**	**(06 Hours)**
	Frequency and channel specifications of IS-95, forward and reverse CDMA channel, packet and frame formats, mobility and radio resource management. Forward and reverse channels in WCDMA and CDMA-2000, Handoff and power control in 3G system.	
UNIT -VI	**Introduction to LTE**	**(06 Hours)**
	4G Introduction and vision, LTE Architecture, Elements of LTE- EPS, LTE Radio / air interface Modulation and features, LTE Channels, 4G, 5G Architecture	

Experiments

1. To understand the pathloss prediction formula.
2. To understand the effect of shadowing on pathloss formula.
3. To find the 3dB beamwidth of a base station antenna.
4. The objective is to calculate the probability that the received signal level crosses a certain sensitivity level.
5. To measure and analyze signal strength and quality parameters in a 4G LTE network.
6. To measure uplink and downlink data rates in a 4G network.
7. To study and analyze beamforming techniques used in 5G networks
8. To measure end-to-end latency in a 5G communication system
9. To analyze how Wi-Fi signal strength varies with distance and obstacles.
10. To measure data transfer rate (throughput) in a wireless LAN under different conditions.

Text Books/ Reference Books:

1. J. Schiller, Mobile Communications, Addison-Wesley, 2nd ed.
2. P. Nicopolitidis, M. S. Obaidat, G. I. Papadimitriou, and A. S. Pomportsis, Wireless Networks, John Wiley & Sons.
3. S. G. Glisic, Advanced Wireless Networks: 4G Technologies, John Wiley & Sons.
4. R. J. Bates, Broadband Telecommunications Handbook, 2nd ed.
5. I. F. Akyildiz, W.-Y. Lee, M. C. Vuran, and S. Mohanty, Cognitive Radio Networks: Architectures, Protocols, and Standards, John Wiley & Sons.

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B. Tech. Sem. VII / VIII : Electronics & Telecommunication Engineering SUBJECT: - Project Work		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 00	End Semester Examination: 00 Marks	Credits: 00
Practical: 16	Internal Assessment: 00 Marks	
Tutorial: 00	TW: 100 Marks	
	Oral: 50 Marks	
	Total Marks : 150	Total Credit: 08

Course Outcomes: After learning this course students will be able to

1	Identify, formulate, and define a real-world engineering problem in the domain of Electronics and Tele-communication Engineering through extensive literature survey.
2	Design and develop a system/model/prototype using appropriate engineering tools, techniques, software, and hardware components to address the identified problem.
3	Analyze and interpret experimental/simulation results using modern engineering and computational tools.
4	Demonstrate effective teamwork, project planning, documentation, and professional ethics while executing the project work.
5	Communicate technical outcomes effectively through project reports, presentations, and viva-voce examinations.
6	Demonstrate independent learning and innovation by extending the project work through advanced features, performance improvement, or research contribution.

For their final-year B.Tech group project in Electronics and Telecommunication Engineering, students shall select a project topic in their area of interest covering major domains of Electronics and Telecommunication Engineering.

While carrying out the project work, each group must systematically perform the following tasks:

- Identification of a real-world problem and conducting an extensive literature survey;
- Defining objectives, scope, methodology, timeline, and feasibility analysis;
- Developing appropriate modeling and simulation using relevant engineering tools;
- Designing the system architecture (hardware, software, or hybrid system);
- Developing and integrating the prototype;
- Conducting testing,
- Validation, and performance evaluation against predefined benchmarks;
- Analyzing results and suggesting improvements; and
- Completing detailed technical documentation, report writing, and effective presentation of the project outcomes during reviews and viva-voce examinations.
- Students are encouraged to publish a research paper based on their project work, which will help them gain academic recognition and showcase their contributions to the research community and society.