NIRMA UNIVERSITY

Institute:	**Institute of Technology, School of Technology**
Name of Programme:	**BTech CSE**
Course Code:	4CS202ME25
Course Title:	**Wireless Networks**
Course Type:	**Department Elective-III**
Year of Introduction:	**2025-26**

L	T	Practical Component				C
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Course Learning Outcomes (CLO):

At the end of the course, the students will be able to –

1. outline design issues involved in different wireless networks (BL2)
2. analyse the evolution of wireless network architectures with the growing needs (BL4)
3. evaluate the available technologies to satisfy various application requirements (BL5)
4. propose technological solutions to satisfy various application requirements. (BL6)

Unit	Contents	Teaching Hours (Total 45)
Unit-I	**Introduction:** Growth of mobile communications, Mobile Communications Fundamentals and its Evolution, Mobile data, Wi-Fi, Bluetooth, Overview of 1G and 2G	04
Unit-II	**Third-Generation (3G) Overview:** Universal Mobile Telecommunications Service (UMTS), UMTS Services, The UMTS Air Interface, Overview of 3GPP Releases Network Architectures, Overview of CDMA2000, TD-CDMA, TD-SCDMA	05
Unit-III	**Universal Mobile Telecommunications Service (UMTS):** UMTS Basics, The WCDMA Air Interface, The UTRAN Architecture, Establishment of a UMTS Voice Call, UMTS Packet Data, High Speed Packet Data, Handover, HSPA Connection Establishment	08
Unit-IV	**CDMA2000:** Radio and Network Components, Network Structure, Packet-Data Transport Process Flow, Radio Network, EVDO	05
Unit-V	**TD-SDMA and TD-CDMA:** Generic TD-SDMA Architecture, Core Network, Radio Network, Interference Mitigation Techniques, RAN Traffic Planning, Handover, Generic TD-CDMA Architecture, Core Network, Radio Network, Interference Mitigation Techniques, RAN Traffic Planning, Handover	05
Unit-VI	**Long-Term Evolution (LTE):** LTE Ecosystem, Standards, Radio Spectrum, LTE Architecture, User Equipment, Enhanced Node B, Core Network, Radio Channel Components, TD-LTE, Multiple Input Multiple Output (MIMO), LTE Scheduler, Carrier Aggregation, Cell Search, Cell Re-selection, Attach and Default Bearer Activation, Handover, Self-Organizing Networks (SONs), Relay Cells, Heterogeneous Network (HetNET), Remote Radio Heads (RRH), VoLTE, LTE Advanced	06

Unit-VII	**Fifth-Generation (5G):** 5G Goals, Performance Requirements, Next Generation Mobile Networks (NGMN) and 3GPP Use case families, building blocks of 5G: New Radio (NR) Interface - Millimeter Wave Spectrum, Massive MIMO, Flexible OFDM Numerologies, Multi-RAT Connectivity, Advance Channel Coding, Network Features - Cloud RAN, 5G Core, Service Based Architecture, RAN Architecture Optimization, Multi-access Edge Computing (MEC), Network Slicing, Virtualization and Automation Technologies	06
Unit-VIII	**Introduction to Sixth-Generation (6G):** Outlook of 6G, Computational Holographic Radio and Enabling Technologies for 6G, Air-interfaces for ultra-low power communications, Semantic Plane Filtering and Control, AI-assisted PHY technologies for 6G, Mobility-Enhanced Edge intelligence (MEET) for 6G	02
Unit-IX	**Wi-Fi:** 802.11 Standards, WiFi Protocols, Frequency Allocation, Modulation and Coding Schemes, Network Architecture, Security, 802.11 Services, Hot Spots, Virtual Private Networks (VPN), Mobile VPN, VPN Types, Wi-Fi Integration with 3G/4G	04

Self-Study:
The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study contents

Suggested Readings/ References:

1. Clint Smith and Daniel Collins, *Wireless Networks*, McGraw Hill
2. Nishith Tripathi and Jeffrey Reed, *5G Cellular Communications: Journey and Destination, A Multimedia*, (eBook) Rohde & Schwarz
3. Kaveh Pahlavan and Prashant Krishnamurthy, *Principals of Wireless Networks: A Unified Approach*, Prentice Hall
4. William Stallings, *Wireless Communications and Networks*, Pearson

Suggested List of Experiments:

Sr. No.	Name of Experiments/Exercises	Hours
1	Explore NS-3 network simulator	02
2	Explore OMNET++ network simulator	02
3	Explore Netsim network simulator	02
4	Simulate Cellular Network Coverage and Capacity.	04
5	Implement and analyze handoff mechanisms	02
6	Investigate and analyze interference and Signal to Noise Ratio in cellular networks	04
7	Simulate and analyze channel coding schemes in cellular network	04
8	Simulate and study the 5G handover procedure	02
9	Measure and analyze WiFi signal strength and coverage	04
10	Investigate and mitigate WiFi interference	04