**NIRMA UNIVERSITY**

| | |
|---|---|
| **Institute:** | Institute of Technology |
| **Name of Programme:** | BTech CSE, Integrated BTech (CSE)-MBA,<br>BTech CSE (Artificial Intelligence & Machine Learning) |
| **Course Code:** | XXXX |
| **Course Title:** | Wireless Networks |
| **Course Type:** | Department Elective-II |
| **Year of Introduction:** | 2025-26 |

| L | T | Practical Component | | | | C |
|---|---|---|---|---|---|---|
| | | LPW | PW | W | S | |
| 3 | 0 | 2 | - | - | - | 4 |

**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 content

**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


**Laboratory Work:**
Laboratory work will be based on the above syllabus with a minimum of 10 experiments to be incorporated. The students in a suitable group size will design and perform one experiment as a part of Laboratory work.

| Sr. No. | List 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 |