Sem. - V

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Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tuts	Theory	Practical	Tuts	Total
MDC501	Wireless and Mobile Communication	3	---	---	3	--	--	3

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		Test 1	Test 2	Total					
MDC501	Wireless and Mobile Communication	20	20	40	60	2	-	-	100

Course Objectives: The course aims to

1. Introduce fundamental concepts of wireless and mobile communication systems relevant to modern digital infrastructure.
2. Provide understanding of cellular technologies and their evolution from 1G to 5G.
3. Familiarize students with widely used wireless technologies such as Wi-Fi, Bluetooth, and IoT-based systems.
4. Explain signal propagation, interference, and practical challenges in wireless environments.
5. Develop system-level understanding of mobile network architecture and operations.
6. Expose students to emerging trends such as 5G, IoT, and smart communication ecosystems.

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

1. Explain basic principles of wireless communication and spectrum utilization.
2. Describe evolution and working of modern cellular systems (GSM, LTE, 5G).
3. Compare different wireless technologies and identify their applications.
4. Analyze effects of propagation, noise, and interference in wireless systems.
5. Illustrate architecture and operations of cellular/mobile networks.
6. Interpret emerging trends such as IoT, 5G, and future communication systems.

Module No.	Topics	Hours	CO Mapping
1	**Basics of Wireless Communication**. 1.1 Wireless Transmission Principles -Need for wireless communication (real-world applications: mobile, IoT, defense), Elements of communication system (Tx, channel, Rx), Wireless transmission basics (path loss concept – qualitative) 1.2 Frequency Spectrum Allocation - Electromagnetic spectrum overview (licensed vs unlicensed bands) 1.3 Introduction to Cellular Communication: Introduction to cellular concept (cells, frequency reuse – intuitive understanding)	7	CO1
2	**Mobile Communication Generations** 2.1 Limitations of wired communication → need for mobility 2.2 Evolution: 1G → 5G (features, services comparison)	8	CO2

	2.3 GSM architecture (simplified: BTS, BSC, MSC) 2.4 CDMA concept (idea of spread spectrum – conceptual) 2.5 LTE/4G basics (high data rate, packet switching) 2.6 Introduction to 5G (use cases: eMBB, URLLC, mMTC)		
3	**Wireless Networking Technologies** 3.1 Wi-Fi (802.11) – working and applications 3.2 Bluetooth – short range communication 3.3 Zigbee – low power IoT networks 3.4 NFC – contactless communication 3.5 Comparison of technologies (range, data rate, power) 3.6 Introduction to Wireless Sensor Networks (WSN) 3.7 Use cases: smart homes, healthcare, agriculture	7	CO3
4	**Signal Propagation and Interference** 4.1 Basics of wave propagation (LOS, NLOS) 4.2 Path loss and shadowing (conceptual only) 4.3 Multipath fading (real-life effect: call drops) 4.4 Noise types (thermal, interference) 4.5 Sources of interference (co-channel, adjacent channel) 4.6 Simple mitigation techniques (power control, frequency planning)	7	CO4
5	**Mobile Network Architecture** 5.1 Cellular network components (BTS, Core Network, User Equipment) 5.2 Call flow (simplified call setup process) 5.3 Handover concept (why required, types) 5.4 Roaming (national/international concept) 5.5 Role of SIM, IMSI, authentication (basic security idea) 5.6 Introduction to packet core networks (data services)	8	CO5
6	**Future Trends in Wireless Communication** 6.1 5G architecture overview (high-level) 6.2 Applications of 5G (smart cities, autonomous systems) 6.3 Internet of Things (IoT ecosystem) 6.4 Smart devices and connected systems 6.5 Edge computing and AI in telecom (introductory) 6.6 Future directions: 6G vision (conceptual awareness)	7	CO6
	Self-Learning Topics Wi-Fi Network Analysis, Edge Computing in Telecom, AI/ML in Wireless Communication, Network Security in Wireless Systems, Mobile App–Network Interaction		

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Text Books:

1. Rappaport, Theodore S. Wireless Communications: Principles and Practice, Pearson.
2. Mischa Schwartz. Mobile Wireless Communications, Cambridge University Press.

References:

1. Feher, Kamilo. Wireless Digital Communications: Modulation and Spread Spectrum Applications, Prentice Hall.
2. Pahlavan, Kaveh & Levesque, Allen H. Wireless Information Networks, Wiley.

Recommended Swayam NPTEL Courses:

1. NPTEL course on ***Wireless Communications by*** Prof. Aditya K. Jagannatham
2. NPTEL course on ***Introduction to Cellular and Mobile Communication by*** Prof. Ranjan Bose

Assessment:

Internal Assessment (IA) for 20 marks each:

- IA will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of the syllabus content must be covered in the IAT-I and the remaining 40% to 50% of the syllabus content must be covered in the IAT-II.

End Semester Theory Examination:

- **Question paper format**

  - Question Paper will comprise a total of **six questions each carrying 15 marks Q.1** will be **compulsory** and should **cover the maximum contents of the syllabus**

  - **Remaining questions** will be **mixed in nature** (part (a) and part (b) of each question must be from different modules. For example, if Q.2 has part (a) from Module 3 then part (b) must be from any other Module randomly selected from all the modules)

  - A total of **four questions** need to be answered

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Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tuts	Theory	Practical	Tuts	Total
MDL501	Wireless and Mobile Communication Lab	-	2	---	-	1	--	1

Course Code	Course Name	Examination Scheme						
		Theory				Term Work	Practical & Oral	Total
MDL501	Wireless and Mobile Communication Lab	Internal Assessment Test (IAT)			End Sem Exam			
		IAT1	IAT2	Total				
		-	-	-	-	25	25	50

Laboratory Objectives:

1. Provide hands-on exposure to cellular and wireless communication concepts.
2. Enable students to simulate and analyze mobile network operations.
3. Familiarize students with short-range wireless technologies such as Wi-Fi and Bluetooth.
4. Introduce spectrum analysis and signal observation using modern tools (including SDR).
5. Develop understanding of wireless security mechanisms and practices.
6. Expose students to real-world applications and emerging wireless technologies.

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Laboratory Outcomes:

After successful completion of the course student will be able to

1. Simulate and analyze basic cellular network operations such as call setup and handover.
2. Configure and evaluate Wi-Fi and Bluetooth communication systems.
3. Analyze RF spectrum and identify signal characteristics.
4. Interpret GSM/LTE communication fundamentals and device interaction.
5. Apply basic wireless security mechanisms in practical scenarios.
6. Evaluate real-world applications and trends in wireless communication.

Suggested List of Experiments:

No	List of Experiments	LO
1	Study of electromagnetic spectrum allocation and wireless bands used in communication.	1
2	Simulation of basic communication system (Tx–Channel–Rx) using MATLAB / Python / online tools.	2
3	Demonstration of frequency reuse concept in cellular systems (simulation/visualization).	2
4	Wi-Fi network scanning using mobile apps (SSID, RSSI, channel mapping).	2
5	Measurement of signal strength vs distance for Wi-Fi router.	3
6	Analysis of channel interference in the 2.4 GHz band.	3

7	Throughput and latency measurement using network tools (e.g., ping, speed test).	4
8	Study of Bluetooth communication using mobile devices (pairing, range testing).	4
9	Data transfer using Bluetooth and analysis of performance.	4
10	Study of path loss in an indoor environment (RSSI vs obstacles).	5
11	Analysis of multipath effects (signal fluctuation observation).	5
12	Noise and interference analysis in wireless communication.	6
13	Study of cellular network parameters using smartphones (signal strength, network type 2G/3G/4G/5G).	6
14	Analysis of handover behaviour while moving (field observation).	6
15	Introduction to network simulation tool (NS-3 / any GUI-based simulator) – basic experiment.	6

Suggested List of Assignments:

Sr. No	List of Assignment/Tutorial	LO
01	1. **Case Study Assignment:** Compare Wi-Fi, Bluetooth, and Zigbee in terms of range, data rate, and applications.	6
02	**Technology Analysis Assignment:** Study evolution of cellular systems (1G to 5G) with focus on real-world applications.	6
03	**Application-Based Assignment:** Analyze wireless communication used in any one system (smart home / drone / healthcare).	6
04	**Mini Design Assignment:** Propose a wireless communication setup for a given scenario (e.g., campus Wi-Fi design, smart parking system).	6

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References

1. Prasad, Ramjee. 4G: LTE/LTE-Advanced for Mobile Broadband, Academic Press.

2. Garg, Vijay K. Wireless Communications & Networking, Morgan Kaufmann.

Assessment:

Term Work: Term Work shall consist of at least 08 practical and 02 assignments based on the above list.

Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 05 Marks (Assignments) + 5 Marks (Attendance)

Practical& Oral Exam: An Oral & Practical exam will be held based on the above syllabus.