GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering
Level: Diploma
Branch: Electronics & Communication Engineering
Subject Code : DI05011011
Subject Name: Mobile Communication

w. e. f. Academic Year:	2026-27
Semester:	5th
Category of the Course:	PCC

Prerequisite:	Knowledge of Basic communication terminologies and modulation-demodulation techniques.
Rationale:	Mobile communication has evolved from basic voice-centric systems to high-speed data-driven networks such as 4G (LTE) and 5G. This course introduces students to cellular communication fundamentals, GSM/CDMA systems, modern wireless techniques, and mobile device technologies. The course emphasizes practical understanding and real-world applications, preparing students for emerging trends in wireless communication.

Course Outcome:
After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Illustrate the concept of cellular System for efficient spectrum utilization.	R, U, A
02	Understand the architecture and functionality of GSM and CDMA system	R, U, A
03	Assess mobile handset specifications and operating systems to make appropriate selection decisions.	R, U, A
04	Understand 4G and 5G Fundamentals.	R, U, A
05	Explore different wireless communication technologies for various applications	R, U, A

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA(M)	PA(I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
Unit 1: Fundamental of Cellular Communication	1.1Evolution of Cellular communication (1G to 5G) 1.2Basic cellular concept and cellular system 1.3Cell types: Macro, Micro, Pico, Selective and Umbrella cell. 1.4Explain concept of cluster 1.5Frequency reuse and system capacity 1.6Co-channel and adjacent channel interference 1.7Channel assignment strategies 1.8Cell splitting and sectoring 1.9Define handoff and differentiate various Handoff techniques 1.10 Multiple Access Techniques: FDMA, TDMA, CDMA, SDMA	10	21
Unit 2: GSM and CDMA Systems	2.1 GSM architecture 2.2 Specification of GSM 900 2.3 GSM channels 2.4 GSM call Procedure (Mobile to Mobile) 2.5 Authentication and security 2.6 Frequency hopping: Fast and Slow 2.7 GSM Identifier: IMSI, IMEI, TMSI, MSISDN, LAI and BSIC 2.8 Spread spectrum concept 2.9 CDMA principle and advantages 2.10 Types of spread spectrum technique a. DSSS- Direct sequence spread spectrum b. FHSS- Frequency hopping spread spectrum 2.11 Comparison: GSM vs CDMA 2.12 Limitations of GSM and CDMA Technology	13	28
Unit 3: Mobile Device	3.1 Mobile handset block diagram 3.2 Baseband and RF section 3.3 Charging control section 3.4 Battery types and management 3.5 SIM card and interface 3.6 eSIM concept and advantages 3.7 Smartphone architecture (SoC, sensors) 3.8 Introduction to mobile OS (Android basics) 3.9 Radiation hazards and SAR	8	18

Unit 4: 4G and 5G Networks	4.1 Introduction to 4G technology 4.2 Features of 4G technology 4.3 Types of 4G technologies LTE (Long-Term Evolution) WiMAX (Worldwide Interoperability for Microwave Access) 4.4 LTE Architecture: 4.5 OFDM Technology (Orthogonal Frequency Division Multiplexing): a. Basic concept b. Advantages 4.6 MIMO Technology (Multiple Input Multiple Output): a. Basic concept b. Advantages 4.7 Advantages and limitations of 4G technology 4.8 Introduction to 5G technology 4.9 5G Architecture: 4.10 Advantages of 5G technology 4.11 IP Multimedia Subsystem (IMS): a. Basic concept b. Architecture 4.12Comparison between 4G and 5G network architecture	8	18
Unit 5: Wireless Technologies	5.1 Bluetooth Technology: Architecture, feature advantages and applications. 5.2 Wi-Fi (IEEE 802.11): Basic concept and overview of modern standards 5.3 RFID and NFC systems: Working principle and applications 5.4 Zigbee: Basic concept, features and applications 5.5 Mobile Adhoc Network (MANET): Concept - Architecture, Advantages, limitations and Comparison with cellular systems	6	15
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
30	**50**	**20**	**-**	**-**	**-**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

No.	Title of Book,	Author	Publication
1.	Wireless Communication Principle & Practice	Rapport T. S	PHI Learning, New Delhi, (Latest Edition)
2.	Mobile Communication	Jochen Schiller	Pearson Education India
3.	An Introduction to LTE: LTE, LTE-Advanced, SAE, VoLTE and 4G Mobile Communications	Christopher Cox	Wiley Publication
4.	Wireless Networking: Introduction to Bluetooth and Wi-Fi	Gordon Colbach	Independently published
5.	Wireless & Cellular Communication	Sanjay Sharma	S.K. Kataria & Sons

(b) Open-source software and website:

1. GNU Octave – https://octave.org/
2. MATLAB (Student Version / Online Resources) – https://www.mathworks.com
3. YouTube Lecture – Wireless Communication Basics
   https://www.youtube.com/watch?v=b3tpOWWL9aU
4. YouTube Lecture – GSM/CDMA Concepts
   https://www.youtube.com/watch?v=_PnToMFmfhk
5. YouTube Lecture – 4G/5G Overview
   https://www.youtube.com/watch?v=5plZGFd-cWc
6. NPTEL Course – Mobile Communication
   http://www.digimat.in/nptel/courses/video/117102062/L04.html
7. Telecom Engineering Centre (TEC), India – 5G Study Paper:
   https://www.tec.gov.in/public/pdf/Studypaper/5G%20Core%20Network_Study%20Paper_v8.pdf
8. 3GPP – 5G System Overview:
   https://www.3gpp.org/technologies/5g-system-overview
9. RF Wireless World – Mobile Hardware and Software Components
   https://www.rfwireless-world.com/articles/mobile-hardware-and-software-components

Reference Articles

10. https://www.rfwireless-world.com/articles/mobile-hardware-and-software-components

Suggested Course Practical List:

SR.NO	Practical Outcomes (PrOs)	Unit	CO	Approx Hrs. Required
1	Study of various wireless communication standards.	1	CO1	2
2	Use the concept of frequency reuse technique for cluster formation (numerical/diagram based).	1	CO1	2
3	Detect/Measure co-channel and adjacent channel interference Using simulation or case study.	1	CO1	2
4	Study of GSM system Architecture	2	CO2	2
5	Generation of Direct Sequence Spread Spectrum (DSSS) signal using trainer kit/Simulation	2	CO2	2
6	Demonstrate CDMA multiplexing.	2	CO2	2
7	Generate Frequency Hopping Spread Spectrum (FHSS) signal using trainer kit/Simulation.	3	CO3	2
8	Measurement of network parameters using mobile applications (signal strength, network monitor, etc.).	3	CO3	2
9	Study of GSM mobile handset blocks and working.	3	CO3	2
10	Measurement of test point voltages using GSM mobile trainer kit.	3	CO3	2
11	Activation of e-SIM in mobile phones.	3	CO3	2
12	Measurement of SAR and radiation awareness study.	3	CO3	2

13	Study of mobile operating systems (Android basics).	3	CO3	2
14	Demonstration of 4G (LTE) network parameters using mobile applications.	4	CO4	2
15	Generation of OFDM signal using MATLAB or similar software.	4	CO4	2
16	Study of 5G system architecture (case study/demo).	4	CO4	2
17	Implementation of Bluetooth communication using hardware or simulation.	5	CO5	2
18	Measurement of Wi-Fi signal strength using mobile applications.	5	CO5	2
19	Explore uses of RFID-based systems (e.g., FASTag).	5	CO5	2
20	Study/Simulation of Mobile Ad hoc Network (MANET).	5	CO5	2
	Minimum 15 practical			**30 Hrs**

Note:
The list of practical/projects is suggestive. The subject teacher may add or modify experiments based on available facilities and requirements.

List of Laboratory / Learning Resources Required

A. Hardware / Trainer Kits

1. GSM Mobile Trainer Kit
2. CDMA Trainer Kit / Spread Spectrum Trainer
3. Mobile Phone Trainer (Handset trainer)
4. Wireless Communication Trainer Kit
5. Zigbee Trainer Kit
6. Bluetooth Communication Module / Trainer
7. RFID Trainer Kit

8. Smartphones (4G/5G enabled)
9. Wi-Fi Router / Access Point
10. SIM cards (for GSM/VoLTE experiments)
11. Digital Storage Oscilloscope (DSO)
12. Function Generator
13. Spectrum Analyzer
14. Multimeter
15. Power Supply
16. Laptop/PC systems

B. Software / Simulation Tools

1. MATLAB / Simulink (for OFDM, DSSS, MIMO)
2. Python (basic signal simulation – optional)
3. Network Analyzer Mobile Apps (Android):
    - Network Signal Info
    - NetMonitor
    - Signal Strength Checker

Suggested Project List:

1. Mobile Phone Signal detector
2. SMS-Based Remote-Control System
3. RFID-Based Attendance System
4. SMS-Based Alert System:
5. Wi-fi signal analyzer

Suggested Activities for Students:

1. Industrial visit to telecom tower/ISP.
2. Seminar on recent and upcoming trends in Wireless technology.
3. One day workshop on “Explore Internal Architecture of Mobile Handset”
4. Seminar on analysis of recent mobile operating system technologies.
5. Poster preparation for recent mobile phone architectures.
6. Installation & analysis of mobile network apps.
7. Study of VoLTE functionality in smartphones.

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