GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: MOBILE COMMUNICATION
(COURSE CODE: 3351102)

Diploma Programme in which this course is offered	Semester in which offered
Electronics and Communication Engineering	5th Semester

1. RATIONALE

The cellular mobile communication has seen an exponential growth over the years. Not only that, but there are different technologies such as GSM and CDMA with their variations and the 4th generation mobile technology is the latest one. This scenario demands the need for more skilled technicians for operation, maintenance and servicing of mobile cellular systems. This course gives the opportunity to the students to learn the fundamentals of these technologies which they will find in the workplace. Hence this course is designed to maintain various types of mobile communication systems.

2. LIST OF COMPETENCY (Programme outcome according to NBA terminology)

The course content should be taught and with the aim to develop different types of skills So that students are able to acquire following competency:

- **Maintain mobile communication systems**

3. COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

i. Identify different standards of mobile communication systems.
ii. Maintain Global System for Mobile (GSM) systems.
iii. Troubleshoot GSM mobile handsets.
iv. Test the functionality of various modules of CDMA cellular systems.
v. Test the functionality of various modules of 4G systems.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	150
4	0	2	6	70	30	20	30	

Legends: L - Lecture; **T -** Tutorial/Teacher Guided Student Activity; **P -** Practical; **C -** Credit; **ESE** - End Semester Examination; **PA** - Progressive Assessment.

5. COURSE DETAILS

Unit	Major Learning Outcomes (outcomes in cognitive domain)	Topics and Sub-topics
Unit – I Fundamental of Cellular Communication	1a. Describe cellular communication Standards -1G, 2G and 3G.	1.1 Cellular communication Standards-1G, 2G and 3G
	1b. Explain the Basic cellular concept and cellular system	1.2 Basic cellular concept and cellular system
	1c. Explain need of various types of cell shape. 1d. Explain macro, micro, Pico, Selective and umbrella cell.	1.3 Type of Cell: macro, micro, Pico, Selective and umbrella cell.
	1e. Calculate GSM user capacity using cluster concept. 1f. Explain frequency reuse planning.	1.4 Cluster concept and frequency reuse 1.5 GSM capacity
	1g. Discuss the impact of Co- channel and adjacent channel interference.	1.6 Co-channel and adjacent channel interference
	1h. Explain the fixed, dynamic and hybrid channel assignment schemes.	1.7 Channel assignment strategies
	1i. Differentiate cell splitting and cell sectoring.	1.8 Enhancing coverage and capacity of cellular system: cell splitting and cell sectoring.
	1j. Define handoff 1k. Differentiate hard and soft, intra and intersystem handoff.	1.9 Handoff : soft and hard, inter and intra system
	1l. Explain Frequency divisions, Multiple Access (FDMA), Time Division Multiple Access (TDMA), 1m. Compare Code Division Multiple Access (CDMA), and Space Division Multiple Access (SDMA).	1.10Multiple access techniques: FDMA,TDMA and CDMA Space Division Multiple Access (SDMA)
Unit– II GSM-Global System for Mobile communication	2a. Describe functions of various blocks of GSM system	2.1 GSM architecture
	2b. List GSM, 900 specifications	2.2 GSM 900 system specification
	2c. Discuss the GSM traffic channel and Control channel. 2d. Explain Frequency correction control channel(FCCH), Random access Control channel (RACH), Access Grant channel(AGCH)	2.3 GSM channel types: Traffic, control
	2e. Discuss GSM frame structure	2.4 GSM burst and frame structures
	2f. Describe location updating procedure. 2g. Explain call origination (mobile to landline), call termination (landline to mobile) and mobile to mobile call with the help of line diagram.	2.5 GSM call Procedure

Unit	Major Learning Outcomes (outcomes in cognitive domain)	Topics and Sub-topics
	2h. Explain frequency hopping. 2i. Describe how power control is achieve for GSM	2.6 Frequency hopping: Fast and Slow 2.7 Power control in GSM
	2j. Explain block diagram of signal processing in GSM	2.8 Signal processing in GSM
	2k. Describe working of GSM speech codec.	2.9 GSM speech codec
	2l. Explain Gaussian minimum shift keying (GMSK) modulation and demodulation technique.	2.10 GSM Modulation Techniques: GMSK
	2l. Explain functional importance of IMSI, IMEI, MSISDN, TMSI, MSRN, LAI and BSIC.	2.11 GSM Identifier: IMSI,IMEI,TMSI,MSISDN, LAI and BSIC
Unit–III Mobile Handset	3a. Explain the block diagram of mobile handset	3.1 Mobile handset: block diagram
	3b. Explain the working principle of baseband section	3.2 Baseband section
	3c. Explain the function of digital signal processing used in mobile hand set.	3.3 Digital signal processor used in mobile hand set
	3d. Describe working function of charging control section	3.4 Charging control section
	3e. Explain types of batteries used for mobile communication and their importance	3.5 Batteries
	3f. Differentiate various types of memories use in mobile handset	3.6 Memories
	3g. Explain the subscriber identity module(SIM) pin connection 3h. Discuss the SIM card interface	3.7 SIM card and SIM card interface
	3i. State the general faults occurring in mobile handset(GSM) 3j. Explain the fault finding procedure in mobile handset	3.8 General faults and fault finding procedures
	3k. Explain the effect of radiation hazards due to mobile and SAR.	3.9 Radiation hazards due to Mobile, SAR
Unit– IV Spread spectrum	4a. Explain the concept of spread spectrum techniques. 4b. Describe advantages of CDMA. 4c. State the criteria and application of spread spectrum.	4.1 Spread spectrum technique and Applications 4.2 Advantages of CDMA
	4d. Explain the PN code generator and PN code detector. 4e. Explain Walsh code generator and Walsh code.	4.3 Spreading codes (PN and Walsh code): generation and detection

Unit	Major Learning Outcomes (outcomes in cognitive domain)	Topics and Sub-topics
	4f. Explain working of DSSS transmitter and receiver. 4g. Explain working of FHSS transmitter and receiver with the help of block diagram .	4.4 Types of spread spectrum technique • DSSS- Direct sequence spread spectrum • FHSS- Frequency hopping spread spectrum
	4h. State need for power control in mobile communication. 4i. Differentiate forward and reverse power control.	4.5 Power control
	4j. Explain channel capacity of CDMA	4.6 Channel capacity
	4k. Describe mode of call processing in CDMA	4.7 Call Processing
Unit-V WCDMA and 4G aspects	5a. Explain working of GPRS with the help of suitable block diagram. 5b. List class of GPRS handset. 5c. State the application of GPRS.	5.1 GPRS- General Packet Radio Service: Block diagram, applications
	5d. Explain concept and transmission scheme in EDGE.	5.2 EDGE- Enhanced Data rate for Global Evolution
	5e. Describe high speed downlink packet access.	5.3 HSDPA
	5f. Describe long term evolution and all IP networks 5g. Explain the OFDM with the help of suitable block diagram . 5h. Explain MIMO system. 5i. Discuss software define radio.	5.4 4^{th} Generation technology: OFDM, MIMO 5.5 Software define radio

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Cellular Communication	10	02	06	04	12
II	GSM-Global System for Mobile Communication	16	06	08	04	18
III	Mobile Handset	10	02	04	08	14
IV	Spread spectrum	10	04	06	04	14
V	WCDMA and 4G aspects	10	04	06	02	12
	Total	**56**	**18**	**30**	**22**	**70**

Legends: R = Remember; U = Understand; A = Apply and above levels (Revised Bloom's taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills ***(outcomes in psychomotor and affective domain)*** so that students are able to acquire the competencies/course outcomes. Following is the list of practical exercises for guidance.

Note*: outcomes in psychomotor domain are listed here as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of* ***Course Outcomes*** *related to affective domain. Thus over all development of* ***Programme Outcomes (****as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty members should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S.No.	**Unit No.**	**Practical /Exercises** (outcomes in psychomotor)	**Approx. Hrs.**
1	I	Analyze cluster and frequency reuse technique	2
2	II	Analyse GSM signal (signal spectrum) using spectrum analyzer	2
3	II	Measure network information using android applications like signal strength checker, network monitor, network signal info.	2
4	II	To explore various blocks and working of GSM mobile phone	2
5	II	Analyse the waveforms of MSK and GMSK modulation schemes using Matlab	2
6	II	To demonstrate general fault finding procedure in GSM mobile handset	2
7	II	To demonstrate blue tooth applications using btprox software	2
8	II	To Measure the PWM signal on the Vibrator motor and on the buzzer of mobile	2
9	III	To code digital message with Direct Sequence SS system using Matlab or trainer board	2
10	III	To code digital message with Direct Sequence SS system using Matlab or trainer board	2
11	IV	To generate and observe PN signal using software or trainer board	2
12	IV	To use mobile as GPRS modem through cable & via Bluetooth.	2
13	V	To study and observe OFDM signal using software codes	2
14	V	To transmit a message using at command from microcontroller to a mobile (Serial communication)	2

S.No.	Unit No.	Practical /Exercises (outcomes in psychomotor)	Approx. Hrs.
15	V	Introduction to WML script and execute a simple script in mobile browser.	2
Total Hours(perform practical form every unit so that 28 hours are utilized)			**30**

8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like:

i. Industrial visit to BTS site or MSC.
ii. Workshop on mobile repair by service technician of any mobile repairing centre.
iii. To explore websites to understand repairing of various mobile handsets.
iv. To design and develop GSM/GPS and other wireless technology based working models/projects.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

i. Arrange visit to nearby BTS/BSC/MSC of any service provider.
ii. Power point presentations with visuals.
iii. Organise workshop for repairing of mobile hand set.
iv. Arrange expert lectures on latest mobile communication technologies.
v. Expert video lectures on mobile communication technologies.

10. SUGGESTED LEARNING RESOURCES

A) List of Books

S. No.	Title of Books	Author	Publication
1	Wireless communication principle & Practice	Rapport T.S.	PHI Learning, New Delhi, (Latest Edition)
2	Mobile and Personal Communication System and Servicing	Pandya Raj	IEEE
3	Mobile Communication	Lee C. Y.	Pearson, New Delhi (Latest Edition)
4	Mobile Cellular Telecommunication System	Lee C.Y.	TMH, New Delhi, (Latest Edition)
5	Wireless communication	Dalal Upena	OXFORD New Delhi,
6	Advance Mobile Repairing	Pandit Sanjib	BPB, (Latest Edition)
7	Mobile Communication	Schiller	PHI Learning, New Delhi, (Latest Edition)
8	Related IEEE/IEE publication		

B) List of Major Equipment/Instruments with Broad Specifications

i.	Oscilloscope / storage oscilloscope	Dual channel 100 MHz
ii.	Spectrum analyzer	• Up to 2-3 GHz capture bandwidth
iii.	GSM Trainer	• GSM wireless standards
iv.	CDMA Trainer	• CDMA standards

v.	Mobile Handset Trainer	• GSM based handset trainer with fault creation and test points. •
vi.	Modulation technique Trainer board	• On board Modulation/Demodulation (GMSK) for mobile system
vii.	PN sequence generator training board	• Generate different PN Data

C) List of Software/Learning Websites

i. www.nptel.iitm.ac.in
ii. www.academia.edu
iii. www.larnerstv.com

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. S.J. Chauhan,** HOD, (EC), Govt. Polytechnic Rajkot.
- **Prof. R.B. Shah,** Sr. Lecturer (EC), Govt. Polytechnic Ahmedabad.
- **Prof. K.K. Shah,** Sr. Lecturer, (EC), Govt. Polytechnic Rajkot.
- **Prof. A. J. Prajapati**, Sr. Lecturer, (EC), B.S.Patel Polytechnic Kherva.

Coordinator and Faculty Members from NITTTR Bhopal

- **Prof. (Mrs.) Anjali Potnis,** Assistant Professor, Department of Electrical and Electronics Engineering.