Lok Jagruti Kendra University
University with a Difference

# Diploma in Electronics & Communication Engineering

LJ Polytechnic

## Subject Code: 025030601
## Mobile & Wireless Communication

| **Programme / Branch Name** | | | Diploma in Electronics and Communication | | | |
|---|---|---|---|---|---|---|
| **Course Name** | Mobile & Wireless Communication | | | | **Course Code** | 025030601 |
| **Course Type** | HSSC | BSC | ESC | PCC | OEC | PEC |

**Legends:** HSSC: Humanities and Social Sciences Courses BSC: Basic Science Courses
ESC: Engineering Science Courses PCC: Program Core Courses
OEC: Open Elective Courses PEC: Program Elective Courses

## 1. Teaching and Evaluation Scheme

| **Teaching Hours / Week / Credits** | | | | **Evaluation Scheme** | | | |
|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Total Credit** | **CCE** | **SEE (Th)** | **SEE (Pr)** | **Total Marks** |
| 4 | 0 | 2 | 5 | 50 | 50 | 50 | 150 |

**Legends:**
L: Lectures T: Tutorial P: Practical
CCE: Continuous & Comprehensive Evaluation
SEE (Th): Semester End Evaluation (Theory)
SEE (Pr): Semester End Evaluation (Practical)

## 2. Prerequisite

- ✓ Digital and analog Communication, Signals & Systems, Electromagnetic Theory, Probability & Random Processes.
- ✓ Estimation and Detection Theory and digital communication systems basics.
- ✓ Mathematical tools like Linear Algebra, Vector spaces, Probability, Statistics and Random process, Fourier Series and Transform.

## 3. 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.

## 4. Objectives

- ✓ Identify different standards of mobile communication systems.
- ✓ Maintain Global System for Mobile (GSM) systems.
- ✓ Troubleshoot GSM mobile handsets.
- ✓ Test the functionality of various modules of CDMA cellular systems.
- ✓ Test the functionality of various modules of 4G systems.

## 5. Contents

| Unit No. | Topics | Sub-Topics | Learning Outcome | % Weigh tage | Hours |
|---|---|---|---|---|---|
| 1 | **Introduction to Wireless Communication System** | 1.1. Cellular communication Standards-1G, 2G,3G and 4G<br>1.2. Basic cellular concept and cellular system<br>1.3. Type of Cell: macro, micro, Pico, Selective and umbrella cell.<br>1.4. Cluster concept and frequency reuse<br>1.5. GSM capacity<br>1.6. Co-channel and adjacent channel interference<br>1.7. Channel assignment strategies<br>1.8. Enhancing coverage and capacity of cellular system: cell splitting and cell sectoring.<br>1.9. Handoff: soft and hard, inter and intra system<br>1.10. Multiple access techniques: FDMA, TDMA and CDMA<br>1.11. Space Division Multiple Access (SDMA) | • cellular communication Standards -1G, 2G 3G and 4G. Basic cellular concept and cellular system.<br>• Need of various types of cell shape.<br>• Macro, micro, Pico, Selective and umbrella cell.<br>• Calculate GSM user capacity using cluster concept.<br>• Frequency reuse planning.<br>• Impact of Co- channel and adjacent channel interference.<br>• Fixed, dynamic and hybrid channel assignment schemes.<br>• Differentiate cell splitting and cell sectoring.<br>• Define handoff<br>• Differentiate hard and soft, intra and intersystem handoff<br>• Frequency divisions, Multiple Access (FDMA), Time Division Multiple Access (TDMA),<br>• Compare Code Division Multiple Access (CDMA), and Space Division Multiple Access (SDMA). | 25 | 14 |

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| **2** | **GSM-Global System for Mobile communication** | 2.1 GSM architecture<br>2.2 GSM 900 system specification<br>2.3 GSM channel types: Traffic, control<br>2.4 GSM burst and frame structures<br>2.5 GSM call Procedure<br>2.6 Frequency hopping: Fast and Slow<br>2.7 Power control in GSM<br>2.8 Signal processing in GSM<br>2.9 GSM speech codec<br>2.10 GSM Modulation Techniques: GMSK<br>2.11 GSM Identifier: IMSI, IMEI, TMSI, MSISDN, LAI and BSIC | • Describe functions of various blocks of GSM system<br>• List GSM, 900 specifications<br>• GSM traffic channel and Control channel.<br>• Frequency correction control channel (FCCH), Random access Control channel (RACH), Access Grant channel (AGCH)<br>• GSM frame structure<br>• Location updating procedure.<br>• Call origination (mobile to landline), call termination (landline to mobile) and mobile to mobile call with the help of line diagram.<br>• Explain frequency hopping.<br>• Describe how power control is achieve for GSM<br>• Block diagram of signal processing in GSM<br>• Working of GSM speech codec.<br>• Gaussian minimum shift keying (GMSK) modulation and demodulation technique.<br>• Functional importance of IMSI, IMEI, MSISDN, TMSI, MSRN, LAI and BSIC. | 25 | 12 |

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| **3** | **Mobile Handset** | 3.1 Mobile handset: block diagram<br>3.2 Baseband section<br>3.3 Digital signal processor used in mobile hand set<br>3.4 Charging control section<br>3.5 Batteries<br>3.6 Memories<br>3.7 SIM card and SIM card interface<br>3.8 General faults and fault-finding procedures<br>3.9 Radiation hazards due to Mobile, SAR | • Block diagram of mobile handset<br>• Working principle of baseband section<br>• Function of digital signal processing used in mobile hand set.<br>• Working function of charging control section<br>• Types of batteries used for mobile communication and their importance<br>• Various types of memories use in mobile handset<br>• Subscriber identity module (SIM) pin connection<br>• Discuss the SIM card interface<br>• General faults occurring in mobile handset (GSM)<br>• Fault finding procedure in mobile handset<br>• Effect of radiation hazards due to mobile and SAR. | 25 | 12 |
| **4** | **Spread spectrum Techniques** | 4.1 Spread spectrum technique and Applications<br>4.2 Advantages of CDMA<br>4.3 Spreading codes (PN Code): generation and detection<br>4.4 Types of spread spectrum technique DSSS- Direct sequence spread spectrum FHSS- Frequency hopping spread spectrum<br>4.5 Power control | • Basic Concept of spread spectrum techniques.<br>• Advantages of CDMA.<br>• Criteria and application of spread spectrum.<br>• PN code generator and PN code detector<br>• Working of DSSS transmitter and receiver.<br>• Working of FHSS transmitter and receiver with the help of block diagram.<br>• Need for power control in mobile communication.<br>• Differentiate forward and reverse power control.<br>• Channel capacity of CDMA<br>• Mode of call processing in | 18 | **10** |

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| | | 4.6 Channel capacity<br>4.7 Call Processing | CDMA | | |
| **5** | **Recent Wireless Technology** | 5.1 GPRS- General Packet Radio Service: Block diagram, applications<br>5.2 EDGE- Enhanced Data rate for Global Evolution<br>5.3 Overview of WCDMA, and Wi-MAX, ZigBee Networks,<br>5.4 Software Defined Radio, UWB Radio, Wireless Adhoc Network and Mobile Portability, Security issues and challenges in a Wireless network. | • Working of GPRS with the help of suitable block diagram.<br>• Class of GPRS handset. application of GPRS<br>• Explain concept and transmission scheme in EDGE<br>• WCDMA, Wi-Fi, Wi-MAX Technologies<br>• Different Higher generation technology<br>• Software defined radio<br>• Security issues and challenges in wireless network | **7** | 8 |
| | | | | **Total Hours** | **56** |

## 6. List of Practicals / Exercises

The practical/exercises should be properly designed and implemented in an attempt to develop different types of skills that students can acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

| Sr. No | Practical / Exercises | Key Competency | Hours |
|---|---|---|---|
| **1** | To study and perform channelization scheme and measure adjacent and co-channel interference in cellular system | | 2 |
| 2 | To explore various blocks and working of GSM mobile phone | Trainer Kit | 2 |
| 3 | Analyze the waveforms of MSK and GMSK modulation schemes using MATLAB | Trainer Kit | 2 |
| 4 | To demonstrate general fault-finding procedure in GSM mobile handset | Trainer Kit | 2 |
| 5 | To study and perform GSM AT commands | Trainer Kit | 2 |
| 6 | Simulate the line coding techniques using MATLAB and Simulink | MATLAB | 2 |
| 7 | Simulate the Binary amplitude shift keying using MATLAB and Simulink. | MATLAB | 2 |
| 8 | Simulate the Binary phase shift keying | MATLAB | 2 |

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|---|---|---|---|
| | using MATLAB and Simulink | | |
| 9 | Simulate the Direct sequence spread spectrum using MATLAB and Simulink. | MATLAB | 2 |
| | | Total Hours | 18 |

## 7. Suggested Specification Table with Hours

| Unit No. | Chapter Name | Teaching Hours | Distribution of Topics According to Bloom's Taxonomy | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | R % | U % | App % | C % | E % | An % |
| 1 | Introduction to Wireless Communication System | 14 | 40 | 20 | 20 | 0 | 10 | 10 |
| 2 | GSM-Global System for Mobile communication | 12 | 20 | 20 | 15 | 20 | 20 | 5 |
| 3 | Mobile Headset | 12 | 20 | 20 | 20 | 15 | 10 | 15 |
| 4 | Spread spectrum Techniques | 10 | 20 | 20 | 15 | 20 | 10 | 15 |
| 5 | Recent Wireless Technology | 8 | 30 | 20 | 20 | 10 | 10 | 10 |

**Legends:** R-Remembering C- Creating
U- Understanding E- Evaluating
App- Applying An- Analyzing

## 8. Textbooks

1) Wireless communication principle & Practice - Rapport T.S. - PHI Learning, New Delhi, (Latest Edition)
2) Mobile Communication - Schiller - PHI Learning, New Delhi, (Latest Edition)

## 9. Reference Books

1) Mobile Communications Engineering, William C. Y. Lee, Mc Graw Hill Publications
2) Mobile and personal Communication system and services by Raj Pandya, IEEE press (PHI).
3) Wireless Communications-T.L. Singh-TMH
4) Adhoc Mobile Wireless network, C.K. Toh Pearson

## 10. Open Sources (Website, Video, Movie)

1. www.nptel.iitm.ac.in
2. www.academia.edu
3. www.larnerstv.com