

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: INFORMATION COMMUNICATION NETWORKS
(COURSE CODE: 3351601)

| | |
|--|----------------------------------|
| Diploma Program in which this course is offered | Semester in which offered |
| Information Technology | 5 th Semester |

1. RATIONALE

This course is to make students learn about the advances in Information Communication Networks. It covers the basic underlying concepts and techniques recently used in the IT industry. After going through this course student will be able to understand digital communication and fundamentals of wireless technologies. They will also learn about various wireless networking architectures, its modulation, multiplexing and other important parameters. They will go through significantly latest wireless technologies.

2. LIST OF COMPETENCY:

The course content should be taught and implemented with the aim to develop required skills in the students so that they are able to acquire following competencies:

- **Explain architecture and functioning of various wireless networks.**
- **Test and verify various parameters such as modulation, multiplexing etc. of a wireless network/ Wireless Communication Technologies.**

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 out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- i. Describe importance of information and wireless information communication technology.
- ii. Explain basic concept of digital communication.
- iii. Test and verify various parameters of a wireless network.
- iv. Explain latest trends in wireless networks.

4. TEACHING AND EXAMINATION SCHEME

| Teaching Scheme (In Hours) | | | Total Credits (L+T+P) | Examination Scheme | | | | |
|-------------------------------|---|---|--------------------------|--------------------|----|-----------------|----|-------------|
| L | T | P | | Theory Marks | | Practical Marks | | Total Marks |
| | | | C | ESE | PA | ESE | PA | |
| 3 | 0 | 4 | 7 | 70 | 30 | 40 | 60 | 200 |

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

5. COURSE CONTENT DETAILS:

| Unit | Major Learning Outcomes (in cognitive domain) | Topics and Sub-topics |
|---|--|---|
| Unit – I Advances in Information Communication Networks | 1a. Describe various concepts of digital communication Networks required for ICN. | 1.0 Various concepts of digital communication. 1.1 Digital modulation techniques (ASK,FSK,PSK) 1.2 Linear digital modulation techniques (QPSK, OQPSK, QAM) 1.3 Continuous envelope modulation(MSK,GMSK) 1.4 choice of digital modulation technique 1.5 PCM 1.6 Various digital coding methods (ON-OFF,BIPOLAR,MANCHESTER) |
| | 1b. Describe wireless communication fundamentals used in ICN. | Wireless communication fundamentals. 1.7 Advantages and disadvantages of wireless communication 1.8 Wireless network generations 1.9 applications of wireless communication 1.10 Radio path (Direct, Line Of Site and obstructive) |
| Unit – II Wireless cellular communication. | 2a. Describe network Computing model for wireless cellular communication required in ICN | Network Computing model for wireless cellular communication used in ICN 2.1 Cell, cluster and coverage area 2.2 Frequency Reuse principal 2.3 frequency reuse distance 2.4 frequency management 2.5 channel assignment (fixed, dynamic, hybrid) 2.6 system parameters to increase cell coverage 2.7 cell spiting, sectoring etc. 2.8 interleaving 2.9 speech and channel coding |
| Unit – III Global System for Mobile Communications (GSM) | 3a. Describe GSM architecture and related concepts. | 3.1GSM Architecture 3.2Frequency allocation 3.3GSM Identifiers: IMEI, IMSI, MSISDN, LAI, MSRN, TMSI, LMSI 3.4 GSM Entities • Mobile Stations • Base Station Subsystem • Network and Switching Subsystem • Operation and Support Subsystem |

| Unit | Major Learning Outcomes (in cognitive domain) | Topics and Sub-topics |
|---|--|---|
| | 3b. Describe GSM call management and related operations. | 3.5 Roaming 3.6 Handoff 3.7 mobile originated and mobile terminated call 3.7 SMS Features 3.8 SMS architecture 3.9 Operator centric push and pull SMS. 3.10 Operator independent push and pull SMS. |
| Unit – IV Third generation communication | 4a. Comprehend GPRS and EDGE technologies. | 4.1 GPRS 4.1.1 Architecture 4.1.2 Protocol Stack 4.1.3 Quality of Service Parameters 4.1.4 Types of GPRS handsets 4.1.5 Mobility Management 4.1.6 GPRS service Parameters 4.2 EDGE 4.2.1 Architecture 4.2.2 Evolved EDGE 4.2.3 Advantages |
| | 4b. Explain 3G communications. | 4.3 UMTS 4.3.1 Architecture 4.3.2 Air Interface 4.3.3 Handoff and its types 4.3.4 Advantages 4.4 WCDMA 4.4.1 Architecture 4.4.2 Advantages 4.5 TD-SCDMA 4.5.1 Specification 4.5.2 Comparison with WCDMA |
| Unit - V Latest trends in ICN. | 5a. Describe Components , their applications of RFID and Bluetooth in ICN 5b. State Protocols Stack , Security Issues of Bluetooth in ICN | 5.1 Radio Frequency Identification(RFID) 5.1.1 Specifications 5.1.2 Components of RFID system 5.1.3 Classification of RFID tags 5.1.4 Advantages and Disadvantages 5.1.5 Applications 5.2 Bluetooth 5.2.1 Specifications 5.2.2 Protocols Stack 5.2.3 Security Issues 5.2.4 Advantages and Disadvantages 5.2.5 Applications |
| | 5b. Describe upcoming wireless technologies in brief | The upcoming wireless technologies. 5.3 IEEE 802.11 WLAN technology 5.3.1 Architecture 5.3.2 Types |

| Unit | Major Learning Outcomes (in cognitive domain) | Topics and Sub-topics |
|------|--|---|
| | | 5.3.3 Security Issues 5.3.4 Roaming 5.3.5 Advantages and ,Limitations 5.4 IEEE 802.15 WPAN technology 5.4.1 Bluetooth(Same as 5.2) 5.4.2 Brief introduction ZigBee 5.4.3 Brief Introduction UWB 5.4.4 Comparison between WPAN technologies 5.5 LTE 5.5.1 Architecture 5.5.2 Features 5.5.3 Security Issues 5.5.4 Advantages and limitations 5.6 MANET technology 5.6.1 Architecture 5.6.2 Features 5.6.3 Deployment Issues 5.6.4 Advantages and ,Limitations 5.6.5 Applications |

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

| Unit No. | Unit Title | Teachin g Hours | Distribution of Theory Marks | | | |
|----------|--|-----------------|------------------------------|-----------|-----------|-------------|
| | | | R Level | U Level | A Level | Total Marks |
| I | Advances in Information Communication Networks | 9 | 7 | 6 | 3 | 16 |
| II | Wireless cellular communication | 8 | 6 | 6 | 2 | 14 |
| III | Global System for Mobile Communications (GSM) | 8 | 4 | 6 | 4 | 14 |
| IV | Third generation communication. | 8 | 2 | 4 | 4 | 10 |
| V | Latest trends in ICN. | 9 | 4 | 6 | 6 | 16 |
| | Total | 42 | 23 | 28 | 19 | 70 |

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's Revised 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/PRACTICAL

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/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes in psychomotor domain are listed 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.*

| Sr. No. | Unit No. | Practical Exercises (Outcomes in Psychomotor Domain) | Approx Hrs. required |
|------------------------------|----------|---|----------------------|
| 1 | I | Test and verify Amplitude Shift Keying.(Modulation and Demodulation) | 2 |
| 2 | | Test and verify Frequency Shift Keying. (Modulation and Demodulation) | 2 |
| 3 | | Test and verify Phase Shift Keying. (Modulation and Demodulation) | 2 |
| 4 | | Test and verify QPSK. (Modulation and Demodulation) | 4 |
| 5 | | Test and verify QAM. (Modulation and Demodulation) | 2 |
| 6 | | Test and verify PCM. (Modulation and Demodulation) | 2 |
| 7 | | Test and verify MSK. (Modulation and Demodulation) | 2 |
| 8 | | Test and verify GMSK. (Modulation and Demodulation) | 2 |
| 9 | | Test and verify ON-OFF coding method. | 2 |
| 10 | | Test and verify BIPOLAR coding method. | 2 |
| 11 | | Test and verify MANCHESTER coding method. | 2 |
| 12 | II | Test the basic parameters of wireless communication using GSM trainer. | 4 |
| 13 | III | Test and Verify various GSM identifier using GSM Trainer | 4 |
| 14 | | Test and Verify GSM Base station using GSM Trainer | 2 |
| 15 | | Test and Verify GSM mobile station using GSM Trainer | 4 |
| 17 | | Test and Verify various GSM identifier , GSM Base station, mobile station using GSM Trainer | 2 |
| 18 | IV | Test and verify working of GPRS. | 2 |
| 19 | | Test and verify working of EDGE. | 2 |
| 20 | | Test and verify working of UMTS. | 3 |
| 21 | | Test and verify working of CDMA. | 3 |
| 22 | V | Test and verify working of RFID. | 3 |
| 23 | | Test and verify working of Bluetooth. | 3 |
| Total Practical Hours | | | 56 |

8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities such as:

- Group Discussion
- Seminar
- Power Point Presentation

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- i. Application for practical will be assigned to the students by the subject faculty and Students will work in a group of 3 maximum
- ii. Assignment can be given based on above topics.

10. SUGGESTED LEARNING RESOURCES

A) List of Books

| S. No. | Title of Book | Author | Publication |
|--------|------------------------|--------------|---|
| 1 | Wireless communication | T. L. Singal | McGraw Hill, 4 th edition 2012 |
| 2 | Wireless communication | U. D. Dalal | Oxford University Press |
| 3 | Wireless Networking | Price | TMH Edition-2012 |

B) List of Major Equipment/ Instrument with Broad Specifications

- i. Dual Trace Oscilloscope - 30 MHz
- ii. Digital Storage Oscilloscope 100 MHz, Color Display , 1GS/s, 2MB memory with USB Port for PC connection with 32 Measurement.
- iii. C.R.O. Attenuator probe - 10:1
- iv. RF Signal Generator - 100 KHz - 50 MHz (Digital) with AM
- v. Advanced AM/FM Signal Generator - 250 MHz (Digital)
- vi. Advance Function Generator - 20 MHz (Digital)
- vii. ASK Modulation Trainer
- viii. ASK Demodulation Trainer
- ix. FSK Modulation Trainer
- x. FSK Modulation Trainer
- xi. PSK Modulation Trainer
- xii. PSK Demodulation Trainer
- xiii. ASK-FSK-PSK Modulation/Demodulation Trainer
- xiv. Digital Line Coding-Decoding Trainer ((NRZ-L,NRZ-M,NRZ-S)
- xv. Bipolar Transmission Trainer
- xvi. Manchester Coding Trainer
- xvii. GSM Trainer
- xviii. GSM Application Module
- xix. CDMA Mobile Phone Trainer

- xx. Wireless Communication System Trainer
- xxi. Wireless USB LAN Networking Trainer
- xxii. Wireless LAN Demonstrator
- xxiii. RFID Trainer (Radio Frequency Identification)
- xxiv. GRPS (Global Radio Packet System) Trainer
- xxv. Bluetooth Networking Trainer

B) List of Software/Learning Websites

Electronic Teaching Slides (Power Point Slides)- CD/DVD

- i. GSM
- ii. CDMA
- iii. Bluetooth
- iv. Wireless Communication - Wifi, Bluetooth, WLL, RFID
- v. Communication Networks - GSM, CDMA, GPS, GPRS

Laboratory Charts

- i. Amplitude Shift Keying
- ii. Frequency Shift Keying
- iii. Phase Shift Keying
- iv. Quadrature Phase Shift Keying
- v. PCM
- vi. CDMA

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. Nandu Ashokbhai Fatak**, Lecturer (IT), B P T I Bhavnagar
- **Prof. Manoj P. Parmar**, In charge Head (IT), Government Polytechnic Himatnagar.

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. K. James Mathai**, Associate Professor, Dept. of Computer Engineering and Applications