

**Centurion University of Technology & Management
School of Engineering & Technology**

**B.Tech
Electronics and Communication Engineering**

**Communication Domain
(2014-18)**

Syllabus

2017

Course Structure
Communication Domain

Sl No.	Course Code	Course Title	Course Nature	Credits
1	DMEC0131	Mobile Communication	Theory	3
2	DMEC0431	MIMO-OFDM Technology	Theory + Practice	5
3	DMEC0132	Spread spectrum technology	Theory	3
4	DMEC0231	CCNA Routing and Switching	Practice	2
5	DMEC0432	4G LTE Communication Technology	Theory+Practice	5
6	DMEC0232	Cell Site , BTS Operation &Maintenance	Practice	2
7	DMEC0233	RF Planning and Drive Test	Practice	2
8	DMEC0300	Project		6
9	DMEC0800	Internship		4
			Total	32

SYLLABUS

Code	Subject	Type of course	T-P-P
DMEC0131	Mobile Communication	Theory	3-0-0

Course Objectives: -

1. Understand the different cellular systems design; increase the coverage capacity, reducing interferences and their advancements from one generation (1G) to other.
2. Different antenna set ups, frequency management, channel assignments, capacity and QoS of the system.

Learning Outcomes: -

Upon successful completion of this course students should be able to,

1. Analyze Global System for Mobile-communication (GSM), GPRS.
2. Apply knowledge of numbering the radio channels, channel sharing, borrowing process Concept of hand off and call processing in mobile communication system.
3. Analyze improved data services advances in cellular communication.

CONTENT:

MODULE-I

Wireless systems and standards:

An Overview of wire and wireless systems: Introduction, History of wireless communication, Generation of wireless standard Networks from 1G to 5G, Evolution of Mobile Radio Communications with examples (paging system, cordless telephones, walkie-talkies and cellular telephones systems).

Standards & devices: Basic concept of AMPS, Global System for Mobile (GSM), architecture. and GPRS.

MODULE-II

Channel model and Cellular systems:

Mobile Radio Propagation and Models: Introduction, AWGN, Free-space propagation path-loss model, Ground reflection model (2-ray), LOS, Multipath propagation, Small scale fading model vs. large scale Fading, Doppler shift.

Fundamentals of Cellular Communications: Introduction to Cellular Systems, Cell Geometry, Splitting & sectoring. Frequencies reuse concept and ratio, Roaming and Hand-off/Hand-over process.

MODULE-III

Modulation and Multiple access Techniques:

Modulation schemes: Introduction to modulation, Phase Shift Keying (BPSK, QPSK).

Multiple Access Techniques: Introduction, Comparisons of FDMA, TDMA, CDMA and SDMA, Multicarrier DS-CDMA (MC-DS-CDMA).

Text Books:

1. T S Rappaport, Wireless Communications, Pearson Education, India
2. Essential Reading: Selected portions from V K Garg, Wireless Communication and Networking; Morgan Kaufman Publishers India; 2008
3. David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", Prentice Hall, 2003.

Reference Books:

1. Dalal Upena, Wireless Communication, Oxford University Press.

2. William Stallings, “Wireless Communication and Networking”, Pearson Education, 2002.
3. Kraus, J.D., “Antennas”, II Edition, John Wiley and Sons, NY, 1977.

Pedagogy

S. No.	Topic	Teaching Method	Reference/Tool	Theory
	MODULE-I			
1	An Overview of wire and wireless systems: Introduction, History of wireless communication	CRT	PPT	3
2	Generation of wireless standard Networks from 1G to 5G			3
3	Evolution of Mobile Radio Communications with examples (paging system, cordless telephones, walkie-talkies and cellular telephones systems).			3
4	Standards & devices: Basic concept of AMPS, Global System for Mobile (GSM), architecture. GPRS.			3
	MODULE II			
5	Mobile Radio Propagation and Models: Introduction, AWGN, Free-space propagation path-loss model, Multipath propagation,	CRT	PPT	3
6	Ground reflection model (2-ray), LOS,			3
7	Small scale fading model vs. large scale Fading, Doppler shift.			3
8	Fundamentals of Cellular Communications: Introduction to Cellular Systems, Cell Geometry,			3
9	Splitting & sectoring. Frequencies reuse concept and ratio			3
10	Roaming and Hand-off/Hand-over process.			3
	MODULE III			
11	Modulation schemes: Introduction to modulation, Phase Shift Keying (BPSK,).	CRT	PPT	3
12	QPSK			2
13	Multiple Access Techniques: Introduction, Comparisons of FDMA, TDMA, ,			3
14	CDMA and SDMA			2
15	Multicarrier DS-SS (MC-DS-SS).			2
	Total Hours			42

Code	Subject	Type of course	T-P-P
DMEC0421	MIMO-OFDM Technology	Theory + Practice	3-2-0

Course Objectives:

Objectives of this course are to

1. Make student understand fundamental building blocks of UMTS/3G, 4G/LTE system evolution, architecture, air-interface, protocols, procedures, performance, security and NGN system.
2. Make student understand the MIMO-OFDM system and its applications.

Learning Outcomes: -

Upon successful completion of this course student should be able to

1. Apply knowledge of design, planning and advances of 3G, 4G system for mobile radio communication system.
2. Analyze improved data services, capacity, QoS in cellular system.
3. Apply knowledge of 4G LTE & VoLTE mobile communication technologies.

MODULE I

Multi Input Multi Output (MIMO) System:

Introduction to SISO, SIMO, MISO and MIMO system, Types of MIMO system, Different antenna configuration and channel model in MIMO system, single and multi-user MIMO system, Capacity, BER analysis of MIMO system,

Practical/Project:

- Design & comparison of SISO, SIMO, MISO and MIMO system
- Capacity, BER & SNR analysis of MIMO system &
- MIMO spatial multiplexing & diversity technique - by using MATLAB simulation or H/W interface.

MODULE II

Orthogonal Frequency division Multiplexing (OFDM) system:

Introduction to OFDM system, OFDM transmitter and receiver channel model; BER, SNR Performance, OFDM Issues-PAPRR-Frequency and Timing Offset Issues.

Practical/Project:

- OFDM transmitter and receiver channel model; BER, SNR Performance &
- MIMO-OFDM system model & Simulation by using MATLAB simulation or H/W interface.

MODULE III

MIMO spatial multiplexing, diversity technique and detection Algorithm. Algorithms; Space Time Block and Trellis Codes, Space Time Block Codes for Fading Channel in MIMO-OFDM system.

MIMO-OFDM system model, transmission & reception process, standards, advantages and Guard band analysis. LTE vs. VoLTE & application. 4G frequency and spectrum allocation, 4G as a MAGIC, new challenges in 4G and 5G.

Practical/Project:

- MIMO-OFDM system model & Simulation by using MATLAB simulation or H/W interface.

Text Books:

1. Gilsic, S.G., “Advanced Wireless Networks: 4G Technology”, John Wiley & Sons. 2006
2. MIMO-OFDM Wireless Communications with MATLAB, John Wiley and sons publications, Yong Soo Cho, Jaekwon Kim, Won Young Yang, Chung G. Kang
3. MIMO-OFDM system model &MIMO-OFDM Simulation and LTE- by using MATLAB simulation or H/W interface

Reference books:

1. “Principles of Mobile Computing” 2nd Edition, Hensmann, Merk&Stobes, Springer, International Edition,2003.
2. Modern wireless communications, I/e Authors; Simon Haykin, Michael Moher.
3. “3G Wireless Networks” Smith & Collins, TMH, 2007.

Pedagogy

S. No.	Topic	Teaching Method	Reference/ Tool	Theory	Practi ce	Total
	MODULE-1					
1	Multi Input Multi Output (MIMO) System: Introduction to SISO, SIMO, MISO and MIMO system, Types of MIMO system.	CRT, Lab , Practice	PPT, (MATLAB Software)	5	3	8
2	Design & comparison of SISO, SIMO, MISO and MIMO system.			4	6	10
3	Different antenna configuration and channel model in MIMO system, single and multi-user MIMO system,			3	6	9
4	Capacity, BER analysis of MIMO system			3	3	6
	MODULE II					
5	MIMO spatial multiplexing, diversity technique and Detection	CRT,	PPT,	4	0	4
6	Algorithms; Space Time Block and Trellis Codes, Space Time Block Codes for Fading Channel in MIMO-OFDM system.	CRT, Lab , Practice	PPT, (MATLAB Software)	4	6	10
7	Orthogonal Frequency division			4	6	10

	Multiplexing (OFDM) system: Introduction to OFDM system, OFDM transmitter and receiver channel model; BER, SNR Performance,					
8	OFDM Issues-PAPRR- Frequency and Timing Offset Issues			4	6	10
	MODULE III					
9	MIMO-OFDM system model, transmission & reception process, standards, advantages and Guard band analysis	CRT, Lab , Practice	PPT, (MATLAB Software)	4	6	10
10	LTE vs. VoLTE& application.	CRT	PPT	2	0	2
11	4G frequency and spectrum allocation, 4G as a MAGIC,			3	0	3
12	New challenges in 4G and 5G.			2	0	2
			TOTAL	42	42	84

Code	Subject	Type of course	T-P-P
DMEC0132	Spread Spectrum Technology	Theory	3-0-0

Course Objectives: -

1. Understand the Different types of Spread Spectrum.
2. Understand Commercial Applications of Spread Spectrum
3. Understand the auto correlation and cross correlation properties
4. To detect jamming problem

Learning Outcomes: -

Upon successful completion of this course students should be able to,

1. Generate different kinds of spreading code.
2. Detect jamming problem and solved by anti-jamming
3. Mitigate the effect of ISI and MAI effect

Module I

Binary Shift – Register Sequences for Spread- Spectrum Systems

Introduction to spread spectrum , Sequence Generator fundamentals, Primitive Polynomial, State – Machine Representation of Shift Register Generators, Maximal length – Sequences and its properties,Pulse -Noise Jamming,Low Probability of Detection, Gold codes, orthogonal codes, Walsh codes,Auto and Cross Correlations of Spreading Codes and Signals.

Module II

Spread Spectrum Modulation Technique

Direct sequence spread spectrum system, frequency hopping spread spectrum system, performance of Direct sequence spread spectrum system, performance of frequency hopping spread spectrum system, overall transmitter and receiver design. Test and evaluation of spread spectrum system- selectivity, sensitivity, jamming margin, synch acquisition, processing gain. Transmitter measurements.

Module III

Multiple Access techniques

CDMA and Its capacity performance. SDMA, packet radio, Packet radio protocol, pure ALOHA and slotted ALOHA. Bit-Error-Rate Analysis of Spreading codes.

Ultra Wideband (UWB) Communication. Minimum auto correlation spreading code, Minimum cross correlation spreading code.

Text Book :

1. R. C. Dixen, “Spread Spectrum Systems with commercial application”, John Wiley, 3rd Ed.
2. H. Taube. And D. L. Schilling, “Principle of Communication Systems”. Tata Mcgraw Hill, 2nd Ed. Reprint 2007

Pedagogy

S. No.	Topic	Teaching Method	Reference/Tool	Theory	
	MODULE-I				
1	Introduction to spread spectrum , Sequence Generator fundamentals	CRT	Chalk /PPT	3	
2	Primitive Polynomial, State –Machine Representation of Shift Register Generators			3	
3	Maximal length – Sequences and its properties, Pulse -Noise Jamming, Low Probability of Detection			3	
4	Gold codes, orthogonal codes, Walsh codes, Auto and Cross Correlations of Spreading Codes and Signals.			6	
	MODULE II				
5	Direct sequence spread spectrum system, frequency hopping spread spectrum system			3	
6	Performance of Direct sequence spread spectrum system, performance of frequency hopping spread spectrum system			3	
7	Overall transmitter and receiver design. Test and evaluation of spread spectrum system- selectivity			2	
8	sensitivity, jamming margin			2	
9	Synchacquisition, processing gain. Transmitter measurements.	2			

	MODULE III			
10	CDMA and Its capacity performance. SDMA			2
11	packet radio,Packet radio protocol			2
12	Pure ALOHA and slotted ALOHA. Bit- Error-Rate Analysis of Spreading codes,			2
13	Ultra Wideband (UWB) Communication			2
14	Minimum auto correlation spreading code, Minimum cross correlation spreading code.			2
Total Hours				37

CCNA Routing and Switching

Code	Subject	Type of course	T-P-P
DMEC0231	CCNA Routing and Switching	Practice	0-2-0

Course Objectives: Objectives of this course are

1. To make student understand the fundamentals of network theory and the TCP/IP Protocol Stack.
2. To demonstrate data networking fundamentals and network device functionality (includes configuring the network devices on LANs).
3. To impart knowledge of the most important aspects of the Internetwork Operating System.
4. Interpreting IOS displays.
5. understanding all of the central network engineering disciplines, including network security, design and troubleshooting

Learning outcome:

Upon successful completion of this course students should be able to

1. Apply addressing and naming schemes at various layers of data networks in IPv4 and IPv6 environments.
2. Design, calculate, and apply subnet masks and addresses to fulfill given requirements in IPv4 and IPv6 networks
3. Explain fundamental Ethernet concepts such as media, services, and operations
4. Build a simple Ethernet network using routers and switches
5. Use Cisco command-line interface (CLI) commands to perform basic router and switch configurations
6. Utilize common network utilities to verify small network operations and analyze data traffic

MODULE-1

Internetworking: Internetworking Basics, Internetworking Models, The Layered Approach , Advantages of Reference Models , The OSI Reference Model.

TCP/IP: TCP/IP and the DoD Model, The Process/Application Layer Protocols, The Hierarchical IP Addressing Scheme, Private IP Addresses, Broadcast Addresses

Sub netting, Variable Length Subnet Masks, (VLSMs): Subnetting Basics, How to Create Subnets, Subnet Masks, Classless Inter-Domain Routing (CIDR), Variable Length Subnet Masks (VLSMs), Troubleshooting IP Addressing.

Cisco's Internetworking Operating System (IOS): The IOS User Interface, Cisco Router IOS, Connecting to a Cisco Router, Bringing Up a Router, Command-Line Interface (CLI).

MODULE-2

IP Routing: Routing Basics, The IP Routing Process, Testing Your IP Routing Understanding, Configuring IP Routing, The debug IPRIP Command, Enabling RIPv2 on Our Internetwork.

Enhanced IGRP (EIGRP) and Open Shortest Path First (OSPF), EIGRP Features and Operation, Configuring EIGRP, Troubleshooting OSPF.

Layer 2 Switching and Spanning Tree: Protocol (STP) Before Layer 2 Switching, Spanning Tree Protocol (STP), Spanning Tree Terms, Spanning Tree Operations and Configuration.

MODULE-3

Virtual LANs (VLANs): VLAN Basics, Configuring Trunk Ports, Troubleshooting VTP.

Telephony: Configuring Voice VLANs, Configuring the Voice VLAN, Configuring IP Phone Voice Traffic, Using the CNA to Configure VLANs and Inter-VLAN Routing.

Network Address Translation (NAT): When Do We Use NAT? Static NAT Configuration, Dynamic NAT Configuration, PAT (Overloading) Configuration.

Cisco's Wireless Technologies: Introduction to Wireless Technology, The 802.11 Standards, Comparing 802.11, Cisco's Unified Wireless Solution, Split-MAC Architecture, MESH and LWAPP, AWPP, Wireless Security, Configuring Our Wireless Internetwork.

Internet Protocol Version 6 (IPv6): Why Do We Need IPv6? Configuring Cisco Routers with IPv6, DHCPv6, ICMPv6, IPv6 Routing Protocols, RIPng, EIGRPv6, OSPFv3.

Text Books:

1. CCNA 200-125 Official Cert Guide Library, Wendell Odom Published May 23, 2013 by Cisco Press.
2. CCNA Routing and Switching Study Guide by Todd Lammle, Wiley.
3. CCNA Routing and Switching Portable Command Guide, Scott Empson, Cisco press, 3rd Edition, 2014.

Pedagogy

Sl. No.	Topic	Teaching Method	Reference/Tool	
	MODULE-1			Practice
1	1.Internetworking Internetworking Basics, Internetworking Models, The Layered Approach, Advantages of Reference Models, The OSI Reference Model	Lab Practice	PPT & Packet Tracer	3
2	Introduction to TCP/IP The Host-to-Host Layer Protocols, The Internet Layer Protocols, IP Addressing, IP Terminology, The Hierarchical IP Addressing Scheme, Private IP Addresses, Broadcast Addresses			3

3	Subnetting Basics , How to Create Subnets , Subnet Masks , Classless Inter-Domain Routing (CIDR) , Classless Inter-Domain Routing (CIDR) , Variable Length Subnet Masks (VLSMs) , VLSM Design, Implementing VLSM Networks , Troubleshooting IP Addressing , Determining IP Address Problems			3
4	Cisco's Internetworking Operating System (IOS) , The IOS User Interface, Cisco Router IOS, Command-Line Interface (CLI), Router and Switch Administrative configurations.			3
	MODULE-2			3
5	IP Routing Routing Basics, Configuring IP Routing, The debug iprip Command , Enabling RIPv2 on Our Internetwork .			3
6	Enhanced IGRP (EIGRP) and Open Shortest Path First (OSPF), EIGRP Features and Operation, Using EIGRP to Support Large Networks , Multiple Access , VLSM Support and Summarization ,			3
7	Layer 2 Switching and Spanning Tree Spanning Tree Protocol (STP) , Spanning Tree Terms , Spanning Tree Operations, Configuring Catalyst Switches , Catalyst Switch Configuration			3
	MODULE-3			3
8	Virtual LANs (VLANs) VLAN Basics, Broadcast Control , Security , VLAN Memberships, Static VLANs , Dynamic VLANs, Configuring Trunk Ports, Configuring Inter-VLAN Routing, Configuring VTP, Troubleshooting VTP			3
9	Telephony: Configuring Voice VLANs, Configuring the Voice VLAN, Configuring IP Phone Voice Traffic, Using the CNA to Configure VLANs and Inter-VLAN Routing.			3

10	Network Address Translation (NAT) When Do We Use NAT? Static NAT Configuration, Dynamic NAT Configuration, PAT (Overloading) Configuration , Simple Verification of NAT , Testing and Troubleshooting NAT			3
11	Cisco's Wireless Technologies Introduction to Wireless Technology, The 802.11 Standards, MESH and LWAPP, AWPP, Wireless Security, Configuring Our Wireless Internetwork.			3
12	Internet Protocol Version 6 (IPv6) Why Do We Need IPv6? The Benefits and Uses of IPv6 , IPv6 Addressing and Expressions			3
13	Autoconfiguration , Configuring Cisco Routers with IPv6 , DHCPv6, ICMPv6 , IPv6 Routing Protocols, RIPng, EIGRPv6, OSPFv3 ,			3
14	Configuring RIPng, Configuring OSPFv3.			3
TOTAL				42

4G LTE Communication Technology

Code	Subject	Type of course	T-P-P
DMEC0432	4G LTE Communication Technology	Theory+ Practice	3-2-0

Course Objectives:

Objectives of this course are

1. To make students familiar with fundamentals of 4G.
2. To choose system (TDMA/FDMA/CDMA) according to the complexity, installation cost, speed of transmission, channel properties etc.
3. To identify the requirements of mobile communication as compared to static communication
4. To identify the limitations of 2G and 2.5G and 3G wireless mobile communication and use design of 3G and beyond mobile communication systems

Course Outcomes:

On successful completion of this course student should be able to

1. To make students familiar with various network planning, propagation model of mobile communications
2. Understand the concept of cellular communication
3. Acquire knowledge of GSM mobile communication standard, its architecture, logical channels, advantages and limitations.

4. Acquire knowledge of communication standard, its architecture, logical channels, advantages and limitations.
5. Acquire knowledge of 4GLTE mobile standards and their comparison with 2G and 3G technologies.

MODULE-1

Introduction to 4G, Why 4G?, spectrum regulation and standardization from 3G to 5G, Frequency standard for 4G, 3GPP LTE,LTE Basic technology, Transmission scheme, spectrum and bandwidth flexibility, LTE Evolution, Radio access network interfaces, Radio protocol architecture, LTE- Radio link control, Time –Frequency structure.Introduction to 5G,5G Agencies,Aim,Goal,Technologies& Spectrum. Modulation and demodulation scheme of LTE(QPSK and QAM Technology), BER Analysis of LTE.

Video over Wireless: Video compression basics, Video coding standards.

Content analysis for communication: Low level feature extraction, Image segmentation, Video object segmentation.

MODULE-2

Network planning, Frequency planning: Modes, TDD mode, FDD mode, FDD planning TDD planning concept, TDD bands. Coverage planning, LTE Capacity planning; Capacity, aim of capacity planning,

Propagation process

LTE Propagation parameters, LTE Propagation parameters, Channelmodel, Values for Multipath & Doppler.

MODULE-3

Propagation Model:LTE propagation model :Free space model, Cost 231 Hata model.

LTE Propagation losses:LTE Propagation losses ,Penetration loss, Propagation parameters,. LTE guard band analysis and Guard band requirements.LTE Link budget; DL link budget, UL link budget.

LTE cell edge rate planning;LTE cell edge rate planning ,Cell edge rate, Interference margin, System reliability.

Text-Book:

1. 4G, LTE-Advanced Pro and The Road to 5G,3rd Edition Authors: Erik Dahlman Stefan Parkvall Johan Skold,Hardcover ISBN: 9780128045756.
2. 4G wireless video communications, Authors: HaohongWang,Lisimachos P. Kondi, Ajay Luthra, Song Ci, A John Wiley and Sons, Ltd., Publication

Reference Books:

1. An Introduction To LTE, Lte-Advanced, Sae And 4G Mobile Communications, Christopher Cox, Director, Chris Cox Communications Ltd, UK.
2. Understanding LTE with MATLAB, Author: HoumanZarrinkoub, A John Wiley and Sons, Ltd., Publication

Pedagogy

S. No	Topic	Teaching Method	Reference/ Tool	Theory	Practic e	Tota l
MODULE-1						
1	Introduction to 4G, Why 4G?	CRT	PPT	1	0	1
2	Spectrum regulation and standardization from 3G to 5G			1	0	1

3	Frequency standard for 4G			1	0	1
4	LTE Basic technology, Transmission scheme			2	0	2
5	Spectrum and bandwidth flexibility, LTE Evolution			1	0	1
6	Radio access network interfaces, Radio protocol architecture.			2	0	2
7	LTE- Radio link control, Time –Frequency structure.			2	0	2
8	Introduction to 5G, 5G Agencies, Aim,Goal,Technologies& Spectrum.			2	0	2
9	Modulation and demodulation scheme of LTE(QPSK and QAM Technology), BER Analysis of LTE,	CRT		2	3	5
10	Video over Wireless: Video compression basics	CRT+ PRACTICE	PPT(MATLAB)	1	3	4
11	Video coding standards.			1	3	4
12	Content analysis for communication: Low level feature extraction,			1	3	4
13	Image segmentation			1	3	4
14	Video object segmentation.			1	3	4
	MODULE-2					
15	Network planning, Frequency planning; Modes, TDD mode, FDD mode, FDD planning TDD planning concept, TDD bands.	PRACTICE	TEMS Software	2	3	5
16	Coverage planning, LTE Capacity planning; Capacity, aim of capacity planning,	PRACTICE	TEMS Software	2	3	5
17	Propagation process LTE Propagation parameters,Channelmodel,Values for Multipath & Doppler.	CRT	PPT	4	0	4
18	Channel model, Values for Multipath & Doppler.	CRT	PPT	2	0	2
	MODULE-3					
19	LTE propagation model: Free space model, Cost 231 Hata model.	CRT	PPT	4	0	4
20	LTE Propagation losses: LTE Propagation losses, Penetration loss, Propagation parameters.	CRT	PPT, TEMS Software	2	6	8

21	LTE guard band analysis and Guard band requirements.	PRACTICE	PPT, TEMS Software	2	3	5
22	LTE Link budget; DL link budget, UL link budget.	CRT	PPT	2	0	2
23	LTE cell edge rate planning; LTE cell edge rate planning, Cell edge rate, Interference margin, System reliability.	RRACTICE	TEMS Software	1	6	7
24	LTE Link budget; DL link budget, UL link budget.	CRT	PPT	2	0	2
25	LTE guard band analysis and Guard band requirements.	RRACTICE	TEMS Software	0	3	3
			TOTAL	42	42	84

Cell Site, BTS Operation & Maintenance

Code	Subject	Type of course	T-P-P
DMEC0232	Cell Site, BTS Operation & Maintenance	Practice	0-2-0

Course Objectives:

Objectives of this course are

1. The person should be able to understand details about Telecom mobile towers; maintain tower sites & repair faults/issues, which are live 24x7 Hrs.
2. Site technician/engineer should be allotting always to recovery the fault as well as reporting to the site supervisor/control room frequently. Individual also needs to travel inter-state and work during odd hours, when required.

Course Outcomes:

On successful completion of this course student should be able to

1. Maintain site hygiene of AC, DG, PIU, LCU, CPU, SMPS and battery bank, as per organization's norms.
2. Adhere and conduct site PM (preventive maintenance) & Task Reporting planes, as per organization's norms.

MODULE I:

The Wireless Communication Concept and Mobile Tower Elements:

Cellular concept (GSM/CDMA/LTE), Types and height of different Towers, antennas used and need of Mobile tower. Basic concept on mains (AC), DG, Battery bank, Solar supply system to a cell site,

MODULE II:**Equipment used in the Shelter (Only PIU, LCU, CPU, FCU):**

Power Interface Unit (PIU) indoor & outdoor; Block diagram & working Principle of PIU, Components of PIU, Physical wiring diagram, Power flow of PIU, Function test of PIU,

Line Conditioning Unit (LCU): Working Principle of LCU, Components of LCU, Physical wiring diagram, Power flow of LCU, Function test of LCU, Fault finding within LCU.

Power Interface Unit(PIU): Working principle of PIU, Components, current flow and fault finding of PIU.

Free Cooling Unit (FCU):Working Principle of FCU, Components and fault finding of FCU.

MODULE III:**(Preventive Maintenance (PM), Task Reporting, Site management& BTS:**

Adhere and Ensure PM activities plan at the tower site, conduct & fill the site PM, Operational maintenance of the site; Basic functioning of alarm box and the interface, identify the reasons for site lock.

BTS/RBS hardware (both indoor & outdoor), node B (in 3G Networks), concept on TRX, PA, Combiner, Multiplexer, Antenna, Control function, &Baseband receiver unit (BBxx).

Text book:

1. "Telecom Tower Maintenance" Vol. 1, Navkar Center for Skills, 2014.

Pedagogy

S. No.	Topic	Teaching Method	Reference/Tool	Theory	Practice	Total
	MODULE-1					
1	Cellular concept (GSM/CDMA/LTE)	CRT,	PPT,	2	0	2
2	Types and height of different Towers, antennas, need of Mobile tower.	CRT ,Lab Practice	PPT	1	3	4
3	Basic concept on mains (AC), DG, Battery bank, Solar supply system to a cell site,	CRT ,Lab Practice	PIU	1	3	4
	MODULE-2			4		
5	PIU indoor & outdoor; Block diagram & working Principle of PIU, Components of PIU	CRT ,Lab Practice	PIU	1	3	4
6	Physical wiring diagram, Power flow of PIU, Function test of PIU	Lab Practice	PIU	0	3	3
9	Line Conditioning Unit (LCU); Working Principle of LCU, Components of LCU, Physical wiring diagram, Power flow of	Lab Practice	LCU	0	3	3

	LCU					
10	Function test of LCU, Fault finding within LCU.	CRT ,Lab Practice	LCU	1	3	4
11	Working principle of PIU, Components, current flow and fault finding of PIU.	CRT ,Lab Practice	PIU	1	3	4
12	Free Cooling Unit (FCU); Working Principle of FCU, Components and fault finding of FCU.	CRT ,Lab Practice	FCU	1	3	4
	MODULE-3			4		
13	Adhere and Ensure PM activities plan at the tower site, conduct & fill the site PM, Perform unique site down PM,	CRT ,Lab Practice	Expt. On site visit	1	0	1
14	Operational maintenance of the site; Basic functioning of alarm box and the interface,	CRT ,Lab Practice	Expt. On site visit	1	3	4
15	BTS/RBS hardware (both indoor & outdoor), node B (in 3G Networks), concept on TRX, PA, Combiner, Multiplexer, Antenna, Control function, & Baseband receiver unit (BBxx).	Lab Practice	Expt. On site visit	2	3	5
			TOTAL	12	30	42

RF Planning and Drive Test

Code	Subject	Type of course	T-P-P
DMEC0233	RF Planning and Drive Test	Practice	0-2-0

Course Objective:

Objective of this subject are:

1. The main focus of the subject is how to improve, optimize and maintain network performances.
2. The course explains network possible problems that may arise on the radio and BSS and the core network side.
3. It discusses how to detect problems and proposes solutions.
4. At the end of this course, students will be able to measure the signal strength, conversant with LTE networks and drive test tools.

Course Outcomes:

On completion of this course students should be able to

- 1.RF Planning at cell site.
- 2.Hands on practice on GSM RF Planning tool.
- 3.Use of mapping software's like Map info/Google KLM.
- 4.Use of drive test tool TEMS for 3G, 4G optimization with field exposure.
- 5.Use of NEMO TOOL for 4G LTE optimization with field exposure.

MODULE-1

RF Planning

RF Propagation path loss, different industry used propagation models ,GSM RF Planning Tool, RF link budget, GSM RF Planning Tool practicing: RF Survey, Frequency Planning, Coverage Planning, and Reports & Analysis.

RF Optimization

Use of mapping software's like Map info/Google KLM, use of wireless network coverage optimization using drive test tool TEMS, Pre optimization Site Audit.GSM RF Optimization &Study of drive key RF parameters, GSM RF Drive Test Tool – TEMS, Overview, Drive test practice using TEMS, RF Optimization and Post Processing Tools.

MODULE-2

3G Optimization

Introduction to 3G networks, 3G Network Architecture, WCDMA Concepts, WCDMA Drive test and optimization. IRAT Handover.3G Drive KPI analysis. Network Performance indicator analysis.

MODULE-3

4G Optimization

Drive test of LTE network using NEMO, LTE Propagation model (cost 231, Okumura Hata model, space propagation model) and Propagation loss analysis, Parameter analysis of LTE Networks.

Text-Book:

1. Advanced cellular network planning and optimization 2G/2.5G/3G. evolution to 4G , Author: Ajay R Mishra, Nokia Networks, John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England

Reference Books:

1. Radio Network Planning and Optimisation for UMTS, Second Edition, JaanaLaiho and AchimWacker, Nokia Group, Finland, Toma´s Novosad,Nokia Networks, Nokia Group, USA, John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England
2. Material: E1-E2 Up gradation Course –Consumer Mobility, RF Planning and Drive Test
3. Material: GTL,RF Optimization

Pedagogy

S. No.	Topic	Teaching Method	Refere nce/To ol	Theor y	Practic e	Total
MODULE-1						
1	RF Planning: RF Propagation path loss, different industry used propagation models	CRT,	PPT,	2	0	2
2	GSM RF Planning Tool	Lab Practice	TEMS Softwa	0	2	2

			re			
3	RF link budget	CRT,	PPT	2	0	2
4	GSM RF Planning Tool practicing: RF Survey	Lab Practice	TEMS Software	0	2	2
5	Frequency Planning, Coverage Planning, and Reports & Analysis	CRT,	PPT	1	0	1
6	Use of mapping software like Map info/Google KLM, use of wireless network coverage optimization using drive test tool TEMS	Lab Practice	Map info/Google KLM	0	2	2
7	GSM RF Drive Test Tool – TEMS, Overview, Drive test practice using TEMS, RF Optimization and Post Processing Tools.	Lab Practice	TEMS Software	0	3	3
	MODULE-2					
8	Introduction to 3G networks, 3G Network Architecture	CRT,	PPT	1	0	1
9	WCDMA Drive test and optimization. Network	Lab Practice	WCDMA tool	1	3	4
10	IRAT Handover.3G Drive KPI analysis.	CRT, Lecture, Practice	PPT, ,KPI tool	1	3	4
11	Performance indicator analysis..	Lab Practice	KPI tool	1	3	4
	MODULE-3					
12	Drive test of LTE network using NEMO.	CRT, Lab Practice	PPT,NEMO Tool	0	3	3
13	Parameter analysis of LTE Networks.	CRT, , Lecture, Practice	PPT ,NEMO Tool	1	3	4
14	LTE Propagation model(cost 231, Okumura Hata model, space propagation model)	CRT, , Lecture, Practice	PPT ,NEMO Tool	1	3	4
15	Propagation loss analysis, Parameter analysis of LTE Networks.	CRT, , Lecture, Practice	PPT ,NEMO Tool	1	3	4

		Total		12	30	42