SRM
UNIVERSITY
(Under section 3 of UGC Act 1956)

M.Tech. (Full Time) - TELECOMMUNICATION NETWORKS
CURRICULUM & SYLLABUS
2015 – 2016

FACULTY OF ENGINEERING AND TECHNOLOGY
SRM UNIVERSITY
SRM NAGAR, KATTANKULATHUR – 603 203

Course Code	Course Name	L	T	P	C
SEMESTER I					
TN2001	Digital Communication Systems	3	0	2	4
TN2002	High Performance Data Networks	3	0	2	4
TN2003	Cryptography and Wireless Network Security	3	2	0	4
CAC2001	Career Advancement Course For Engineers - I	1	0	1	1
	Supportive Course	3	0	0	3
	Program Elective - I	3	0	0	3
	Program Elective – II	3	0	0	3
Total		19	2	5	22
Total Contact Hours		26			
SEMESTER II					
TN2004	RF System Engineering	3	0	2	4
TN2005	Network Routing Algorithms	3	2	0	4
TN2006	Wireless and Mobile Network Architectures	3	2	0	4
TN2007	(OR) Wireless IP Communication Networks	3	2	0	4
CAC2002	Career Advancement Course For Engineers - II	1	0	1	1
	Program Elective –III	3	0	0	3
	Program Elective- IV	3	0	0	3
Total		16	4	3	19
Total Contact Hours		23			
SEMESTER III					
	Program Elective- V	3	0	0	3
	Program Elective- VI	3	0	0	3
	Interdisciplinary Elective	3	0	0	3
TN2047	Seminar	0	0	1	1
TN2048	Industrial Training	0	0	1	1
TN2049	Project work Phase I	0	0	12	6
CAC2003	Career Advancement Course For Engineers - III	1	0	1	1
Total		10	0	15	18
Total Contact Hours		23			
SEMESTER IV					
TN2050	Project work Phase II	0	0	32	16
Total		0	0	32	16
Total Contact Hours		32			

Total credits to be earned for the award of M.Tech degree – 75

CONTACT HOUR/CREDIT:
L: Lecture Hours per week T:Tutorial Hours per week
P:Practical Hours per week C:Credit

PROGRAM ELECTIVES

Course Code	Name of the course	L	T	P	C
TN2101	Multicarrier and Spread Spectrum Systems	3	0	0	3
TN2102	AdHoc Wireless Networks	3	0	0	3
TN2103	Wireless Broadband Networks	3	0	0	3
TN2104	Wireless Local And Personal Area Networks	3	0	0	3
TN2105	Architectures and Protocols for Wireless Sensor Networks	3	0	0	3
TN2106	Cooperative Communications	3	0	0	3
TN2107	Radio Network Planning and Optimization	3	0	0	3
TN2108	MIMO- OFDM Communication Networks	3	0	0	3
TN2109	Cognitive Wireless Networks	3	0	0	3
TN2110	TCP/IP Principles, Protocols and Architecture	3	0	0	3
TN2111	Antenna Array Engineering	3	0	0	3
TN2112	Millimeter Wave Communication Networks	3	0	0	3
TN2113	Wireless Body Area Networks	3	0	0	3
TN2114	Telecom Billing and Revenue Management	3	0	0	3
TN2115	Telecom Network Management	3	0	0	3

SUPPORTIVE COURSES

Course Code	Name of the course	L	T	P	C
MA2010	Graph Theory and Optimization Techniques	3	0	0	3
MA2017	Random Process and Statistical Methods	3	0	0	3

Sl. No.	Category	Credits				
		I Semester	II Semester	III Semester	IV Semester	Category Total
1.	Core courses	12	12	---	---	24
2.	Program Elective courses	6	6	6	---	18
3.	Interdisciplinary elective courses	--	--	3		3
4.	Supportive courses - mandatory	3	---	--	---	3
5.	Seminar	---	---	1	---	1
6.	Industrial Training (during summer vacation between II and III semesters)	--	--	1	--	1
7.	Career Advancement Courses	1	1	1	-	3
8.	Project work	---	---	06	16	22
Total						75

SEMESTER I

TN2001	DIGITAL COMMUNICATION SYSTEMS	L	T	P	C
	Total contact hours -75	3	0	2	4
	Prerequisite				
	Nil				

PURPOSE	
This course discusses the principles that underline the analysis and design of digital communication systems.	
INSTRUCTIONAL OBJECTIVES	
1.	Understand basic components of digital communication systems.
2.	To design optimum receivers for digital modulation techniques
3.	To analyze the error performance of digital modulation techniques.

UNIT I - CHARACTERIZATION OF COMMUNICATION SIGNALS AND SYSTEMS (9 hours)

Signal space representation of waveforms, Digital modulation schemes: PAM, QAM, CPFSK, CPM, Power spectrum of digitally modulated signals.

UNIT II - DESIGN OF OPTIMUM RECEIVERS (9hours)

Signal design for band-limited channels, Optimum receivers for channels with ISI and AWGN: ML and MLSE receivers.

UNIT III - CARRIER AND SYMBOL SYNCHRONIZATION (9 hours)

Carrier and symbol synchronization, carrier phase estimation: Decision directed loops, symbol timing estimation: Types of symbol timing estimation

UNIT IV - EQUALIZATION (9 hours)

Linear Equalization: MSE Criterion, Decision Feedback equalizers, Adaptive equalization: Zero-forcing algorithm, LMS algorithm, Adaptive decision-feedback equalizer.

UNIT V - DIGITAL COMMUNICATION THROUGH FADING MULTIPATH CHANNEL (9 hours)

Characterization of fading multipath channels, Diversity techniques for fading multipath channels, Trellis coded modulation for fading channels.Channel models for multiple antenna systems, capacity of MIMO channels

LIST OF EXPERIMENTS (30 hours)

1. QPSK with Rayleigh fading & AWGN.
2. M-ary QAM with AWGN fading.
3. BER For BPSK Modulation With ZFE Equalizer In 3 Tap ISI Channel.
4. BER for BPSK modulation with Minimum Mean Square Error (MMSE) equalization in 3 tap ISI channel.
5. Comparative analysis of BER for BPSK modulation in 3 tap ISI channel with ZFE and MMSE Equalization.
6. Lease Mean Square (LMS) Algorithm
7. Comparative Analysis of Different Modulation Techniques.
8. Performance Analysis of Various Channel Characteristics.
9. Analysis of Coded Modulation Techniques.
10. Study of 2 x 2 MIMO Antenna Systems.

REFERENCES

1. John. G, Proakis, MasoudSalehi "*Digital Communications*", McGraw Hill, 5e, 2008.
2. Bernard Sklar, Pabitra Kumar Ray, *"Digital Communications – Fundamentals and Applications"*, Pearson Publications, 2e, 2001.
3. Rodger. E, Ziemer, Roger. W, Peterson, *"Introduction to Digital Communication"*, Prentice Hall, 2e, 2001.
4. Bernard Sklar, *"Digital Communications"*, Pearson Education,2e, 2003.
5. Edward .A, Lee, David G. Messerschmitt and John R. Barry, *"Digital Communication",*Springer, 3e, 2003.

TN2002	HIGH PERFORMANCE DATA NETWORKS	L	T	P	C
	Total contact hours –75	3	0	2	4
	Prerequisite				
	Nil				

PURPOSE

To know the evolution of data communication and networking paradigms, to describe OSI and IP protocol suite, and to introduce different LAN technologies, to explain the overview of ATM networks, To introduce the concept of optical networks .

INSTRUCTIONAL OBJECTIVES

1.	To analyze the Categories and topologies of networks (LAN ,and WAN) Layered architecture OSI and TCP/IP) and protocol suites
2.	Ability to understand the Channel error detection and correction mechanism, MAC protocols, Ethernet and WLAN
3.	Understand the Backbone and Trunking Technologies(ATM,SDH,SONET)

UNIT I - NETWORK SERVICES AND LAYERED ARCHITECTURE (9 hours)

Networking principle, Network service, network elements, Basic Networks mechanism: Multiplexing, Switching, Error control, Flow control, Congestion Control, Resource Allocation, Layered Architecture: Layers, Implementation of Layers.

UNIT II - PACKET SWITCHED NETWORK (9 hours)

OSI and IP Model. Ethernet (IEEE 802.3): Physical Layer, MAC, LLC and Token ring (IEEE 802.5): Physical layer, MAC. LLC, FDDI, DQDB, SMDS, Internetworking with SMDS.

UNIT III - ASYNCHRONOUS TRANSFER MODE (9 hours)

ATM Overview, ATM protocol architecture, Detail functionality of ATM layer: ATM header structure, addressing, signaling, routing, ATM adaptation layer (need different types and comparison). ATM service categories, ATM QOS parameters, Classical IP over ATM.

UNIT IV - WIRELESS NETWORKS (9 hours)

Wireless Networks: Wireless Channel: Path loss, Shadow fading, Multipath flat fading, Intersymbol Interference, Doppler frequency shift, Capacity limits of wireless channels,Link level design, channel access, network design

UNIT V - OPTICAL NETWORKS (9 hours)

Optical link: Transmitter, Receiver, fiber, subcarrier multiplexing, WDM systems, Optical Cross-Connects, Optical LANs: single hop LAN, Multi hop LAN, SONET/SDH: Layers, Frame Structure, SONET Multiplexing, SONET Networks.

LIST OF EXPERIMENTS (30 hours)

1. Packet Transmission in Data Link Layer
2. Stop & Wait Protocol
3. Sliding Window Protocol
4. Sliding Window Protocol – Selective Repeat
5. Carrier Sense Multiple Access in Medium Access Control
6. CSMA with Collision Detection (CSMA / CD)
7. Token Ring
8. CSMA with Collision Avoidance
9. Distance Vector Routing Protocol in Network Layer
10. Link State Routing Protocol

REFERENCES

1. Jean Walrand&PravinVaria, "*High Performance Communication Networks*", 2nd edition, 2009.
2. Behrouz .A, Forouzan ,"*Data Communication and Networking*", Tata McGraw-Hill,2008
3. William Stallings ,"*ISDN and Broad band ISDN with Frame Relay and ATM*", 4th edition (Pearson Education),2009.
4. SumitKasera and PankajSethi, "*ATM Networks Concept and Protocol*", Tata McGraw Hill Publication, 2006.
5. Rajiv Ramaswami,Kumar N. "*Optical Networks*", Morgan Kaufmann Publishers 2nd Edition, 2008.

TN2003	CRYPTOGRAPHY AND WIRELESS NETWORK SECURITY	L	T	P	C
	Total contact hours –75	3	2	0	4
	Prerequisite				
	Nil				

PURPOSE

The main purpose of this course is to introduce to students to the emerging areas of Wireless Network security. This will enable the students to acquire a solid understanding of different components involved in the Wireless Network security techniques and different ways of distributing the multimedia data.

INSTRUCTIONAL OBJECTIVE

1.	The Students will be enabled to understand and acquire knowledge in security mechanism of wireless systems/ networks.
2.	To emphasis on knowledge-building to solve problems in communication systems.
3.	To provide a complete understanding on concepts, to identify how the algorithm is designed to provide security, as well as what are its pros and cons.

UNIT I - INTRODUCTION TO CRYPTOSYSTEMS (15 hours)

Security Services, Mechanisms and Attacks, Network Security Model, Classical Encryption Techniques, Steganography, Data Encryption Standard (DES),

UNIT II - PUBLIC-KEY CRYPTOSYSTEM (15 hours)

Public Key Crypto System – Principles- RSA Algorithm. Key Management, Diffie-Hellman Key Exchange. Message Authentication and Hash Functions. Digital Signature, Digital Signature Standard.

UNIT III - NETWORK SECURITY APPLICATION (15 hours)

Kerberos, X.509 Authentication Service, Electronic Mail Security - PGP, IPSec, Web Security Considerations – SSL and TLS, SET

System Security: Intruders, Intruder detection, Viruses and Related Threats, Firewalls – Design Principles, Trusted Systems.

UNIT V - WLAN/ WPAN (15 hours)

Security in Wireless Environment: Mobile Network Environment, Limitations, Attacks and security issues in mobile environment. WLAN: IEEE802.11 Architecture, Wireless LAN Components, Security of 802.11 Wireless LANs, Security Requirements and Threats, Risk Mitigation, Emerging Security Standards and Technologies. WPAN: Bluetooth Overview, Security of Bluetooth, Security Requirements and Threats, Risk Mitigation.Wireless Handheld Device: Overview, Benefits, Security Requirements and Threats, Counter measures.

UNIT V - SECURITY IN 2G, 3G AND 4G SYSTEMS (15 hours)

Security in 2G Systems: GSM Overview, Architecture, GSM Security, I-Mode. Security in 3G & 4G Systems:3G Wireless Communication systems, 3GPP Objectives, 3G Security Architecture, Authentication and Key Agreement in 3GPP, Confidentiality and Data Integrity, $G Communication Systems.

REFERENCES

1. William Stallings, *"Cryptography and Network Security",* 8th Edition, Pearson Education, 2009.
2. Hideki Imai, Mohammad GhulamRahman and KazukuniKobara, *"Wireless Communication s Security"*, Artech House Universal Personal Communication, 2006.
3. Tom Karygiannis, Les Owens,*"Wireless Network Security 802.11, Bluetooth and Handheld Devices"*, National Institute of Standards and Technology, US Dept. of CommerceSpecial Publication 800-48, 2002.
4. AtulKahate, " *Cryptography and Network Security"*, Tata McGraw Hill, 2006.
5. B.A. Forouzan, *"Cryptography & Network Security",* Tata McGrawHill, 2007.

SEMESTER II

TN2004	RF SYSTEM ENGINEERING	L	T	P	C
	Total contact hours – 75	3	0	2	4
	Prerequisite				
	Nil				

PURPOSE

The course presents RF system design techniques with a focus on radio frequency circuit design. The course aims to develop the skills required to design and simulate RF circuits for communication systems Also develop theability to recognize when RF design techniques are required and the skills to implement them

INSTRUCTIONAL OBJECTIVES

1.	Demonstrate a systematic understanding of the challenges relating to RF circuit design and be able to critically evaluate RF implementation techniques
2.	Demonstrate an understanding of Radio frequency devices (Passive and Active)
3.	Apply mathematical and software skills to design and simulate RF system building blocks and analyze their performance.
4.	Analyze the effect of high frequencies on RF circuits

UNIT I - INTRODUCTION TO RF DESIGN (9 hours)

RF behaviour of passive components, Chip components and circuit board considerations. Units in RF Design, Effects of Non linearity: Harmonic distortion, Gain compression, Intermodulation distortion, Cascaded Nonlinear stages, Device noise, Representation of noise in RF circuits, Sensitivity and dynamic range. Smith chart, Impedance and admittance transformation, Parallel and series connection of networks, ABCD and scattering parameters.

UNIT II - RF FILTERS AND MATCHING (9 hours)

RF filter – Basic resonator and filter configurations – Butterworth and Chebyshev filters. Filter design using low pass prototype -Implementation of microstrip filter. coupled filters. Impedance matching using discrete components.Microstrip line matching networks.

UNIT III - ACTIVE RF COMPONENTS AND MODELLING (9 hours)

IMPATT diode, PIN diode, Schottky diode - Bipolar junction transistor –RF MESFET- High electron mobility transistors-Transistor models (Large signal and small signal BJT and FET models)-Scattering parameter device characterization.

UNIT IV - RF AMPLIFIERS (9 hours)

Amplifier classes of operation and biasing networks - characteristics of amplifiers- amplifier power relations- Stability circle and conditional stability, Simultaneous conjugate matching for unconditionally stable transistors- Stability testing of RF amplifiers - broadband amplifiers, high power amplifiers, multistage amplifiers.

UNIT V - RF OSCILLATORS AND SYSTEM DESIGN (9 hours)

Basic oscillator model- Feedback oscillators- Crystal oscillator -Dielectric Resonance Oscillator –YIG tuned oscillators -Basic characteristics of mixer- Balanced Mixer - Transceiver System Design Example.

LIST OF EXPERIMENTS (30 hours)

1. Design and simulation of a Low Pass Prototype (LPP) microwave filter
2. DC Sweep Analysis on a BJT
3. Small Signal AC Analysis on a BJT circuit.
4. S-Parameter Measurement on BJT Circuit
5. Design and simulation of impedance matching/transformation using lumped elements
6. Design and simulation of a Class A Power Amplifier Using the Load-Pull Method
7. Harmonic Balance Simulation for Large Signal Steady State AC Simulation
8. Stability Testing of RF Amplifiers
9. Basic Circuit Envelope Simulation with Single Source
10. Design and simulation of a Single Ended UHF Mixer

REFERENCES

1. Reinhold Ludwig, Gene Bogdanov, *"RF circuit design: Theory andApplications"* Prentice Hall, 2e, 2009.
2. BehzadRazavi, *"RF Microelectronics"* , Prentice Hall ,2012.
3. William F Egan, *"Practical RF system design"*, John Wiley and Sons, 2003.

TN2005	NETWORK ROUTING ALGORITHMS	L	T	P	C
	Total contact hours -75	3	2	0	4
	Prerequisite				
	Nil				

PURPOSE

The main purpose of this course is to explore the functionalities of network routing algorithms.

INSTRUCTIONAL OBJECTIVES

1.	To understand the basics of Routing concepts.
2.	To gain knowledge on the various router architectures and understand the various routing algorithms.

UNIT I - NETWORK ROUTING (15 hours)

Network Routing - An Introduction, Basics and Foundation, Shortest path and Widest Path, Framework and Principles, Network Flow Modeling.

UNIT II - ROUTING IN IP NETWORKS (15 hours)

Routing IP Networks-IP Routing and Distance vector routing Protocol family, OSPF and Integrated IS-IS, IP traffic Engineering, BGP, Internet Routing Architectures..

UNIT III - ROUTING IN PSTN (15 hours)

Routing in the PSTN- Hierarchical and Dynamic Call routing, Traffic engineering, SS7, PSTN architecture and routing.

UNIT IV- ROUTER ARCHITECTURES (15 hours)

Router Architectures-IP address Look-Up Algorithms, IP Packet Filtering and Classification.

UNIT V - TOWARDS NEXT GENERATION ROUTING (15 hours)

Towards Next Generation - QoS routing, MPLS and GMPLS, Routing and Traffic Engineering with MPLS, VoIP Routing, Interoperability through IP and PSTN.

REFERENCES

1. DeepankarMedhi and KarthikeyanRamasamy, "*Network Routing: Algorithms, Protocols, and Architectures*", Elsevier, 2007.
2. Martha SteenStrup, "*Routing in Communication Networks*", Prentice Hall, 1995.
3. William Stallings, "*Data and Computer Communications*", Pearson Education, 2006.

TN2006	WIRELESS AND MOBILE NETWORK ARCHITECTURES	L	T	P	C
	Total contact hours -75	3	2	0	4
	Prerequisite				

	Nil				
PURPOSE					
To introduce to the fundamental techniques and architectures of cellularnetworks and ad- hoc networks. This course examines the characterizing aspects of these wireless architectures and introduces to related problems and solutions.					
INSTRUCTIONAL OBJECTIVES					
1.	To understand the architecture of existing Mobile and Wireless networks.				
2.	To analyze the various architecture and protocols of typical Communications Networks				

UNIT I - CELLULAR MOBILE WIRELESS NETWORKS (15 hours)

Systems and Design Fundamentals, Propagation Models Description of cellular system, Frequency Reuse, Co-channel and Adjacent channel interference, Propagation Models for Wireless Networks, Multipath Effects in Mobile Communication, Models for Multipath Reception

UNIT II - GSM: ARCHITECTURE AND PROTOCOLS (15 hours)

Air Interface, GSM Multiple Access Scheme, GSM Channel Organization, Traffic Channel multiframe, Control (Signaling) Channel Multiframe, Frames, Multi-frames, Super-frames and Hyper-frames, GSM Call Set up Procedure, GSM Protocols andSignaling, Location Update Procedure, Routing of a call to a Mobile Subscriber.

2.5G Networks - The General Packet Radio Services: (GPRS) GPRS Networks Architecture, GPRS Interfaces and Reference Points, GPRS Logical Channel, GPRS Mobility Management Procedures, GPRS Attachment and Detachment Procedures, Session Management and PDP Context, Data Transfer Through GPRS Network and Rout, GPRS Location Management Procedures, GPRS Roaming, The IP Internetworking Model, GPRS Interfaces and Related Protocols, GPRS Applications

UNIT III - OVERVIEW OF CDMA SYSTEMS: IS-95 NETWORKS (15 hours)

3G – The Universal Mobile Telecommunication System (UMTS) - UMTS Network Architecture –Release 99, UMTS Interfaces, UMTS Network Evolution UMTS Release 5, UMTS FDD and TDD, UMTS Channels, Logical Channels, UMTSdownlink transport and physical channels, UMTS uplink transport and physical channels UMTS Time Slots, UMTS Network Protocol Architecture, Mobility Management for UMTS Network

UNIT IV - CELLULAR AND WLAN INTEGRATION (15 hours)

Heterogeneous Network Architecture, Step towards 4G Networks - Why Integration, Benefits of Integration, internetworking Network Architecture: Point of Integration, Overview of UMTS Network, IEEE 802.11 Overview Integration Architecture: Tight Coupling Integration, Loose Coupling Integration, Handoff in integrated network architecture

UNIT V - MOBILITY MANAGEMENT ISSUES (15 hours)

Role of IP on Wireless Networks - IP for GPRS and UMTS R99, Protocol Reference Model for UMTS PS domain, Packet- Switched Domain Protocol Stacks: Role of Interfaces; Packet routing and transport of user data in UMTS network, Configuring PDP Addresses on Mobile Stations, Mobility Management in Wireless Networks, Mobility Classification, Seamless Terminal Mobility Management, Limitations of current TCP/IP networks for mobility support, Mobility solution, Accessing External PDN through GPRS/UMTS PS Domain; Transparent Access, Use of Mobile IP Access.

REFERENCES

1. Gordan. L, Stuber, "*Principles of Mobile Communication*", Springer, 2011.
2. William Stallings, "*Wireless Communication & Networking*", Pearson Education Asia, 2010
3. Rappaport T.S, "*Wireless Communications; Principles and Practice*", Pearson Education, 2010
4. Pahlavan . K and. Krishnamurthy. P *"Networking Fundamentals: Wide, Local and Personal Area Communications*", Wiley, 2009.
5. Stallings. W *"Data and Computer Communications"* (8th Ed), Prentice Hall, 2007.
6. William. C.Y, Lee, *'"Wireless and Cellular Communication",* McGraw Hill, 3e, 2006.
7. Tanenbaum. S *"Computer Networks*", Prentice Hall, 4e, 2003

TN2007	WIRELESS IP COMMUNICATION NETWORKS	L	T	P	C
	Total contact hours -75	3	2	0	4
	Prerequisite				
	Nil				

PURPOSE

To expose the students the fundamental concepts of IP based Wireless Communication Systems/Networks. It provides a brief introduction on the research area of 4G communication systems.

INSTRUCTIONAL OBJECTIVE

1.	The Students will be enabled to understand and acquire knowledge in wireless IP / 4G networks.
2.	To emphasis on knowledge-building to solve problems.
3.	To provide a complete understanding on concepts, to identify the pros and cons of designing a IP based secured wireless networks.

UNIT I - WIRELESS IP EVOLUTION (15 hours)

Introduction to Wireless IP –Challenges for Heterogeneous Environment, Evolution to Wireless IP. Wireless IP Communications with GPRS – GPRS Overview, Attach Procedure, Mobility Handling. UTRAN - Evolution to All-IPArchitecture .4G IP-Based Mobile Networks. Ad Hoc Networks- Mobile IPv6.

UNIT II - QOS AND RESOURCE MANAGEMENT (15 hours)

Integrated Services for IP Applications over UMTS Access Networks – All-IP End – to – End Scenarios, UMTS Service Classes and Parameters.QoS Support for VoIP over Wireless. Radio Access Control in Wireless IP Networks, RRM in Multicarrier Allocation –Based Systems.

UNIT III - TCP/ IP IN WIRELESS IP NETWORKS (15 hours)

Performance of TCP/IP over Next Generation Broadband Wireless Access Networks. Reliable Multicast Congestion Control for TCP/IP in Heterogeneous (Wired/Wireless/Mobile) Networks.

UNIT IV - HANDOFF, MOBILITY AND SIGNALING (15 hours)

Mobile IP, Handoff Initiation in Mobile IPv6.IP Micro-Mobility Management Using Host Based Routing. Distributed Signaling and Routing Protocols in Integrated Cellular and Ad-Hoc Relay (iCAR) System. Reducing Link and Signaling Costs in Mobile IP.

UNIT V - SERVICES AND APPLICATIONS (15 hours)

Mobile Content Distribution for Wireless IP Wireless IP Networks: A QoS Perspective. Video Transcoding for Mobile Internet Access. IP Telephony. On Security in Wireless IP Networks.

REFERENCES

1. Sudhir Dixit and Ramjee Prasad, "*Wireless IP and Building the Mobile Internet*", Artech House, 2003.
2. Abbas Jamalipour, "*The Wireless Mobile Internet: Architectures, Protocols, and Services*", John Wiley & Sons, 2003.
3. Jyh-Cheng Chen and Tao Zhang, "*IP-Based Next-Generation Wireless Networks : Systems, Architectures and Protocols*", John Wiley & Sons, 2004.

TN2047	Seminar	L	T	P	C
		0	0	1	1
PURPOSE					
To train the students in preparing and presenting technical topics.					
INSTRUCTIONAL OBJECTIVE					
The student shall be capable of identifying topics of interest related to the program of study and prepare and make presentation before an enlightened audience.					

The students are expected to give at least two presentations on their topics of interest which will be assessed by a committee constituted for this purpose. This course is mandatory and a student has to pass the course to become eligible for the award of degree. Marks will be awarded out of 100 and appropriate grades assigned as per the regulations

TN2048	INDUSTRIAL TRAINING (Training to be undergone after II semester)	0	0	1	1
	3 week practical training in industry				
	Prerequisite				
	Nil				
PURPOSE					
To provide practical exposure in Telecommunication Networks related organizations.					
INSTRUCTIONAL OBJECTIVES					
1.	Students have to undergo three – week practical training in Telecommunication Networks related organizations so that they become aware of the practical applications of theoretical concepts studied in the class rooms.				

Students have to undergo three-week practical training in Telecommunication Networks related organizations of their choice but with the approval of the department. At the end of the training student will submit a report as per the prescribed format to the department.

Assessment process

This course is mandatory and a student has to pass the course to become eligible for the award of degree. The student shall make a presentation before a committee constituted by the department which will assess the student based on the report submitted and the presentation made. Marks will be awarded out of 100 and appropriate grades assigned as per the regulations.

TN2049	PROJECT WORK PHASE I (III semester)	L	T	P	C
		0	0	12	6
TN2050	PROJECT WORK PHASE II (IV semester)	0	0	32	16
PURPOSE					
To undertake research in an area related to the program of study					
INSTRUCTIONAL OBJECTIVE					
The student shall be capable of identifying a problem related to the program of study and carry out wholesome research on it leading to findings which will facilitate development of a new/improved product, process for the benefit of the society.					

M.Tech projects should be socially relevant and research oriented ones. Each student is expected to do an individual project. The project work is carried out in two phases – Phase I in III semester and Phase II in IV semester. Phase II of the project work shall be in continuation of Phase I only. At the completion of a project the student will submit a project report, which will be evaluated (end semester assessment) by duly appointed examiner(s). This evaluation will be based on the project report and a viva voce examination on the project. The method of assessment for both Phase I and Phase II is shown in the following table:

Assessment	Tool	Weightage
In- semester	I review	10%
	II review	15%
	III review	35%
End semester	Final viva voce examination	40%

Student will be allowed to appear in the final viva voce examination only if he / she has submitted his / her project work in the form of paper for presentation / publication in a conference / journal and produced the proof of acknowledgement of receipt of paper from the organizers / publishers.

PROGRAM ELECTIVES

TN2101	MULTICARRIER AND SPREAD SPECTRUM SYSTEMS	L	T	P	C
	Total contact hours -45	3	0	0	3
	Prerequisite				

	Nil				

PURPOSE
To describe and analyze the basic concepts of multi-carrier OFDM transmission and its combination with spread spectrum (MC-CDMA).

INSTRUCTIONAL OBJECTIVES	
1.	To understand and gain complete knowledge about different types of Multicarrier Spread Spectrum and their Commercial Applications.
2.	To learn about multicarrier Techniques-Orthogonal Frequency Division Multiplexing, MC-CDMA and MC-DS-CDMA

UNIT I - INTRODUCTION (9 hours)

Introduction to Spread Spectrum, Direct Sequence Code Division Multiple Access, Advantages and Drawbacks of DS-CDMA, Applications of Spread Spectrum. Multi-Carrier Spread Spectrum - Principle of Various Schemes, Advantages and Drawbacks Examples of Future Application Areas.

UNIT II - MULTICARRIER SPREAD SPECTRUM (9 hours)

MC-CDMA - Signal Structure, Downlink Signal, Uplink Signal, Spreading Techniques, Pre-Equalization, Combined Equalization, Soft Channel Decoding, Flexibility in System Design, Performance Analysis.MC-DS-CDMA.

UNIT III - HYBRID MULTIPLE ACCESS SCHEMES (9 hours)

Multi-Carrier FDMA- Orthogonal Frequency Division Multiple Access (OFDMA), OFDMA with Code Division Multiplexing: SS-MC-MA, Distributed DFT-Spread OFDM: Interleaved FDMA (IFDMA), Localized DFT-Spread OFDM.Ultra Wideband Systems, Pseudo-Random PPM UWB Signal Generation, UWB Transmission Schemes

UNIT IV - IMPLEMENTATION ISSUES (9 hours)

Multi carrier modulation and demodulation, synchronization, channel estimation, Channel coding and decoding. Signal Constellation, Mapping, De-mapping and equalization, Adaptive technique in multi carrier transmissions, RF Issues.

UNIT V - APPLICATIONS (9 hours)

3GPP Long Term Evolution (LTE) -Requirements on LTE, Radio Access Network, Architecture, Radio Protocol Architecture, Downlink Transmission Scheme, Uplink Transmission Scheme, Performance. WiMAX - Scope, From IEEE 802.16x and ETSI BRAN HIPERMAN Towards WiMAX , System Architecture . Broadband Wireless Access Standards: HIPERMAN and IEEE 802.16x ,Transmit Diversity / MIMO in WiMAX.

REFERENCES

1. Fazel. K, Kaiser. S "*Multi Carrier and Spread Spectrum Systems*", John Wiley & Sons, 2nd edition, 2008.
2. Ramjee Prasad, "*OFDM for Wireless Communications Systems*", Artech House, 2004.
3. Richard Van Nee and Ranjee Prasad, "*OFDM for Wireless Multimedia Communication*", Artech House, 2000.
4. Rodger. E, Ziemer, Roger. W, Peterson, "*Introduction to Digital Communication*", 2e, Prentice Hall, 2001.
5. Valery. P, Ipatov, "*Spread Spectrum and CDMA Principles and Applications*", John Wiley, 2005.

TN2102	ADHOC WIRELESS NETWORKS	L	T	P	C
	Total contact hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE	
The main purpose of this course is to introduce various types of networks and provides in-depth knowledge of Ad hoc Wireless Network concepts.	
INSTRUCTIONAL OBJECTIVES	
1.	To understand and gain complete knowledge about MobileAdhoc Networks and the various protocols used in mobile Adhoc networks.
2.	To emphasis knowledge in various functional areas such as MAC Layer, Network Layer, Transport & Application Layer of Adhoc Networks
3.	To analyse and design the various routing protocols for Adhoc and Adhoc wireless networks.

UNIT I - INTRODUCTION TO ADHOC NETWORKS (9 hours)

Introduction – Cellular and AdHoc Networks - Mobile Ad hoc Networking with 4G - Application of Mobile Ad Hoc Networks - Issues in Mobile Ad Hoc networks-Ad Hoc wireless Internet- Mobile Quality of Service - QoS Parameters-Issues and Challenges in providing Mobile QoS. Mobility models – types.

UNIT II - MAC AND MACAW PROTOCOLS (9 hours)

Issues and Challenges in designing a MAC protocol for mobile ad hoc networks-Design goals of MAC protocol-Classification of MAC protocols. Contention based protocols: MACAW, Floor acquisition Multiple Access Protocols, Media access with reduced handshake protocol. Contention Based Protocols with reservation mechanisms: Distributed packet reservation multiple access protocol, collision avoidance time allocation protocol, Five Phase reservation Protocol.

UNIT III - DESIGNING ROUTING PROTOCOLS FOR ADHOC NETWORKS (9 hours)

Mobile Ad hoc networks – Routing Technology for Dynamic wireless networking - Issues in Designing a routing protocols for Ad Hoc Networks-Classification of Routing Protocols. Approaches in Mobile Adhoc Networks. Table Driven routing protocols: Destination Sequenced Distance Vector Routing Protocol-Wireless Routing Protocol-Cluster head Gateway switched routing protocol.

UNIT IV –ROUTING PROTOCOLS FOR ADHOC WIRELESS NETWORKS - ON DEMAND AND HYBRID ROUTING (9 hours)

On Demand routing protocol: Dynamic source routing protocol, AODV routing protocol, temporarily ordered routing algorithm. Hybrid routing protocols: Zone routing protocol, Zone based Hierarchical link state routing protocol.

UNIT V – TRANSPORT LAYER PROTOCOL AND QoS IN ADHOC WIRELESS NETWORKS (9 hours)

Issues in designing a transport layer protocol for mobile ad hoc networks-Design goals of transport layer- Mobile TCP over ad hoc wireless networks-Ad hoc transport protocol-Secure routing in ad hoc networks. Introduction to Mobile QoS - Classification of QoS solutions-MAC layer solutions-Network layer solutions-Mobile QoS framework for Mobile Ad hoc networks

REFERENCES

1. Sivaram Murthy. C and Manoj. B.S "*Ad Hoc Wireless Networks*", Pearson Education, Second Edition India, 2001.
2. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan Stojmenovic, "*Mobile Ad Hoc Networking*", John Wiley, 2004.
3. George Aggelou "*Mobile Ad Hoc Networks*", McGrawHill, 2004.
4. Amitabh Mishra "*Security and Qualityof Service in Ad hocWireless Networks*", Cambridge University Press, 2008.

TN2103	WIRELESS BROADBAND NETWORKS	L	T	P	C
	Total No. of hours : 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

This course introduces the students to the emerging areas of wireless broadband networks, thus enabling the students to acquire a solid understanding of WiMAX, MIMO and networking aspects of broadband wireless networks.

INSTRUCTIONAL OBJECTIVES

1.	To understand the basics of WiMAX and MIMO
2.	To design Antenna system, channel model, and beam forming for wimax and MIMO
3.	To analyze the networking and services aspects of Broadband Wireless

UNIT I - INTRODUCTION TO BROADBAND WIRELESS (9 hours)

Evolution of Broadband Wireless; Fxied Broadband Wireless and Mobile Broadband Wireless; WiMAX, 3G & Wi-Fi Systems; Spectrum Options for Broadband Wireless; Technical Challenges for Broadband Wireless - Wireless Radio Channel:Path loss and Shadowing; Spectrum Scarcity, Quality of Service, Mobility, Portability, Security, Supporting IP in Wireless. Orthogonal Frequency Division Multiplexing, Multicarrier Modulation – OFDM;Introduction to Multiple Antenna Techniques.

UNIT II - OVERVIEW OF WiMAX (9 hours)

WiMAX; Salient Features of WiMAX – Physical Layer & MAC-Layer Overview; Advanced Antenna Systems; Improved Frequency Reuse; Performance Characterization - Throughput and Spectral Efficiency and Sample Link Budgets and Coverage Range.

UNIT III - NETWORK ARCHITECTURE AND SERVICES ASPECTS (9 hours)

Design Principles of the WiMAX Network Architecture ,QoS, Security, Mobility Management, Location Management, Handoff Management, Mobile IP, TCP in Wireless, Radio Resource Management.

UNIT IV - LTE AND EVOLUTION TO 4G (9 hours)

LTE System Overview, The Evolution from UMTS to LTE; Requirements and Targets for LTE; LTE Radio Access –Transmission Scheme, Spectrum Flexibility, Channel Dependent Scheduling and Rate Adaptation, Inter-Cell Interference Combining, Multi-Antenna Transmission.; Technologies for LTE; Network Architecture – Overall Architecture Overview, Protocol Architecture

UNIT V - LTE ADVANCED (9 hours)

LTE Advanced – Introduction, Requirements, Main Features, Backward Compatibility, Deployment Aspects, UE Categories for LTE Advanced.

REFERENCES

1. Jeffrey. G, Andrews, ArunabhaGhosh and RiasMuhamed, "*Fundamentals of WiMAX: Understanding Broadband Wireless Networking*", Pearson Education, 2007.
2. Yan Zhang and Hsiao-Hwa Chen, "*Mobile WiMAX : toward broadband wireless metropolitan area networks*",Auerbach Publications, 2007
3. Moray Rumney, "*LTE and Evolution to 4G Wireless: Design and Measurement Challenges*", Agilent Technologies, 2008.
4. StefaniaSesia, IssamToufik, Matthew Baker, "*LTE – The UMTS Long Term Evolution: From Theory to Practice*", John Wiley & Sons, 2e, 2011.
5. Luis .M, Correia, "*Mobile Broadband Multimedia Networks: Techniques, Models and Tools for 4G*", Elseiver, 2006.

TN2104	WIRELESS LOCAL AND PERSONAL AREA NETWORKS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

This course deals with the concepts related to WLANs & PANs.

INSTRUCTIONAL OBJECTIVES

1. To understand various IEEE 802 wired/wireless standards
2. To learn about architecture & layers of IEEE 802 wired/wireless standards

UNIT I - INTRODUCTION (9 hours)

Elements &Chronology of Information Networks - Standards Organizations for Information Networking: Evolution of Local & Personal Area Networks - IEEE 802.3 Ethernet, IEEE 802.11 WLAN, IEEE 802.15.

UNIT II-IEEE802.3 ETHERNET OVERVIEW (9 hours)

IEEE 802.3 Ethernet Overview - Packet Format and the Physical Layer - CSMA for MAC - MAC Performance - Fast Ethernet, Gigabit Ethernet and Beyond.

UNIT III - OVERVIEW OF IEEE 802.11 WLANS (9 hours)

Overview of IEEE 802.11 WLANs - Wireless Local-Area Network operations - MAC & Physical Layer - Deployment of Wireless Local-Area Networks - Security Issues and Implementation in IEEE 802.11 - Wireless Local-Area Network Standards and 802.11 Standards Activities

UNIT IV - IEEE 802.15 WPAN STANDARDS (9 hours)

IEEE 802.15 Wireless Personal-Area Network Standardization Series - IEEE 802.15.1 Bluetooth Overall Architecture - Protocol Stack Physical & MAC Mechanism

- Frame Formats - Connection Management & Security. Interference between Bluetooth and 802.11.

UNIT V - IEEE 802.15.3a ULTRA WIDEBAND WPAN (9 hours)

IEEE 802.15.3a Ultra Wideband Wireless Personal-Area Networks- Direct Sequence Ultra Wideband - Multiband Orthogonal Frequency-Division Multiplexing - IEEE 802.15.4 ZigBee Overall Architecture - Protocol Stack - Physical & MAC Layers- Frame Format - Comparison of ZigBee with Bluetooth and WiFi.Millimeter Waves for Gb/s Wireless PANs - Applications, Description, and Requirements - IEEE 802.15.3c standardization.

REFERENCES

1. KavehPahlavan and Prashant Krishnamurthy, *"Networking Fundamentals: Wide, Local and Personal Area Communications"*, John Wiley & Sons, 2009.
2. Edited by Shao-Qiu Xiao, *"Millimeter wave technology in wireless PAN, LAN, AND MAN"*, Auerbach Publications, CRC Press, 2008.
3. Ramjee Prasad and Luis Munoz, "*WLANs and WPANs towards 4G Wireless*", Artech House, 2003.
4. Su-Khiong Yong, Pengfei Xia and Alberto Valdes-Garcia, "*60GHz Technology for Gbps WLAN and WPAN: From Theory to Practice*", Wiley 2010

TN2105	ARCHITECTURES AND PROTOCOLS FOR WIRELESS SENSOR NETWORKS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

This course provides an essential study of issues and methods in wireless and sensor networks.Students will explore current sensor technologies by researching key areas such as algorithms, protocols, hardware, and applications. Students will learn about embedded operating system such as TinyOS, a prominent application development environment for sensor systems using Motes.

INSTRUCTIONAL OBJECTIVES

1.	To describe the unique issues in sensor networks
2.	To describe current technology trends for the implementation and deployment of wireless sensor networks.
3.	To discuss the challenges in designing MAC and routing protocols for wireless sensor networks.
4.	To gain an understanding of WSN Standards and future trends in WSN.

UNIT I - INTRODUCTION (9 hours)

Applications, Challenges for WSNs, Development of WSN. Hardware components,Energy consumption of sensor nodes, Operating systems (TINYOS) and

execution environments, Examplesof sensor nodes -'MICA MOTE' family, EYES node, BTnodes.

UNIT II - PHYSICAL LAYER ISSUES (9 hours)

Sensor network scenarios-Sources and Sinks, single hop vsMultihop, optimization goals andfigures of merit, Design principles for WSNs, Physical layer and transceiver designconsiderations in WSNs.

UNIT III - SENSOR NODE IMPLEMENTATION (9 hours)

Practical implementation issues-Partitioning decision, Transducer interfaces, Time basedaccuracy and average power consumption, Power management, Antennas and RF performancedefinitions.

UNIT IV - MAC LAYER PROTOCOLS (9 hours)

MAC protocols for WSN, Low duty cycle protocols and wakeup concepts (STEM, SMAC),Contention based protocols, schedule based Protocols. Energy efficient unicast, Routing formobile nodes- mobile sinks, mobile data collectors.

UNIT V - WSN STANDARDS (9 hours)

Wireless sensor network standards-IEEE 802.15.4 Low rate WPAN standard, The ZIGBEEalliance etc. Future trends in wireless sensor networks: Wireless Multimedia Sensor Networks,Sensor Network Applicationsin Challenging Environments.

REFERENCES

1. Holger Karl, Andreas Willig, *"Protocols and Architectures for Wireless SensorNetworks",* John Wiley, 2006.
2. Edgar. H, Callaway Jr, *"Wireless Sensor Networks - Architectures and Protocols",*AUERBACH Publications, CRC Press, 2004.
3. Zheng. J and Jamalipour. A, *"Wireless Sensor Networks: A Networking Perspective",*John Wiley & Sons, 2009.
4. Edited by Mohammad Ilyas,,*"The Handbook of ad hoc wireless networks"*, CRC Press,2002.
5. Mohammad Ilyas and ImadMahgaob, *"Handbook of Sensor Networks: CompactWireless And Wired Sensing Systems"*, CRC Press, 2005.

TN2106	COOPERATIVE COMMUNICATIONS	L	T	P	C
	Total No. of hours : 45	3	0	0	3
	Prerequisite				
	Nil				
PURPOSE					

The main purpose of this course is to introduce to the students the emerging areas of cooperative communication and cognitive radio communication. This will enable the students to acquire a solid understanding of different cooperative protocols in wireless communication.	
INSTRUCTIONAL OBJECTIVES	
1.	Understand the basics of cooperative communication
2.	Analyze Relay selection according to the Requirement
3.	Simulate the different cooperative protocols

UNIT I - INTRODUCTION (9 hours)

Cooperative communications - Cooperation protocols - Hierarchical cooperation; Cooperative Communications with single relay; Multi-node cooperative communications;

UNIT II - DISTRIBUTED SPACE–TIME & SPACE–FREQUENCY CODING (9hours)

Distributed space–time coding (DSTC) - Distributed space–frequency coding (DSFC); Relay selection- Differential modulations for DF cooperative communications - Differential modulation for AF cooperative communications;

UNITIII - COOPERATIVE MULTIPLE ACCESS & ROUTING (9 hours)

Cooperative multiple access-System Model, Content-aware Cooperative multiple access protocol Distributed cooperative routing- Network Model, Cooperation based routing protocol Source–channel coding with cooperation;

UNIT IV - BROADBAND COOPERATIVE COMMUNICATIONS (9 hours)

Broadband cooperative communications - System model - Cooperative protocol and relay assignment scheme - Performance analysis; Network lifetime maximization via cooperation - System models - Lifetime maximization by employing a cooperative node - Deploying relays to improve device lifetime.

UNIT V - COGNITIVE RADIO COMMUNICATIONS (9hours)

Cognitive multiple access via cooperation; Cognitive Radios and Dynamic Spectrum Access - Fundamental Limits of Cognitive Radios - Mathematical Models Toward Networking Cognitive Radios; Network Coding for Cognitive Radio Relay Networks.

REFERENCS

1. Rayliu. K.J Sadek. A.K , Weifeng Su& Andres Kwasinski, "*Cooperative Communications and Networking*", Cambridge University Press, 2009.
2. MischaDohler, Yonghui Li, "*Cooperative Communications: Hardware, Channel & PHY*", John Wiley & Sons, 2010.
3. Kwang-Cheng Chen and Ramjee Prasad, "*Cognitive Radio Networks*", John Wiley & Sons, 2009.

	RADIO NETWORK PLANNING & OPTIMISATION	L	T	P	C

TN2107	Total No. of hours : 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

This course is targeted to provide details about Radio Network Planning &Optimisation, especially for Network Systems RF Engineering.

INSTRUCTIONAL OBJECTIVES

1.	To know about detailed descriptions of the radio network planning and optimisationof UMTS networks based on Frequency Division Duplex (FDD) WCDMA technologyup to Release 5 of the 3GPP standardisation work and including High-speed Downlink Packet Access (HSDPA).
2.	To have wide knowledge about Radio Resource Management.

UNIT I - INTRODUCTION (9 hours)

Introduction to Radio Network Planning and Optimisation - Future Trends - Towards a Service-driven Network Management - Wireless Local Area Networks (WLANs) - Next-generation Mobile Communication

UNIT II - WCDMA RADIO NETWORK PLANNING (9 hours)

WCDMA Radio Network Planning: Dimensioning - Detailed Planning - Verification of Dimensioning with Static Simulations - Verification of Static Simulator with Dynamic Simulations - Optimisation of the Radio Network Plan.

UNITIII - WCDMA–GSM CO-PLANNING ISSUES (9 hours)

WCDMA–GSM Co-planning Issues - Radio Frequency Issues - Radio Network Planning Issues; Coverage and Capacity Enhancement Methods - Techniques for Improving Coverage - Techniques for Improving Capacity

UNIT IV-RADIO RESOURCE MANAGEMENT (9 hours)

Radio Resource Utilisation: Introduction to Radio Resource Management - Power Control - Handover Control - Congestion Control - Resource Management; RRU for High-speed Downlink Packet Access (HSDPA) - Impact of Radio Resource Utilisation on Network Performance.

UNIT V - RADIO NETWORK OPTIMISATION (9 hours)

Radio Network Optimisation Process - Introduction to Radio Network Optimisation Requirements - Introduction to the Telecom Management Network Model - Tools in Optimisation; Advanced Analysis Methods and Radio Access Network Autotuning - Advanced Analysis Methods for Cellular Networks - Automatic Optimisation.

REFERENCES

1. JaanaLaiho, AchimWacker& Tomas Novosad, "*Radio Network Planning and Optimisation*", John Wiley, 2006.
2. Morten Tolstrup, "*Indoor Radio Planning: A Practical Guide for GSM, DCS, UMTS and HSPA*", John Wiley, 2008.

3. IanaSiomina, "*Radio Network Planning and Resource Optimization*", LiU-Tryck, Link¨oping, Sweden, 2007.

TN2108	MIMO-OFDM COMMUNICATION NETWORKS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

This course provides a comprehensive introduction to the basic theory of wireless channel modeling, OFDM, and MIMO.

INSTRUCTIONAL OBJECTIVES

1.	To understand the concepts, techniques, andequations appearing in the field of MIMO-OFDM communication.
2.	To understand the fundamental concepts of wireless channel modeling techniques.
3.	To analyze The various MIMO techniques including MIMO channel capacity,Antenna diversity and space-time codes.

UNIT I - THE WIRELESS CHANNEL: PROPAGATION AND FADING (9 hours)

Large-Scale Fading, Small-Scale Fading; SISO Channel Models - Indoor Channel Models and Outdoor Channel Models; MIMO Channel Models-Statistical MIMO Model, I-METRA MIMO Channel Model, SCM MIMO Channel Model.

UNIT II - INTRODUCTION TO OFDM (9 hours)

Single-Carrier vs. Multi-Carrier Transmission; Basic Principle of OFDM; OFDMA: Multiple Access Extensions of OFDM.PAPRReduction - Introduction to PAPR, PAPR Reduction Techniques.Synchronization for OFDM - Effect of STO, Effect of CFO.

UNIT III - CHANNEL ESTIMATION (9 hours)

Pilot Structure; Training Symbol: Based Channel Estimation; DFT-Based Channel Estimation; Decision-Directed Channel Estimation; Advanced Channel Estimation TechniquesMIMO: Channel Capacity - Useful Matrix Theory, Deterministic MIMO Channel Capacity, Channel Capacity of Random MIMO Channels.

UNIT IV - ANTENNA DIVERSITY AND SPACE-TIME CODING TECHNIQUES (9 hours)

Antenna Diversity: Receive Diversity, Transmit Diversity. Space-Time Coding (STC): Overview: System Model, Pairwise Error Probability, Space-Time Code Design; Space-Time Block Code: (STBC),Alamouti Space-Time Code, Generalization of Space-Time Block Coding, Decoding for Space-Time Block Codes, Space-Time Trellis Code.

UNIT V - SIGNAL DETECTION FOR SPATIALLY MULTIPLEXED MIMO SYSTEMS (9 hours)

Linear Signal Detection -ZF Signal Detection, MMSE Signal Detection, OSIC Signal Detection , ML Signal Detection,Sphere Decoding Method, QRM-MLD Method, Lattice Reduction-Aided Detection, Lenstra-Lenstra-Lovasz (LLL) Algorithm, Application of Lattice Reduction, Soft Decision forMIMO Systems, Log-Likelihood-Ratio (LLR) for SISO Systems, LLR for Linear Detector-Based MIMO System, LLR for MIMO System with a Candidate Vector Set, LLR for MIMO System Using a Limited.

REFERENCES

1. Yong Soo Cho, Jaekwon Kim, "*MIMO-OFDM Wireless Communications With Matlab"* John Wiley and Sons, 2010.
2. EzioBiglieri, Robert Calderbank, *"MIMO Wireless Communications"* Cambridge University Press 2007.
3. Claude Oestges,*"MIMO Wireless Communications",* 2e, Prentice Hall, 2010.

TN2109	COGNITIVE WIRELESS NETWORKS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

This course provides an in depth knowledge of Cognitive wireless networks. Students will explore current cognitive radio technology by researching key areas such as Cognitive Radio Relay Networks, SDR, Architectures and applications.

INSTRUCTIONAL OBJECTIVES

1.	The Students will be enabled to understand and acquire knowledge in Cognitive RadioNetworks.
2.	To emphasis on knowledge-building to understand architectures for various networks.
3.	To provide a complete understanding on concepts, to identify the pros and cons of designing a Cognitive Wireless network and SDR.

UNIT I - INTRODUCTION (9 hours)

Aware, Adaptive and Cognitive Radios.Cognitive Radio Technology, Cognitive Radio Network Architectures, Cognitive Radio Networks Applications.

UNIT II - COGNITIVE RADIO NETWORKS (9 hours)

Network Coding for Cognitive Radio Relay Networks. Cognitive Radio Networks Architecture. Terminal Architecture for CRN. Mathematical Models Toward Networking Cognitive Radios. Scaling Laws of CRN.

UNIT III - SPECTRUM SENSING AND SPECTRUM MANAGEMENT (9 hours)
Spectrum Sensing to detect specific Primary System. Spectrum Sensing for Cognitive Radio OFDMA Systems and Cognitive Multi-Radio Networks. Spectrum Management- Spectrum Sharing, Spectrum Pricing, Mobility Management to Heterogeneous Wireless Networks, Regulatory Issues and International Standards.

UNIT IV - TRUSTED COGNITIVE RADIO NETWORKS (9 hours)
Framework of Trust in CRN; Trusted Association and Routing; Trust with Learning; Security in CRN.

UNIT V - SOFTWARE DEFINED RADIO (9hours)
Introduction to SDR. Evolution of SDR Baseband Requirements. SDR Architectures – Ideal SDR Architectures, Realistic SDR Architecture. SDR and Cognitive Radio Relationship.

REFERENCES

1. Kwang-Cheng Chen and Ramjee Prasad, *"Cognitive Radio Networks"*, John Wiley & sons, 2009.
2. Ahmed Khattab, Dmitri Perkins, MagdyBayoumi, *"Cognitive Radio Networks : From Theory to Practice",* Springer, 2013.
3. Walter Tuttlebee, *"Software Defined Radio- Baseband Technology for 3G Handsets and Base stations"*, John Wiley @ Sons, 2004

TN2110	TCP/IP PRINCIPLES, PROTOCOLS AND ARCHITECTURE	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				
PURPOSE					
To provide better understanding of TCP/IP Architecture, Principles and IPv6.					
INSTRUCTIONAL OBJECTIVES					
1.	To Understand the Network Architecture				
2.	To know about various Protocols used in TCP/IP model				
3.	Understand the concepts involved IPv6				
4.	To Gain knowledge on Traffic Engineering				

UNIT I V - INTRODUCTION (9 hours)
Network architecture - Standards and underlying technologies - Internet addressing - ARP -RARP – BOOTP - DHCP.

UNIT II - INTERNET PROTOCOL (9 hours)
IP Datagram - IP Package - IP forwarding and routing algorithms - computing paths – RIP OSPF- ICMP - IGMP.

UNIT III - TCP (9 hours)

TCP header – services - Connection establishment and termination - Interactive data flow -Bulk data flow – Flow control and Retransmission - TCP timers - Urgent Data processing– Congestion control – Extension headers.

UNIT IV - IP SWITCHING AND TRAFFIC ENGINEERING (9 hours)

Switching technology- MPLS fundamentals – signaling protocols – LDP – IP traffic Engineering – ECMP – SBR – Routing extensions for traffic engineering – Trafficengineering limitations and future developments.

UNIT V-IPv6 (9 hours)

IP security protocol-IPv6 addresses –Packet format-Multicast-Anycast-ICMPv6-Interoperation between IPv4 and IPv6-QoS –Auto configuration.

REFERENCES

1. Douglas. E, Comer,*"Internetworking with TCP/IP Principles, Protocols, and Architecture",* Volume-1, Prentice Hall, 5e, 2006.
2. Adrian Farrel, *"The Internet and its Protocols- A Comparative approach",* Morgan Kaufmann, 2004.
3. RichardStevens. W "*TCP/IP Illustrated,The Protocols*". Volume I, Pearson Education India 2003.
4. BehrouzA.Forouzan, *"TCP/IP Protocol Suite"*, Tata McGraw Hill, 3e, 2006.
5. Pete Loshin, *"IPv6 Theory, Protocol and Practice"*,Morgon Kaufmann, 2e, 2003.

TN2111	ANTENNA ARRAY ENGINEERING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To provide an introduction to array antennas, beamforming techniques and antenna measurements/simulations.

INSTRUCTIONAL OBJECTIVES

1.	To get a clear concept of antenna arrays
2.	To gain knowledge in antenna array beamforming

UNIT I - INTRODUCTION TO ANTENNAS (9 hours)

Fundamental parameters and definitions of antennas, Antenna elements-wire elements: dipoles, monopoles and loops, Aperture and Reflector antennas, Microstrip antennas, Wideband antennas.

UNIT II - ANTENNA ARRAYS (9 hours)

Antenna array basics, Linear arrays- Two element array, N-Element linear array, Circular arrays, Planar arrays, Array factor analysis, Pattern multiplication, Design procedure, Antenna array applications.

UNIT III - LINEAR AND PLANAR ARRAY FACTOR SYNTHESIS (9 hours)
Synthesis of amplitude phase tapers, Analytical synthesis of amplitude tapers, Numerical synthesis of low side lobe tapers, Aperiodic arrays, Suppressing grating lobes due to sub-array weighting, Null synthesis.

UNIT IV - PHASED ARRAYS AND BEAMFORMING NETWORK (9hours)
Array feeds for Reflectors, Array feeds for Horn antennas, Array feeds for Microstrip antennas, Phase shifters, Linear phased array antenna, Planar phased array antenna, Digital beamforming,Smart antenna arrays.

UNIT V - SPECIAL ARRAY CONFIGURATIONS AND MEASUREMENTS (9hours)
Conformal array, Volume array, Sequential rotation and phasing, Reactive loading, Input impedance, Self coupling and Mutual coupling, Radiation pattern measurement-Far field antenna measurement range, Anechoic chamber, Compact antenna test range, Near field Antenna measurement range, Scan element pattern.

REFERENCES

1. Balanis .A, *"Antenna Theory Analysis and Design",* Third Edition, John Wiley & Sons, 2005.
2. Balanis. C A, *"Modern Antenna Hand Book",* John Wiley, 2008.
3. John. D, Kraus and Ronald J. Marhefka, *"Antennas For All Applications"*,McGraw-Hill, 2002.
4. Randy. L, Haupt, *"Antenna Arrays, A Computational Approach",* John Wiley & Sons, 2010.
5. Hubregt. J, Visser.*"Array and Phased Array Antenna Basics"*,John Wiley & Sons,2005.

TN2112	MILLIMETER WAVE COMMUNICATION NETWORKS	L	T	P	C
	Total contact hours - 45	3	0	0	3
	Prerequisite				
	Nil				
PURPOSE					
To provide in-depth knowledge of MillimeterWave Communication System concepts.					
INSTRUCTIONAL OBJECTIVES					
1.	To understand the modulation techniques in MillimeterWave Communication				
2.	Study of millimeter wave antennas and beam forming/beam steering concepts				

UNIT I - MULTI-GIGABIT 60-GHz MILLIMETER WAVE RADIOS (9 hours)

Millimeter wave characteristics-Channel performance at 60GHz, Gigabit wireless communication, Standards- WiGig, IEEE 802.11ad, IEEE 802.15.3c,WirelessHD,ECMA-387/ISO/IEC 13156,Coexistence with wireless backhaul, Millimeter wave applications- WLAN, WPAN, Outdoor point to point.

UNIT II - MILLIMETER WAVE ANTENNAS (9 hours)

Path loss and antenna directivity, Antenna beamwidth, Maximum possible gain to Q, Polarization, Beam steering antenna, Millimetre wave design consideration.

UNIT III - MILLIMETER WAVE TRANSCEIVERS (9 hours)

Millimeter wave link budget, Transceiver architecture, Receiver without local oscillator, Millimeter wave calibration, Modulation techniques-OOK, PSK, FSK, QAM, OFDM.

UNIT IV - ADVANCED BEAM STEERING AND BEAM FORMING (9 hours)
Need for beam steering and beam forming, Adaptive frame structure-Advanced beam steering technology, Advanced beam forming technology, Advanced antenna ID technology.

UNIT V - MILLIMETER WAVE MIMO (9 hours)
Spatial diversity of antenna arrays, Multiple antennas, Multiple transceivers, Noise coupling in MIMO system.

REFERENCES

1. Kao-Cheng Huang, Zhaocheng Wang, *"Millimeter wave communication systems",*John Wiley & Sons, Hoboken, New Jersey, 2011.
2. Jonathan Wells, *"Multi-Gigabit Microwave and Millimeter-Wave Wireless Communications",*Artech House, 2010.
3. Su-Khiong Yong, Pengfei Xia and Alberto Valdes-Garcia, "*60GHz Technology for Gbps WLAN and WPAN: From Theory to Practice*", Wiley 2010.

TN2113	WIRELESS BODY AREA NETWORKS	L	T	P	C
	Total contact hours - 45	3	0	0	3
	Prerequisite				
	NIL				
PURPOSE					
The main purpose of this course is to provide in-depth knowledge of wireless body area networks and antenna system.					
INSTRUCTIONAL OBJECTIVES					
1.	To understand WBAN.				
2.	Study of antennas and ULTRA WIDEBAND for WBAN				

UNIT I - INRODUCTION TO WBAN (9 hours)
Introduction to WBAN-Standard-Architecture-WBAN layers-Drawback of WBAN.

UNIT II - HARDWARE DEVELOPMENT AND SYSTEM FOR WBAN (9 hours)
Wireless body sensors-Sensor nodes and hardware designs-Wireless systems and platforms-Wireless transceivers and microcontrollers-Existing sensor boards-Design of implanted sensor nodes for WBAN-WBAN Systems-Software programs and monitoring.

UNIT III - NETWORK AND MAC PROTOCOL DESIGN FOR WBAN (9 hours)
Network topologies and configuration-Basics of MAC protocol-Traffic characteristics-Scheduled protocol-Random access protocol-Hybrid MAC protocol-Energy management in WBAN-Performance analysis of WBAN.

UNIT IV - ANTENNA DESIGN AND PROPAGATION FOR WBAN (9 hours)
Introduction-Antenna gain, Return loss, Efficiency, Reciprocity-Miniaturized Antennas-Implanted Antennas-Volume Conduction Antennas.

UNIT V - ULTRA WIDEBAND FOR WBAN (9 hours)
Introduction-Advantages and limitations of UWB for WBAN-UWB hardware development-PHY layer for UWB WBAN-UWB WBAN Application-Design and Implementation of an UWB -WBAN System.

REFERENCES

1. Huan-Bang Li, KamyaYekehYazdandoost Bin-Zhen, *"Wireless Body Area Networks"*,River Publishers, 2010.
2. MuhannadQuwaiderSubirBiswas, *"Wireless Body Area Networks"*
3. Mark Andrew Hanson, Amy Nicole Miller, *"Wireless Body Area Sensor Network Technology For Motion Based Health Assessment"*
4. Mehmet RastiYuce, JamilY.Khan, *"Wireless Body Area Network:Technology, Implementation And Application"*

TN2114	TELECOM BILLING & REVENUE MANAGEMENT	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				
PURPOSE					
To provide better understanding of Telecom Billing architecture, Billing Process and Project Management.					
INSTRUCTIONAL OBJECTIVES					
1.	To understand the Telecom Billing Architecture				
2.	To know about various Tariff and Bill Structure				
3.	To understand the concepts behind Indian Telecom Service Providers & Real Time Billing Process				
4.	To gain knowledge on Telecom Product & Project Management				

UNIT I - BILLING INTRODUCTION (9 hours)

Telecommunications History, Bell Telephone Company, Indian Telecom Companies & Service Providers, TRAI-Regulations, Introduction to Billing, North American Numbering Plan, Re-Engineering, Convergent Billing, Billing Management, Competition, Business Model, Global and Functional Resources, Resource Pooling, Input, Output and Processing, Wholesale vs Retail services, Billing Architecture.

UNIT II - BILLING SYSTEMS (9 hours)

Billing Types, Electronic Bill Presentation and Payment, Billable Charges, Billable Events, Payment Management, Account Management, Tax and Fee Management, Credit Classification, Packages and Promotions, Rate Plan, Consumer vs Complex Ordering, Billing Cycle, Invoicing and Rating Engine, Billing Reconciliation, Call Detail Record(CDR), CDR Attributes & Processing.

UNIT III - BILLING STRATEGIES & CUSTOMER CARE (9 hours)

Packaging Strategies, Service Negotiation Session, Self Service Ordering, Industry Standards, Technology Barriers, Customer Relationship Management (CRM), CRM Strategies, Service Order Processing, Segmentation, Predictable Marketing, Customer care, Knowledge Management, Business Partner Software, Call Center Software, Resource Allocation, Quality of Service, Customer Life Cycle, Telecommunications Auditing, Analysis of Real Time Billing and Payments.

UNIT IV - T ELECOM PRODUCT MANAGEMENT (9 hours)

Product Marketing strategies, Offer & Bundle Management, Tools, Auditing, Sales Negotiation and Account Management Software, Support Levels, Customer Retention, Decision Support Systems, Dynamic Building of Services, Configuration Methodology, Affiliate Products, Dynamic Product Definitions, Enterprise Product Tools

UNIT V - TELECOM PROJECT MANAGEMENT (9 hours)

Establishing a Process, Promoting excellence, Stakeholders, Project Managers, Project Management Process and Responsibilities, Project Managers, Proper Talent Organization, Capability Maturity Model, Robust Software Services, Planning, Problem Analysis, Logical Separation, Programming Phase, Integration Testing, Effective Revenue Management Solutions for Real Time Service Providers.

REFERENCES

1. Bell. A.T , "*Telecommunication Billing*",Virtualbookworm.com, 2005.
2. Nolan Vincent Jones, "*Telecommunications Management*", Virtualbookworm.com, 2004.
3. AviOfrane, Lawrence Harte,"*Introduction to Telecom Billing, Usage Events, Call Detail Records, and Billing Cycles*", 2004.
4. Jane M Hunter, Maud Thiebaud,"*Telecommunications Billing Systems*" , McGraw-Hill, 2002.
5. Lillian Goleniewski"*Telecommunications Essentials, The Complete Global Source, 2/e*",Pearson, 2007.
6. Jane Laino"*The Telecom Handbook: Understanding Telephone Systems & Services*",CMP Books,2002.
7. Brian Dimarsico, Thomas Phelps IV, William A. Yarberry, Jr, "*Telecommunications Cost Management*" Auerbach Publications, 2003.

TN2115	TELECOM NETWORK MANAGEMENT	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				
PURPOSE					
To provide better understanding of Telecom Network Management.					
INSTRUCTIONAL OBJECTIVES					
1.	To understand the principles of Telecommunication Network Management.				
2.	To gain knowledge on telecomm network management protocols.				

UNIT I - INTRODUCTION (9 hours)

Overview of Data Communication and Network Management – Goals, Organization and Functions; Network Management – Architecture and Organization; Network Management Perpestives; Current Status and Future of Network Management. Network Topology, Network Node Components, Transmission Technology.

UNIT II - SNMP AND NETWORK MANAGEMENT (9 hours)

Network Management Standards, Network Management Models, Organizational Model, Information Model, Communication Model. SNMPv1 –History of SNMP, Internet Organization and Standards, SNMP Model, Organizational Model, System Overview, Information Model. SNMP Communication Model, Functional Model.SNMPv2 and SNMv3.

UNIT III - TELECOMMUNICATIONS MANAGEMENT NETWORK (9 hours)

TMN Conceptual Model, TMN Standards, TMN Architecture, TMN Management Service Architecture, TMN Integrated View, TMN Implementation.

UNIT IV - NETWORK MANAGEMENT APPLICATIONS (9 hours)

Configuration Management, Fault Management, Performance Management, Security Management, Service Level Management, Accounting Management, Report Management, Policy- Based Management.

UNIT V - WEB BASED MANAGEMENT AND IP NETWORK MANAGEMENT (9 hours)

Setting-UP LAN Access, SNMP configuration, Switched Port Analyzer, Web Browser / Web Server Communication.IP Network Management – Configuration, Management Information Base, Simple Network Management Protocol, IP-Based Service Implementation- Network Management Issues, OSS Architecture.

REFERENCES

1. Mani Subramanian *"Network Management – Principles and Practice",* Addison-Wesley, 2000.
2. Salah Aiidarons, Thomas Plevayk, *"Telecommunications Network Technologies and Implementations"*, Eastern Economy Edition IEEE press, New Delhi, 1998.
3. Lakshmi. G, Raman, *"Fundamentals of Telecommunication Network Management",* Eastern Economy Edition IEEE Press, New Delhi
4. J. Richard Burke, *"Network Mamagement: Concepts and Practice, A Hands-on Approach ",* Pearson Education, 2008.

SUPPORTIVE COURSES

MA2010	GRAPH THEORY AND OPTIMIZATION TECHNIQUES	L	T	P	C
	Total contact hours -45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To develop analytical capability and to impart knowledge in graphs, linear programming problem and statistical methods and their applications in Engineering & Technology and to apply their concepts in Engineering problems they would come across.

INSTRUCTIONAL OBJECTIVES

1.	To understand graphs and linear programming problems
2.	To apply statistical concepts in solving the Engineering problems..

UNIT I - BASICS OF GRAPH THEORY (9 hours)

Graphs - Data structures for graphs - Subgraphs - Operations on Graphs Connectivity – Networks and the maximum flow - Minimum cut theorem - Trees - Spanning trees - Rooted trees – Matrix representation of graphs.

UNIT II - CLASSES OF GRAPHS (9 hours)

Eulerian graphs and Hamiltonian graphs - Standard theorems - Planar graphs - Euler's formula - Five colour theorem - Coloring of graphs - Chromatic number (vertex and edge) properties and examples - Directed graphs

UNIT III - GRAPH ALGORITHM (9 hours)

Computer Representation of graphs - Basic graph algorithms - Minimal spanning tree algorithm - Kruskal and Prim's algorithm - Shortest path algorithms - Dijsktra's algorithm - DFS and BFS algorithms.

UNIT IV - OPTIMIZATION TECHNIQUES (9 hours)

Linear programming – Graphical methods – Simplex method (Artificial variables not included) – Transportation and assignment problems

UNIT V - STATISTICS (9 hours)

Linear programming – Graphical methods – Simplex method (Artificial variables not included) – Transportation and assignment problems.

REFERENCES

1. NarsinghDeo, *"Graph Theory with Applications to Engineering and Computer Science"*, PHI.
2. Rao. S.S, *"Engineering Optimization: Theory and Practice",* New Age International Pvt. Ltd., 3rd Edition1998.

MA2017	RANDOM PROCESS AND STATISTICAL METHODS	L	T	P	C
	Total contact hours -45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To introduce the students to the idea of random variables, distribution and random process, an important mathematical tool in signal processing.The queuing theory concepts are also introduced.

INSTRUCTIONAL OBJECTIVES

1.	To provide fundamental knowledge of the basic probability concepts and standard distributions which can describe real life phenomena
2.	To acquire skills in handling situations involving more than one random variable and functions of random variables
3.	To Understand & characterize phenomena which evolve w.r.t. time in a probabilistic manner.
4.	Be exposed to basic characteristic features of a queuing system and acquire skills in analyzing queuing models.

UNIT I - PROBABILITY AND RANDOM VARIABLES (9 hours)

Introduction to probability theory – Random variables – Properties – Moments – Moment Generating Functions and their properties – Commonly used continuous and discrete distributions and their properties – Functions of a random variables.

UNIT II - TWO DIMENSIONAL RANDOM VARIABLES (9 hours)

Joint distributions – Marginal and Conditional distributions – Covariate – Correlation and regression – Transformation of random variables – Central Limit Theorem.

UNIT III - RANDOM PROCESS AND MARKOV CHAINS (9 hours)

Classification – Stationary process – Markov process – Poisson process – Birth and death process – Markov chains – Transition probabilities – Limiting distributions – Steady state and transient analysis.

UNIT IV - SIMULATION RANDOM NUMBER GENERATION (9 hours)

Pseudo random numbers: Methods of generation and testing, methods for generating conditions and discrete distributions – Monto Carlo techniques.

UNIT V - QUEUEING THEORY (9 hours)

Markovian models – M/M/1, M/M/C, finite and infinite capacity - M/M/∞ queues – Finite source model – M/G/1 queue (steady state solutions only) – Pollaczek –

Khintchine formula – Special cases- Networks and Flows - Flow cuts – Max flow min theorems – Perfect square.

REFERENCES
1. Ross. S.M, *"Stochastic Processes",* John Wiley & Sons, 3rd Edition, 2010.
2. Medhi .J, "*Stochastic Processes",* New Age International, 2012.
3. Taha .H.A, *"Operations Research – An Introduction",* Pearson Education Asia, 7e, 2002.
4. Veerarajan. T *"Probability, Statistics and Random Processes",* Tata McGraw Hill Publishing Company Ltd., 2003.
5. Allen. A.O, "*Probability, Statistics and Queueing Theory",* Academic press, New Delhi, 1981.
6. Sheldon. M, Ross, *"Introduction to Probability Models",* 7th Edition, Academic press, 2002.

SEMESTER I

CAC2001	**Career Advancement Course For Engineers - I**	L	T	P	C
	Total Contact Hours - 30	**1**	**0**	**1**	**1**
	Prerequisite				
	Nil				
PURPOSE					
To enhance holistic development of students and improve their employability skills					

INSTRUCTIONAL OBJECTIVES

1. To improve aptitude, problem solving skills and reasoning ability of the student.
2. To collectively solve problems in teams & group.
3. Understand the importance of verbal and written communication in the workplace
4. Understand the significance of oral presentations, and when they may be used.
5. Practice verbal communication by making a technical presentation to the class
6. Develop time management Skills

UNIT I–BASIC NUMERACY

- Types and Properties of Numbers, LCM, GCD, Fractions and decimals, Surds

UNIT II-ARITHMETIC – I

- Percentages, Profit & Loss, Equations

UNIT III-REASONING - I

- Logical Reasoning

UNIT IV-SOFT SKILLS - I

- Presentation skills, E-mail Etiquette

UNIT V-SOFT SKILLS - II

- Goal Setting and Prioritizing

ASSESSMENT

Soft Skills (Internal)
Assessment of presentation and writing skills.

Quantitative Aptitude (External)
Objective Questions- 60 marks
Descriptive case lets- 40 marks*
Duration: 3 hours
*****Engineering problems will be given as descriptive case lets.

REFERENCE:

1. Quantitative Aptitude by Dinesh Khattar – Pearsons Publicaitons
2. Quantitative Aptitude and Reasoning by RV Praveen – EEE Publications
3. Quantitative Aptitude by Abijith Guha – TATA Mc GRAW Hill Publications
4. Soft Skills for Everyone by Jeff Butterfield – Cengage Learning India Private Limited
5. Six Thinking Hats is a book by Edward de Bono - Little Brown and Company
6. IBPS PO - CWE Success Master by Arihant - Arihant Publications(I) Pvt.Ltd – Meerut

SEMESTER II

CAC2002	**Career Advancement Course For Engineers - II**	L	T	P	C
	Total Contact Hours - 30	**1**	**0**	**1**	**1**
	Prerequisite				
	Nil				
PURPOSE					
To enhance holistic development of students and improve their employability skills					

INSTRUCTIONAL OBJECTIVES

1. To improve aptitude, problem solving skills and reasoning ability of the student.
2. To collectively solve problems in teams & group.
3. Understand the importance of verbal communication in the workplace
4. Understand the significance of oral presentations, and when they may be used.
5. Understand the fundamentals of listening and how one can present in a group discussion
6. Prepare or update resume according to the tips presented in class.

UNIT I-ARITHMETIC – II

- Ratios & Proportions, Mixtures & Solutions

UNIT II - MODERN MATHEMATICS

- Sets & Functions, Data Interpretation, Data Sufficiency

UNIT III – REASONING - II

- Analytical Reasoning

UNIT IV – COMMUNICATION - I

- Group discussion, Personal interview

UNIT V - COMMUNICATION - II

- Verbal Reasoning test papers

ASSESSMENT
Communication (Internal)

- Individuals are put through formal GD and personal interviews.
- Comprehensive assessment of individuals' performance in GD & PI will be carried out.

Quantitative Aptitude (External)

Objective Questions- 60 marks (30 Verbal +30 Quants)
Descriptive case lets- 40 marks*
Duration: 3 hours
*Engineering problems will be given as descriptive case lets.

REFERENCES

1. Quantitative Aptitude by Dinesh Khattar – Pearsons Publicaitons
2. Quantitative Aptitude and Reasoning by RV Praveen – EEE Publications
3. Quantitative Aptitude by Abijith Guha – TATA Mc GRAW Hill Publications
4. General English for Competitive Examination by A.P. Bharadwaj – Pearson Educaiton
5. English for Competitive Examination by Showick Thorpe - Pearson Educaiton
6. IBPS PO - CWE Success Master by Arihant - Arihant Publications(I) Pvt.Ltd - Meerut
7. Verbal Ability for CAT by Sujith Kumar - Pearson India
8. Verbal Ability & Reading Comprehension by Arun Sharma - Tata McGraw - Hill Education

SEMESTER III

CAC2003	**Career Advancement Course For Engineers - III**	L	T	P	C
	Total Contact Hours - 30	**1**	**0**	**1**	**1**
	Prerequisite				
	Nil				
PURPOSE					
To develop professional skills abreast with contemporary teaching					

learning methodologies	
INSTRUCTIONAL OBJECTIVES **At the end of the course the student will be able to**	
1	acquire knowledge on planning, preparing and designing a learning program
2	prepare effective learning resources for active practice sessions
3	facilitate active learning with new methodologies and approaches
4	create balanced assessment tools
5	hone teaching skills for further enrichment

UNIT I- DESIGN **(2 hrs)**

- Planning &Preparing a learning program.
- Planning & Preparing a learning session

UNIT II – PRACTICE **(2 hrs)**

- Facilitating active learning
- Engaging learners

UNIT III – ASSESSMENT **(2 hrs)**

- Assessing learner's progress
- Assessing learner's achievement

UNIT IV – HANDS ON TRAINING **(10 hrs)**

- Group activities – designing learning session
- Designing teaching learning resources
- Designing assessment tools
- Mock teaching session

UNIT V – TEACHING IN ACTION **(14 hrs)**

- Live teaching sessions
- Assessments

ASSESSMENT (Internal)

Weightage:

Design - 40%
Practice – 40%
Quiz – 10%
Assessment – 10%

REFERENCES

Cambridge International Diploma for Teachers and Trainers Text book by Ian Barker - Foundation books

Whitehead, Creating a Living Educational Theory from Questions of the kind: How do I improve my Practice? Cambridge J. of Education

AMENDMENTS

S. No.	Details of Amendment	Effective from	Approval with date