RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
PROGRAMME: Electronics and Communication Engineering
COURSE: EC-601 Data Communication and Networks

Category of course	Course Title	Course code	Credit-4C			Theory paper (ES)
			L	T	P	
Departmental Core (DC-11)	Data Communication and Networks	EC- 601	3	1	0	Max. Marks-100 Min. Marks: 35 Duration: 3 hrs.

Course Contents

Unit – I

Introduction to Data Communication and Networks: Data Communication, Networks – Physical structures; different topologies, Categories of Networks: LAN, MAN, WAN, Interconnection of networks, The Internet, Protocols and Standards, Standards Organizations. Network Models, Layered tasks, The OSI model, different layers in OSI model. TCP/IP protocol suite ; different layers, addressing, - physical, logical, port and specific addresses, Analog and digital, digital signals-Bit Length, Digital Signal as a Composite Ana
log Signal, Transmission of Digital Signals, Data Rate Limits-Noiseless Channel, Noisy Channel.

Unit – II

Physical Layer : Digital-to-Digital Conversion-Line Coding, Line Coding Scheme, Block Coding, Scrembling. Multiplexing – Frequency Division, Wavelength Division, Synchronous Time Division, Statistical Time Division Multiplexing. Circuit-Switched Networks – Three Phases, Efficiency, Delay. Datagram Networks - Routing Table, Efficiency, Delay, Datagram Networks in the Internet. Virtual Circuit Networks - Addressing, Three Phases, Efficiency, Delay, Circuit Switched Technology in WANs. Structure of Circuit and Packet switches, Dial-up Modems, Digital Subscriber Line - ADSL, ADSL Lite, HDSL, SDSL, VDSL, Cable TV for Data Transfer- Bandwidth, Sharing, CM and CMTS, Data Transmission Schemes.

Unit – III

Data Link Layer: Introduction - Types of Errors, Redundancy, Detection Vs Correction, Forward Error Correction Vs Retransmission, Modular Arithmetic. Block Coding - Error Detection, Error Correction, Hamming Distance, Minimum Hamming Distance. Linear Block Codes, Cyclic Codes - Cyclic Redundancy Check, Hardware Implementation, Polynomials, Cyclic Code Analysis, Advantages. Checksum, Framing - Fixed and Variable-Size. Flow and Error Control, Protocols, Noiseless Channels – Simplest and Stop-and-Wait Protocols. Noisy Channels - Stop-and-Wait Automatic Repeat Request, Go-Back-N Automatic Repeat Request, Selective Repeat Automatic Repeat Request.

Unit - IV

Medium Access: Random Access- ALOHA, Carrier Sense Multiple Access (CSMA), Carrier Sense Multiple Access with Collision Detection (CSMA/CD), Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA). Controlled Access-Reservation, Polling, Token Passing. Channelization- Frequency-Division Multiple Access (FDMA), Time-Division Multiple Access (TDMA), Code-Division Multiple Access (CDMA). IEEE Standards, Standard Ethernet, Changes in the Standard, Fast Ethernet, Gigabit Ethernet, IEEE 802.11- Architecture, MAC Sub layer, Addressing Mechanism, Physical Layer. Bluetooth- Architecture, Radio Layer, Baseband Layer, L2CAP.

Unit V

Connecting LANs: Connecting Devices- Passive Hubs, Repeaters, Active Hubs, Bridges, Two-Layer Switches, Three-Layer Switches, Gateway. Backbone Networks-Bus, Star, Connecting Remote LANs. Virtual LANs - Membership, Configuration, Communication between Switches, Network layer – logical addressing - . IPv4Addresses- Address Space, Notation, Classful Addressing, Classless Addressing, Network Address Translation (NAT). IPv6 Addresses - Structure and Address Space. Internetworking - Need for Network Layer, Internet as a Datagram Network, Internet as a Connectionless Network. IPv4- Datagram, Fragmentation, Checksum, Options. IPv6 - Advantages, Packet Format, Extension Headers. Transition from IPv4 to IPv6. Address Mapping- Logical to Physical Address, Physical to Logical Address, Routing – Delivery forwarding techniques and processes, routing table,, Unicast routing protocols – Optimization, inter domain, intra domain, distance vector, link state and path vector routing, Multicast routing protocol - Unicast, multicast and broadcast, applications, multicast routing and routing protocols.

References:

1. B. A. Forouzan and Sophia Chung Fegan: Data Communications and Networking, 4th Ed, TMH.
2. W. Tomasi: Introduction to Data Communications and Networking, Pearson Education.
3. A. S. Tanenbaum: Computer Networks, Pearson Education.
4. W. Stalling: Data and Computer Communication, Pearson Education.

5. P. C. Gupta: Data Communications and Computer Networks, PHI.
6. A. Elahi and M. Elahi: Data Network and Internet-Communications Technology, Cengage Learning.
7. Duck: Data Communication and Networking, Pearson Education.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
PROGRAMME: Electronics and Telecommunication
COURSE: EC-602 Cellular Mobile Comm.

Category of course	Course Title	Course code	Credit-4C			Theory paper (ES)
Departmental Core (DC-13)	Cellular Mobile Communication	EC- 602	L	T	P	Max. Marks-100 Min. Marks: 35 Duration: 3 hrs.
			3	1	0	

Course Contents

Unit-I

Introduction to cellular mobile system, a basic cellular system, performance criteria, Uniqueness of mobile radio environment, Operation of cellular systems, Planning of cellular system.

Elements of Cellular Radio System Design: General description of problem, Concept of frequency reuse, channels, Co channel interference, reduction factor, Hand off mechanisms, Cell splitting, Consideration of the components of cellular systems.

Unit-II

Co-channel Interference, real time co-channel interference measurement at mobile radio transceivers, Design of antenna system - Omni directional and directional, Lowering the antenna height, Reduction of co-channel interference, Umbrella- Pattern effect, Diversity receiver, Designing a system to serve a predefined area that experiences Co-Channel Interference.

Types of Non co-channel interference- adjacent channel Interference, Near-End-Far-End interference, Effects on Near-End mobile units, Cross-Talk, Effects on coverage and interference by applying power decrease, antenna height decrease, Beam Tilting, Effects of cell site Components, Interference between systems, UHF TV Interference, long distance interference.

Unit-III

Cell coverage for signal and traffic : General introduction, Obtaining the mobile point-to-point model, Propagation over water or flat open area, foliage loss, propagation in near in distance, long distance propagation, point-to-point prediction model, Cell site antenna heights and signal coverage cells, Mobile-to-mobile propagation.

Cell site antennas and mobile antennas: Equivalent circuits of antennas, Gain and Pattern Relationship, Sum and Difference patterns, Antennas at cell site, mobile antennas.

Unit-IV

Frequency management and Channel Assignment: Frequency management, Frequency spectrum utilization, Setup channels, Fixed channels assignment, Non-fixed channel assignment algorithms, Traffic and channel assignment.

Handoffs and Dropped Calls: Types of Handoff, Initiation of Handoff, Delaying a Handoff, Forced Handoff, Queuing of Handoff, Power- Difference Handoff, Mobile Assisted Handoff and Soft Handoff, Cell-site Handoff and Intersystem Handoff, Dropped Call Rate.

Unit-V

Digital Cellular System: GSM, Architecture, Layer Modeling, Transmission, GSM channels and Channel Modes, Multiple Access Scheme: CDMA, Terms of CDMA systems, output power limits and control, Modulation characteristics, Call processing, Hand off procedures.

Miscellaneous Mobile Systems: TDD Systems, Cordless Phone, PDC, PCN, PCS, Non Cellular Systems, Mobile Integrated Radio Systems, Mobile Satellite Communication.

References:

1. Lee: Cellular and Mobile Communication, 2nd edition, McGraw Hill.
2. D. P. Agrawal and Q. An Zeng: Wireless and Mobile Systems, Cengage Learning, 2006.
3. Faher Kamilo: Wireless Digital Communication, Prentice Hall of India, New Delhi, 2006.
4. G. J. Mullet: Introduction to Wireless Telecommunication Systems and Networks, Cengage Learning.
5. Raj Kamal: Mobile Computing, Oxford University Press.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
PROGRAMME: Electronics and Telecommunication
COURSE: EC--603 Digital Signal Processing

Category of course	Course Title	Course code	Credit-6C			Theory paper (ES)
			L	T	P	
Departmental Core (DC-11)	Digital Signal Processing	EC- 603	3	1	2	Max. Marks-100 Min. Marks: 35 Duration: 3 hrs.

Course Contents

Unit – I

Discrete-Time Signals and Systems

Discrete-Time Signals, Discrete-Time Systems, Analysis of Discrete-Time Linear Time-Invariant Systems, Discrete Time systems described by Difference Equation, Implementation of Discrete-Time Systems, Signal flow Graph representation of digital network, matrix representation.

Unit - II

The z-Transform: The Direct z-transform, Properties of the z-transform, Rational z-transforms, Inversion of the z-transform, analysis of Linear Time-Invariant systems in the z- domain.

Unit - III

Frequency Analysis of Discrete Time Signals: Discrete Fourier series (DFS), Properties of the DFS, Discrete Fourier Transform (DFT), Properties of DFT, Two dimensional DFT, Circular Convolution.

Unit - IV

Efficient Computation of the DFT: FFT algorithms, decimation in time algorithm, Decimation in frequency algorithm, Decomposition for 'N' composite number.

Unit - V

Digital filters Design Techniques: Design of IIR and FIR digital filters, Impulse invariant and bilinear transformation, windowing techniques- rectangular and other windows, Examples of FIR filters, design using Windowing.

References:

1. A.V. Oppenheim and R. W. Schafer: Digital Signal Processing, Prentice Hall.
2. Ingle VK and Proakis John G : Digital Signal Processing A MATLab based Approach, Cengage Learning
3. L.R. Rabiner and B. Gold: Theory and Application of Digital Signal Processing, Prentice Hall
4. John. G. Proakis and Monolakis: Digital Signal Processing, Pearson Education
5. Johnny R. Johnson: Introduction to Digital Signal Processing, PHI, New Delhi.
6. Salivahanan and Vallavraj: Digital Signal Processing, Mc Graw Hill.
7. S. K. Mitra: Digital Signal Processing- A Computer based Approach, Mc Graw Hill.
8. Schilling and Harris: Fundamentals of DSP using MATLAB, Cengage Learning.

List of experiments:

The following practicals should be performed using Scilab/ Matlab/ any DSP simulation software like MentorDSP

1. Generation, analysis and plots of discrete-time signals.
2. Implementation of operations on sequences (addition, multiplication, scaling, shifting, folding etc).
3. Implementation of Linear time-invariant (LTI) systems and testing them for stability and causality.
4. Computation and plot of DTFT of sequences, verification of properties of DTFT.
5. Computation and plots of z-transforms, verification of properties of z-transforms.
6. Computation and plot of DFT of sequences, verification of properties of DFT.
7. Computation and plots of linear/circular convolution of two sequences.
8. Computation of radix-2 FFT- Decimation in time and Decimation in frequency.
9. Implementation of IIR and FIR filter structures (direct, cascade, parallel etc).
10. Implementation of **v**arious window design techniques (Rectangular, Bartlett, Hann, Hamming etc).

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
PROGRAMME: Electronics and Telecommunication
COURSE: EC- 604 Microwave Engineering

Category of course	Course Title	Course code	Credit-6C			Theory paper (ES)
			L	T	P	
Departmental Core (DC-14)	Microwave Engineering	EC- 604	3	1	2	Max. Marks-100 Min. Marks: 35 Duration: 3 hrs.

Course Contents

Unit-I
Microwave Transmission System
General representation of E M field in terms of TEM, TE and TM components, Uniform guide structures, rectangular wave guides, Circular Wave guides, Solution in terms of various modes, Properties of propagating and evanescent modes, Dominant modes, Normalized model voltages and currents, Power flow and energy storage in modes frequency range of operation for single mode working, effect of higher order modes, Strip line and micro strip lines- general properties, Comparison of coaxial, Micro strip and rectangular wave guides in terms of band width, power handling capacity, economical consideration etc.

Unit-II
Microwave Networks and Component
Transmission line ports of microwave network, Scattering matrix, Properties of scattering matrix of reciprocal, nonreciprocal, loss less, Passive networks, Examples of two, three and four port networks, wave guide components like attenuator, Phase shifters and couplers, Flanges, Bends, Irises, Posts, Loads, Principle of operation and properties of E-plane, H-plane Tee junctions of wave guides, Hybrid T, Multi-hole directional coupler, Directional couplers, Microwave resonators- rectangular. Excitation of wave guide and resonators by couplers. Principles of operation of nonreciprocal devices, properties of ferrites, Isolators and phase shifters.

Unit-III
Microwave Solid State Devices and Application
PIN diodes, Properties and applications, Microwave detector diodes, detection characteristics, Varactor diodes, parametric amplifier fundamentals, Manley-Rowe power relation MASER, LASER , Amplifiers, Frequency converters and harmonic generators using Varactor diodes, Transferred electron devices, Gunn effect, Various modes of operation of Gunn oscillator, IMPATT, TRAPATT and BARITT.

Unit-IV
Microwave Vacuum Tube Devices
Interaction of electron beam with electromagnetic field, power transfer condition. Principles of working of two cavity and Reflex Klystrons, arrival time curve and oscillation conditions in reflex klystrons, mode-frequency characteristics. Effect of repeller voltage variation on power and frequency of output. Principle of working of magnetrons. Electron dynamics in planar and cylindrical magnetrons, Cutoff magnetic field, Resonant cavities in magnetron, Π-mode operation Mode separation techniques, Rising sun cavity and strapping. Principle of working of TWT amplifier. Slow wave structures, Approximate gain relationship in forward wave TWT.

Unit-V
Microwave Measurements
Square law detection, Broadband and tuned detectors. Wave-guide probes, Probe and detector mounts, Slotted line arrangement and VSWR meter, Measurement of wave-guide impedance at load port by slotted line, Microwave bench components and source modulation.
Measurement of scattering matrix parameters, High, Medium and low-level power measurement techniques, Characteristics of bolometers, bolometer mounts, Power measurement bridges, Microwave frequency measurement techniques, calibrated resonators (transmission and absorption type). Network Analyzer and its use in measurements.

References:

1. Y. S. Liao: Microwave Devices, PHI.
2. R. E. Collins: Foundations of Microwave Engineering, 2nd Edition, Wiley Publications.
3. J.H. Reich: Microwave Principles, East West Press.
4. D. M. Pozar: Microwave Engineering, 3rd Edition, Wiley Publications.

List of Experiment:

Following illustrative practical should be simulated with the help of any RF simulation software e.g. FEKO / HFSS / IE3D / Microwave Office / Microwave Studio or any other similar software:-

1. Study the characteristics of Klystron Tube and to determine its electronic tuning range.
2. To determine the frequency and wavelength in a rectangular wave-guide working on TE_{10} mode.
3. To determine the Standing Wave-Ratio and reflection coefficient.
4. To measure an unknown impedance with Smith Chart.
5. To study the V-I characteristics of Gunn Diode.
6. To study the following characteristics of Gunn Diode.
    (a) Output power and frequency as a function of voltage.
    (b) Square wave modulation through PIN diode.
7. Study the function of Magic Tee by measuring the following parameters.
    (a) Measurement of VSWR at different ports and
    (b) Measurement of isolation and coupling coefficient.
8. Study the function of Isolator / Circulator by measuring the following parameters.
    (a) Input VSWR measurement of Isolator / Circulator.
    (b) Measurement of insertion loss and isolation.
9. Study the function of Attenuator (Fixed and Variable type) by measuring the following parameters.
    (a) Input VSWR measurement.
    (b) Measurement of insertion loss and attenuation.
10. Study the function of Multi Hole Directional Coupler by measuring the following parameters.
    (a) To measure main line and auxiliary line VSWR.
    (b) To measure the coupling factor and directivity.
11. Study of a network analyzer and measurements using it.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
PROGRAMME: Electronics and Telecommunication
COURSE: EC-605 Communication Network and Transmission Lines

Category of course	Course Title	Course code	Credit-6C			Theory paper (ES)
			L	T	P	
Departmental Core (DC-15)	Communication Network and Transmission Lines	EC-605	3	1	2	Max. Marks-100 Min. Marks: 35 Duration: 3 hrs.

Course Contents

Unit – I
Characteristic Parameters of symmetrical and asymmetrical two port networks and their design: image impedance, iterative impedance, characteristic impedance, propagation coefficient, image transfer coefficient ,iterative transfer coefficient, Lattice and Bridged-T networks, reactive matching networks, matching techniques, Insertion Loss, symmetrical and asymmetrical attenuators and their design.

Unit – II
Passive LC Filters: Analysis and design of Low pass, high pass, band pass and band elimination filters, m-derived filters, composite filters, Filter specifications, Butterworth approximation, Chebyshev approximation, elliptic function approximation, frequency transformation.

Unit – III
Positive real function, LC, RL, RC, and RLC network synthesis, Foster and Cauer network, minimum positive real function, Brune's method, Bott-Duffin method, Synthesis-Coefficient.

Unit – IV
Transmission line fundamentals: Lumped parameter equivalent, voltage and current on a transmission line, infinite line, characteristic impedance and propagation constant, waveform distortion, attenuation and phase equalizers, distortion-less line, loading, liner reflection on a line, reflection coefficient, input and transfer impedances, open circuit and short circuit line, reflection factors, reflection loss, insertion loss, T and π equivalents of a line, location of line fault. Construction and design of two wire line and coaxial cable.

Unit – V
Line at radio frequencies, parameters of line and coaxial cable at radio frequencies, dissipation-less line, voltage and current on a dissipation-less line, standing waves, standing wave ratio, input impedance of open circuit and short circuit, power and impedance measurement on lines, eighth-wave, quarter-wave and half wave line, circle diagram, Smith chart, solution of problems using Smith chart, single and double stub matching .introduction to micro-strip lines and its analysis.

References:

1. J.D. Ryder: Networks and Transmission Lines, 2nd edition, PHI
2. M.E. Valkenberg: Introduction to Modern Network synthesis, Wiley Eastern Ltd.
3. G.K. Mithal: Network Analysis, Khanna Publishers.
4. Umesh Sinha: Networks and Transmission Lines, Satya Prakashan.
5. Suresh: Electric Circuits and Networks, Pearson Education.

List of Experiments:

Following illustrative practical should be simulated with the help of any RF simulation software e.g. FEKO / HFSS / IE3D / Microwave Office / Microwave Studio or any other similar software:-

1. To set up Transmission Line Analyzer for measurements.
2. To set up the standing waves formation on a transmission line and observe their maxima and minima using frequency domain method.
3. To measure the characteristic impedance of transmission lines using frequency domain method and to differentiate between the matched and unmatched lines.
4. To measure the VSWR, reflection coefficient and return loss in a transmission line.
5. To measure the dielectric constant of insulator in the transmission line.
6. To measure the velocity of propagation and wavelength in the given transmission line.
7. To study the attenuation characteristics of signal along a transmission line and observe its variation with frequency. Also calculate the phase constant and propagation constant.
8. To study the effect of reactive loads on transmission lines.
9. To study the difference between lossy and loss less line.

10. To study the physical dimensions of transmission line and estimation of characteristic impedance.
11. To study behavior of infinite and short lines.
12. To study the operation of Balun transformer.
13. To study the loading of transmission lines and estimate the cut off frequency of a loaded line.
14. To study the use of coaxial lines as tuned circuits and delay lines.
15. To study the input and output impedance of any RF circuits and match it to 50/75 ohms.
16. Simulation of various filters.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

PROGRAMME: Electronics and Telecommunication

COURSE: EC-606 Minor Project

Category of course	Course Title	Course code	Credit-4C			Practical Exam
			L	T	P	
Departmental Core (DC-16)	Minor Project	EC-606	0	0	4	Max. Marks-50

Course Contents

Circuits/ Projects based on courses studied/ covered in previous semesters and in this semester should be designed/ simulated/ fabricated in the institution laboratories and a report should be submitted.