Rajiv Gandhi Technological University, Bhopal (MP)

B.E. (EC) Electronics and Communication Engineering

Revised Syllabus and Scheme of Examination Effective from July 2007

FIFTH SEMESTER

S. No	Course Category	Course Code (New)	Subject	Period Per Week				Distribution of Marks					
								Theory Exam	Practical Exam	Internal Assessment			Total
										MST	TW	Total	
				L	T	P	C	I	II			III	I+II+III
1.	DC-6	EC-501	Voice Communication	3	1	0	4	100	-	20		20	**120**
2.	DC-7	EC-502	Electro-Magnetic Theory	3	1	0	4	100	-	20		20	**120**
3.	DC-8	EC-503	Digital Communication	3	1	2	6	100	50	20	30	50	**200**
4..	DC-9	EC-504	Microprocessors, Microcontroller and Embedded Systems	3	1	2	6	100	50	20	30	50	**200**
5.	DC-10	EC-505	CMOS VLSI Design	3	1	2	6	100	50	20	30	50	**200**
6.	IT-4	EC-506	Software Lab-II	0	0	4	4	-	50	-	50	50	**100**
7.	NECC-5	EC-507	Self Study	0	0	1	1	-	-	-	30	30	**30**
8.	NECC-6	EC-508	Seminar / Group Discussion etc.	0	0	1	1	-	-	-	30	30	**30**
TOTAL				**15**	**5**	**12**	**32**	**500**	**200**	**100**	**200**	**300**	**1000**

Rajiv Gandhi Technological University, Bhopal (MP)

B.E. (EC) Electronics and Communication Engineering

Revised Syllabus and Scheme of Examination Effective from July 2007

SIXTH SEMESTER

S. No.	Course Category	Course Codes (New)	Subject	Period Per Week				Distribution of Marks					
								Theory Exam	Practical Exam	Internal Assessment			Total
										MST	TW	Total	
				L	T	P	C	I	II			III	I+II+III
1.	DC-11	EC-601	Digital Signal Processing	3	1	0	4	100	-	20	-	20	**120**
2.	DC-12	EC-602	Cellular Mobile Communication	3	1	0	4	100	-	20	-	20	**120**
3.	DC-13	EC-603	Data Communication and Networks	3	1	2	6	100	50	20	30	50	**200**
4.	DC-14	EC-604	Microwave Engineering	3	1	2	6	100	50	20	30	50	**200**
5.	DC-15	EC-605	Communication Network and Transmission Lines	3	1	2	6	100	50	20	30	50	**200**
6.	DC-16	EC-606	Minor Project	0	0	4	4	-	50	-	50	50	**100**
7.	NECC-7	EC-607	Self Study	0	0	1	1	-	-	-	30	30	**30**
8.	NECC-8	EC-608	Seminar / Group Discussion etc.	0	0	1	1	-	-	-	30	30	**30**
TOTAL				**15**	**5**	**12**	**32**	**500**	**200**	**100**	**200**	**300**	**1000**

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
PROGRAMME: Electronics and Communication Engineering
COURSE: EC-501 Voice Communication

Category of course	Course Title	Course code	Credit-4C			Theory paper (ES)
Departmental Core (DC-6)	Voice Communication	EC-501	L 3	T 1	P 0	Max. Marks-100 Min. Marks: 35 Duration: 3 hrs.

Course Contents

Unit I

Basic Telephony : Introduction, standard telephone set, function, local loop, block diagram, basic call procedure, call progress tones and signals, cordless telephones, caller identification, electronic telephones, telephone circuit - local subscriber loop, channel noise and units of power measurements, transmission parameters, voice frequency circuit arrangements, crosstalk.

Unit II

Public telephone network: Introduction, transmission system environment, public telephone network, instruments, local loops, trunk circuits, telephone exchanges - local exchanges, automated central office switches and exchanges, telephone numbering plan, telephone services, telephone switching hierarchy, common channel signaling system-evolution of SS7, signaling points, call setup, Multiplexing of telephone channels - frequency division multiplexing, FDM hierarchy, composite base-band signals, formation of groups, super groups, master groups and radio channel, wavelength division multiplexing.

Traffic analysis: traffic characterization and measurement, arrival and holding time distributions, loss systems, lost call estimation, network blocking probabilities.

Unit III

Digital telephony: Introduction, advantages and disadvantages of digital voice network, voice digitization, time division multiplexing of PCM signals, digital carrier, Super-frame TDM format, Fractional T Carrier Service, Digital hierarchy, Master Group and Commercial TV, Picture Phone Terminal, Data Terminal, Digital Carrier Line Encoding, Duty Cycle, Bandwidth Requirement, Clock and Framing Bit Recovery, Error Detection, T Carrier System, T-1 Carrier System, , Statistical TDM, Codec and Combo Chips.

Unit IV

Digital transmission: Introduction, digital data and digital signal, pulse transmission, inter-symbol, interference, synchronous and asynchronous transmission, line coding – level encoding, bipolar coding, Code Space redundancy, N zero substitution, Pair Selected ternary, Ternary coding, digital biphase, differential encoding, coded mark inversion, multilevel signaling, partial response signaling, error performance, performance monitoring, time division multiplexing - Bit vs Word Interleaving, framing, TDM loops and rings.

Unit V

Digital switching: Switching function, space division switching, multistage switching, non-blocking switches, blocking probabilities, four wire switches, switch matrix control, time division switching – analog and digital, two dimensional switching, multi stage time and space switching, STS and TST switching, digital cross connect systems, digital switching in analog environment.

References:

1. W. Tomasi: Advanced Electronic Communication Systems, 6th Edition, PHI
2. W. Tomasi: Electronic Communication Systems, Pearson Education
2. John C.Bellamy: Digital Telephony, 3rd Edition, Willey India Pvt. Limited
3. T. Vishwanathan: Telecommunication Switching Systems and Networks, PHI.
4. James Martin: Telecommunication and Computers, PHI
5. G. F. Snyder: Introduction to Telecommunication Networks, Vikas Publishing House.
6. Cole Marion: Introduction to Telecommunication, Pearson Education.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
PROGRAMME: Electronics and Communication Engineering
COURSE: EC-502 Electromagnetic Theory

Category of course	Course Title	Course code	Credit-4C			Theory paper (ES)
Departmental Core (DC-7)	Electromagnetic Theory	EC-502	L 3	T 1	P 0	Max. Marks-100 Min. Marks: 35 Duration: 3 hrs.

Course Contents

Unit I

Cartesian, cylindrical and spherical co-ordinate systems, scalar and vector fields, gradient, divergence and curl of a vector field, Divergence theorem and Stokes's theorem, concept of vectors.

Electrostatic Fields – Coulomb's law, electric field intensity due to different charge distribution viz. line charge, sheet charge, Field due to continuous volume – electric potential, properties of potential function, potential gradient equipotential surfaces, line of force, Gauss law, applications of Gauss law, Gauss law in point form method of images.

Unit II

Laplace's and Poisson's equations, solution of Laplace's equation. Electric dipole, dipole moment, potential and electric field intensity due to dipole. Behavior of conductors in an electric field. Conductor and insulator, electric field inside a dielectric, polarization. Boundary value conditions for electric Field. Capacitance and Capacitances of various types of capacitors. Energy stored and energy density in static electric field. Current density, conduction and convection current density, Ohms law in point form, equation of continuity.

Unit III

Static Magnetic Field, Biot-Savart's law, Magnetic Field intensity due to straight current carrying filament, circular, square and solenoidal current carrying wire. Relationship between magnetic flux, flux density and magnetic field intensity.

Ampere's circuital law and its applications, magnetic field intensity due to infinite sheet and various other configurations, Ampere's circuital law in point form.

Magnetic force, moving charge in a magnetic field, Lorentz force on straight and long current carrying conductors in magnetic field, force between two long and parallel current carrying conductors. Magnetic dipole and dipole moment, a differential current loop as dipole, torque on a current carrying loop in magnetic field, magnetic boundary conditions.

Unit IV

Scalar magnetic potential and its limitations, Vector magnetic potential and its properties, vector magnetic potential due to different simple configurations**;**

Self and Mutual inductances, determination of self and mutual inductances, self inductance of solenoid, toroid coils, mutual inductance between a straight long wire and a square loop. Energy stored in magnetic Field and energy density.

Faraday's Law, transformer and motional EMF equations. Displacement current, Maxwell's equations as generalization of circuit equations, Maxwell's equation in free space, Maxwell's equation for harmonically varying field, static and steady fields. Maxwell's equations in differential and integral form.

Unit V

Electro Magnetic Waves: Uniform plane wave in time domain in free space, Sinusoidally time varying uniform plane wave in free space, Wave equation and solution for various medium, Uniform plane wave in dielectrics and conductors.

Poynting Vector theorem, instantaneous, average and complex poynting vector, power loss in a plane conductor, energy storage.

Polarisation of waves. Reflection by conductors and dielectric – Normal and Oblique incidence. Reflection at surface of a conducting medium, surface impedance, transmission line analogy.

References:

1. Mathew N.O Sadiku: Elements of Electromagnetic, Oxford.
2. N.N. Rao: Element of Engineering Electromagnetic, Pearson Education.
3. William H. Hayt: Engineering Electromagnetic, TMH.
4. John D. Kraus: Electromagnetics, Mc. Graw Hill.
5. Jordan Balmian: Electromagnetic wave and Radiating System, PHI.
6. David K. Cheng: Electromagnetic Fields and Wave, Addison Wesley.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
PROGRAMME: Electronics and Telecommunication Engineering
COURSE: EC-503 Digital Communication

Category of course	Course Title	Course code	Credit-6C			Theory paper (ES)
Departmental Core (DC-8)	Digital Communication	EC- 503	L 3	T 1	P 2	Max. Marks-100 Min. Marks: 35 Duration: 3 hrs.

Course Contents

Unit-I
Random Processes
Random variables:- Cumulative distribution function, Probability density function, Mean, Variance and standard deviations of random variable, Gaussian distribution, Error function, Correlation and autocorrelation, Central-limit theorem, Error probability, Power Spectral density of digital data.

Unit-II
Pulse Modulation
Analog Signals:- Sampling of Signal, Sampling Theorem for Low Pass and Band Pass Signals, Aliasing, Pulse Amplitude Modulation (PAM), Time Division Multiplexing (TDM), Channel Bandwidth for PAM-TDM Signal, Types of Sampling, Instantaneous, Natural and Flat Top (Mathematical and Spectral Analysis), Aperture Effect, Introduction to Pulse Position and Pulse Duration Modulation.

Unit-III
Pulse Code Modulation
Digital Signal:- Quantization, Quantization Error, Pulse Code Modulation (PCM), Signal-to-Noise Ratio in PCM, Companding, Data Rate and Bandwidth of Multiplexed PCM Signal, Inter-symbol Interference, Differential PCM (DPCM), Delta Modulation (DM), and Adaptive Delta Modulation (ADM), Comparison of various system in terms of Bandwidth and Signal-to-Noise Ratio.

Unit-IV
Digital Modulation Techniques :- Analysis, Generation and Detection (Block Diagram), Spectrum and Bandwidth of Amplitude Shift Keying (ASK), Binary Phase Shift Keying (BPSK), Differential Phase Shift Keying (DPSK), Offset and Non-offset Quadrature Phase Shift Keying (QPSK), M-ary PSK, Binary Frequency Shift Keying (BFSK), M-ary FSK, Minimum Shift Keying, Quadrature Amplitude Modulation (QAM), Comparison of digital modulation techniques on the basis of probability of error, Matched Filter.

UNIT –V
Spread Spectrum Modulation
Introduction to Spread Spectrum modulation, Generation and Characteristics of p-n Sequences, Direct sequence Spread Spectrum System, Spread Spectrum with Code division Multiple Access (CDMA), Frequency Hopping Spread Spectrum.

References:

1. Taub and Schilling: Principles of Communication System, TMH
2. Simon Haykins: Communication Systems, 4th Edition, John Wiley.
3. Singh and Sapre: Communication System, TMH
4. B.P. Lathi: Modern Analog and Digital Communication System, Oxford
5. Tomasi: Advanced Electronics Communication Systems, 6th Edition, PHI
6. Couch: Digital and Analog Communication, Pearson Education.

List of Experiments:

Simulation of different modulation techniques using Scilab (Freeware-Downloadable from www.Scilab.com) **/Matlab/Any Similar Software. Plotting of signal constellation diagrams and signals (modulated/ unmodulated). Calculation of Bit error rates BER and comparison of various modulation techniques.**

1. Study of Sampling Process and Signal Reconstruction and Aliasing.
2. Study of PAM, PPM and PDM.
3. Study of PCM Transmitter and Receiver.
4. Time Division Multiplexing (TDM) and Demultiplexing.
5. Study of ASK, PSK and FSK Transmitter and Receiver.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
PROGRAMME: Electronics and Communication Engineering
COURSE: EC-504 Microprocessor, Microcontroller and Embedded Systems

Category of course	Course Title	Course code	Credit-6C			Theory paper (ES)
			L	T	P	
Departmental Core (DC-9)	Microprocessor, Microcontroller and Embedded Systems	EC- 504	3	1	2	Max. Marks-100 Min. Marks: 35 Duration: 3 hrs.

Course Contents

UNIT-I
Microprocessor 8086 Architecture - BIU and EU, Registers, Pin Diagram, Memory Addressing, Clock Generator 8284, Buffers and Latches, Maximum and Minimum Modes.

UNIT-II
Addressing Modes, Instruction set of 8086, Assembly Language Programming, Assemblers, Procedures, Macros, Interrupts, 8086 Based Multiprocessor Systems - Coprocessors (8087 NDP), Closely and Loosely Coupled Multiprocessor Systems (8089 IOP).

UNIT-III
Interfacing Chips- IC 8155 (Static Ram with I/O Ports and Timer), 8755 (EPROM with I/O Ports), 8251A (USART), 8255A (Programmable Peripheral Interface), 8253/8254 (Programmable Interval Timer/Counter), 8257 (DMA Controller), 8259A (Programmable Interrupt Controller).

UNIT-IV
Microprocessors Vs Microcontrollers - Microcontroller 8051- Architecture, Pin Diagram, I/O Ports, Internal RAM and Registers, Interrupts, Addressing Modes, Memory Organization and External Addressing, Instruction Set, Assembly Language Programming, Real Time Applications of Microcontroller- Interfacing with LCD, ADC, DAC, Stepper Motor, Key Board and Sensors.

UNIT-V
Embedded Systems-Introduction, Classification, Processors, Hardware Units, Software Embedded into System, Applications and Products of Embedded Systems, Structural Units in Processor, Memory Devices, I/O Devices, Buses, Interfacing of Processor Memory and I/O Devices, Case Study of an Embedded System for a Smart Card.

References:

1. B. B. Brey: The Intel Microprocessors, Architecture, Programming and Interfacing, Pearson Education.
2. Liu Gibson: Microcomputer Systems: The 8086/8088 Family- Architecture, Programming and Design , PHI
3. D. V. Hall: Microprocessors and Interfacing, TMH.
4. Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education.
5. Ayala Kenneth:- The 8051 microcontroller, Third Edition, Cengage Learning
6. A. V. Deshmukh: Microcontroller (Theory and Application), TMH.
7. Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi.
8. Barret: Embedded Systems, Pearson Education

List of Experiments:

1. Assembly Language Programs of Microprocessor 8086,
2. Assembly Language Programs of Microcontroller 8051.
3. Assembly Language Programs for Interfacing Chips.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
PROGRAMME: Electronics and Telecommunication
COURSE: EC-505 CMOS VLSI Design

Category Course	Course Title	Course Code	Credit-6C			Theory Paper (ES)
			L	T	P	
Departmental Core (DC-10)	CMOS VLSI Design	EC-505	3	1	2	Max. Marks-100 Min. Marks: 35 Duration: 3 Hrs.

Course Contents

UNIT-I
Introduction
CMOS Logic: Inverter, NAND Gate, Combinational Logic, NOR Gate, Compound Gates, Pass Transistors and Transmission Gates, Tristates, Multiplexers, Latches and Flip-Flops, CMOS Fabrication and Layout: Inverter Cross-section, Fabrication Process, Layout Design rules, Gate Layout, Stick Diagrams. VLSI Design Flow.
MOS Transistor Theory: Ideal I-V Characteristics, C-V Characteristics: MOS Capacitance Models, MOS Gate Capacitance Model, MOS Diffusion Capacitance Model. Nonideal I-V Effects: Velocity Saturation and Mobility Degradation, Channel Length Modulation, Body Effect, Subthreshold Conduction, Junction Leakage, Tunneling, Temp. and Geometry Dependence. DC Transfer characteristics: Complementary CMOS Inverter DC Characteristics, Beta Ratio Effects, Noise Margin, Ratioed Inverter Transfer Function, Pass Transistor DC Characteristics, Tristate Inverter, Switch- Level RC Delay Models.

UNIT-II
CMOS Processing Technology
CMOS Technologies: Background, Wafer Formation, Photolithography, Well and Channel Formation, Silicon Dioxide (SiO2), Isolation, Gate Oxide, Gate and Source/Drain Formation, Contacts and Metallization, Passivation, Metrology. Layout Design Rules: Design Rules Background, Scribe Line and Other Structures, MOSIS Scalable CMOS Design Rules, Micron Design Rules. CMOS Process Enhancements: Transistors, Interconnect, Circuit Elements, Beyond Conventional CMOS.

UNIT-III
Circuit Characterization and Performance Estimation
Delay Estimation: RC Delay Models, Linear Delay Model, Logical Effort, Parasitic Delay. Logical Effort and Transistor Sizing: Delay in a Logic Gate, Delay in Multistage Logic Networks, choosing the Best Number of Stages. Power Dissipation: Static Dissipation, Dynamic Dissipation, Low-Power Design. Interconnect: Resistance, Capacitance, Delay, Crosstalk. Design Margin: Supply Voltage, Temperature, Process Variation, Design Corners. Reliability, Scaling.

UNIT-IV
Analog Circuits
MOS Small-signal Model, Common Source Amplifier, The CMOS Inverter as an Amplifier, Current Mirrors, Differential Pairs, Simple CMOS Operational Amplifier, Digital to Analog Converters, Analog to Digital Converters, RF Circuits.

UNIT-V
Combinational Circuit Design
Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Differential Circuits, Sense Amplifier Circuits, BiCMOS Circuits, Low Power Logic Design, Comparison of Circuit Families. Standard Cell Design: Cell Hierarchies, Cell Libraries, Library Entries, Cell Shapes and Floor Planning.

References:

1. Neil H.E. Weste, David Harris, Ayan Banerjee: CMOS VLSI Design, Third Edition, Pearson.
2. Neil H.E. Weste, Kamran Eshraghian: Principle of CMOS VLSI Design, Pearson Education.
3. J. P. Uyemura: Chip Design for Submicron VLSI, Cengage Learning.
4. Philip E. Allen and Douglas R Holberg: CMOS Analog Circuit Design, Oxford
5. Carver Mead and Lynn Conway: Introduction to VLSI systems, BS Publication.
6. J. P. Uyemura: Introduction to VLSI Circuits and Systems, Wiley.
7. Plummer: Silicon VLSI Technology, Pearson Education.

List of Experiments:

1. Design of MOS Generator Using any Electronic Design Automation (EDA)- eg. Microwind / Cadence / Sylvaco / Tanner silicon HiPer / Xilinx ISE 9i or any similar software
2. DC MOSFET Curves using EDA.
3. Design of CMOS Logic Gates using EDA.
4. Draw the following CMOS circuits using 0.12 μm and 65 nm technology and simulate for transfer characteristics along with 2D and 3D view from 45^0 angles. Compare power consumption and rise/fall delays in both technologies:
    a. CMOS Inverter with 0.1pF and 0.1fF capacitance loads, in both cases with equal rise and fall times. Plot output eye diagram also.
    b. CMOS NAND and NOR gates with 0.01pF load and equal rise and fall times. Comment on area requirement of both gates.
5. To design Current Mirror using CMOS 0.18 micron Technology.
6. Design a basic differential amplifier circuit using current mirror logic. Show gain of amplifier and comment on bandwidth.
7. Design the Schmitt trigger circuit with UTP= 4.5 V and LTP = 2.0 V. Plot transfer curve analysis (with hysteresis effect) V_O versus V_I.
8. Design a 2-bit parallel adder from schematic and its CMOS layout. List global delay of all nodes. Identify the critical path and comment on its optimization.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
PROGRAMME: Electronics and Telecommunication
COURSE: EC-506 Software Lab-II- Hardware Description Languages

Category Course	Course Title	Course Code	Credit-4C			Practical Exam
IT-4	Software Lab-II	EC-506	L	T	P	Max. Marks-50
			0	0	4	

Course Contents

SECTION A: ELECTRONIC DESIGN AUTOMATION SOFTWARE

Introduction to EDA environment, eg. Microwind / Cadence / Sylvaco / Tanner silicon HiPer / Xilinx ISE 9i / any similar software / Any Freeware - EDA, its study and simulation/analysis/design of circuits.

SECTION B: VERILOG

Introduction, Language Element, Expression, Gate Level Modeling, User-Defined Primitives, Data Flow Modeling, Behavioral Modeling, Structural Modeling, Synthesize, Verilog Constructs To Gate, Modeling- Combinational Logic, Modeling-Sequential Logic, Modeling A Memory.

SECTION C: VHDL

Introduction, Entity Declaration, Architecture Body, Configuration and Package Declaration, Package Body, Model Analysis, Simulation, Basic Language Elements, Behavioral Modeling, Data Flow Modeling, Structural Modeling.

References:

1. J. Bhasker: A Verilog HDL Primer, New Edition, Pearson Education.
2. J. Bhasker: A Verilog HDL Synthesis, BS Publication.
3. D. L. Perry: VHDL: Programming by Example, TMH.
4. V. A. Pedroni: Circuit Design with VHDL, PHI.
5. J. R. Armstrong and F. G. Gray: VHDL Design Representation and Synthesis, Pearson Education.
6. Palnitkar: VHDL, Pearson Education.
7. Software Manuals.

List of Experiments:

Simulation of Following Using Verilog/VHDL.

1. Half Adder, Full Adders, Subtractor, Flip-Flop's, 4-bit Comparators
2. 2:1, 4:1 and 8:1 Multiplexer.
3. Parity Generator.
4. 4 Bit Up/Down Counter with Loadable Count.
5. 2:4, 3:8 and 4:16 Decoder.
6. 8-bit Shift Resistors.
7. Barauel Shifter.
8. Design 8-bit Arithmetic unit.
9. N by M Binary Multipiler.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
PROGRAMME: Electronics and Telecommunication
COURSE: EC--601 Digital Signal Processing

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

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.

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, rectangular and other windows, Examples of FIR filters, design using Windows

References:

1. A.V. Oppenheim and R. W. Schafer: Digital Signal Processing, Prentice Hall.
2. L.R. Rabiner and B. Gold: Theory and Application of Digital Signal Processing, Prentice Hall
3. John. G. Proakis and Monolakis: Digital Signal Processing, Pearson Education
4. Johnny R. Johnson: Introduction to Digital Signal Processing, PHI, New Delhi.
5. S. Ghosh: Signal and Systems, Pearson Education.
6. Schilling and Harris: Fundamentals of DSP using MATLAB, Cengage Learning.

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)
			L	T	P	
Departmental Core (DC-12)	Cellular Mobile Communication	EC- 602	3	1	0	Max. Marks-100 Min. Marks: 35 Duration: 3 hrs.

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 Noncochannel 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. Faher Kamilo: Wireless Digital Communication, Prentice Hall of India, New Delhi, 2006.
3. D. P. Agrawal and Q. An Zeng: Wireless and Mobile Systems, Cengage Learning, 2006.
4. Schiller : Mobile Communication, Pearson Education

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
PROGRAMME: Electronics and Communication Engineering
COURSE: EC-603 Data Communication and Networks

Category of course	Course Title	Course code	Credit-6C			Theory paper (ES)
Departmental Core (DC-13)	Data Communication and Networks	EC- 603	L	T	P	Max. Marks-100 Min. Marks: 35 Duration: 3 hrs.
			3	1	2	

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 Analog 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. Duck: Data Communication and Networking, Pearson Education

List of Experiments:

Simulation of various ARQ protocols, error detection and correction techniques in Scilab (Freeware-Downloadable from www.Scilab.com) **/ MATLAB/ Any Similar software, Simulation of various MAC sublayer protocols using Matlab Software.**

1. Demonstration of working of different ARQ Protocols.
2. Demonstration of different error detection and error correction techniques.
3. To initialize and establish the logical ring using IEEE 802.4.
4. To establish Point to Point Communication between two nodes in the network.
5. To establish Broadcast Communication from one node to all other nodes.
6. To demonstrate the Network Management in any network.
7. To demonstrate different ring management operations in IEEE 802.5.

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)
Departmental Core (DC-14)	Microwave Engineering	EC- 604	L	T	P	Max. Marks-100 Min. Marks: 35 Duration: 3 hrs.
			3	1	2	

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)

References:

1. Y. S. Liao: Microwave Devices, PHI.
2. M. Kulkarni: Microwave and Radar Engineering, Umesh Publications.
3. A. K. Maini: Microwave and Radar, TMH.

4. R.E.Collins: Foundations of Microwave Engineering, 2nd Edition, Wiley Publications.
5. J.H. Reich: Microwave Principles, East West Press.
6. D. M. Pozar: Microwave Engineering, 3rd Edition, Wiley Publications.

List of Experiment:

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, distortionless 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, dissipationless line, voltage and current on a dissipationless line, standing waves, standing wave ratio, input impedance of open circuit and short circuit, power and impedance measurement on lines, eighthwave, quarter-wave and half wave line, circle diagram, Smith chart, solution of problems using Smith chart, single and double stub matching .introduction to microstrip 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 Experimental:

1. Introduction: Measurement set up of Transmission Line Analyzer.
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.