HINDUSTAN
INSTITUTE OF TECHNOLOGY & SCIENCE
(DEEMED TO BE UNIVERSITY)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

M.Tech.(COMMUNICATION SYSTEMS)

Out Come based Curriculum and Syllabi
Regulations 2014-15

(Applicable to the students admitted from the Academic year 2014- 2015 onwards)

Semester I

Sl. No	Course Code	Course Title	L	T	P	C	TCH
Theory							
1.	PMA106	Advanced Applied Mathematics	3	1	0	4	4
2.	PES101	Digital Signal Processing	3	1	0	4	4
3.	PCS105	Material Science and Engineering	3	1	0	4	4
4.	PVL102	Digital CMOS Design	3	1	0	4	4
5.	PCS106	Solid State Devices	3	1	0	4	4
6.	PCS102	Advanced Radiation Systems	3	1	0	4	4
Total						**24**	**24**

Semester II

Sl. No	Course Code	Course Title	L	T	P	C	TCH
Theory							
1.	PCS201	Mobile Communication Networks	3	1	0	4	4
2.	PCS202	Multimedia Compression Techniques	3	1	0	4	4
3.	PCS203	Microwave Integrated Circuits	3	1	0	4	4
4.	PCS204	Satellite Communication	4	0	0	4	4
5.		Elective I	3	0	0	3	3
6.		Elective II	3	0	0	3	3
Practical							
7.	PCS205	Communication System Lab	0	0	3	2	3
Total						**24**	**25**

Semester III

Sl. No	Course Code	Course Title	L	T	P	C	TCH
Theory							
1.		Elective III	3	0	0	3	3
2.		Elective IV	3	0	0	3	3
3.		Elective V	3	0	0	3	3
Practical							
4.	PCS301	Project Work (Phase I)	0	0	12	6	12
Total						**15**	**21**

Semester IV

Sl. No	Course Code	Course Title	L	T	P	C	TCH
Practical							
1.	PCS401	Project Work (Phase II)	0	0	24	12	24
Total						**12**	**24**

TOTAL CREDITS : 75

LIST OF ELECTIVES

S.No	Course Code	Course Title	L	T	P	C	T C H
1	PCS701	Communication Protocol Engineering	3	0	0	3	3
2	PCS704	Network Routing Algorithms	3	0	0	3	3
3	PCS705	Global Positioning Systems	3	0	0	3	3
4	PCS706	Digital Image Processing	3	0	0	3	3
5	PCE704	Internetworking Multimedia	3	0	0	3	3
6	PCS708	Electromagnetic Interference and Compatibility in System Design	3	0	0	3	3
7	PCS709	Communication Network Security	3	0	0	3	3
8	PCS711	Wireless Sensor Networks	3	0	0	3	3
9	PCS103	Optical Communication Networks	3	0	0	3	3
10	PIT101	Advanced Data Communication	3	0	0	3	3
11	PCS712	Cognitive Radio	3	0	0	3	3

SEMESTER-I
ADVANCED APPLIED MATHEMATICS

L	T	P	C
3	1	0	4

PMA106	**ADVANCED APPLIED MATHEMATICS**	**4 Credits**
Goal	Develop the Mathematical skills to formulate certain practical problems, solve them and physically interpret the results	

Objectives	**Outcomes**
The course should enable the student to 1. Understand the techniques to solve the system of equations using direct method and indirect methods. Learns to decompose the matrix in the LU form and to find the Eigen value of a matrix using power and Jacobi methods. 2. Learn to classify the initial and boundary value problems. Understands the D'Alemberts solution of the one dimensional wave equation. Learn significance of characteristic curves. 3. Learn series solutions of Bessel's and Legendre equations. Understand recurrence relation, generating functions and orthogonal properties. 4. Learn basics of probability, addition and multiplication, Baye's theorems. Understands the concept of random variable, moment generating function and their properties. Learn standard distributions in discrete and continuous cases 5. Learns the different Markovian models with finite and infinite capacity and understands to classify them.	The students should be able to: 1. Able to write the algorithm for solving the simultaneous equations for direct and indirect methods. Identifies the Eigen values using conventional method and compares with numerical solutions. Able to write the algorithm to find the Eigen values of a matrix. 2. Able to form the wave equations with initial conditions and solve them using D'Alemberts solutions. Solves the wave equations using Laplace transform for displacements in long string – long string under its weight and free and forced vibrations. 3. Solves the Bessel's equation and Legendre equations. Using Bessel's function solves many practical problems that arise in electrical transmission problems and vibration of membranes as in loudspeakers. 4. Evaluates the probability using addition and multiplication theorem. Applies Baye's for practical problems to find the probability. Verifies whether a given function is a probability mass or density function. Applies the discrete and continuous distributions for solving practical problems. Evaluates the moments of the distributions using moment generating function. 5. Able to analyze and classify the models, M / M / 1, M / M / C, finite and infinite capacity and solves practical problems related to the queuing models.

UNIT I LINEAR ALGEBRAIC EQUATION AND EIGEN VALUE PROBLEMS 12

System of Equations – Solution by Gauss Elimination and Gauss Jordan methods – LU decomposition method – Indirect methods – Gauss Jacobi and Gauss Seidel methods – Eigen values of a matrix using Jacobi and power methods.

UNIT II WAVE EQUATION 12

Solution of initial and boundary value problems - Characteristics - D'Alembert's solution - Significance of characteristic curves - Laplace transform solutions for displacement in a long string, in a long string under its weight - a bar with prescribed force on one end - Free vibrations of a string.

UNIT III SPECIAL FUNCTIONS 12

Series solutions - Bessel's equation - Bessel functions - Legendre's equation - Legendre polynomials - Rodrigue's formula - Recurrence relations - Generating functions and orthogonal property for Bessel functions of the first kind - Legendre polynomials.

UNIT IVPROBABILITY AND RANDOM VARIABLE 12

Discrete and Continuous random variables – Moments – Moment generating functions - Standard distributions - Binomial, Poisson, Geometric, Negative Binomial, Uniform, Normal ,Exponential, Gamma and Weibull distributions – Two dimensional random variables – Joint, Marginal and Conditional distributions. Correlation and Regression.

UNIT V QUEUING THEORY 12

Markovian models – Birth and death queuing models – Steady state – Single and Multiple servers – M/M/1 – Finite and infinite capacity – M/M/C – finite and infinite capacity.

TOTAL: 60

REFERENCES

1) Taha, H.A., "Operations Research - An Introduction ", Prentice Hall of India Ltd., 6th Edition, New Delhi, 1997.
2) Dr.Singaravelu A., Dr.Siva Subramanian S., and Dr.Ramachandran C., "Probability and Queuing Theory", Meenakshi agency, 20th edition, January 2013.
3) Veerarajan T., "Probability, Statistics and Random Processes", Tata McGraw-Hill, second edition, 2004.
4) Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 34th edition.
5) Sankara Rao K., "Introduction to Partial Differential Equations", PHI, 1995.
6) Veerarajan T., "Mathematics IV", Tata McGraw-Hill, 2000.

DIGITAL SIGNAL PROCESSING

L T P C
3 1 0 4

PES101	**DIGITAL SIGNAL PROCESSING**	**4 CREDITS**
Prerequisite		
Goal	To introduce the Fundamental Concepts of different signal processing techniques using Digital Processors and various transforms and their utility in control systems.	
Objectives	**Outcomes**	
The course should enable the students to : (1) Study the Concept of Signals and Systems and their processing techniques. (2) Study the Sampling and Quantization techniques and to change the rate of sampling. (3) Study the Characteristics and various transform analysis of LTI systems (4) Study the design techniques of IIR and FIR filters. (5) Study the fundamental concepts of real time Digital Signal Processors.	At the end of the course the student should be able to: (1) Understand the various types of Signals and Systems along with their properties. (2) Understand the sampling and Reconstruction of Band limited and Band pass signals along-with sampling rate conversion procedures. (3) Understand the performance parameters of LTI system and various Transform techniques in Frequency domain. (4) Understand the structure and design techniques of IIR and FIR filters and their conversion between domains. (5) Know the various type of processors and programming concepts.	

UNIT I DISCRETE TIME SIGNALS AND SYSTEMS 9

Discrete time signal- Basic definition- Some elementary Discrete Time Signals-Representation of signals-Discrete time systems- Basic operation sequences-linear systems-Time invariant systems-Causal systems-Stable systems- Linear time invariant systems-Properties of LTI systems- Linear Constant Coefficient Difference Equations-Fourier Transform Of Discrete Time Signals - Z-Transform-Inverse Z-Transform

UNIT II SAMPLING OF CONTINUOUS TIME SIGNALS 9

Periodic Sampling-Reconstruction of Band Limited Signal from its samples- Sampling of Band Pass signals-Sampling rate conversion-Decimation by decimation factors- Inter polarization by

an integer Factor-Sampling rate conversion by rational Factor-Sampling rate conversion of Band pass signals-A/D Conversion- Quantization -Coding-D/A conversion.

UNIT III TRANSFORM ANALYSIS OF LTI SYSTEMS 9

Ideal filter characteristics-System function and frequency response of LTI systems-Stability and Causality-All pass systems-Minimum phase systems-Discrete Fourier Transform-Relationship between DFT and Fourier Transform of a Discrete Time Signal-Frequency analysis of signals using DFT-Fast Fourier Transform.

UNIT IV DESIGN OF FILTERS 9

Block Diagram and signal flow graph representation- Basic structure of IIR Systems-Basic Structure of FIR Systems-Design of FIR Filters -Design of FIR filter by windowing-Classical continuous -Time Low Pass Filter Approximations-Conversion of transfer functions from continuous to discrete Time frequency Transformations of Low Pass Filters.

UNIT V PRACTICAL DIGITAL SIGNAL PROCESSORS 9

Fundamentals of Fixed Point DSP architecture-Fixed Point representation of numbers-
Arithmetic computation- Memory accessing-Pipelining of instructions-Features of example processors- Floating point DSPs-Floating point Representation of numbers- Comparison of DSPs.

L = 45, T=15, TOTAL=60

TEXT BOOKS:

1. Oppenheim and RW Scaffer- Digital Signal Processing-PHI,2000
2. Proakis And Manolakis “Digital Signal Processing: principles, Algorithms and applications “PHI,1992

REFERENCE:

1. Rabiner and Gold-Theory and Application of Digital Processing-PHI,1975.

MATERIAL SCIENCE AND ENGINEERING

L T P C
3 1 0 4

PCS105	**MATERIAL SCIENCE AND ENGINEERING**	**4 CREDITS**
Prerequisite	-	
Goal		
Objectives	**Outcomes**	
The course should enable the students to 1. Students get the knowledge of Engineering Materials, Basic Structure, Properties and Performance also, about bonding structures 2. Students are exposed to detailed study on cubic and non-cubic structures Polymorphism, Unit Cell Geometry, Crystal Directions, Planes, Diffraction, Also exposure to Imperfection in crystalline Materials, Order and Disorder in Polymers, Solid Solutions, in Ceramic and Metallic Compounds and Polymers. 3. Exposure to **Conductivity and E**nergy Bands, Intrinsic & Extrinsic Semiconductors, and exposure to magnetic materials properties, domain, ceramic magnets, metallic magnets and dia magnetism 4. Students study in detail about dielectric and optical ceramics and polymer. 5. Exposure is given about Material Service Performance, Corrosion and Control, Effect of Temperatures and radiation	At the end of the course the student should be able to: 1. Differentiate the materials based on structure, properties and performance and bonding. 2. Awareness about cubic and non-cubic Polymorphism, Disorder in Metallic Structures, Polymers and Solutions 3. Capable of analyzing depth of conduction in materials about magnetics 4. Knowledge about optical properties of dielectric materials, polarization, and about the optical properties of ceramic dielectric transparent materials, Light Emitting Solids. 5. Students gain the knowledge about engineering materials under various conditions, effect of corrosion and control.	

Unit :1

Introduction to Material Science and Engineering

Materials and Civilization, Materials and Engineering, Structure, Properties and Performance, Types of Materials

Atomic Bonding and Co-ordination

Atoms, Ions, Molecules, Macromolecules (Polymers), Three-dimensional bonding, Interatomic distances, Generalizations based on Atomic Bonding.

Unit :2

Crystals

Cubic & Non-Cubic Structures, Polymorphism, Unit Cell Geometry, Crystal Directions, Crystal Planes, X-Ray Diffraction.

Disorder in Solid Phase

Imperfection, Non-crystalline Materials, Order and Disorder in Polymers, Solid Solutions, Solid Solutions in Ceramic and Metallic Compounds, Solid Solutions in Polymers.

Unit :3

Conduction Materials

Charge Carriers Metallic Conductivity Energy Bands, Intrinsic & Extrinsic Semiconductors, Semiconductor Processing.

Magnetic Properties of Ceramics and Metals

Magnetic Materials, Magnetic Domains Ceramic Magnets, Metallic Magnets, Dia Magnetism.

Unit :4

Dielectric and Optical Properties of Ceramics and Polymers

Dielectric Materials, Polarization Polymeric Dielectrics, Transparent Materials, Light Emitting Solids.

Unit : 5

Performance of Materials in Service

Service Performance, Corrosion, Corrosion Control, Performance at High Temperatures, Performance of Polymers. Performance of Ceramics at High Temperature, Radiation Damage

Text :

1. Lawrence H.Van Vlack Elements of Materials Science and Engineering, Addison – Wesley Publishing Company (Latest Edition)

References:

1. B.D. Cullity, Introduction to Magnetic Material's, Addison Wesley Publishing Company
2. M.I.T. Press, Cambridge, Encyclopedia of Materials Science and Engineering
3. L.H.Vanvleck, Materials for Engineers Concepts & Applications
4. OH. Wyahand D.Dew-Hugnes, Metals, Ceramics & Polymers Cambridge, Unit Press.

DIGITAL CMOS DESIGN

L T P C
3 1 0 4

PVL102	**DIGITAL CMOS DESIGN**	**4 CREDITS**
Prerequisite	-	
Goal	The student will get to know the CMOS process technology, CMOS Transistor theory and design of combinational and sequential circuits using CMOS and the basics of verilog programming language.	
Objectives	**Outcomes**	
The course should enable the students to 6. Study the concept of CMOS transistor theory and CMOS process technology 7. Study the concept of CMOS inverter and the design of combinational logic circuits , 8. Study the concept of sequential circuits with timing issues, clocking strategies and pipeline techniques, 9. Study the concept of arithmetic building blocks, 10. Study the concept of Verilog HDL language.	At the end of the course the student should be able to: 6. Understand the concept of CMOS transistor theory and CMOS process technology, 7. Understand the concept of CMOS inverter and able to draw stick diagram for the logic gates and design of combinational logic circuits, 8. Understand the concept of sequential circuits with timing issues, clocking strategies and pipeline techniques, 9. Understand the concept of arithmetic blocks and also able to design the arithmetic blocks, 10. Understand the concept of verilog HDL language and able to write verilog code.	

UNIT I MOS TRANSISTOR THEORY AND PROCESS TECHNOLOGY 9

NMOS and PMOS transistors, Threshold voltage –Body effect- Design equations – Second order effects, MOS models and small signal AC characteristics-Basic CMOS technology

UNIT II CMOS INVERTER AND COMBINATIONAL LOGIC 9

NMOS and CMOS inverters, Stick diagram, Propagation delay, Examples of combinational logic design, Pass transistor logic – Power dissipation

UNIT III SEQUENTIAL LOGIC CIRCUITS 9

Static and Dynamic Latches and Registers, Timing Issues, Pipelines, Clocking strategies, Synchronous and Asynchronous Design.

UNIT IV DESIGNING ARITHMETIC BUILDING BLOCKS 9

Datapath circuits, Architectures for Adders, Accumulators, Multipliers, Barrel Shifters, Memory Architectures, and Memory control circuits

UNIT V VERILOG HARDWARE DESCRIPTION LANGUAGE 9

Overview of digital design with Verilog HDL, Hierarchical modeling concepts, Modules and port definitions, Gate level modeling, Data flow modeling, Behavioral modeling, Task & functions, Test Bench.

TOTAL:60

REFERENCES:

1. Jan Rabaey, Anantha Chandrakasan, B Nikolic, "Digital Integrated Circuits: A Design Perspective". Second Edition, Feb 2003, Prentice Hall of India.
2. N.Weste, K. Eshraghian, " Principles of CMOS VLSI Design". Second Edition, 1993 Addision Wesley,
3. M J Smith, "Application Specific Integrated Circuits", Addisson Wesley, 1997
4. Samir Palnitkar, "Verilog HDL", Pearson Education, 2nd Edition, 2004.
5. Eugene D.Fabricius, "Introduction to VLSI Design", McGraw Hill International Editions, 1990.
6. Pucknell, "Basic VLSI Design", Prentice Hall of India Publication, 1995.

SOLID STATE DEVICES

L T P C
3 1 0 4

PCS106	**SOLID STATE DEVICES**	**4 CREDITS**
Goal	The aim of this course is to familiarize the student with the principle of operation, capabilities and limitation of various electron devices so that he will be able to use these devices effectively.	

Objectives	**Outcomes**
The course should enable the student to 1. Learn about motion of charge in electric and microtic field effect of force and moving charge calculation of cyclotron frequency, electro static magnetic deflection sensitivity, Fermi - Dirac probability distribution function, thermal generation intrinsic semiconductors, mass action law 2. Learn Energy band structure of materials, Electrical neutrality, calculation of fermi level – hole – electron, mobility drift current, conductivity diffusion current Hall effect, band structure of PN Junction, temperature depend in characteristics. 3. Learn Calculation of transition and diffusion capacitance, characteristics of varactor diode, avalanche and zener breakdown, effect of temperature and breakdown, Effect of light and tunneling effect. 4. Learn junction transistors, current components, gain-with modulation Breakdown characteristics, Ebers–Moll model, Transistor switching times. Characteristics of JFET, pinch off voltage and drain current MOSFETs 5. Learn charectersistics of ohmic contacts, semiconductor powercontrol devices such as UJT, SCR Triac and Diac.	The students should be able to: 6. Calibrate force and motion of a charge in electric and magnetic fields, carrier densities in intrinsic and extrinsic semiconductor, implementing mass action law. 7. Apply law of electrical neutrality calculation of location of Fermi level and hole densities in extrinsic semiconductors as well as mobility, drift current, diffusion current, use of continuity equation and hall effect, evaluate the conduction of PN Junction as a function of temperature. 8. Evaluate the characteristics of given diode for application 9. Analyze the characteristics of given transistor, at critical voltage and current values as required by the applications. 10. Evaluate ohmic contact characteristics, power control device characteristics and application

UNIT I ELECTRON BALLISTICS AND INTRINSIC SEMICONDUCTORS 9

Force on charge in electric field – Motion of Charge in uniform and time varying electric fields – Force on a moving charge in a magnetic field – calculation of cyclotron frequency – calculation of electrostatic and magnetic deflection sensitivity.

Energy band structure of conductors, semiconductors and insulators – Density distribution of available energy states in semiconductors – Fermi- Dirac probability distribution function at different temperatures – Thermal generation of carriers – Calculation of electron and hole densities in intrinsic semiconductors – Intrinsic concentration – Mass Action Law.

UNIT II EXTRINSIC SEMICONDUCTOR AND PN JUNCTIONS 9

N and P type semiconductors and their energy band structures – Law of electrical neutrality – Calculation of location of Fermi level and free electron and hole densities in extrinsic semiconductors – Mobility, drift current and conductivity – Diffusion current – Continuity equation - Hall effect.

Band structure of PN Junction – Current Component in a PN Junction – Derivation of diode equation – Temperature dependence of diode characteristics.

UNIT III SWITCHING CHARACTERISTICS OF PN JUNCTION AND SPECIAL DIODES 9

Calculation of transition and diffusion capacitance – Varactor diode – charge control description of diode – switching characteristics of diode – Mechanism of avalanche and Zener breakdown – Temperature dependence of breakdown voltages – Backward diode – Tunneling effect in thin barriers Tunnel diode – Photo diode – Light emitting diodes.

UNIT IV BIPOLAR JUNCTION TRANSISTORS AND FIELD EFFECT TRANSISTORS 9

Construction of PNP and NPN transistors – BJT current components – Emitter to collector and base to collector current gains – Base width modulation CB and CE characteristics – Breakdown characteristics – Ebers – Moll model – Transistor switching times.

Construction and Characteristics of JFET – Relation between Pinch off Voltage and drain current – Derivation. MOSFET – Enhancement and depletion types.

UNIT V METAL SEMICONDUCTOR CONTACTS AND POWER CONTROL DEVICES 9

Metal Semiconductor Contacts - Energy band diagram of metal semiconductor junction Schottky diode and ohmic contacts.

Power control devices: Characteristics and equivalent circuit of UJT - intrinsic stand off ratio. PNPN diode – Two transistor model, SCR, Triac, Diac.

L = 45, TOTAL = 45

TEXT BOOK

Jacob Millman & Christos C.Halkias, "Electronic Devices and Circuits" Tata McGraw–Hill, 1991 .

REFERENCES

1. Nandita Das Gupta and Amitava Das Gupta, Semiconductor Devices – Modeling
2. and Technology, Prentice Hall of India, 2004.
3. Donald A.Neaman," Semiconductor Physics and Devices" 3rd Ed., Tata McGraw-Hill, 2002.
4. S.Salivahanan, N.Sureshkumar and A.Vallavaraj, Electronic Devices and Circuits, TMH, 1998.
5. S.M.Sze, Semiconductor Devices – Physics and Technology, 2nd edn. John Wiley, 2002.
6. Ben G.Streetman and Sanjay Banerjee, Solid State Electronic Devices, Pearson Education 2000.

ADVANCED RADIATION SYSTEMS

L T P C
3 1 0 4

PCS102	ADVANCED RADIATION SYSTEMS	4 CREDITS
Prerequisite	Antennas & Propagation	
Goal	To make the student knowledge be in various types of antennas used in communication	

Objectives	Outcomes
The course should enable the students to: ‘ 1. Review the fundamentals of E.M. radiation 2. Reason for using arrays types and advantages 3. Discuss the operative types of Antennas 4. Have knowledge about micro strip antennas and their advantages. 5. Discuss and appreciate polarization as related to antennas and exploit it.	At the end of the course the students : 1.Must become familiar with fundamental and specifications for antennas 2. Must become knowledgeable for reasons for going for arrays and their advantages & disadvantages. 3. Should have knowledge of several aperture type antennas and their advantages. 4. Understand the various micro strip antennas and typical uses for them. 5. Familiar with polarization and its utilization in increasing bandwidth.

UNIT I CONCEPTS OF RADIATION 9

Retarded vector potentials – Heuristic approach and Maxwell’s equation approach. The Lorentz gauge condition. Vector potential in Phasor form. Fields radiated by an alternating current element. Total power radiated and radiation resistance. Radiation from Half wave dipole from assumed current distribution. Power radiated in the farfield. Electric vector potential F for a magnetic current source M. Far zone fields due to magnetic source M.

UNIT II ANTENNA ARRAYS 9

N element linear arrays – uniform amplitude and spacing. Phased arrays. Directivity of Broadside and End fire arrays. Three dimensional characteristics. Binomial arrays and Dolph-Tchebycheff arrays. Circular array. Antenna Synthesis- Line source and discretization of continuous sources. Schelkunoff polynomial method. Fourier transform method.

UNIT III APERTURE ANTENNAS 9

Magnetic current – Duality. Electric and Magnetic current sheets as sources. Huyghens source. Radiation through an aperture in an absorbing screen. Fraunhoffer and Fresnel diffraction. Cornu Spiral. Complimentary screens and slot antennas. Slot and dipoles as dual antennas. Babinets principle. Fourier transform in aperture antenna theory.

UNIT IV HORN, MICROSTRIP, REFLECTOR ANTENNAS 9

E and H plane sectoral Horns. Pyramidal horns. Conical and corrugated Horns. Multimode horns. Phase center. Microstrip antennas – feeding methods. Rectangular patch- Transmission

line model Parabolic Reflector antennas – Prime focus and cassegrain reflectors. Equivalent focal length of Cassegrain antennas. Spillover and taper efficiencies. Optimum illumination.

UNIT V ANTENNA POLARIZATION 9

Simple relationship involving spherical triangles. Linear, Elliptical and circular polarization. Development of the Poincare sphere. Representation of the state of polarization in the Poincare sphere. Random polarization – Stokes parameters.

L=45, T=15, TOTAL= 60

TEXT BOOKS:

1. Balanis, C.A., "Antenna Theory" Wiley, 2003
2. Jordan, E.C., "Electromagnetic waves and Radiating systems". PHI 2003

REFERENCES:

1. Krauss, J.D., "Radio Astronomy" McGraw-Hill 1966, (UNIT V)
2. Krauss, J.D.,, Fleisch, D.A., "Electromagnetics" McGraw-Hill,1999

SEMESTER II
MOBILE COMMUNICATION NETWORKS

L T P C
4 0 0 4

PCS201	**MOBILE COMMUNICATION NETWORKS**	**4 CREDITS**
Prerequisite	Nil	
Goal	To introduce the evolution and concepts of mobile communication networks, various modulation techniques, propagation models, network architecture and protocol standards.	

Objectives	**Outcomes**
The course should enable the students to: 1. Describe the evolution and the fundamental of cellular radio concepts. 2. Discuss the different radio propagation models and air protocols. 3. Understand the various Mobile network architecture. 4. Understand the various issues in Wireless Networks. 5. Learn the various security related issues in the wireless networks.	At the end of the course the student should be able to: . 1. Learn the evolution and concepts of cellular communication 2. Learn the various radio propagation models. 3. Discuss the famous mobile network architecture and its operation. 4. Learn the various issues of wireless network. 5. Understand various security mechanism of a wireless networks.

UNIT I OPERATION OF MOBILE COMMUNICATION NETWORKS 12

Operation of first, second and third generation wireless networks: cellular systems, medium access techniques, Mobile networks, elementary Principles of cellular Telephony Channel Division Techniques (TDMA, FDMA, CDMA) Cellular Coverage Methods Network Planning and Resource Allocation, Network Dimensioning and Mobility Management Procedures.

UNIT II PROPAGATION MODELS AND AIR PROTOCOLS 12

Radio propagation models, error control techniques, handoff, power control, Soft handover, Forward link - Reverse link - common air protocols (AMPS, IS-95, IS-136, GSM, GPRS, EDGE, WCDMA, cdma2000, etc)

UNIT III MOBILE NETWORK ARCHITECTURE 12

General Architecture definition, Mobile Terminals (MT, SIM) Radio Section (BTS, BSC) Core Network (MSC, G-MSC, VLR, HLR, AuC) User and Control Plane Protocol Stack, MAP & SS#7, the Key Role of Signaling Interfaces and Network Entities Relation The Physical Channel, The Logical Channels Terminal, Call and Network Management Procedures, Network Planning.

UNIT IV WIRELESS LOCAL AREA NETWORKS 12

Wireless Local Area Networks , General Characteristics of the Hyper LAN System, 802.11 Standard, Basic DCF access scheme, DCF Access Scheme with Handshaking, PCF Access Scheme, The 802.11a Standard, Mobile Ad Hoc Networks, Wireless Sensor Networks, Routing Energy Efficiency, Localization, Clustering.

UNIT V SECURITY ISSUES IN WIRELESS NETWORKS 12

Security in Wireless Networks, Secure routing, Key Pre-distribution and Management, Encryption and Authentication, Security in Group Communication, Trust Establishment and Management, Denial of Service Attacks, Energy-aware security mechanisms, Location verification, Security on Data fusion.

L = 60, TOTAL= 60

TEXT BOOK

1. T.S. Rappaport, "Wireless Communications: Principles & Practice", Second Edition, Prentice Hall, 2002.

REFERENCES

1. W. Stallings, "Wireless Communications and Networks", Prentice Hall, 2002.
2. V.K. Garg, "IS-95 CDMA and CDMA 2000", Prentice Hall PTR, 2000.
3. Leon-Garcia and I. Widjaja, "Communication Networks, Fundamental Concepts and Key Architectures", McGraw-Hill, 2000.
4. J.Schiller,"Mobile Communications", Addison Wesley, 2000.
5. Fred Halsall, "Multimedia Communications, Applications, Networks, Protocols and Standards", Addison Wesley, 2001.
6. Uyless Black ,"Mobile and Wireless Networks" , Prentice Hall PTR, 1996.

MULTIMEDIA COMPRESSION TECHNIQUES

L T P C
4 0 0 4

PCS202	**MULTIMEDIA COMPRESSION TECHNIQUES**	**4 CREDITS**
Prerequisite		
Goal	To introduce the Fundamental Concepts in Multimedia and its compression techniques and standards for transmission and storage	
Objectives	**Outcome**	
The course should enable the students to : (6) Study the Concepts in Video and Digital Audio (7) Study the Text Compression (8) Study the Audio Compression (9) Study the Image Compression (10) Study the Video Compression	At the end of the course the student should be able to: (6) Understand the concept Multimedia Compression and Error analysis (7) Understand the various Coding Techniques (8) Understand the concepts of μ- Law, A- Law, G.722, MPEG audio (9) Understand the concept of Predictive techniques and JPEG standards (10) Know the various MPEG standards and DVI technologies and applications	

UNIT I INTRODUCTION **12**

Special features of Multimedia – Graphics and Image Data Representations – Fundamental Concepts in Video and Digital Audio – Storage requirements for multimedia applications –Need for Compression - Taxonomy of compression techniques – Overview of source coding, source models, scalar and vector quantization theory – Evaluation techniques – Error analysis and methodologies

UNIT II TEXT COMPRESSION **12**

Compaction techniques – Huffmann coding – Adaptive Huffmann Coding – Arithmetic coding– Shannon-Fano coding – Dictionary techniques – LZW family algorithms

UNIT III AUDIO COMPRESSION **12**

Audio compression techniques - μ- Law and A- Law companding. Frequency domain and filtering – Basic sub-band coding – Application to speech coding – G.722 – Application to audio coding – MPEG audio, progressive encoding for audio – Silence compression, speech compression techniques – Formant and CELP Vocoders

UNIT IV IMAGE COMPRESSION **12**

Predictive techniques – DM, PCM, and DPCM: Optimal Predictors and Optimal Quantization – Contour based compression – Transform Coding – JPEG Standard – Sub-band coding algorithms: Design of Filter banks – Wavelet based compression: Implementation using filters – EZW, SPIHT coders – JPEG 2000 standards - JBIG, JBIG2 standards.

UNIT V VIDEO COMPRESSION 12

Video compression techniques and standards – MPEG Video Coding I: MPEG – 1 and 2 – MPEG Video Coding II: MPEG – 4 and 7 – Motion estimation and compensation techniques – H.261 Standard – DVI technology – PLV performance – DVI real time compression – Packet Video.

L = 60, TOTAL=60

REFERENCES:

1. Khalid Sayood, Introduction to Data Compression, Morgan Kauffman Harcourt India, 2nd Edition, 2000.
2. David Salomon, Data Compression – The Complete Reference, Springer Verlag New York Inc., 2nd Edition, 2001.
3. Yun Q.Shi, Huifang Sun, Image and Video Compression for Multimedia Engineering - Fundamentals, Algorithms & Standards, CRC press, 2003.
4. Peter Symes, Digital Video Compression, McGraw Hill Pub., 2004.
5. Mark Nelson, Data compression, BPB Publishers, New Delhi,1998.
6. Mark S.Drew, Ze-Nian Li : Fundamentals of Multimedia, PHI, 1st Edition, 2003.
7. Watkinson,J, Compression in Video and Audio, Focal press,London.1995.
8. Jan Vozer , Video Compression for Multimedia, AP Profes, NewYork, 1995

MICROWAVE INTEGRATED CIRCUITS

L T P C
4 0 0 4

PCS203	MICROWAVE INTEGRATED CIRCUITS	4 CREDITS
Prerequisite	Microwave Engineering, Electromagnetic fields.	
Goal	To know the Integrated circuit technology for Microwave IC fabrication, to analyze the various Stiplines and waveguide structures and to design Lumped and Non-reciprocal components for Microwave applications.	

Objectives	Outcomes
The course should enable the students to: 1. Understand Microwave Integrated Circuit technology, thin film and active devices. 2. Develop an in-depth knowledge on MMICs and various process steps 3. Study the various in the design of micro-striplines. 4. Study the integration of waveguides and couplers on chip. 5. Understand the design of microwave lumped and non-reciprocal elements.	At the end of the course the student should be able to: 1. Have a good knowledge on the thin film technology. 2. Understand the various techniques used in MMIC technology 3. Solve microstrip line related problems and numerical design of the same. 4. Understand various forms of waveguide embedding and coupler design. 5. Understand the design of various microwave lumped elements.

UNIT I TECHNOLOGY OF HYBRID MICS **12**

Dielectric substrates - thick film technology and materials - thin film technology and materials – methods of testing – encapsulation of devices for MICs – mounting of active devices.

UNIT II TECHNOLOGY OF MONOLITHIC MICS **12**

Processes involved in fabrication – epitaxial growth of semiconductor layer – growth of dielectric layer – diffusion-ion implantation – electron beam technology.

UNIT III ANALYSIS OF MICROSTRIP LINE **12**

Methods of conformal transformation – numerical method for analysis – hybrid mode analysis – coupled mode analysis- method of images – losses in miscrostrips.

UNIT IV COUPLED MICROSTRIPS, SLOT LINE AND COPLANAR WAVEGUIDES **12**

Coupled microstrips – even and odd mode analysis – microstrip directional couplers – branch line couplers – periodic branch line couplers – synchronous branch line couplers.

UNIT V LUMPED ELEMENTS AND NON-RECIPROCAL COMPONENTS **12**

Design and fabrication using microstrips – flat resistors – flat inductors – interdigital capacitors – sandwich capacitors – ferromagnetic substrates for non-reciprocal devices – microstrip circulators– latching circulators – isolators – phase shifters.

TOTAL=60

TEXT BOOK:

1. Gupta,K.C, and Amarjit singh – "Microwave Integrated Circuits" – John Wiley and sons – Wiley Eastern Reprint, 1978.

REFERENCE:

1. Hoffmann, R.K – "Handbook of Microwave Integrated Circuits" – Artech House,

SATELLITE COMMUNICATION

L T P C
4 0 0 4

PCS204	**SATELLITE COMMUNICATION**	**4 CREDITS**
Prerequisite		
Goal	The student will get to know the satellite systems advantages and disadvantages and the various services offered by Satellite Systems	

Objectives	**Outcomes**
The course should enable the students to 1. Know keplers laws of Planetary motion and its application to Earth satellite systems, orbital elements and controlling of them. 2. Know the 3 types of orbits and launching satellite into there orbits and maintaining them there throughout their life. 3. Know the details of communication link throughout the satellite both uplink and downlink 4. Know how a satellite can be accessed by many who come within its range of visibility 5. To know the several services offered by a satellite and the national, regional and international systems currently operating.	At the end of the course the student should be able to: 1. Keplers laws for planetary motion and its application to Earth Satellite System 2. The three types of orbits to which the satellite can be launched and maintaining them in the specified orbits to the accuracy requires by Indiana tuned authorities. 3. Must be capable of designing satellite communication links for a given range and for given specifications either digital or Analogue. 4. Must understand the various multiple access technique available for the users of the satellite and the comparative merits and demerits 5. To become familiar with the several services possible in satellite system and to know the capabilities of national, regional & international systems

UNIT I ORBITAL MECHANICS **12**

Kepler's laws of motion, Orbits, Orbit Equations, Orbit Description, Locating the Satellite in the Orbit and with Respect to Earth, Orbital Elements-Look Angle Determination and Visibility – Orbital Perturbations, Orbit Determination, Launch Vehicles, Orbital Effects in Communication System -Performance Attitude control; Satellite launch vehicles, spectrum allocations for satellite systems.

UNIT II SPACECRAFT SUB SYSTEMS AND EARTH STATION **12**

Spacecraft Subsystems, Altitude and Orbit Control, Telemetry and Tracking, Power Systems, Communication Subsystems, Transponders, Antennas, Equipment Reliability, Earth Stations, example of payloads of operating and planned systems.

UNIT III SPACE LINKS 12

The Space Link, Satellite Link Design - Satellite uplink -down link power Budget, Basic Transmission Theory, System Noise Temp, G/T Ratio, Noise Figure, Downlink Design, Design of Satellite Links for Specified C/N - Microwave Propagation on Satellite-Earth Paths – Interference between satellite circuits, Energy Dispersal, propagation characteristics of fixed and mobile satellite links.

UNIT IV MULTIPLE ACCESS TECHNIQUES AND NETWORK ASPECTS 12

Single access vs. multiple access (MA). Classical MA techniques: FDMA, TDMA. Single channel per carrier (SCPC) access - Code division multiple access (CDMA). Demand assignment techniques. Examples of MA techniques for existing and planned systems (e.g. the satellite component of UMTS) - Mobile satellite network design, ATM via satellite - TCP/IP via satellite – Call control, handover and call set up procedures - Hybrid satellite-terrestrial networks.

UNIT V SERVICES AND APPLICATIONS 12

Fixed and mobile services - Multimedia satellite services - Advanced applications based on satellite platforms - INTELSAT series - INSAT, VSAT, Remote Sensing - Mobile satellite service: GSM - GPS, INMARSAT, Navigation System, Direct to Home service (DTH), Special services, E-mail, Video conferencing and Internet connectivity.

TOTAL=60

TEXT BOOKS:

1. Dennis Roddy, “Satellite Communications”, Third Edition, Mc Graw Hill International Editions, 2001.

REFERENCES:

1. Bruce R.Elbert, “The Satellite Communication Applications Hand Book, Artech House Boston,1997.

2. Wilbur L.Pritchard, Hendri G.Suyderhood, Robert A.Nelson,”Satellite Communication Systems Engineering”, II Edition, Prentice Hall, New Jersey, 1993

3. Tri T.Ha, “Digital satellite communication”, 2nd Edition, McGraw Hill, New york.1990

COMMUNICATION SYSTEM LAB

L T P C
0 0 3 2

PCS205	**COMMUNICATION SYSTEM LAB**	**2 CREDITS**
Prerequisite	NIL	
Goal	To Provide hands on training with MATLAB simulator with various tool boxes available in MATLAB and Simulink block sets for communication engineering.	
Objectives	**Outcomes**	
The course should enable the students to: 1. Know MATLAB simulation software to perform Signal Processing exercises, 2. Learn how to the S-parameters of microwave devices 3. Obtain the performance of digital modulation techniques and CDMA system 4. Learn how to the characteristics of a transmission line 5. Learn to Use Computer vision tool box 6. Learn Simulation of audio and speech compression using MATLAB	At the end of the course the student should be able to: 1. MATLAB simulation software to perform various Signal Processing exercises, 2. Write MATLAB coding to determine S-parameters of microwave devices. 3. Use Communication system tool box to evaluate the performance of digital modulation techniques and CDMA system 4. Analyze the characteristics of a transmission line 5. Use Computer vision tool box for Thresholding, Histogram, Edge detection 6. Obtain the audio and speech compression using MATLAB.	

LIST OF EXPERIMENTS

1. Simulation of Modulation and Coding in an AWGN Communication Channel using Simulation Packages. 6
2. Implementation of Adaptive Filters, periodogram and multistage multirate system in DSP Processor. 6
3. Simulation of QMF using Simulation Packages. 6

4.	Implementation of linear and cyclic codes.	3
5.	S-parameter estimation of Microwave devices.	3
6.	Performance evaluation of simulated CDMA System.	3
7.	Characteristics of λ/4 and λ/2 transmission lines.	3
8.	Thresholding, Histogram, Edge detection using Computer Vision Tool box.	6
9.	Performance evaluation of digital modulation techniques.	6
10.	Audio and speech compression.	3

TOTAL:45

SEMESTER III
PROJECT WORK (PHASE I)

L T P C
0 0 12 6

PCS301	**PROJECT WORK(PHASE I)**	**6 CREDITS**
Prerequisite		
Goal	To develop the student's skills and enable innovation in design and fabrication work from the theoretical and practical skill acquired from the previous semesters.	

Objectives	**Outcomes**
The course should enable the students to: 1. Select and work on real life application in the field of Electronics & Communication, 2. Implement their skills acquired in the previous semesters to practical problems, 3. Apply and enhance the knowledge acquired in the related field, 4. Make the students come up with new ideas in their area of interest.	At the end of the course the student should be able to: 1. Appreciate various aspects of the curriculum which support students in increasing their mastery, 2. Get an idea and develop confidence in designing, analyzing and executing the project, 3. Develop knowledge of latest trends in fabrication and relate their ideas to industrial applications, 4. Have complete understanding of making a product.

NOTE:

The objective of the project work is to enable the students on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Twelve hours per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.

Each student will be assigned any one of the following types of project/thesis work:

(a) Industrial case study
(b) Preparation of a feasibility report
(c) Thesis by experimental research, and
(d) Design and development of equipment.

Each report must contain student's own analysis or design presented in the approved format.

Sessional marks will include

(a) Evaluation of the student's progress,
(b) Degree of involvement and participation,
(c) Merit of the project.

A student will have to defend his/her project/thesis and credit will be given on the merits of presentation and viva-voce examination.

SEMESTER IV
PROJECT WORK (PHASE II)

L T P C
0 0 24 12

PCS401	**PROJECT WORK(PHASE II)**	**12 CREDITS**
Prerequisite		
Goal	To develop the student's skills and enable innovation in design and fabrication work from the theoretical and practical skill acquired from the previous semesters.	

Objectives	**Outcomes**
The course should enable the students to: 1. Select and work on real life application in the field of Electronics & Communication, 2. Implement their skills acquired in the previous semesters to practical problems, 3. Apply and enhance the knowledge acquired in the related field, 4. Make the students come up with new ideas in his area of interest.	At the end of the course the student should be able to: 1. Appreciate various aspects of the curriculum which support students in increasing their mastery, 2. Get an idea and develop confidence in designing, analyzing and executing the project, 3. Develop knowledge of latest trends in fabrication relate their ideas to industrial applications, 4. Have complete understanding of making a product.

NOTE:

The objective of the project work is to enable the students on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Twenty four hours per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.

Each student will be assigned any one of the following types of project/thesis work:

(a) Industrial case study
(b) Preparation of a feasibility report
(c) Thesis by experimental research, and
(d) Design and development of equipment.

Each report must contain student's own analysis or design presented in the approved format.

Sessional marks will include

(a) Evaluation of the student's progress,
(b) Degree of involvement and participation,
(c) Merit of the project.

A student will have to defend his/her project/thesis and credit will be given on the merits of presentation and viva-voce examination.

LIST OF ELECTIVES

COMMUNICATION PROTOCOL ENGINEERING

L T P C
3 0 0 3

PCS701	**COMMUNICATION PROTOCOL ENGINEERING**	**3 CREDITS**
Prerequisite	-	
Goal	To learn and understand the OSI model and TCP/IP protocol suite for Communication Protocol Engineering.	

Objectives	**Outcomes**
The course should enable the students to 1. Study the OSI model and TCP/IP architecture for data communication, 2. Study the Internet protocol, SDL and its specification languages, 3. Study the concept of protocol verification and validation, 4. Study the concept of protocol conformance and performance testing, 5. Study the concept of protocol synthesis and implementation.	At the end of the course the student should be able to: 1. Understand the network reference models for data communications, 2. Understand the concepts of Internet protocol and SDL protocol, 3. Verify a protocol using finite state machines and validate them through different protocol validation approaches, 4. Understand the concept of protocol conformance test architecture and interoperability and scalability testing, 5. Understand the different protocol synthesis algorithms and implementation techniques.

UNIT I NETWORK REFERENCE MODEL **9**

Communication model-software, subsystems, protocol, protocol development methods, Protocol engineering process, Layered architecture, Network services and Interfaces, Protocol functions, OSI model, TCP/IP protocol suite.

UNIT II PROTOCOL SPECIFICATIONS **9**

Components of protocol, Specifications of Communication service, Protocol entity, Interface, Interactions, Multimedia protocol, Internet protocol, SDL, SDL based protocol- other protocol specification languages

UNIT III PROTOCOL VERIFICATION AND VALIDATION 9

Protocol verification, Verification of a protocol using finite state machines, Protocol validation, protocol design errors, Protocol validation approaches, SDL based protocol verification and validation.

UNIT IV PROTOCOL CONFORMANCE AND PERFORMANCE TESTING 9

Conformance testing methodology and frame work, Conformance test architectures, Test sequence generation methods, Distributed architecture by local methods, Conformance testing with TTCN, systems with semi controllable interfaces - RIP,SDL based tools for conformance testing, SDL based conformance testing of MPLS Performance testing, SDL based performance testing of TCP and OSPF, Interoperability testing, SDL based interoperability testing of CSMA/CD and CSMA/CA protocol using Bridge, Scalability testing.

UNIT V PROTOCOL SYNTHESIS AND IMPLEMENTATION 9

Protocol synthesis, Interactive synthesis algorithm, Automatic synthesis algorithm, Automatic synthesis of SDL from MSC, Protocol Re-synthesis; Requirements of protocol implementation, Object based approach to protocol implementation, Protocol compilers, Tool for protocol engineering.

L = 60, TOTAL= 60

REFERENCES

1. Pallapa Venkataram and Sunilkumar S.Manvi, “Communication protocol engineering”, Prentice Hall of India, 2004.
2. Richard Lai and Ajin Jirachiefpattana, “Communication Protocol Specification and Verification”, Kluwer Publishers, Boston, 1998.
3. Tarnay, K., “Protocol Specification and Testing”, Springer, 1991.
4. Mohamed G. Gouda, “Elements of Network Protocol Design”, Wiley-Interscience, New York, 1998.
5. V.Ahuja, “Design and Analysis of Computer Communication networks”, McGraw-Hill, London, 1982.
6. G.J.Holtzmann, “Design and validation of Computer protocols”, Prentice Hall, New York,

NETWORK ROUTING ALGORITHMS

L T P C
3 0 0 3

PCS704	**NETWORK ROUTING ALGORITHMS**	**3 CREDITS**
Prerequisite	-	
Goal	To learn the various Network routing algorithms for High speed and Mobile networks.	

Objectives	**Outcomes**
The course should enable the students to 1. study the circuit switching networks and its routing algorithms 2. study the packet switching networks and its routing algorithms 3. study the routing algorithms for High speed networks. 4. study the routing algorithms for mobile radio networks. 5. learn the communication strategies and routing algorithm for MANETs.	At the end of the course the student should be able to: 1.Understand the circuit switching network and its routing algorithm, 2.Understand the packet switching network and its routing algorithm, 3.Understand the routing algorithm for high speed networks and ATM networks, 4.Understand the architecture, mobility management and routing in mobile radio communication networks, 5.Understand the concept and different routing algorithms in Mobile Adhoc networks.

UNIT I CIRCUIT SWITCHING NETWORKS 9

AT & T's Dynamic Routing Network, Routing in Telephone Network-Dynamic Non Hierarchical Routing - Trunk Status Map Routing - Real Time Network Routing, Dynamic Alternative Routing - Distributed Adaptive Dynamic Routing - Optimized Dynamic Routing.

UNIT II PACKET SWITCHING NETWORKS 9

Distance vector Routing, Link State Routing, Inter domain Routing - Classless Interdomain routing (CIDR), Interior Gateway routing protocols (IGRP) - Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Exterior Gateway Routing Protocol (EGRP) - Border Gateway Protocol (BGP), Apple Talk Routing and SNA Routing.

UNIT III HIGH SPEED NETWORKS 9

Routing in optical networks-The optical layer, Node Designs, Network design and operation, Optical layer cost tradeoffs, Routing and wavelength assignment, Architectural variations, Routing in ATM networks-ATM address structure, ATM Routing, PNNI protocol, PNNI signaling protocol, Routing in the PLANET network and Deflection Routing.

UNIT IV MOBILE NETWORKS **9**

Routing in Cellular Mobile Radio Communication networks-Mobile Network Architecture, Mobility management in cellular systems, Connectionless Data service for cellular systems, Mobility and Routing in Cellular Digital Packet Data (CDPD) network, Packet Radio Routing-DARPA packet radio network, Routing algorithms for small, medium and large sized packet radio networks.

UNIT V MOBILE AD-HOC NETWORKS (MANET) **9**

Internet based mobile ad-hoc networking, communication strategies, routing algorithms –Table-driven routing - Destination Sequenced Distance Vector (DSDV), Source initiated on-demand routing- Dynamic Source Routing (DSR), Ad-hoc On- demand Distance Vector (AODV), Hierarchical based routing- Cluster head Gateway Switch Routing (CGSR) and Temporally-Ordered Routing Algorithm (TORA), Quality of Service.

L = 60, TOTAL= 60

REFERENCES

1. M. Steen strub, “Routing in Communication networks”, Prentice Hall International, NewYork, 1995.
2. “ Internetworking Technologies Handbook”, Fourth Edition, Inc. Cisco Systems, ILSG Cisco Systems, 2003.
3. William Stallings, “ISDN and Broadband ISDN with Frame Relay and ATM”, PHI, New Delhi, 2004.
4. Behrouz A Forouzan, “Data Communications and Networking (3/e), TMH, 2004
5. William Stallings, “High Speed Networks TCP/IP and ATM Design Principles”, Prentice Hall International, New York, 1998.
6. Mohammad Ilyas, “The Handbook of Ad hoc Wireless Networks” CRC Press, 2002.
7. Vijay K.Garg, “Wireless Network Evolution: 2G to 3G”, Pearson Education, New Delhi, India, 2003.
8. Rajiv Ramaswami and Kumar N.Sivarajan, “Optical Networks”,Morgan Kaufmann Publishers,1998.
9. Sumit Kasera and Pankaj Sethi, ”ATM Networks”, Tata McGraw-Hill Publishing Company limited, New Delhi,2001.
10. IEEE Journal on Selected Areas in Communications, Special issue on Wireless Ad-hoc Networks, Vol. 17, No.8, 1999
11. Scott. M. Corson, Joseph P. Macker, Gregory H. Cirincione, IEEE Internet Computing Vol.3, No. 4, 1999.
12. Alder M.Scheideler.Ch. Annual ACM Symposium on Parallel Algorithms and Architectures, ACM, NewYork 1998

GLOBAL POSITIONING SYSTEMS

L T P C
3 0 0 3

PCS705	GLOBAL POSITIONING SYSTEMS	3 CREDITS
Prerequisite	Fundamentals of Satellite communication and basics of coordinate systems.	
Goal	The goal of the programme is to study To study the History of GPS and its various segments, study the co-ordinate system for the GPS systems, to know the navigational aids and signal processing for GPS systems, the propagation media for the GPS, and to learn the Inter disciplinary applications for GPS	

Objectives	**Outcomes**
The course should enable the students to: 1. Understand the evolution GPS systems and its operation methodology. 2. Develop an in-depth knowledge on various GPS coordinate systems, Keplerian elements and different GPS time systems. 3. Study the various coding techniques used in GPS, data formats and signal processing techniques. 4. Study the propagation effects of GPS signals and related problems in signal propagation. 5. Understand the interdisciplinary applications of GPS atmosphere and climate research using GPS	At the end of the course the student should be able to: 1. Have a good knowledge on the history of GPS systems and its various techniques. 2. Understand the terrestrial and celestial coordinate systems and GPS precision time systems. 3. Understand GPS coding and signal processing techniques. 4. Understand various propagation impairments of GPS signals over various layers of atmosphere. 5. Develop knowledge on the applications and importance of GPS on various fields.

UNIT I 9

History of GPS – BC-4 System – HIRAN – NNSS – NAVSTAR GLONASS and GNSS Systems– GPS Constellation – Space Segment – Control Segment – User Segment – Single and DualFrequency – Point – Relative – Differential GPS – Static and Kinematic Positioning – 2D and 3D– reporting Anti Spoofing (AS); Selective Availability (SA) – DOP Factors.

UNIT II 9

Coordinate Systems – Geo Centric Coordinate System – Conventional Terrestrial ReferenceSystem – Orbit Description – Keplerian Orbit – Kepler Elements – Satellite Visibility – TopocentricMotion – Disturbed Satellite Motion – Perturbed Motion – Disturbing Accelerations - Perturbed Orbit– Time Systems – Astronomical Time System – Atomic Time – GPS Time – Need for Coordination– Link to Earth Rotation – Time and Earth Motion Services.

UNIT III 9

C/A code; P-code; Y-code; L1, L2 Carrier frequencies – CodePseudoRanges – Carries Phases – PseudoRanges – Satellite Signal Signature – Navigation Messages and Formats – Undifferenced and Differenced Range Models – DeltaRanges – Signal Processing and ProcessingTechniques – Tracking Networks – Ephemerides – Data Combination: Narrow Lane; Wide Lane– OTF Ambiguity.

UNIT IV 9

Propagation Media – Multipath – Antenna Phase Centre – Atmosphere in brief – Elements ofWave Propagation – Ionospheric Effects on GPS Observations – Code Delay – Phase Advances– Integer Bias – Clock Error – Cycle Slip – Noise-Bias – Blunders – Tropospheric Effects on GPSOberservables – Multipath Effect – Antenna Phase Centre Problems and Correction.

UNIT V 9

Inter Disciplinary Applications – Crystal Dynamics – Gravity Field Mapping – AtmosphericOcculation – Surveying – Geophysics – Air borne GPS – Ground Transportation – Space borneGPS – Metrological and Climate Research using GPS.

L = 60, TOTAL= 60

REFERENCES:

1. A.Leick, “GPS Satellites Surveying”, 2nd edition, John Wiley & Sons,NewYork,1995
2. B.Parkinson, J.Spilker, Jr.(Eds), “GPS: Theory and Applications”, Vol.I & Vol.II, AIAA, 370L’Enfant Promenade SW, Washington, DC20024, 1996
3. A.Kleusberg and P.Teunisen(Eds), “GPS for Geodesy”, Springer-Verlag, Berlin,1996
4. L.Adams, “The GPS - A Shared National Asset”, Chair, NationalAcademy Press, Washington,DC, 1995

Websites:

5. http://www.auslig.gov.au
6. http://igscb.jpl.nasa.gov
7. http://gibs.leipzig.ifag.de
9. http://www.navcen.uscg.mil

DIGITAL IMAGE PROCESSING

L T P C
3 0 0 3

PCS706	**DIGITAL IMAGE PROCESSING**	**3 CREDITS**
Prerequisite		
Goal	To introduce the students to various image processing techniques.	
Objectives	**Outcome**	
The course should enable the students to: 1. Study the image fundamentals, 2. Study the mathematical transforms necessary for image processing, 3. Study the image enhancement techniques and image restoration procedures, 4. Study the image segmentation and recognition techniques, 5. Study the various image compression methods,	At the end of the course the student should be able to: 1. Understand the image fundamentals, 2. Understand the two dimensional image transforms, 3. Understand how to improve the image quality by using enhancement techniques and Restore the image by the use of various filtering techniques, 4. Understand the various segmentation methods and recognition techniques, 5. Understand the various image compression techniques.	

UNIT I DIGITAL IMAGE FUNDAMENTALS 9

Elements of digital image processing systems, Elements of visual perception, psycho visual model, brightness, contrast, hue, saturation, mach band effect, Color image fundamentals - RGB,HIS models, Image sampling, Quantization, dither, Two-dimensional mathematical preliminaries.

UNIT II IMAGE TRANSFORMS: 9

1D DFT, 2D transforms – DFT, DCT, Discrete Sine, Walsh, Hadamard, Slant, Haar, KLT, SVD, Wavelet Transform.

UNIT III IMAGE ENHANCEMENT AND RESTORATION 9

Histogram modification and specification techniques, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contraharmonic and Yp mean filters, Homomorphic filtering, Color image enhancement. Image Restoration – degradation model, Unconstrained and Constrained restoration, Inverse filtering – removal of blur caused by uniform linear motion, Wiener filtering, Geometric transformations – spatial transformations, Gray-Level interpolation.

UNIT IV IMAGE SEGMENTATION AND RECOGNITION 9

Edge detection. Image segmentation by region growing, region splitting and merging, edge linking.. Image Recognition – Patterns and pattern classes, Matching by minimum distance classifier, Matching by correlation, Back Propagation Neural Network, Neural Network applications in Image Processing.

UNIT V IMAGE COMPRESSION 9

Need for data compression, Huffman - Run Length Encoding, Shift codes, Arithmetic coding, Vector Quantization, Block Truncation Coding. Transform Coding – DCT and Wavelet – JPEG - MPEG. Standards, Concepts of Context based Compression.

L = 60, TOTAL= 60

TEXT BOOKS

1. Rafael C. Gonzalez, Richard E.Woods, 'Digital Image Processing', Pearson Education, Inc., Second Edition, 2007.
2. Anil K. Jain, 'Fundamentals of Digital Image Processing', Prentice Hall of India, 2002.

REFERENCES:

1. David Salomon : Data Compression – The Complete Reference, Springer Verlag New York Inc., 2nd Edition, 2001
2. Rafael C. Gonzalez, Richard E.Woods, Steven Eddins, ' Digital Image Processing using MATLAB', Pearson Education, Inc., 2004.
3. William K.Pratt, ' Digital Image Processing', John Wiley, NewYork, 2002.
4. Milman Sonka, Vaclav Hlavac, Roger Boyle, 'Image Processing, Analysis, and Machine Vision', Brooks/Cole, Vikas Publishing House, II ed., 1999.
5. Sid Ahmed, M.A., 'Image Processing Theory, Algorithms and Architectures', McGrawHill, 1995.

INTERNETWORKING MULTIMEDIA

L T P C
3 0 0 3

PCE704	INTERNETWORKING MULTIMEDIA	3 CREDITS
Prerequisite		
Goal	To learn the Internetworking techniques and standards for the Multimedia communication across the networks	
Objectives	**Outcomes**	
The course should enable the students to : (1) Study the Multimedia Networking (2) Study the Broadband Network Technology (3) Study the Reliable Transport Protocol And Applications (4) Study the Multimedia Communication Standards. (5) Study the Multimedia Communication Across Networks	At the end of the course the student should be able to: (1) Understand the concept Basic Multimedia Networking and various Compression Techniques. (2) Understand the Broadband services and Storage and media services (3) Understand the Reliability of transport protocols and its applications. (4) Understand the various standards like MPEG 7, MPEG 21, H322 (5) Know the various communications across the Networks	

UNIT I MULTIMEDIA NETWORKING 9

Digital sound, video and graphics, basic multimedia networking, multimedia characteristics, evolution of Internet services model, network requirements for audio/ video transform, multimedia coding and compression for text, image, audio and video.

UNIT II BROADBAND NETWORK TECHNOLOGY 9

Broadband services, ATM and IP, IPV6, High speed switching, resource reservation, Buffer management, traffic shaping, caching, scheduling and policing, throughput, delay and jitter performance - Storage and media services, voice and video over IP, MPEG-2 over ATM/IP, indexing synchronization of requests, recording and remote control.

UNIT III RELIABLE TRANSPORT PROTOCOL AND APPLICATIONS 9

Multicast over shared media network, multicast routing and addressing, scaling multicast and NBMA networks, Reliable transport protocols, TCP adaptation algorithm, RTP, RTCP - MIME, Peerto- Peer computing, shared application, video conferencing, centralized and distributed conference control, distributed virtual reality, light weight session philosophy.

UNIT IV MULTIMEDIA COMMUNICATION STANDARDS 9

Objective of MPEG- 7 standard, Functionalities and systems of MPEG-7, MPEG-21 Multimedia Framework Architecture - Content representation, Content Management and usage, Intellectual property management, Audio visual system- H322: Guaranteed QOS LAN systems; MPEG_4 video Transport across internet.

UNIT V MULTIMEDIA COMMUNICATION ACROSS NETWORKS 9

Packet Audio/video in the network environment, video transport across Generic networks- Layered video coding, error Resilient video coding techniques, Scalable Rate control, Streaming video across Internet, Multimedia transport across ATM networks and IP network, Multimedia across wireless networks.

L = 60, TOTAL= 60

TEXT BOOKS

1. Jon Crowcroft, Mark Handley, Ian Wakeman, Internetworking Multimedia, Harcourt Asia Pvt. Ltd. Singapore, 1998.
2. B.O. Szuprowicz, Multimedia Networking, McGraw Hill, Newyork. 1995
3. Tay Vaughan, Multimedia - Making it to work, 4ed, Tata McGraw Hill , NewDelhi, 2000.
4. K.R.Rao, Zoran S. Bojkovic and Dragorad A. Milovanovic, Multimedia Communication systems, PHI , 2003

ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY IN SYSTEM DESIGN

L T P C
3 0 0 3

PCS708	**ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY IN SYSTEM DESIGN**	**3 CREDITS**
Prerequisite		
Goal	To study source of EMI, standards, testing equipments and compatibility measures for equipments and PCBs**.**	

Objectives	**Outcomes**
The course will enable the students to: (i) understand the Electromagnetic interference concepts and its environment (ii) understand the different kinds of EMI coupling. (iii) know the EMI/EMC standards and to know the various measurement arrangements and methods. (iv) know different types EMI control techniques . (v) understand the Electro Magnetic Compatibility design for PCB's	After completion of the course, the students are expected to: (i) Gain sound knowledge about EMI concepts and its environment . (ii) have knowledge in different kinds of EMI Coupling (iii) gain sound knowledge in EMI/EMC standards , various measurement arrangements and techniques (iv)have knowledge in EMI controlling techniques. (v) Learn the concepts of EMC and to design PCB's with the inherent EMC.

UNIT I EMI ENVIRONMENT 9

EMI/EMC concepts and definitions, Sources of EMI, conducted and radiated EMI, Transient EMI, Time domain Vs Frequency domain EMI, Units of measurement parameters, Emission and immunity concepts, ESD.

UNIT II EMI COUPLING PRINCIPLE 9

Conducted, Radiated and Transient Coupling, Common Impedance Ground Coupling, Radiated Common Mode and Ground Loop Coupling, Radiated Differential Mode Coupling, Near Field Cable to Cable Coupling, Power Mains and Power Supply coupling.

UNIT III EMI/EMC STANDARDS AND MEASUREMENTS 9

Civilian standards - FCC,CISPR,IEC,EN,Military standards - MIL STD 461D/462, EMI Test Instruments /Systems, EMI Shielded Chamber, Open Area Test Site, TEM Cell, Sensors/Injectors/Couplers, Test beds for ESD and EFT, Military Test Method and Procedures (462).

UNIT IV EMI CONTROL TECHNIQUES 9

Shielding, Filtering, Grounding, Bonding, Isolation Transformer, Transient Suppressors, Cable Routing, Signal Control, Component Selection and Mounting.

UNIT V EMC DESIGN OF PCBs 9

PCB Traces Cross Talk, Impedance Control, Power Distribution Decoupling, Zoning, Motherboard Designs and Propagation Delay Performance Models.

L=60 , Total =60

REFERENCES:

1. Henry W.Ott, "Noise Reduction Techniques in Electronic Systems", John Wiley and Sons, NewYork. 1988.
2. C.R.Paul, “Introduction to Electromagnetic Compatibility” , John Wiley and Sons, Inc, 1992
3. V.P.Kodali, "Engineering EMC Principles, Measurements and Technologies", IEEE Press, 1996.
4. Bernhard Keiser, "Principles of Electromagnetic Compatibility", Artech house, 3rd Ed, 1986.

COMMUNICATION NETWORK SECURITY

L T P C
3 0 0 3

PCS709	**COMMUNICATION NETWORK SECURITY**	**3 CREDITS**
Prerequisite	-	
Goal	To introduce the student about the various techniques and standards for communication network security and also introduce the system security for the Intruders; expose students to current thinking on network security from the viewpoint of end users.	
Objectives	**Outcomes**	
The course should enable the students to 1. Study the need for information and network security and know symmetric cryptography. 2.Understand in depth the advanced and emerging communication technologies and techniques of symmetric ciphers II. 3.Study the concept of public key cryptography, principles, and key management and distribution and authentication protocols. 4.Explain security issues in electronic mail security, IP security, Web security. 5.Discuss ways to prevent and detect network attacks.	At the end of the course the student should be able to: 1. Describe concepts of information security, including security models, various security mechanisms and methods of symmetric cryptography. 2. Apply advanced symmetric cryptographic techniques and security protocols in communication networks. 3. Apply RSA, Diffie-Hellman, and DSA algorithms for cryptography applications; state the requirements and mechanisms for identification and authentication; explain and identify typical security pitfalls in authentication protocols; explain the need for key distribution and its methods. 4. Outline the protocols for IP Security and the two modes for both protocols. Use combinations of IP security protocols to achieve a given security goal (e.g., source authentication, content authentication, traffic confidentiality, etc.); Explain SSL/TLS protocols. 5. State program security issues, including virus, worm, and logical bombs, basic concepts and general techniques in security auditing and intrusion detection.	

UNIT I SYMMETRIC CIPHERS (Techniques and Standards) –I 9

Introduction – Services, Mechanisms and Attacks, OSI security Architecture, Model for network Security; Classical Encryption Techniques- Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Stegnography; Block Ciphers and Data

Encryption Standard- Simplified DES, Block Cipher Principles, Data Encryption Standard, Strength of DES, Differential and Linear Crypt Analysis, Block Cipher Design Principles, Block Cipher Modes of Operation.

UNIT II SYMMETRIC CIPHERS (Techniques and Standards) 9

Advanced Encryption Standard - Evaluation Criteria for AES, AES Cipher; Contemporary Symmetric Ciphers - Triple DES, Blowfish, RC5, Characteristics of Advanced Symmetric Block Ciphers, RC4 Stream Cipher; Confidentiality using Symmetric Encryption- Placement of Encryption Function, Traffic Confidentiality, Key Distribution and Random Number Generation.

UNIT III PUBLIC-KEY ENCRYPTION AND HASH FUNCTIONS 9

Public Key Cryptography and RSA- Principles of Public Key Cryptosystems, RSA Algorithm; Key Management and other public key cryptosystems- Key Management, Diffie-Hellman Key Exchange, Elliptic Curve arithmetic, Elliptic Curve Cryptography; Message Authentication and Hash Functions- Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions- Simple hash functions – Security of Hash functions and MACs; Hash Algorithms- MD5 Message Digest Algorithm; Secure Hash Algorithm, HMAC; Digital Signatures and Authentication Protocols - Authentication Protocols & Digital Signature Standards.

UNIT IV NETWORK SECURITY PRACTICE 9

Authentication Applications- Kerberos – version4, X.509 Authentication Service; Electronic Mail Security- Pretty Good Privacy – operational description – Cryptographic keys and key rings - S/MIME; IP Security- IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload; Web Security- Web Security Considerations, Secure Sockets Layer and Transport Layer Security, Secure Electronic Transaction.

UNIT V SYSTEM SECURITY 9

Intruders- Intruder Detection – Audit records - Statistical Anomaly detection – Rule based intrusion detection – Honeypots; Password Management – password protection – selection strategies; Malicious Software- Virus and Related Threats, Virus Counter Measures; Firewalls- Firewall Design Principles, Trusted Systems – Torjan horse defense.

L = 60 ,Total = 60

TEXT BOOKS:

1. William Stallings, “Cryptography and Network Security”, 3ed. Prentice Hall of India, New Delhi ,2004
2. William Stallings, “Network Security Essentials”, 2 ed. Prentice Hall of India, New Delhi, 2004

WIRELESS SENSOR NETWORKS

L T P C
3 0 0 3

PCS711	**WIRELESS SENSOR NETWORKS**	**3CREDITS**
Prerequisite	Nil	
Goal	Introduce the student to recent advancement in the sensor networks and its architectural Protocol design	

Objectives	**Outcomes**
The course should enable the students to: 1. Describe the current technology trends and unique issues for the implementation in sensor networks, 2. Learn Physical layer concept and MAC layer Protocol design, Transport, Network and Data Link Layer issues and its function, 3. Understand design issues in the topology formation and Routing Technique of sensor networks, 4. Learn Network Management requirements and design issues. 5. Understand the various tools and programming challenges for simulating a environment for sensor systems using Motes.	At the end of the course the student should be able to: . 1. Know the characteristics and challenges in the sensor networks, 2. Discuss the challenges in designing MAC, Transport, Network and Data link Protocols for wireless sensor networks, 3. Know how the sensor networks is self configured and the formation of topology and routing the packets. 4. Understand various network managements models and thesis performance. 5. Program and communicate with embedded operating system such as TinyOS, a prominent application development environment for sensor systems using Motes.

UNIT I OVERVIEWOF WIRELESS SENSOR NETWORKS 9

Introduction , Basic Overview of the Technology ,Basic Wireless Sensor Technology, Single node architecture: hardware and software components of a sensor node, Energy consumption, Sensor network Scenarios, optimization goals and figure of merit, Design Principles, WSN operating Environment , wireless Transmission Technology and Systems, Applications,

UNIT II COMMUNICATION PROTOCOLS 9

Medium Access Control Protocols for WSN,Sensor-MAC Case Study,IEEE802.15.4 LR-WPANS, Time synchronization protocols-Transport Layer protocol-Network layer protocol-Data link Protocol-

UNIT III ROUTING TECHNIQUES 9

Routing Protocols, Data Dissemination and Gathering, Routing Challenges and Design Issues, Routing Strategies, Data-Centric Routing, Data aggregation, Hierarchical networks by Clustering.

UNIT IV NETWORK MANAGEMENT FOR WIRELESS SENSOR NETWORKS 9

Network Management Requirements, Design Issues, Network Management Models, Performance and Traffic Management, WSN design issues, Performance Modeling of WSNs, Case Study.

UNIT V SENSOR NETWORK PLATFORMS & TOOLS 9

Sensors and actuators, Some Examples of Sensor Node, Sensor node hardware, programming challenges, node level software platforms (Tiny OS, nes C) node level simulators, (ns2 and TOSSIM) programming beyond individual nodes Security - Privacy issues - Attacks and counter measures.

L= 60, TOTAL = 60

TEXT BOOK:

1. Kazem Sohraby,Daniel Minoli, Taieb Znati Wireless Sensor Networks.Technology,Protocols,and Applications Wiley Student Edition

REFERENCES:

1. Feng Zhaoand, Leonidas J Guibas, “Wireless Sensor Networks” Morgan Kaufmann Publishers and imprint of Elsevier, 2004
2. Mohammad Ilyas and Imad Mahgoub, “Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems” CRC Press 2009.
3. Raghavendra.C.S, Krishna M. Sivalingam, Taieb F. Znati, “Wireless Sensor Networks”, 2nd edition, Springer, 2004
4. Holger Karl, Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley and Sons, 2005

OPTICAL COMMUNICATION NETWORKS

L T P C
3 0 0 3

PCS103	OPTICAL COMMUNICATION NETWORKS	3 CREDITS
Prerequisite	Fundamentals of optical communication and computer networking	
Goal	The goal of the programme is to study the Optical network components for Optical Network communication, study various Network architecture and topologies for optical networks and to study the issues in the network design and operation for wavelength routing in optical networks.	

Objectives	Outcomes
The course should enable the students to: 1. Understand the evolution of optical networks, first and second generation and various developments over the years, and various optical networking components 2. Develop an in-depth knowledge on TDM signals, Layers, Framing, Transport overhead, Alarms, Multiplexing, Network elements, Topologies, Protection architectures and Network Management. 3. Understand various broadcast and select networks. How the medium is to effectively share through various protocols. 4. Understand the bottlenecks in network design and wavelength assignment. 5. Study various high capacity optical networks and TDM techniques in optical domain.	At the end of the course the student should be able to: 1. Have a good knowledge on first- and second-generation optical networks. Learn the operation of couplers, isolators, circulators, multiplexers and filters and optical amplifiers. Understand various optical switching mechanisms and wavelength converters. 2. Solve various networking problems and to understand the concept of network management. 3. Understand single-hop, multi-hop and shufflenet networks and media access protocols. 4. Learn techniques for effective wavelength assignment with existing efforts as examples. 5. Develop clear understand on high capacity optical networks and techniques to realize the same.

UNIT I OPTICAL NETWORKING COMPONENTS **12**

First- and second-generation optical networks, Components: couplers, isolators, circulators, multiplexers, filters, amplifiers, switches and wavelength converters.

UNIT II SONET AND SDH NETWORKS **12**

Integration of TDM signals, Layers, Framing, Transport overhead, Alarms, Multiplexing, Network elements, Topologies, Protection architectures, Ring architectures, Network Management.

UNIT III BROADCAST – AND- SELECT NETWORKS 12

Topologies, Single-hop, Multihop, and Shufflenet multihop networks, Media-Access controlprotocols, Test beds.

UNIT IV WAVELENGTH-ROUTING NETWORKS 12

Node designs, Issues in Network design and operation, Optical layer cost Tradeoffs, Routingand Wavelength assignment, Wavelength routing test beds.

UNIT V HIGH CAPACITY NETWORKS 12

SDM, TDM, and WDM approaches, Application areas, Optical TDM Networks: Multiplexingand demultiplexing, Synchronization, Broadcast networks, Switch-based networks, OTDM testbeds.

TOTAL= 60

TEXT BOOK:

1. Rajiv Ramaswami and Kumar Sivarajan, Optical Networks: A practical perspective, MorganKaufmann, 1st edition, 2001.

REFERENCES:

1. Vivek Alwayn, Optical Network Design and Implementation, Pearson Education, 2004.
2. Hussein T.Mouftab and Pin-Han Ho, Optical Networks: Architecture and Survivability, KluwerAcademic Publishers, 2002.
3. Biswanath Mukherjee, Optical Communication Networks, McGraw Hill, 1997

ADVANCED DATA COMMUNICATION

L T P C
3 0 0 3

PIT101	**ADVANCED DATA COMMUNICATION**	**3 CREDITS**
Prerequisite	Nil	
Goal	To provide a wide knowledge in the Advanced Communication systems.	

Objectives	**Outcomes**
The course should enable the student to: 1. understand the concepts of TCP/IP, UDP and OSI architecture. 2. have knowledge about the ATM Services and Connection 3. know about the congestion control parameters 4. establish the graph and finding the shortest path among different routing protocols. 5. understand the key concepts of integrated service architecture and label switching	The student should be able to: 1. understood the fundamental concepts of data communications and networking 2. have some idea about the ATM protocol architecture and services. 3. know about how to control the congestion in layers. 4. Apply the different routing protocols to find the shortest path. 5. design the ISA and several concepts on it.

UNIT I NETWORK ARCHITECTURES **12**

The need for speed and quality of service, Advanced TCP/IP and ATM Networks, The need for a protocol architecture, The TCP/IP protocol architecture, The OSI model, Internetworking, TCP, UDP, Ipv6.

UNIT II ATM NETWORKS **12**

Packet-switching networks, Frame relay networks, ATM protocol architecture, ATM logical connections, ATM cells, ATM service categories, ATM Adaptation Layer (AAL), The emergence of high-speed LANs, Ethernet, Fibre channel, Wireless LANs.

UNIT III TRAFFIC MANAGEMENT **12**

Congestion control in data networks and internets, Effects of congestion, Congestion and control, Traffic management, Congestion control in Packet-Switching networks, Frame relay congestion control, The need for flow and error control, Link control mechanisms, ARQ performance, TCP flow control, TCP congestion control performance of TCP over ATM.

UNIT IV ROUTING PROTOCOLS **12**

Overview of graph theory and least-cost paths, Elementary concepts of graph theory, Shortest path length determination, Internet routing principles, Distance-Vector protocol, RIP, Link-State protocol, OSPF, Path-Vector protocols, BGP and IDRP, Multicasting.

UNIT V ADVANCED NETWORKING CONCEPTS **12**

Integrated Services Architecture (ISA), Queuing discipline, Random early detection, Differentiated services, Real-Time traffic, Resource Reservation : RSVP, Multiprotocol label switching, Real-Time Transport Protocol (RTP).

Total 60

REFERENCE BOOKS

1. Willam Stallings, "High Speed Networks and Internets - Performance and Quality of Service", 2nd Ed., Pearson Education.
2. Andrew S. Tanenbaum, "Computer Networks", 4th Ed., Pearson Education.
3. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach featuring the Internet".
4. William Stallings, "Data and Computer Communications", 9th Ed., Pearson Education.

PCS712 - COGNITIVE RADIO

L T P C

3 0 0 3

UNIT I : INTRODUCTION TO SDR **9**

Software Radio aspects, The Need for Software Radios, Characteristics and Benefits of a Software Radio, Design Principles of a Software Radio Definitions and potential benefits, Role of SDR, Features of SDR, software radio architecture evolution – foundations, technology tradeoffs and architecture implications.

UNIT II: SDR ARCHITECTURE **9**

Essential functions of the software radio- Radio architecture evolution, canonical SDR architecture, software radio overview, open architecture software tools, architecture goals, top level component topology, computational properties of functional components, interface topologies among plug and play modules, architecture partitions.

UNITIII : INTRODUCTION TO COGNITIVE RADIOS **9**

Marking radio self-aware, Aware, Adaptive & cognitive radios, the cognition cycle, organization of cognition tasks, structuring knowledge for cognition tasks– concepts, architecture, design considerations, , Ultra wide band C shaped monopole Antenna for Cognitive Radio.

UNIT IV : COGNITIVE RADIO ARCHITECTURE **9**

Primary Cognitive Radio functions, Behaviors, Components, prior knowledge taxonomy, observe phase data structures, Radio Procedure Knowledge Encapsulation, components of orient, plan, decide phases, act phase knowledge representation, design rules.

UNIT V : NEXT GENERATION WIRELESS NETWORKS **9**

The XG Network architecture, spectrum sensing- Overview – Classification - Matched filter – waveform based sensing – cyclostationary based sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross – layer design.

TOTAL: 45 PERIODS

REFERENCES:

1.Alexander M. Wyglinski, Maziar Nekovee, And Y. Thomas Hou, " Cognitive Radio Communications And Networks - Principles And Practice", Elsevier Inc. , 2010.

2. "E. Biglieri, A.J. Goldsmith., L.J. Greenstein, N.B. Mandayam, H.V. Poor, Principles of

Cognitive Radio", Cambridge University Press, 2013.
3. Kwang-Cheng Chen and Ramjee Prasad, " Cognitive Radio Networks" , John Wiley & Sons, Ltd, 2009.
4. Khattab, Ahmed, Perkins, Dmitri, Bayoumi, Magdy, "Cognitive Radio Networks - From Theory to Practice", Springer Series: Analog Circuits and Signal Processing, 2009.
5. J. Mitola, " Cognitive Radio: An Integrated Agent Architecture for software defined radio", Doctor of Technology thesis, Royal Inst. Technology, Sweden 2000.
6. Simon Haykin, "Cognitive Radio: Brain –empowered wireless communications", IEEE Journal on selected areas in communications, Feb 2005.
7. Ian F. Akyildiz, Won – Yeol Lee, Mehmet C. Vuran, Shantidev Mohanty, " NeXt generation /dynamic spectrum access / cognitive radio wireless networks: A Survey Elsevier Computer Networks, May 2006.