SCHEME OF EXAMINATION
&
DETAILED SYALLBUS

for

MASTER OF TECHNOLOGY
in
[Digital & Wireless communication]

Offered by
University School of Information Technology

Guru Gobind Singh Indraprastha University
Kashmere Gate, Delhi [INDIA] –110 403
www.ipu.ac.in

Proposed scheme for

M.Tech. in Digital & Wireless communication

It is proposed to start a PG course offering M.tech. Degree in Digital &Wireless communication, and shall commence starting from the academic year 2008-09. The focus is on a thorough in depth study of various advances in the field of wireless communication and the support telecommunication networks which forms the back bone of all wireless communications. There is tremendous explosion of knowledge in the area; where in several generations of wireless applications (1G through 4G) have crept in offering various gadgets and different technologies. A lot of manpower is required in this specialized area to cater to the needs of industry, R&D and as well skilled faculty to teach subjects of the area. The focus is on digital wireless communication aspects which include subjects such as signal processing, hardware design, security aspects, applications areas of wireless, Adhoc & sensor based systems and telecommunication networks. The complementary subjects on data networks and allied fields are chosen for completeness. Thrust is given to emerging areas in the field and several electives have been floated. Due importance is attached to laboratory sessions and one on one laboratory facility is being provided to give hands on experience to the students.

Admission Criteria & Eligibility

Admission Criteria:

Admission will be based on the merit list of the candidates in the qualifying examination. Preference will be given to GATE qualified candidates, if there is any vacancy left then the seats will be offered to the non-GATE candidates as per merit list of the candidates in the qualifying examinations**.**

Entry Level: 60% or equivalent in the qualifying examination**.**

B.Tech. / B.E. in Electronics & Communication / Electronics Engineering/Computer Science & Engineering / Information Technology/Electrical Engineering or Equivalent
M.Sc. in Electronics or equivalent

SPONSORED CATEGORY

The Sponsored candidate in addition to the fulfillment of eligibility conditions as specified above must have a minimum of one year of Full-time work experience in a registered firm / company / industry /educational and research institution / any Government Department/ Autonomous Organization in the relevant field in which admission is being sought after the completion of qualifying examination as on 30th June 2008.

Guru Gobind Singh Indraprastha University
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SCHEME OF EXAMINATION

M.Tech. (Digital & Wireless communication)

FIRST SEMESTER

Code No.	Paper	L/P	T	Credits
Theory				
ITD 601	Advanced Digital Communication	3	1	4
ITD 603	DSP for wireless communication	3	1	4
ITR 719	Cellular and Mobile communication	3	1	4
IT - 503	Optical Communication	3	1	4
ITR 721	Satellite Communication	3	1	4
Laboratories				
ITD 651	Digital comm. Lab	2	-	2
ITD 653	DSP Lab	2	-	2
ITD 655	Cellular and Mobile Comm. Lab	2	-	2
ITD 657	Satellite Comm. & Optical Comm. Lab	2	-	2
Total		**23**	**05**	**28**

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SCHEME OF EXAMINATION

M.Tech. (Digital & Wireless communication)

SECOND SEMESTER

Code No.	Paper	L/P	T	Credits
Theory				
ITR 606	Wireless Mobile Networks	3	1	4
ITD 602	Spread spectrum communication	3	1	4
ITD 604	Advances in Data and Computer Communication	3	1	4
ITD 606	ARM Architecture for Mobile Communication	3	1	4
ITR 628	Information Theory and Coding	3	1	4
Laboratory				
ITD 652	Wireless Mobile Networks Lab	2	-	2
ITD 654	CDMA Lab	2	-	2
ITD 656	Advanced Computer networks Lab	2	-	2
ITD 658	ARM Architecture for Mobile Comm. Lab	2	-	2
Total		**23**	**05**	**28**

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SCHEME OF EXAMINATION

THIRD SEMESTER

Code No.	Paper	L/P	T	Credits
Theory				
ITD 701	Probability and Stochastic Process	3	1	4
ITD 703	Adhoc and Sensor based Networks	3	1	4
ITR 717	Telecommunications switching and networks.	3	1	4
	Elective I	3	1	4
	Elective II	3	1	4
Laboratory				
ITD 751	Minor Project I	4	-	4
ITD 753	Adhoc and Sensor based Networks Lab.	2	-	2
ITD 755	Advanced communication Lab.	2	-	2
Total		**23**	**05**	**28**

Elective I		**Elective II**	
Course Code	**Subject**	**Course Code**	**Subject**
ITD 707	Personal wireless networks	ITD 729	Internetworking technologies
ITD 709	RF Engineering and propagation	ITD 731	Network Design
ITD 711	Multimedia communications and system design	ITR 727	Digital Image processing
ITD 713	Secure Wireless communication	ITD 733	High speed communication networks
ITD 715	Advances in Information Theory	ITD 735	Cryptography
ITD 717	RF design of wireless communications (VLSI)	ITD 737	Sensor technology and RF MEMS
ITD 719	Smart Antennas	ITD 739	Detection and estimation
ITD 721	Microwave and Radar Engineering	ITD 741	Recent trends in Optical network security
ITD 723	Microwave devices & circuits	ITD 743	Embedded systems for mobile comm.
ITD 725	Recent Trends in Mobile Communication Technology	ITD 745	Personal Ethics and Human values
ITD 727	Encryption Techniques and Security Protocols	ITD 747	Next Generation Networks
ITR 707	Advances and Coding Theory	ITD 749	Telecommunication System Modeling and Simulation

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SCHEME OF EXAMINATION

FOURTH SEMESTER

Code No.	Paper	L/P	T	Credits
ITD 752	Dissertation	-	-	18
ITD 754*	Seminar & progress Report	-	-	3
ITD 756*	Comprehensive viva	-	-	3
	Total			24

Note:
*** - Non University Examination system**

1. The total number of credits of the programme M.Tech. [Digital & WirelessCommunication]=108
2. Each student shall be required to appear for examinations in all courses. However, for the award of the degree a student shall be required to earn the minimum of 100 credits.

Note: Elective course(s) will be offered only if it is opted by 33% of actual strength of the class.

Paper Code: ITD – 601 **L T C**
Paper: Advanced Digital Communication **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: The objective of the paper is to facilitate the student with the basics of digital communications aspects that are required for his understanding of wireless communications and lay emphasis on principles and methods used in wireless systems. The prerequisites are to have basic understanding of communication theory and analog communications.

UNIT I

Analog-to-Digital Conversion: Sampling theorem, Pulse-Amplitude Modulation, Channel bandwidth for PAM signal, Natural sampling, Flat top sampling, Quantization of signals, Quantization error, Pulse-code modulation (PCM), Electrical representation of binary digits, The PCM system, Companding, Multiplexing PCM signals, Differential PCM, Delta modulation, Adaptive delta modulation, Vocoders, Channel Vocoder, Linear Predictive coder.

UNIT II

Digital Modulation Techniques: Binary Phase-Shift Keying (BPSK), Differential Phase-Shift Keying, Differentially-Encoded PSK (DEPSK), Quadrature Phase-Shift Keying (QPSK), Quadrature Amplitude Shift Keying (QASK), Binary Frequency-Shift Keying (BFSK), Similarity of BPSK and BFSK, M-ary FSK, Minimum Shift Keying (MSK).

UNIT III

Data Transmission: A base band signal receiver, Probability of error, The Optimum Filter, Matched Filter, Probability of error in Matched filter, Coherent reception, Coherent reception of PSK and FSK, Non-Coherent reception of FSK, PSK and QPSK, Calculation of error probability of BPSK and BFSK, Error probability for QPSK] Bit-by-bit encoding versus Symbol-by-Symbol encoding, Relationship between Bit error rate and Symbol Error rate and comparison of modulation systems.

UNIT IV

Information Theory and Coding: Discrete messages, The concept of amount of information, Entropy, Information rate, Coding to increase average information per bit, Shannon's theorem, Capacity of a Gaussian channel, Bandwidth-S/N tradeoff, use of orthogonal signals to attain Shannon's limit, Efficiency of orthogonal signal transmission, Coding: Parity check bit coding for error detection, Coding for error detection and error correction, Block codes (coding and decoding), Convolution codes (coding and decoding), Comparison of error rates in coded and uncoded transmission.

Text:

1. Wayne Tomasi, "Electronic communications systems" 5th edition Pearson Educaion Asia, 2006
2. Taub and Schilling, "Principles of Communication Systems", TMH, IInd Edition, 2006

References:

1. S. Haykin, "Digital Communication", Wiley, 2006.
2. S. Haykin, "Analog and Digital Communication", Wiley.

Paper Code: ITD – 603 **L T C**
Paper: DSP for Wireless Communications **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: The objective of the paper is to facilitate the student with review signals and systems, study of DFT and FFT filters and study typical applications in wireless communications. The prerequisites are to have basic understanding of communication theory and analog and digital communication.

Unit I

Discrete Time Signals and Systems, Frequency Domain Representation, Z-Transforms, Discrete Fourier Transforms, Impulse Response and Transfer functions, Convolution and Correlation.

Unit II

IIR Filter Design: Filter Approximation, Impulse Invariant Method, Frequency Transformations (LP-LP, LP-HP, LP-BP, LP-BR), Matched Z-Transform method, Bi-linear Transformation method filter structures, Finite word length effects, limitations of IIR filters.

Unit III

FIR Filter Design: Linear phase response, Windowing technique, Gibb's Phenomenon, Frequency Sampling Method, FIR Filter structures.

Frequency Domain Realization of Digital Filters, Radix-2 FFT Algorithm, Goertzel's Algorithm, and Overlap add and Overlap save methods.

Unit IV

Power Spectrum Estimation, Classical Spectral Estimation, Parametric Modeling - AR, MA, ARMA methods, Minimum variance spectral estimations. Principles of DSP Architecture.

Text:

1.Roman Kuc "Introduction to Digital Signal Processing", McGraw Hill 1988.
2. A.V. Oppenheim and R.W. Schafer "Discrete Time Signal Processing", PHI 1992.

References:

1. J.G.Proakis and D.G. Manolakis “Introduction to Digital Signal Processing" McMillan 1992.
2. Steven M. Kay "Modern Spectral Estimation", PHI 1988.
3. S.Salivahanan and others, “Digital Signal processing”, TMH 2000.
4. Venkataramani, Bhaskar, “Digital signal processors”, TMH 2002.
5. Clark Cory.L, “Lab view DSP and Digital comm.”, TMH 2005.

Paper Code: ITR – 719 **L T C**
Paper: Cellular & Mobile communication **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Objective: The objective of the course is to introduce basic architecture of mobile and cellular services starting from 1G through to 2G (GSM). The prerequisites are Data communication, Antennas and wave propagation.

Unit I

Introduction to Cellular Mobile Systems

A basic cellular system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, planning a cellular system, overview of generations of cellular systems.

Elements of Cellular Radio Systems Design and interference

General description of the problem, concept of frequency reuse channels, co-channel interference reduction factor, desired C/I from a normal case in an omni directional antenna system, cell splitting, consideration of the components of cellular systems. Introduction to co-channel interference, co-channel measurement design of antenna system, antenna parameter and their effects,

Unit II

Cell Coverage for Signal & antenna structures

General introduction, obtaining the mobile point to point mode, propagation over water or flat open area, foliage loss, propagation near in distance, long distance propagation, point to point prediction model-characteristics, cell site, antenna heights and signal coverage cells, mobile to mobile propagation. Characteristics of basic antenna structures, antenna at cell site, mobile antennas.

Frequency Management & Channel Assignment, Hand Off & Dropped Calls

Frequency management, fixed channel assignment, non-fixed channel assignment, traffic & channel assignment. Why hand off, types of handoff and their characteristics, dropped call rates & their evaluation.

Unit III

Modulation methods and coding for error detection and correction

Introduction to Digital modulation techniques, modulation methods in cellular wireless systems, OFDM. Block coding, convolution coding and Turbo coding. Multiple access techniques: FDMA, TDMA, CDMA;

Time-division multiple access (TDMA), code division multiple access (CDMA), CDMA capacity, probability of bit error considerations, CDMA compared with TDMA.

Unit IV

Second generation, digital, wireless systems

GSM, IS_136 (D-AMPS), IS-95, mobile management, voice signal processing and coding.

Text Books:

1 Mobile Cellular Telecommunications; 2nd ed.; William, C Y Lee McGraw Hill

2 Mobile wireless communications; Mischa Schwartz, Cambridge University press, UK, 2005

Reference Books

1 Mobile Communication Hand Book; 2nd Ed.; IEEE Press

2 Wireless communication principles and practice, 2nd Ed, Theodore S rappaport, Pearson Education.

3 3G wireless Demystified; Lawrence Harte, Mc. Graw Hill pub.

4 Principles of Wireless Networks, Kaveh Pahlavan and Prashant Krishnamurthy: PHI

5 Wireless communication theory, Blake, pub: Thomson Delmar 2004

IT-503 Optical Communication **L T C**
3 1 4

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Objective: The objective of the course is to introduce basic ideas on optical principles and fibers used as a back bone networks.. The prerequisites are basic communication, Analog devices and circuits.

Unit-1

Introduction: concepts of information, general communication systems, evolution of optical fiber communication systems, advantages, disadvantage of optical fiber, communication systems.

Wave propagation in dielectric waveguide: snell's law, internal reflection, dielectric slab wave guide, numerical aperture, propagation of model & rays. Step-index fibers, graded index fibers.

Unit-2

Attenuation in optics fibers: Fiber attenuation, connectors &splices, bending loses, Absorption, scattering, very low loss materials, plastic & polymer-clad-silica fibers.

Wave propagation in fibers: wave propagation in step index & graded index fiber, fiber dispersion, single mode fibers, multimode fibers, dispersion shifted fiber, dispersion flattened fiber, polarization.

Unit-3

Optical sources & detectors: principles of light emitting diodes (LED's) , design of LED's for optical fiber communications, semiconductor LASER for optical fiber communication system ,principles of semiconductor photodiode detectors, PIN photodiode, Avalanche photodiode detectors.

Optical fiber communication system: telecommunication, local distribution series, computer networks local data transmission & telemetry, digital optical fiber communication system, first & second generation system, future system.

Unit-4

Advanced multiplexing strategies: Optical TDM, subscriber multiplexing (SCM), WDM

Optical networking: data communication networks, network topologies, MAC protocols, Network Architecture- SONET/TDH, optical transport network, optical access network, optical premise network.

Reference Books:

1. Senior J., optical fiber communications, principles & practice, PHI.
2. Keiser G., optical fiber communications, McGraw-hill.
3. Gowar J., optical communication systems, PHI.
4. William B. Jones jr., Introduction to optical fiber communication systems, Holt, Rinehart and Winston, Inc.

ITR – 721 Satellite Communication **L T C**
3 1 4

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Objective: The objective of the course is to introduce basic understanding on principles governing the satellite communication . The prerequisites are Analog and Digital communication, Antennas and wave propagation.

Unit-1

Introduction:

Origin and brief history of satellite communications, an overview of satellite system engineering, satellite frequency bands for communication.

Orbital theory:

Orbital mechanics, locating the satellite in the orbit w.r.t. earth look angle determination. Azimuth & elevation calculations.

Unit-2

Spacecraft systems:

Attitude and orbit control system, telemetry, tracking and command (TT&C), communications subsystems, transponders, spacecraft antennas.

Satellite link design:

Basic transmission theory, noise figure and noise temperature, C/N ratio, satellite down link design, satellite uplink design.

Unit-3

Modulation, Multiplexing, Multiple access Techniques:

Analog telephone transmission, Fm theory, FM Detector theory, analog TV transmission, S/N ratio Calculation for satellite TV linking, Digital transmission, base band and band pass transmission of digital data, BPSK, QPSK , FDM, TDM,

Access techniques: FDMA, TDMA, CDMA.

Unit-4

Encoding & FEC for Digital satellite links:

Channel capacity, error detection coding, linear block, binary cyclic codes, and convolution codes.

Satellite Systems:

Satellite Earth station Technology, satellite mobile communication, VSAT technology, Direct Broadcast by satellite (DBS).

Reference Books:

1. Timothy Pratt, Charles W. Bostian, "Satellite communication", John Wiley &sons Publication, 2003
2. J.J. Spilker, "Digital Communication by satellite, PHI Publication, 1997
3. J. Martin, "Communication satellite systems", PHI publication, 2001

ITD -651 Digital Communications Lab.

The practical will be based on Digital Communication course.

ITD-653: DSP Lab.

The practical will be based on DSP course.

ITD – 655 Cellular and Mobile Communication Lab

The practical will be based on Cellular & Mobile Communication.

ITD – 657 Satellite Communications & Optical Communication Lab

The practical will be based on Satellite Communication & Optical Communication.

ITR-606 Wireless Mobile Networks

L	T	C
3	1	4

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Objective: The objective of the course is to introduce various mobile networks and their basic architecture starting from 2G through to 3G. The prerequisites are Data communication, Antennas and wave propagation.

Unit - I

Introduction to Personal Communication Services (PCS): PCS architecture, Mobility management, Networks signaling.

Global system for Mobile Communication (GSM) system overview: GSM Architecture, Mobility Management, Network signaling.

Unit - II

General Packet Radio Services (GPRS): GPRS architecture, GPRS Network nodes.

Mobile Data Communication: WLANs (Wireless LANs) IEEE 802.11 standard, Mobile IP.

Unit - III

Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, Wireless Markup Languages (WML)

Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G.

Unit – IV

Wireless local Loop (WLL): Introduction to WLL architecture, WLL technologies.

Global Mobile Satellite Systems: Case studies of IRIDIUM and GLOBALSTAR systems.

Bluetooth technology and Wi-Max

Text Books:

1. "Wireless and mobile Networks Architecture," by Yi –Bing Lin & Imrich Chlamatac, John Wiley & Sons, 2001.
2. "Mobile & Personnel communication Systems and Services", By Raj Pandya, Prentice Hall India, 2001.
3. "Wireless Communication- Principles and practices," 2nd Ed., Theodore S. Rappaport, Pearson Education Pvt. Ltd, 2003.
4. "Mobile communications," Jochen Schiller, Pearson Education Pvt. Ltd., 2002.
5. "The Wireless Application Protocol," Singhal & Bridgman et. al., Pearson Education, 2004.

References:

1. "Principles of Mobile Computing," 2nd Ed., Hensmann, Merk, & Stober, Springer International Edition, 2003.
2. "Mobile Computing," Talukdar & Yaragal, TMH, 2005.
3. "3G Wireless Networks," Smith & Collins, TMH, 2007.

Paper Code: ITD – 602 **L T C**
Paper: Spread Spectrum Communication **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: The objective of the paper is to facilitate the student with the digital communications Modulation techniques used in wireless communications and lay emphasis on principles and methods used in wireless systems. The prerequisites are to have basic understanding of both analog and digital communication and Antennas.

Unit-1

Advanced Digital and Demodulation Techniques, QPSK, Continuous Phase PSK (CPPSK), GMSK, QAM, Trellis Coded Modulation (TCM) Clock and Carrier Recovery Schemes.

Unit-2

Frequency hopping multiple access (FHMA) principle and functional block diagram, DSSS, Code division multiple access, Mathematical representation, Effect of multipath propagation on CDMA. CDMA systems, Multi-user detection.

Unit-3

Orthogonal Frequency Division Multiplexing (OFDM), Principle, Implementation of Transceivers, Frequency selective channels, channel estimation, Intercarrier interference, multicarrier code division multiple access.

Unit-4

Multiantenna systems, smart antennas, capacity increase, receiver structures, algorithms for adaptation of antenna weights. Multiple input and multiple output systems, channel state information, capacity of non fading channels and flat fading channels.

Text Book:

1. Andreas F. Molish, “Wireless Communications” 2006, John Wiley & Sons

Reference Books:

1. R.D.Gitlin and others, "Data Communication Principles", McGraw Hill.
2.R.L.Peterson and others, "Introduction to Spread Spectrum Communication", Prentice Hall International Edition 1995.
3.Marvin K.Simon & others, "Digital Communication Techniques: Signal Design & Detection", Prentice Hall International 1995.
4. Kasera Narang, “3G Networks-architectures protocols and procedures”, TMH 2004.

Paper Code: ITD 604 **L T C**
Paper: Advances in Data & Computer communications **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: The objective of the paper is to facilitate the student with the advances in the area data communications and computer network aspects that are required for his understanding of protocols used in wireless communications and lay emphasis on principles and methods used in wireless systems. The prerequisites are to have basic understanding of data networks and computer networks.

Unit I

Introduction to Network models ISO – OSI, SNA, and AppleTalk and TCP/IP models.

LAN Standards: Ethernet (IEEE 802.3), Over View of Token ring and Token Bus, Wireless LAN standard (IEEE 802.11 b/a/g)

Unit II

WAN Standards: X.25, Frame Relay, and ATM

Class full and Classless IP Addresses, ARP and RARP, IPv4, and IPv6, RIP, OSPF and BGP

Unit III

User Datagram Protocol (UDP), Transmission Control Protocol (TCP) and Stream Controlled Transmission Protocol (SCTP)

Overview of WWW, DNS, e-mail, SNMP, RMON

Unit IV

Cryptography, Firewalls, Secure Socket Layer (SSL), Security at different layers in application Layer Protocols, and Virtual Private Networks (VPN)

Textbooks:

1. Behrouz A. Forouzan, "TCP/IP Protocol Suit", TMH, 2000
2. Wayne Tomasi, "Introduction to Data communications and Networking", Pearson Ed. 2007
3. Tananbaum A. S., "Computer Networks", 3rd Ed., PHI, 1999

References:

1. Black U, "Computer Networks-Protocols, Standards and Interfaces", PHI, 1996
2. Stallings W., "Data and Computer Communications", 6th Ed., PHI, 2002.
3. Stallings W., "SNMP, SNMPv2, SNMPv3, RMON 1 & 2", 3rd Ed., Addison Wesley, 1999
4. Laurra Chappell (Ed), "Introduction to Cisco Router Configuration", Techmedia

Paper Code: ITD – 606 **L T C**
Paper: ARM Architecture for Mobile communication **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Objective: The objective of the paper is to facilitate the student with the understanding of embedded system design and ARM architecture in particular. The prerequisites are to have basic understanding of programming concepts and embedded programming in C and C ++, RTOS.

Unit – I
Introduction to Embedded System Design, Embedded System Architecture, Embedded System model, an overview of Programming Languages and examples of their standards, Embedded Processor: ISA Architecture Models, Application-specific ISA models, FSMD model, JVM model, CISC & RISC model, Instruction – Level Parallelism ISA model, Von Neumann & Harvard Architectures.

Unit – II
ARM Embedded System, ARM Processor Fundamentals: Registers, Pipeline, Exceptions, Interrupts and vector tables, ARM Processor family, ARM Instruction Set, Thumb Instruction Set

Unit –III
Overview of C compiler and Optimization: Register allocation, Functions Calls, Pointer aliasing, Structure arrangement, Portability issues, writing and optimizing ARM assembly code

Unit –IV
Interrupts and interrupt handling Scheme, firmware and Boot loader, Real-Time operating Systems: Context Switching, task tables and kernels, Time Slice, Scheduler algorithms: RMS, Deadline monotonic Scheduling; Priority Inversion, Tasks, Threads and process, Exceptions, Exception handling

Text books:
1. Embedded Systems Architecture by Tammy Overgaard; Elsevier Publisher; 2005
2. ARM System Developer's Guide by A.N. Sloss, D. Symes and C. Wright; Elsevier Publisher; 2006

Reference books:
1. Embedded System Design by Steve Heath, Elsveir Publisher; 2006
2. Embedded Systems by Raj Kamal, TMH; 2006
3. Embedded Microcomputer Systems, Thomson Publisher; 2005
4. Embedded system Design, Kluwer Academic Publisher; 2005
5. An Introduction to the design of small-scale embedded Systems by T. Wilmshurst, Palgrav publisher; 2001

Paper Code: ITR 628 **L T/P C**
Paper: Information Theory and Coding **4 0 4**

Information, channel capacity, The concept of amount of information, entropy, Information rate, Conditional and joint entropies.

Source coding: Noise less coding, Shannon's first fundamental theorem, Discrete memory less channel, Mutual information, Sources with finite memory, Markov sources, Shannon's second fundamental theorem on coding, Huffman coding, Lempel – Ziv algorithm, Shannon-Fano algorithm.

Channel coding: Error detecting codes, Hamming distance, Error correcting codes, Repitition codes, Linear block codes, binary cyclic codes, BCH codes, Reed-Soleman codes, Golay codes.

Convolution Coding: Code tree, state diagram, Trellis diagram, Maximum-Likelihood decoding – Viterbi's algorithm, sequential decoding.

Network information theory, introduction to Cryptography

Text Books:

1. T M Gover, J M Thomos, "Elements of Information Theory", Wiley , 1991
4. S. Haykin, "Digital Communication", Wiley. 2002
3. J.G.Proakis,"Digital Communications", Mc Graw Hill, 2002

ITD -652 Wireless Mobile Networks Lab.

The practical will be based on Wireless Mobile Networks.

ITD-654: CDMA Lab

The practical will be based on CDMA course.

ITD – 656 Advanced Computer Network Lab

The practical will be based on Advanced Computer Network course

ITD – 658 ARM Architecture for Mobile Communication lab

The practical will be based on ARM Architecture for Mobile Communication course

Paper Code: ITD 701 **L T C**
Paper: Probability and Stochastic Process **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: The objective of the paper is to facilitate the student with the basics of probability and stochastic processes used in communication. The scope of the subject is to acquire skills to apply the stochastic processes in engineering problems.

Unit I
Sets, Probability, Conditional Probability, Bernoulli Trials, Asymptotic Theorems, Poisson Theorem, Random Variables, Distribution and Density Functions, Conditional and Total Probability, Mean, Variance, Moments, Cumulants, Characteristic Functions.

Unit II
Bivariate and Multivariate Random Variables, Joint Moments, Joint Characteristic Functions, Conditional Distributions, Conditional Expected Values, Sequences of Random variables, Mean Square Estimation, Stochastic Convergence and Limit Theorems, Random Numbers: Meaning and Generation, Parameter Estimation, Hypothesis Testing.

Unit III
Systems with Stochastic Inputs, Power Spectrum, Digital Processes, Random Walks, Brownian Motion, Thermal Noise, Poisson Point and Shot Noise, Modulation, Cyclostationary Processes, Bandlimited Processes and Sampling Theory, Spectral Representation.

Unit IV
Ergodicity, Spectral Estimation, Extrapolation and System Identification, Prediction, Filtering, Kalman Filters, Entropy, Maximum Entropy Principle, Markov Processes.

Text:

1. A. Popoulis and S. V. Pillai, "Probability, Random Variables and Stochastic Processes," TMH, 2002.

References:

1. H. C. Tijms, "A First Course in Stochastic Models," Wiley, 2003.
2. S. Ross, "A First Course in Probability," PHI, 1998.
3. W. Feller, "An Introduction to Probability Theory and its Applications," vol. 1, Wiley, 1968.
4. G. Schay, "Introduction to Probability with Statistical Applications," Birkhauser, 2007.
5. T. T. Soong, "Funadamentals of Probability and Statistics for Engineers," Wiley, 2004.
6. L. B. Koralov and Y. G. Sinai, "Theory of Probability and Random Processes," Springer, 2007.
7. H. P. Hsu, "Theory and Problems of Probability, Random Variables and Random Processes," Schaum's Outline Series, MH, 1997.
8. A. V. Skorokhod, "Basic Principles and Applications of Probability Theory," Springer, 2005.
9. G. Bolch, S. Greiner, H. de Meer and K. S. Trivedi, "Queueing Networks and Markov Chains," Wiley, 2006.
10. D. W. Stroock, "An Introduction to Markov Processes", Springer, 2005.

Paper Code: ITD 703 **L T C**
Paper: Adhoc and Sensor based networks **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: To provide basic for various techniques in mobile networks/Adhoc networks and sensor based networks. The objective of the paper is to facilitate the student with the understanding of Infrastructure less networks and their importance in the future directions for wireless communications. The prerequisites are to have basic understanding of infrastructured networks, basic protocols used on computer networking.

Unit I

AD HOC Wireless

Introduction, Mobile Ad Hoc Networks, Technologies for Ad Hoc Network, Issues in Ad hoc wireless Networks, IEEE 802.11 Architecture and protocols.

Protocol for AD HOC Wireless Networks

Issues and classification of MAC protocol, other MAC protocols, Dynamic Source Routing (DBR), Adhoc Distance Vector (AoDV) routing, Routing Protocols, Multicasting Routing issues

Unit II

Transport layer & Security protocols

Issues in designing transport layer protocols, TCP over Ad Hoc Wireless Networks, Network Security Attacks, and Key management.

Unit III

Wire Sensor Networks

Basic Sensor Network Architectural Elements, Applications of Sensor Networks, Comparison with Ad Hoc Wireless Networks, Challenges and Hurdles.

Architecture of WSNs Hardware components, Operating systems and execution environments, some examples of sensor nodes, Network Architecture, Sensor networks scenarios, Optimization goals and figures of merit, Design principles for WSNs.

Unit IV

Communication Protocols

Physical Layer and Transceiver design considerations in WSNs, Fundamentals of (wireless) MAC protocol, Address and name management in wireless sensor networks, Localization and positioning

Routing protocols Data Dissemination and Gathering, Routing Challenges and Design Issues in Wireless, Routing Strategies in Wireless Sensor Networks, QoS in wireless sensor networks, Coverage and deployment

Text Book:

1. Ad HOC Wireless Networks: Architectures & Protocols by C Siva Ram Murty & BS Manoj 2nd Ed, Pearson Education.
2. Adleshein & Gupta, "Fundamentals of Mobile and Pervasive Computing, TMH, 2005

Reference:

1. Handbook of Ad Hoc wireless network, By Mohamed Illayas, CRC press
2. Protocols and Architectures for Wireless Sensor Networks, By Holger Karl, John Wiley & Sons.
3. Wireless Sensor Networks Technology, Protocols, and applications by Kazem Sohraby, Daniel Minoli, Taieb Znati, John Wiley & Sons.

Paper Code: ITR 717 **L T C**
Paper: Telecommunication Switching and Traffic Networks **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Objective: *To introduce fundamental functions of a telecom switching office, digital multiplexing, digital switching and digital subscriber access, further to introduce mathematical models for the analysis of telecommunication traffic.*

Unit – I: Multiplexing

Transmission Systems, FDM Multiplexing and modulation, Time Division Multiplexing, Digital Transmission and Multiplexing: Pulse Transmission, Line Coding, Binary N – Zero Substitution, Digital Biphase, Differential Encoding, Time Division Multiplexing, Time Division Multiplex Loops and Rings.

SONET/SDH: SONET Multiplexing Overview, SONET Frame Formats SONET Operations, Administration and Maintenance, Payload Framing and Frequency Justification, Virtual Tributaries, DS3 Payload Mapping, E4 Payload Mapping, SONET Optical Standards, SONET Networks. SONET Rings: Unidirectional Path-Switching Ring, Bidirectional Line-Switched Ring.

Unit – II: Digital Switching

Switching Functions, Space Division Switching, Time Division Switching, two-dimensional switching: STS Switching, TST Switching, No.4 ESS Toll Switch, Digital Gross-Connect Systems, and Digital Switching in an Analog Environment. Elements of SSNO7 Signaling.

Unit – III: Network Synchronization Control and Management

Timing: Timing Recovery: Phase-Locked Loop, Clock Instability, Jitter Measurements, Systematic Jitter. Timing Inaccuracies: Slips, Asynchronous Multiplexing, Network Synchronization, U.S. Network Synchronization, Network Control, Network Management.

Unit – IV: Digital Subscriber Access and traffic analysis

ISDN: ISDN Basic Rate Access Architecture, ISDN U Interface, ISDN D Channel Protocol. High-Data-Rate Digital Subscriber Loops: Asymmetric Digital Subscriber Line, VDSL. Digital Loop Carrier Systems: Universal Digital Loop Carrier Systems, Integrated Digital Loop Carrier Systems, Next-Generation Digital Loop Carrier, Fiber in the Loop, Hybrid Fiber Coax Systems, and Voice band Modems: PCM Modems, Local microwave Distribution Service, Digital Satellite Services. Traffic Characterization: Arrival Distributions, Holding Time Distributions, Loss Systems, And Network Blocking Probabilities: End-to-End Blocking Probabilities, Overflow Traffic, And Delay Systems: Exponential Service Times, Constant Service Times, Finite Queues.

Text:

1. Bellamy John, "Digital Telephony", John Wily & Sons, Inc. 3rd ed. 2000
2. Viswanathan. T., "Telecommunication Switching System and Networks", PHI 1994

References:

1. Robert G. Winch, "Telecommunication transmission systems", 2nd ed. TMH 2004
2. Marion Cole, "Intro. to Telecommunications" 2nd ed. Pearson education 2008.
3. Tom Sheldon, "Encyclopedia of Networking and telecom." TMH seventh reprint2006

Paper Code: ITD 707 **L T C**
Paper: Personnel wireless Networks **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj. : To teach the various aspects of Bluetooth, WLAN, Infrared technologies and Home RF. The goal of IEEE and Bluetooth SIG is to find standards (802.15) Wireless PAN, which shall have interoperability between a broad range of consumer devices and allow global use of Personal Area Networks. Keeping in view the three relevant technologies are studied.

Unit-1

Over view of all technologies, IEEE 802.15 WPAN,Home RF, Blue tooth, interface between blue tooth and WLAN, standards, major telecommunications standards organizations, the radio frequency spectrum, interoperability issues.

Unit-2

Infrared Standards

Differences between the OSI communications model and the IEEE 802 of a radio system, Describe how different factors effect communications, standards, infrared WLAN, features of IrDA

Unit-3

Bluetooth Technology

Bluetooth protocol architecture, Link management, Logical Link control, Blue tooth profiles and Blue tooth security

Unit-4

WLANs

Historical overview of LAN industry, evolution, wireless home networking, Versions of 802.11b, 802.11g, IEEE 802.11a, The Phy layer, MAC layer, Mobility in WLAN, Deploying WLAN, Managing Wi-fi Networks

Textbooks:

1. Kaven pahlavan and others, "Principles of Wireless networks", Pearson ed. 2002.
2. Nathan J Muller, "Blue tooth Demystified" TMH, Third reprint 2007.
3. William Stallings, "Wireless communications and Networks", 2nd ed. PHI 2007.
4. John R Barry, "Wireless infrared communications" ISBN 0792394763

Reference books:

1. Dee M Bakker and others, "Blue tooth end to end" ISBN 978-0-7645-4887-1
2. Jochen Schiller, "Mobile communications", Pearson ed. 2003
3. Martyr Mallick, "Mobile and Wireless Design Essentials", Wiley Dreamtech, 2004.
4. Asoke Talukder, Yavagal, "Mobile Computing", TataMcGraw Hill, 2005

Paper Code: ITD 709 **L T C**
Paper: RF Engineering and Propagation **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: The objective of the paper is to facilitate the student with the basics of field theory and fundamentals of antennas, types of antennas and propagation aspects of RF energy. These aspects are required for understanding of wireless communications and lay emphasis on principles and methods used in mobile antennas. The prerequisites are to have basic understanding of Field theory.

Unit – I

Radiation fields of wire antennas: Concept of vector potential. Modification for time varying retarded case. Fields associated with Hertzian dipole. Power radiated and radiation resistance of current element. Radiation resistance of elementary dipole with linear current distribution. Radiation from half-wave dipole and quarter – wave monopole. Assumed current distribution for wire antennas. Use of capacity hat and loading coil for short antennas.

Unit – II

Antenna Fundamentals and Antenna Arrays: Definitions: Radiation intensity. Directives gain. Directivity. Power gain. Beam Width. Band Width. Gain and radiation resistance of current element. Half-wave dipole and folded dipole. Reciprocity principle. Effective length and Effective area. Relation between gain effective length and radiation resistance.

Loop Antennas: Radiation from small loop and its radiation resistance. Radiation from a loop with circumference equal to a wavelength and resultant circular polarization on axis. Aelical Antenna. Normal mode and axial mode operation. Antenna Arrays: Expression for electric field from two and three element arrays. Uniform linear array. Method of pattern multiplication. Binomial array. Use of method of images for antennas above ground.

Unit III

Traveling wave (wideband) antennas: Radiation from a traveling wave on a wire. Analysis of Rhombic antenna. Design of Rhombic antennas. Coupled Antennas: Self and mutual impedance of antennas. Two and Three element Yagi antennas. Log periodic antenna. Reason for feeding from end with shorter dipoles and need for transposing the lines. Effects of decreasing. Aperture and Lens Antennas: Radiation from an elemental area of a plane wave (Huygen's Source). Radiation from the open end of a coaxial line. Radiation from a rectangular aperture treated as an array of Huygen's sources. Equivalence of fields of a slot and complementary dipole. Relation between dipole and slot impedances. Method of feeding slot antennas. Thin slot in an infinite cylinder. Field on the axis of an e-plane sectoral horn. Radiation form circular aperture. Beam width and effective area. Reflector type of antennas (dish antennas). Dielectric lens and metal plane lens antennas. Lumeberg lens. Spherical waves and biconical Antenna.

Unit IV

Propagation: The three basic types of propagation; ground wave, space wave and sky wave propagation. Sky wave propagation: Structure of the ionosphere. Effective dielectric constant of ionized region. Mechanism of refraction. Refractive index. Critical frequency. Skip distance. Effect of earth's magnetic field. Energy loss in the ionosphere due to collisions. Maximum usable frequency. Fading and Diversity reception. Space wave propagation: Reflection from ground for vertically and horizontally polarized waves. Reflection characteristics of earth. Resultant of direct and reflected ray at the receiver. Duct propagation. Ground wave propagation: Attenuation characteristics for ground wave propagation. Calculation of field strength at a distance.

Text book

1. E.C. Jordan and Balmain, "Electro Magnetic Waves and Radiating Systems", PHI, 1968, Reprint 2003

References:

1. John D. Kraus and Ronalatory Markefka, "Antennas", Tata McGraw-Hill Book Company, 2002
2. R.E. Collins, "antennas and Radio Propagation", McGraw-Hill, 1987
3. Ballany, "Antenna Theory", John Wiley & Sons, Second Edition, 2003

Paper Code: ITD 711 **L T C**
Paper: Multimedia communications and system Design **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Objective: The objective of the paper is to facilitate the student with the idea of how multimedia content is processed the issues in transportation and the use of compression techniques needed wireless free space communications The prerequisites are to have basic understanding of voice, video and data, basic processing techniques.

Unit-1

Multimedia Communication: Introduction, Network requirements, multimedia terminals, multimedia Requirement for ATM networks, Multimedia terminals. Audio visual Integration. Audio to visual mapping.

Unit-2

Multimedia Processing in Communications: Introduction, Digital Media, Signal processing elements, Challenges in multimedia information processing, Perceptual coding of Digital audio signals, Transform audio coders, Image coding, Video Coding.

Unit-3

Distributed multimedia systems, Resource management of DMS, IP networking, Multimedia operating systems, distributed multimedia servers, Distributed multimedia applications, Multimedia File Formats

Unit-4

Multimedia communication standards, MPEG-1, MPEG-2, MPEG-4Audio/Video, MPEG-4 Visual Texture coding (VTC), Multimedia communication across networks.
Compression Techniques: JPEG, MPEG

Text:

1. Rao, Bojkovic, Milovanovic, "Multimedia Communication Systems", PHI
2. Andleigh, Thakrar, "Multimedia System Design", PHI

References:

1. Sharda, "Multimedia Information Networking", PHI
2. Vaughan, "Multimedia making it work", Tata Mc Graw Hill

Paper Code: ITD 713 **L T C**
Paper: Secure Wireless Communications **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: The objective of the paper is to facilitate the student with the understanding of various security principles used for secure wireless communications and lay emphasis on principles and methods used in wireless systems.

Unit I
Introduction to Wireless Communication, Wireless Network Architecture: Review of Wireless LAN, Review of WPAN, Review of WMAN, Review of WWAN

Unit II
Wireless Security: Traditional Security Issues, Mobile and Wireless Security Issues, Types of Attacks
Approaches to Security: Physical Limitations, Encryption, Integrity Codes, IPSEC, AAA

Unit III
Security in WPAN: Basic security mechanisms, Bluetooth security modes, encryption, Authentication, limitations and problems.

Security in WLAN: Security mechanisms: WEP, WPA, Radius, CHAP, EAP, 802.11i,
(RF transmission, MAC Address Control, SSID, Authentication)

Unit IV
Security in WMAN: Broadband Wireless Access, 802.16 Security, Key Management, Authorisation,
Security in WWAN: Encryption Security in CDMA, GSM authentication and encryption, Problems with GSM security, Security mechanisms of 3G.

Text:

1. 1. R. K. Nichols, P. C. Lekkas, "Wireless Security: Models, Threats and Solutions", TMH, 2006.
2. A. E. Earle, "Wireless Security Handbook," Auerbach Publications, 2006.
3. Adelstein, Gupta, et al., "Fundamentals of Mobile and Pervasive Computing", TMH, 2005
4. Conklin, Williams et al., "Principals of Computer Security", Dreamtech, 2004

Reference:

1. Y Xiao, X. Shen and D.-Z. Zu, "Wireless Network Security," Springer, 2007.
2. P. Chandra, "Bulletproof Wireless Security," Elsevier, 2005.
3. F. Anjum and P. Mouchtaris, "Security for Wireless Ad Hoc Networks," Wiley-Interscience, 2007.
4. T. M. Swaminatha and C. R. Elden, "Wireless Security and Privacy: Best Practices and Design Techniques," Pearson Education, 2003.
5. R. D. Vines, "Wireless Security Essentials," Wiley, 2002.
6. Martyr Mallik, "Mobile and Wireless Design Essentials", Wiley Dreamtech, 2004

Paper Code: ITD 715 **L T C**
Paper: Advances in Information Theory **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: The objective of the paper is to facilitate the student with the understanding of how information is measured. Further the student is made to understand the advances in Information theory. Coding methods transmitting the information with out errors are studied.

Unit I

Discrete Entropy: Entropy, Uniqueness of Entropy Function, Joint Entropy, Conditional Entropy, Relative Entropy and Mutual Information, Chain rules (for Entropy, Relative Entropy and Mutual Information), Jensen's Inequality, Log sum inequality, Fano's inequality, Asymptotic Equipartition Property (AEP), High probability and the typical set, Markov Chains, Entropy rate, Hidden Markov Model.
Codes: Kraft's inequality, Optimal Codes, Bounds on optimal codes, Kraft inequality for uniquely decodable codes, Huffman Codes, Optimality of Huffman Codes, Shannon – Fano – Elias coding, Arithmetic Coding, Competitive optimality of Shannon code.

Unit II

Channels: Channel Capacity, Symmetric Channels, Jointly Typical Sequences, Channel Coding Theorem, Zero – Error Codes, Fano's inequality and the converse to the coding theorem, Equality in the converse to the channel coding theorem, Hamming codes, Feedback capacity, Joint Source Channel Coding Theorem.
Differential Entropy: AEP for Continuous Random Variables, Differential Entropy; Joint, Conditional, Relative, and Mutual Differential Entropy, Differential Entropy Bounds on Discrete Entropy; Gaussian Channel, Maximum Entropy and Spectral Estimation.

Unit III

Kolmogorov's Entropy: Models of Computation, Kolmogorov Complexity and Entropy, Kolmogorov complexity of integers, Algorithmically random and incompressible sequences, Universal Probability, Halting problem and Kolmogorov Complexity, The number Ω, Occam's Razor, Kolmogorov Sufficient Statistic.
Informatioon Theory and Statistics: The method of types, the law of large numbers, universal source coding large deviation theory, Sanov's theorem, Conditional Limit Theorem, Hypothesis Testing, Stein's Lemma, Chernoff Bound, Lempel – Ziv Coding, Fisher information and Cramer – Rao inequality.

Unit IV

Rate Distortion Theory and Network Information Theory: Quantization, Rate Distribution Function, Rate Distribution Theorem, Strongly Typical Sequences, Channel Capacity and the Rate Distortion Function. Gaussian Multiple User Channels, Jointly Typical Sequences, Multiple Access Channel, Encoding of Correlated Sources, Duality between Slepian – Wolf encoding and Multiple Access Channels, Broadcast Channel, Relay Channel, Source Encoding with side information, Rate Distortion with Side Information.

Text:

1. T. M. Cover and J. A. Thomas, "Elements of Information Theory", Wiley, 1991.

References:

1. A. I. Khinchin, "Mathematical Foundations of Information Theory", Dover, 1957.
2. F. M. Reza, "An Introduction to Information Theory", Dover, 1994.
3. R. B. Ash, "Information Theory", Dover, 1990.
4. R. M. Gray, "Entropy and Information Theory", Springer-Verlag, 1990.
5. S. Kullback, "Information Theory and Statistics", Wiley, 1959.

Paper Code: ITD 717 **L T C**
Paper: RF Design of wireless communications (VLSI) **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: The objective of the paper is to facilitate the student with the understanding of RF design of various components for the use in Wireless communication devices. The prerequisites are to have basic understanding of microelectronics and VLSI.

To impart the modeling of RF system design in the field of communication system

Unit I

RF Filter design

Basic resonator and filter configurations-special filter realization-filter implementation-coupled filter

Unit II

Active RF Components

RF diodes-bipolar junction transistor –RF field effect transistor-high electron mobility transistors-diode models-transistor models-measurement of active devices-scattering parameter device characterization

Unit III

Matching and biasing networks

Impedance matching using discrete components-micro strip line matching networks-amplifier classes of operation and biasing networks

Unit IV

RF Transistor amplifier design

Characteristics of amplifier-amplifier power relations-stability consideration-constant gain-broadband, high power, and multistage amplifiers, Oscillators and mixers: Basic oscillator model-high frequency oscillator configuration-basic characteristics of mixer.

TEXT BOOK

1. Reinhold Ludwig, “RF circuit design, theory and applications” Pavel Bretchko, “Pearson Asia Education”, edition 2001

REFERENCE BOOKS

1. D.Pozar, “Microwave Engineering”, John Wiley & Sons, New York, 1998
2. Bahil and P. Bhartia, “Microwave Solid State Circuit Design, John Willey & Sons, New York, 1998

Paper Code: ITD 719 **L T C**
Paper: Smart Antennas **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: The objective of the paper is to facilitate the student with the understanding and design aspects of smart antennas used for mobile applications. The prerequisites are to have basic understanding of EMF and antenna theory.

UNIT I
Basic concepts of Radiation
Radiation mechanism – Basic sources of Radiation- Current distribution on antennas, Basic antenna parameters

UNIT II
Analysis and synthesis of antennas
Vector potential, Antenna theorems and definitions, dipole, loop, reflector, slot antennas. Types of linear arrays, current distribution in linear arrays, Antenna synthesis techniques.

UNIT III
Smart antennas
Spatial processing for wireless systems: Introduction, Vector channel impulse response & the spatial signature. Spatial processing receivers, fixed beamforming Networks, switched beam systems, Adaptive antenna systems, Wide band smart antennas, Digital radio receiver & software radio for smart antennas.

UNIT IV
Smart antenna techniques for CDMA
Non-coherent & coherent CDMA spatial processors, spatial processing rake receiver, Multi-user spatial processing, dynamic resectoring, downlink beam forming for CDMA, MIMO

TEXT BOOKS

1. Balanis A., "Antenna Theory Analysis and Design", John Wiley and Sons, New York, 1982.
2. Joseph C. Liberti, Theodore S. Rappaport – "Smart Antennas for Wireless Communications: IS95 and third generation CDMA Applications", Prentice Hall, Communications Engineering and Emerging Technologies Series.

REFERENCE BOOKS

1. Kraus J.D., "Antennas", II edition, John Wiley and Sons, New York, 1977.
2. Collin R.E. and Zucker F. – "Antenna theory" Part I, Tata Mc Graw Hill, New York, 1969.

Paper Code: ITD – 721 **L T C**
Paper: Microwave and Radar Engineering **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Objective: *To familiar the students with active and passive microwave devices and components used in microwave engineering, further understanding the principles of radar and its applications.*

UNIT – I
MICROWAVE COMPONENTS AND SEMICONDUCTOR DEVICES
Introduction to S – parameters, Waveguides Tees, Hybrid rings, Bends and twists, Directional coupler, S – matrix of a directional coupler, Circulators, Microwave isolators, Microwave bipolar transistors, Microwave field effect transistors, Avalanche transit time devices, IMPATT diode, TRAPATT diode, BARITT diodes.

UNIT – II
MICROWAVE LINEAR TUBES AND CROSSFIELD TUBES
Klystron, Velocity modulation concept, Bunching process, Multi cavity klystron amplifiers, Reflex klystrons, Power output efficiency, Traveling wave tube and its amplification process. Magnetron oscillators, cylindrical magnetron, coaxial magnetron, Tunable magnetron, Integration microwave integrated circuits.

UNIT – III
INTRODUCTORY RADAR SYSTEMS
Basic radar, Radar range equation, Radar cross section of targets, Transmitter power-pulse, Repetition frequency, MTI and pulse Doppler radar, Automatic tracking with surveillance radar, Radar receiver, Radar displays.

UNIT – IV
NAVIGATIONAL METHODS
Radio direction finding, Loop antenna, Automatic direction finders, Range and accuracy of direction finders, Radio ranges, VHF omni directional range (VOR)-recent developments, Loran-A equipment, Range and precision of standards.

TEXTBOOKS
1 Samuel Y.LIAO, "Microwave Devices and Circuits", Prentice Hall of India–3rd edition (2003)
2 Merill I.Skolnik, "Introduction to Radar Systems", Tata Mcgraw Hill (3rd edition) 2003.

REFERENCES
1 David M.POZAR, "Microwave Engg.", John Wiley & Sons – 2nd Edition (2003).
2 Peyton Z.Peebles, "Radar Principles", John Wiley, 2004.

Paper Code: ITD 723 **L T C**
Paper: Microwave Devices and Circuits **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: The objective of the paper is to facilitate the student with the basics of device aspects used in microwave region of working. TED's and transistors, klystrons and mirocstrip lines are considered. The prerequisites are to have basic understanding of semiconductor devices and circuits.

UNIT – I

Microwave frequencies, Interactions between electrons and fields, Electromagnetic plane waves, Electric and magnetic wave equations, Poynting theorem, Uniform plane waves and reflection, Plane wave propagation in free space and lossless dielectric, Plane wave propagation in lossy media, Plane wave propagation in metallic film coating on plastic substrate.

UNIT – II

Transmission line equations and solutions, Reflection coefficient and transmission coefficient, Standing wave and standing wave ratio, Line impedance and admittance, Smith chart, Microwave waveguides and components, Rectangular waveguides, Microwave cavities, Directional couplers, Circulators and isolators, Microwave transistors and tunnel diodes, Microwave bipolar transistors, Heterojunction transistors, Microwave tunnel diodes, Microwave field effect transistors, Junction field effect transistors, Metal semiconductor field effect transistors.

UNIT – III

Transferred electron devices, Gunn – effect diodes – GaAs diode, Ridley-watkins-Hilsum (RWH) theory, Modes of operation, LSA diodes, InP diodes, Avalanche transit time devices, Read diode, IMPATT diode, TRAPATT diodes, BARITT diodes, Microwave linear beam tubes (O Type), Conventional vacuum triodes, , Tetrodes and pentodes, klystrons, Multicavity klystron amplifiers, Reflex klystrons, Helix traveling wave tubes (TWT), Coupled cavity traveling wave tubes, Microwave crossed filed tubes (M Type), Magnetron oscillators, Forward wave crossed field amplifier (FWCFA OR CFA).

UNIT – IV

Strip lines, Microstrip lines, Parallel strip lines, Coplanar strip lines, Shielded strip lines, Monolithic microwave integrated circuits, Materials, Monolithic microwave integrated circuit growth, MOSFET fabrication.

Text Book:

1.Samuel Y.Liao, " Microwave Devices and Circuits" Third edition,PHI
2. SK Roy, M Mitra, "Microwave semiconductor devices", PHI 2003

Reference Books:

1. David M. Pozar, "Microwave Engineering" Wiley

Paper Code: ITD 725 **L T C**
Paper: Recent Trends in Mobile Communication Technology **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: T*o study the various advances in the area such as applications in 4G, Next generation networks, Adhoc and sensor based networks etc.*

Networks are taking off from voice services to fully converged solutions, by introducing new integrated services which include voice, data, multimedia delivery and full motion video paving to the way for Next generation networks. Advances in infrastructure less networks and sensor based networks furthering their applications by using WIMAX and 802.20 solutions for global networking .The research focus areas have to dealt in this paper, allowing the student to explore various journals and study the recent trends of the area.

Paper Code: ITR 707 **L T C**
Paper: Advances in Coding Theory **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: The objective of the paper is to facilitate the student with the advances in Coding theory. The requisites are to have basic understanding of ITC theory.

Unit I
Basic Digital Communication, Signal Detection, Memoryless Channels, Hamming Codes, Overview of Information Theory (Random variables, Entropy, Conditional Entropy, Relative Entropy, Mutual Entropy, Channel Capacity, Channel Coding Theorem (without proof) and its implication).

Groups (Definition and properties, Subgroups, Cyclic groups and order, Cosets, Lagrange's theorem, Isomorphism, Homomorphism), Linear Algebra (Vector Spaces, Independence, Basis, dimension, inner product, dual space, orthogonality), Rings (Definition, Polynomials, Quotient Rings, Ideals); Number Theory and Algebra (Divisibility, Euclidean Algorithm, Sugiyama Algorithm, Congruences, ϕ function, Chinese Remainder Theorem, Fields over $\boldsymbol{R}$ and $\boldsymbol{C}$, Galois Fields, Galois Field Arithmetic, Irreducible and Primitive Polynomials, Krawtchouk Polynomials).

Unit II
Linear Block Codes (Generator Matrix, Parity Check Matrix, Dual Codes, Weight Distribution, Hamming Codes and their Dual, Erasure Decoding); Cyclic Codes (Cyclic Encoding, Syndrome Decoding, Binary CRC Codes); BCH, Reed Solomon Codes, Goppa Codes, Peterson's Algorithm, Belekamp – Massey Algorithm, Forney's Algorithm.

Unit III
Welch – Berlekamp Key Equation, Guruswami –Sudan Decoding Algorithm and Soft RS decoding, Hadamard Matrices and Codes, Reed Muller Codes, Quadratic Residue Codes, Golay Codes; Gilbert – Varshamov Bound, Plotkin Bound, Griesmer Bound, Linear Programming and Related Bounds, McEliece – Rodemich – Rumsey – Welch Bound; Bursty Channels, Interleavers and Concatenation; Soft Decision Decoding Algorithms;

Unit IV
Convolutional Codes, Viterbi Algorithm, Error Analysis, Puncturing, Suboptimal decoding algorithm for Convolutional codes, convolutional codes as block codes, Trellis representation of Block and Cyclic Codes, Trellis Coded Modulation.
Turbo Codes – Encoding parallel concatenated codes, decoding algorithms, Error Floor and Weight Distribution. Low Density Parity Check Codes – Construction, Tanner graphs, Decoding.
Space Time Coding – Fading Channels, Rayleigh Fading, MIMO Channel, Space Time Block Codes, Space – Time Trellis Codes.

Text:
1. T. K. Moon, "Error Correction Coding: Mathematical Methods and Algorithms", Wiley, 2006.

References:
1. W. C. Huffman and V. Pless, "Fundamentals of Error – Correcting Codes", CUP, 2003.
2. S. Lin and D. J. Costello, "Error Control Coding: Fundamentals and Application", 1983.
3. R. H. Morelos-Zaragoza, "The Art of Error Correcting Codes", Wiley, 2002.
4. E. R. Berlekamp, "Algebraic Cding Theory", Aegean Park Press, 1984.

Paper Code: ITD 727 **L T C**
Paper: Encryption Techniques and Security Protocols **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: T*o study the various advances in the areas of Encryption and security and their applications in 4G, Next generation networks, Adhoc and sensor based networks.*

Unit – I
Basic Encryption Concepts, Encryption algorithms: Symmetric key and Asymmetric encryption techniques, Stream Ciphering and Block Ciphering.

Unit – II
Private Key encryption: Substitution ciphers; one time pads, Data Encryption Standards (DES), Password Encryption, The Advanced Encryption Standard (AES); Rijndael.

Unit – III
Public key encryption: Diffie – Hellman Key Exchange, RSA Algorithm; Elliptic Carve, Hashing Algorithms: MD5, SHA, Message Authentication code (MAC)

Unit – IV
Security Protocols: Secure Socket Layer (SSL), Transport-Layer Security (TLS), WTLS, PKI, Digital Signatures, Certification, Secure Electronic Transaction (SET), IPSec.

Text Books:
1. Asoke Talukder, Yavagal, "Mobile Computing, TMH, 2005.
2. Eric Maiwald, "Fundamentals of Network Security", Dreamtech Press, 2004.

Reference Books:
1. Arthur Conklin, Williams, "Principles of Computer Security", Dreamtech Press, 2004.
2. Atul Kahate, "Cryptography and Network Security", TMH, 2003.

Paper Code: ITD 729 **L T C**
Paper: Internetworking Technologies **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: The objective of the paper is to facilitate the student with the basics of Internetworking technologies and their utilization in wired networks. The prerequisites are to have basic understanding of Data communications and networking.

Unit -I

Internetworking model, application & upper layers, physical & data link layers network layer & path determination, router basics: Types, configuration & operation

Unit-II

TCP/IP, IP Addressing, IP routing configuration, Multi protocol routing, IP Subnets, IP routing protocols: OSPF, RIP, BGP, IP forwarding, classless inter domain routing, traffic management with access lists.

Unit-III

Transport protocols: TCP, basic behavior, versions of TCP, UDP, and link layer technologies: ARP, RARP, Ethernet, HDLC, and LAP-B. Modems, CSU/DSU, B.35 and G.7.3 interfaces, ISDN, Fire walling, IPSEC basics, L2TP, New services over internet.

Unit-IV

Introduction to WAN connection, configuration of X.25, configuration of frame-relay, new services over the Internet: VOIP, Fax over IP, VOATM, VOFR, RTP/RTCP, SIP, H.323.
Virtual private network, IP-multicast, QOS architectures in the Internet, IntServ, DiffServ, Core Stateless fare Queing., Internet access technologies- security, directory enabled networking, network caching technologies.

Text

1. W R Stevens, " TCP/IP Illustrated- Volume 1- The Protocols, Pearson Edition Asis Education,
2. Duglas Comer, "Internetworking withTCP/IP Volume 1 – Principles, protocols and architecture, Prentice Hall, 4th Edition 2000

References

1. Internetworking Technologies handbook, 2nd edition, 1999, Cisco Press
2. Introduction to CISCO router configuration; 1998, Cisco Press

Paper Code: ITD 731 **L T C**
Paper: Network Design **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: The objective of the paper is to facilitate the student with the various design aspects of a network. Particular emphasis is given to access and back bone networks. The prerequisites are to have basic understanding of networking layers.

Unit-I

Review of OSI layers, circuit types & services, topologies, networking hardware, common protocols & interfaces in physical, data, and network & transport layers.
Switching technologies, multiplexing, circuit switching, packet switching X.25, frame relax, SMDs ATM, B-ISDN, traffic matrix, traffic pattern calculations, performance issues of packet networks, delay, availability and reliability

Unit-II

Comparisons: circuits vs. packets vs. frame vs. cell Technologies & services, protocols & interface comparisons, switching comparisons, Sods vs. B-ISDN, FDDE Vs SMDS
Network Design for Access: Campus network design, leased line and radio modems, DDR & ISDN Access Network design, X.25 remote access network design, Frame-relay interfaces & traffic shaping VSAT & WLAN network design. Scaling access networks.

Unit-III

Network Design for Backbone: Identification & selection of internetworking devices, CISCO routers & Nortel switches, EIGRP
Network Design for convergence: UDP broadcasts, IP Networks for Voice, Data, Video, Fax, Soft & hard design examples for IP Technology networks, network design for digital video broadcast

Unit-IV

Data Network Management Systems: Managing IP, ICMP, TCP, UDP, X.25 reporting Ethernet traffic, managing bridges & routers. Microsoft & HP, NMS Tools.
Case Studies: selected from design, architecture & topology areas of internetworks.

Text Books:

1. Data Network Design; D L Spolin, Mc-Graw Hill 3rd Edition, 2002

Reference Books

1. SNMP "Feit" Mc-Graw Hill Inc., 1995
2. Network Design & Case Studies "CISCO Systems Inc.", CISCO Press, 1993

Paper Code: ITR 727 **L T C**
Paper: Digital Image Processing **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: The objective of the paper is to facilitate the student with the basics of Image processing techniques, such as transformations, compression and recognition. The prerequisites are to have basic understanding of DSP.

Unit-I
Introduction and Digital Image Fundamentals
The origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamentals Steps in Image Processing, Elements of Digital Image Processing Systems, Image Sampling and Quantization, Some basic relationships like Neighbors, Connectivity, Distance Measures between pixels, Linear and Non Linear Operations.

Unit-II
Image Enhancement in the Spatial Domain
Some basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic and Logic operations, Basics of Spatial Filters, Smoothening and Sharpening Spatial Filters, Combining Spatial Enhancement Methods. Image Enhancement in the Frequency Domain
Introduction to Fourier Transform and the frequency Domain, Smoothing and Sharpening Frequency Domain Filters, Homomorphic Filtering. Image Restoration A model of The Image Degradation / Restoration Process, Noise Models, Restoration in the presence of Noise Only Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear Position-Invariant Degradations, Estimation of Degradation Function, Inverse filtering, Wiener filtering, Constrained Least Square Filtering, Geometric Mean Filter, Geometric Transformations.

Unit-III
Image Compression
Coding, Interpixel and Psychovisual Redundancy, Image Compression models, Elements of Information Theory, Error free comparison, Lossy compression, Image compression standards. Image Segmentation:
Detection of Discontinuities, Edge linking and boundary detection, Thresholding, Region Oriented Segmentation, Motion based segmentation.

Unit-IV
Representation and Description
Representation, Boundary Descriptors, Regional Descriptors, Use of Principal Components for Description, Introduction to Morphology, Some basic Morphological Algorithms. Object Recognition Patterns and Pattern Classes, Decision-Theoretic Methods, Structural Methods.

Text Books:
1. Rafael C. Conzalez & Richard E. Woods, "Digital Image Processing", 2nd edition, Pearson Education, 2004
2. A.K. Jain, "Fundamental of Digital Image Processing", PHI, 2003

Reference Books:
1. Rosefield Kak, "Digital Picture Processing", 1999
2. W.K. Pratt, "Digital Image Processing", 2000

Paper Code: ITD 733 **L T C**
Paper : High Speed Communication Networks **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: The objective of the paper is to facilitate the student with the understanding of High speed networks working on ATM and congestion control methods and services. The prerequisites are to have basic understanding of computer networks.

Unit – I
High Speed Networks
Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL.
High Speed LAN's: Fast Ethernet, Gigabit Ethernet, Fiber Channel – Wireless LAN's: applications, requirements – Architecture of 802.11.

Unit – II
Congestion and Traffic Management
Queuing Analysis – queuing Models – Single Server Queues – Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control.

Unit – III
TCP and ATM Congestion Control
TCP Flow Control – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO back off – KARN's Algorithm – Window Management – Performance of TCP over ATM
Traffic and Congestion control in ATM – Requirements – Attributes – Traffic Management Frame work, Traffic control – ABR traffic Management - ABR rate control, RM cell formats ABR Capacity allocations – GFR traffic management.

Unit – IV
Integrated and Differentiated Services
Integrated Services Architecture – Approach, Components, Services – Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ – Random Early Detection, Differentiated Services. Protocols for QOS Support: RSVP – Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms – Multiprotocol Label.
Switching – Operations, Label Stacking, Protocol details – RTP – Protocol Architecture, Data Transfer Protocol, RTCP.

Textbook:

1 .William Stallings, "High Speed Networks and Internet", Communication networks", Jean Harcourt Asia Pvt. Ltd., II Edition, 2001

Reference Book:
1.Irvan Pepelnjk, Jim Guichard and Jeff Apcar, "MPLS and VPN architecture", Cisco Press, Volume 1 and 2, 2003.
2. Tom Sheldon, "Encyclopedia of Networking and telecommunications" TMH, 2001

Paper Code: ITD 735 **L T C**
Paper : Cryptography **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: The objective of the paper is to facilitate the student with the understanding of various cryptographic techniques for secure data transfer. The prerequisites are to have basic understanding of network security, probability and stochastic processes.

Unit I

Cryptology, Cryptographic Systems, Algebraic Structures, Homomorphisms and Isomorphisms, Permutations, GCD, LCM, Fundamental Theorem of Arithmetic, primes, Congruences, Euler ϕ function, Fermat's Little Theorem, Euler's Generalization of FLT, Wilson's Theorem, The functions τ and σ, Mobius μ function, Arithmetic Functions, primitive roots, Quadratic congruences and quadratic reciprocity law, Primality and Factoring, Finite Fields Modulo Irreducible Polynomials, Blums Integers, Elliptic Curves.

Unit II

Probability: Basic Terms and Concepts, Random Variables, Probability Distributions, Marginal Distributions, Conditional Probability Distributions, Expectation, Independence, Markov's Inequality, Variance and Standard Deviation, Chebyshev's Inequality.
Information Theory: Introduction, Entropy, Joint Entropy, Conditional Entropy, Mutual Information, Redundancy, Key Equivocation and Unicity Distance.
Complexity Theory: Introduction, Asymptotic Notation, Computational Models, Classes P, NP coNP, PP and Its subclasses.

Unit III

Unkeyed Cryptosystems: Candidate one – way functions (Discrete Exponentiation function, RSA function, Modular Square Function), Integer Factorization Algorithms, Algorithms for computing discrete logarithms, Elliptic Curve Cryptology, Merkle Damaged Construction, MD4, MD5, SHA-1, Random Bit Generation.
Secret Key Cryptosystems: Symmetric Encryption Systems (DES, AES, Stream ciphers), Message Authentication Codes, Pseudorandom Bit Generators (Blum-Micalli, RSA, BBS), Pseudorandom Functions.

Unit IV

Public Key Cryptosystems: Asymmetric Encryption Systems (RSA, Rabin, ElGamal, Probabilistic Encryption), Digital Signature Systems, Key Establishment, Key distribution protocol (Merkle's Puzzles, Shamir Three-Pass Protocol, Asymmetric Encryption Based Key Distribution), Key Agreement Protocol, Entity Authentication, Key Management.

Text:

1. R. Oppliger, "Contemporary Cryptography," Artech House, 2005.
2. H. Delfs and H Knebl, "Introduction to Cryptography," Springer, 2007.
3. B. Schneier, "Applied Cryptography," Wiley, 2006.

References:

1. N. Koblitz, "A course in number theory and cryptography," Springer – Verlag, 1994.
2. W. Stallings, "Cryptography and Network Security," PHI, 2006.
3. B. A. Forouzan, "Cryptography and Network Security," TMH, 2007.
4. D. E. Denning, "Cryptography and Data Security," AWL, 1983.
5. R. A. Mollin, "An Introduction to Cryptography," Chapman & Hall/CRC, 2007.
6. D. R. Stinson, "Cryptography: Theory and Practice," CRC, 1995.
7. A. J. Menezes, P. C. van Oorschot, S. A. Vanstone, "Handbook of Applied Cryptography," MIT Press, 1996.
8. W. Mao, "Modern Cryptography: Theory and Practice," Prentice Hall PTR, 2004.

Paper Code: ITD 737 **L T C**
Paper: Sensor Technology and RF MEMS **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: The objective of the paper is to facilitate the student with the basics of Sensor technologies used in variety of applications including that of wireless communications as Sensor based networks

Unit-1

Sensors types and classification – mechanical, acoustic, magnetic, thermal, chemical, radiation and biosensors.

Unit-2

Micro sensors.
Sensors based on surface-acoustic wave devices.

Unit-3

Micromachining techniques
MEMS for automotive, communication and signal processing applications.

Unit-4

Modeling and simulation of microsensors and actuators. Sensors and smart structures.
Micro-opto-electro-mechanical sensors and system.

Text Books:

1. Ristic L "Sensor Technology and Devices", Artech House, London, 1994.
2. Sze S.M "Semiconductor Sensors", John Wiley, New York, 1994 Wise

Reference Book:

1. K.D. (Guest Editor) "Integrated Sensors, Microp-actuators and micro-systems (MEMS)", Special Issue of proceedings of IEEE, Vol. 86, No.8, August 1998.

Paper Code: ITD 739 **L T C**
Paper: Detection & Estimation **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: The objective of the paper is to facilitate the student with the understanding of information detection methods and lay emphasis on principles and methods used in wireless systems.

Unit I
Sets and Probability, Random Variables, Moments, Transformations of Random Variables, Distributions (Discrete and Continuous), Random Processes, Expectations, Autocorrelations, Cross correlation. Random Walk and Weiner Process, Markov Process, Power Spectral Density, LTI Systems, Ergodicity, Sampling Theorem, Hilbert Transform,

Unit II
AR Process, MA process, ARMA Process, Bayes' Criterion, Hypothesis Testing, MinMax Criterion, Neyman-Pearson Criterion, Composite Hypothesis Testing, Maximum Likelihood estimation, Bayes' Estimation, Cramer-Rao inequality, Multiple parameter Estimation, Least Square and Recursive Least Square Estimation.

Unit III
Linear transformation and Orthogonality principle, Wiener Filters, Kalman Filters; Orthogonal Functions, Gram – Schmidt Orthogonalization, Fourier Series, Gree'ns Functions, Integral Equations, General Gaussian Problem.

Unit IV
Binary Detection, M-ary detection, linear estimation, Non-linear Estimation, Binary Detection with unwanted parameters, Binary Detection in coloured noise, Adaptive thresholding with constant false alarm rate (CFAR) detection.

Text:
1. M. Barkat, "Signal Detection and Estimation," Artech house, 2005.

Reference:
1. H. V. Poor, "An Introduction to Signal Detection and Estimation," Springer, 1994.
2. S. M. Kay, "Fundamentals of Statistical Signal Processing: Estimation Theory," PH PTR, 1993
3. S. M. Kay, "Fundamentals of Statistical Signal Processing: Detection Theory," PH PTR, 1993
4. H. L. van Trees, "Detection, Estimation and Modulation Theory", Part 1, Wiley, 2001.
5. D. Simon, "Optimal State Estimation: Kalman, H-infinity, and Nonlinear Approaches", Wiley, 2006.

Paper Code: ITD 741 **L T C**
Paper: Recent Trends in Optical Communication & Networks **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: The objective of the paper is to facilitate the student with the understanding of optical communication aspects of communications. The prerequisites are to have basic understanding of communication theory and analog communications.

UNIT – I
ELEMENTS OF LIGHT AND SOLID STATE PHYSICS
Wave Nature of Light, Polarization, Interference, Diffraction, Light Source, Review of Quantum Mechanical Concept, Review of Solid State Physics, Review of Semiconductor Physics and Semiconductor Junction Device.

UNIT – II
LED, LASERS AND OPTICAL DETECTORS
Introduction, Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence, LED, Plasma Display, Liquid Crystal Display, Numeric Displays, Laser Emission, Absorption, Radiation, Population Inversion, Optical Feedback, Threshold condition, Laser Modes, Classes of Lasers, Mode Locking, Laser Applications. Photo Detector, Thermal Detector, Photo Devices, Photo Conductors, Photo Diodes, Detector performance.

UNIT – III
COMPONENTS OF FIBER OPTIC NETWORKS
Fiber optic networks, Transceivers for fiber optic networks, Semiconductor optical amplifiers (SOA), general considerations and principles of operation of SOA, Erbium doped fiber amplifiers (EDFA), Gain and noise considerations, couplers / splitters, Wavelength division multiplexers and demultiplexers.

UNIT – IV
FIBER OPTIC NETWORKS
Telephone networks, Computer networks, element of the architecture of fiber optic networks, Networks protocols and services, OSI reference models, SONET networks and layers, Layered architecture of fiber optic networks, Network management and the future of fiber optic networks.

TEXTBOOKS
1 John Gowar, "Optical Communication systems", 2nd ed. PHI 1999.
2 Djafar K.Mynbaev, Lowell L.Scheiner, "Fiber-optic communications technology", Pearson Education.

REFERENCES
1 Gerd Keiser, "Optical fiber communications", Mc Graw Hill.
2 Walter goralski, "Optical Networking and WDM", TMH 2001.

Paper Code: ITD 743 **L T C**
Paper: Embedded Systems for Mobile Communication **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: The objective of the paper is to facilitate the student with the basics of Embedded systems, development process, emphasizing various mobile application development environments. The prerequisites are to have basic understanding of Computer architecture, programming languages and operation systems.

Unit – I

Introduction to an embedded systems design (ESD): Introduction to Embedded system, classification of Embedded Systems, issues in ESD and Co-design, development phase of an embedded systems, Languages for embedded systems development, Processors for ES, tools for an ES development.

Unit – II

Operating systems: Inter-process Communication and Synchronization of Processes Tasks and Threads, Problem of Sharing Data by Multiple Tasks, Real Time Operating Systems, Basic Concepts, OS Services, I/O Subsystems, Interrupt Routines in RTOS Environment, RTOS Task Scheduling model, Interrupt Latency and Response times of the tasks.

Unit – III

A case study of Windows CE RTOS for mobile applications.

Unit – IV

Introduction to windows mobile PC and development environment.

Text Books:

1. Programming Microsoft windows CE, .Net, Douglas boling, wp publishers & Distributors.
2. An Embedded Software Primer by David E. Simon, Pearson Education, 2001

References:

1. 8051 Microcontroller & Embedded Systems by Dr. Rajiv Kapadia, Jaico Press, 2003
2. Embedded Systems Design by Frank Vahid, Tony Givargis, John Wiley & Sons, Inc,
3. Programming Embedded Systems by Michael Barr, O'reilly, 2002
4. Computers as Components by Wayne Wolf, Harcourt India Pvt. Ltd., 2002
5. The 8051 Microcontroller and Embedded Systems by M.A. Mazidi and J. G. Mazidi, Pearson Education press, PHI, 2004

Paper Code: ITD 745 **L T C**
Paper: Professional Ethics and Human Values **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 60**
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Obj: To create awareness on Engineering Ethics and Human values.

Unit-I

Human Values: Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – Caring – Sharing – Honesty – Courage – Valuing Time – Cooperation – Commitment – Empathy – Self-Confidence – Character – Spirituality.

Unit-II

Engineering Ethics: Senses of 'Engineering Ethics' – variety of moral issued types of inquiry – moral dilemmas – moral autonomy – Kohlberg's theory – Gilligan's Theory – consensus and controversy – Models of Professional Roles – Theories about right action – Self-interest – customs and religion – uses of ethical theories. Engineering as social experimentation**:** Engineering as experimentation – engineers as responsible experimenters – codes of ethics – a balanced outlook on law – the challenger case study.

Unit-III

Safety, Responsibilities and Rights: Safety and risk – assessment of safety and risk – risk benefit analysis and reducing risk – the Three Mile Island and Chernobyl case studies. Collegiality and loyalty – respect for authority – collective bargaining – Confidentiality – conflicts of interest – occupational crime – professional rights – employee rights – Intellectual Property Rights (IPR) – discrimination

Unit-IV

Global Issues : Multinational corporations – Environmental ethics – computer ethics – weapons development – engineers as managers-consulting engineers-engineers as expert witnesses and advisors - moral leadership – sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), India Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE), India, etc.

Text Books:

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, New York, 1996.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

References

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education /Prentice Hall, New Jersey, 2004, (Indian Reprint).
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Learning, United States, 2000, (Indian Reprint now available).
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.

Paper Code: ITD 747 **L T C**
Paper: Next Generation Networks **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Objective: The objective of this course is to provide exposure to the new technologies and services that telecommunication operators have as they create new 3G networks and beyond where multimedia coverage is based on packet switched rather than circuit switched Telephony.

Unit – I
Introduction to next generation networks.
Communicating in the new Era, New Era of Networking, Technologies influencing change, IP Everywhere, Optical fiber anywhere, wireless access, building blocks for NGN, IP Networks, VOIP, Multi service Flexible Networks architecture. VPNs, Optical Networks, Wire line & Wireless Networks, NGN Services, Network Infrastructure convergence, services convergence, from technology push to service pull.

Unit II
IP Networks
IP past, present and future, IP influence and confluence, IP version 4, I. P. Version 6, IP Network convergence, LAN Technologies, IP Routing, LAN Switching, WAN's, WAN Technologies and Topologies. Wireless IP LANS, Mobility Networks, Global IP Networks, Global capacity, Globally Resilient IP, Internet – A Network of Networks. Beyond IP, Technology Brief – IP Networks, Business Drivers, Success factors, Applications and Service Value.

Unit III
Muti service Networks
Origin of multi service ATM, Next Generation Multi service Networks, Next Generation Multi service ATM switching, Multi protocol Label switching, Networks, Frame Based MPLS, Cell based MPLS, MPLS services and their benefits, multi service provisioning platforms (MSPP) & Multi service switching platform (MSSP)

Unit IV
NGN Applications
Internet connectivity, e-commerce, call center, third party application service provision, UMTS, WAP, WiMAX, integrated billing, security and directory enable networks.

Textbooks
1. Next Generation Networks Services, Technologies and Strategies, Neill Wilkinson, Wiley.
2. Next Generation Network Services, Robet Wood, Pearson

Reference Books

1. Next Generation Telecommunications Network, Parliament office of Science and Technology (Postnote). Dec 2007, No. 296 Ref. www.parliament.uk
2. Mobile Next Generation Networks Huber, JF IEEE Multimedia Vol. 11, Issue I Jan- March 2004.
3. Next Generation Network (NGN) Service, J.C. Crimi, A Telecoolia Technologies white paper refer www.telecodia.com

Paper Code: ITD 749 **L T C**
Paper: Telecommunication System Modeling and Simulation **3 1 4**

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Objective: To model the random variables and random process applied to telecommunications system and to learn the methods of system simulation and performance evaluation.

UNIT – I
SIMULATION OF RANDOM VARIABLES RANDOM PROCESS
Generation of Random numbers and Sequence, Gaussian and Uniform random numbers Correlated random sequences, testing of random numbers generators, Stationary and Uncorrelated Noise, Goodness of fit test.

UNIT – II
MODELING OF COMMUNICATION SYSTEMS
Radio frequency and Optical sources, Analog and Digital signals, Communication channel and Models, Free Space channels, Multipath channel and discrete channel noise and interference.

UNIT – III
ESTIMATION OF PERFORMANCE MEASURE FOR SIMULATION
Quality of Estimator, Estimation of SNR, Probability density function and Bit Error Rate, Monte Carlo method, Importance Sampling method, Extreme Value Theory.

UNIT – IV
SIMULATION AND MODELING METHODOLOGY
Simulation Environment, Modeling considerations, Performance Evaluation techniques, Error Source Simulation, Validation. Case Studies: Simulations of QAM Digital Radio link in environment, Light wave communication link and Satellite system.

TEXTBOOKS
1 MC.Jeruchim, P.Balaban and Sam K Shanmugam, "Simulation of communication systems: Modeling, Methodology and Techniques", Plenum Press, New York, 2001.

REFERENCES
1 Averill.M.Law and W.David Kelton, "Simulation Modeling and Analysis", McGraw-Hill, 2000.
2 Geoffrey Garden, "System Simulation", Prentice Hall of India, 2nd Edition, 1992.
3 W.Turin, "Performance Analysis of Digital Communication Systems", Computer Science Press, New York, 1990.
4 Jery Banks and John S.Carson, "Discrete Event System Simulation", Prentice Hall of India, 1984.

ITD -751 Minor Project-I

Objective: Students are required select a topic of their interest and develop a minor project on it. The student will submit a synopsis at the beginning of the semester for the approval to the school project committee in a specified format (available on www.ipu.ac.in). The student will have to present the progress of the work through seminars. A report must be submitted to the school for evaluation purpose at the end of the semester in a specified format.

ITD-753: Adhoc and Sensor Based Networks Lab.

The practical will be based on Adhoc and Sensor Based Networks Lab.

ITD-755: Advances and Communication Lab.

The practical will be based on Electives.

ITD –752 Dissertation

Objective: Students are required to select a topic of their interest and prepare a dissertation on it. The student will submit a synopsis at the beginning of the semester for the approval from the school project committee in the specified format. Synopsis must be submitted within two weeks. The first defense, for the dissertation work, should be held with in one month. Dissertation Report must be submitted in specified format (available on www.ipu.ac.in) to the school for evaluation purpose.

ITD – 754* Seminar & Progress Report

The student will have to present the progress of the dissertation work through seminars and progress reports at the interval of four weeks during the semester. Minimum two seminars will be held during the semester to assess the progress of dissertation work.

ITD – 756* Comprehensive Viva
Objective: Students are required give viva-voce exam.

*** Non University Exam Scheme**