

**UNIVERSITY OF MUMBAI**  
**I. SCHEME OF INSTRUCTIONS AND EXAMINATIONS**  
at  
**B.E. (Electronics and Telecommunication Engineering)**  
**(R-2001)**  
**(Revised Scheme considering 60 Minutes' Period as per AICTE Guide – lines)**

## SEMESTER VIII

Sr. No.	Subjects	No. of Periods per week			Duration of Theory Paper(Hrs)	Marks				
		Lectures	Practicals	Tutorials		Theory Paper	Term Work	Practical	Oral	Total
1	Satellite Communication	4	-	2	3	100	25	-	25	150
2	Optical Fiber Communication	4	2	-	3	100	25	-	25	150
3	Computer Communication Networks	4	2	-	3	100	25	-	25	150
4	Elective-II	4	2	-	3	100	25	-	25	150
5	Project-B	-	8	-	-	-	50	-	50	100
<b>Total</b>		<b>16</b>	<b>14</b>	<b>2</b>	<b>-</b>	<b>400</b>	<b>150</b>	<b>-</b>	<b>150</b>	<b>700</b>

**Elective II (any one)**

- 1)Wireless Network(Tut)
- 2)Digital Voice Communication (Tut)
- 3)Telecommunication Network Management (Tut)
- 4)Microwave Amplifier and Oscillator Design(Tut)
- 5)Optical Network(Tut)
- 6)Internet Communication Engineering(Tut)

**UNIVERSITY OF MUMBAI**

(		Class: B.E.( <u>Electronics and Telecommunication Engg.</u> )		Semester VIII	
-		<b>Sub:- Satellite Communication</b>			
0 Periods per week 0 1 period of 60 min. 1	Lecture		4		
	Practical		-		
	Tutorial		2		
)			Hours	Marks	
Evaluation System		Theory Examination		3	100
		Practical		-	-
		Oral Examination		-	25
		Term Work		-	25
Detailed Syllabus					

1. **Introduction:**  
General background, frequency allocations for satellite services, basic satellite system, system design considerations, applications.
2. **Satellite Orbits:**  
Introduction, laws governing satellite motion, orbital parameters, orbital perturbations, Doppler effects, geostationary orbit, antenna look angles, antenna mount, limits of visibility, Earth eclipse of satellite, sun transit outage, inclined orbits, sun-synchronous orbit, language of geostationary satellites.
3. **Wave Propagation and Polarization:**  
Introduction, atmospheric losses, ionospheric effects, rain attenuation, other impairments, antenna polarization of satellite signals, cross polarization discrimination, ionospheric depolarization, rain depolarization, ice depolarization.
4. **Satellite Antenna:**  
Antenna basics, aperture antennas, parabolic reflectors, offset feed, double reflector antennas, shaped reflector systems.
5. **Link Design:**  
Introduction, transmission losses, link power budget equation, system noise, carrier to noise ratio for uplink and downlink, combined uplink and downlink carrier to noise ratio, inter modulation noise.
6. **Communication Satellites:**  
Introduction, design considerations, lifetime and reliability, spacecraft sub systems, spacecraft mass and power estimations, space segment cost estimates.
7. **Earth Stations:**  
Introduction, design considerations, general configuration and characteristics.
8. **Multiple Access Techniques:**  
Introduction, FDMA, TDMA, FDMA / TDMA, operation in a multiple of systems.

**Term Work:**

Each student has to appear for at least one written test during the term. Report on eight assignments on all topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments –15 marks.

Written Test- 10 marks

**Text Books:**

1. Satellite Communications- Dennis Roddy- 3<sup>rd</sup> edition, Mc-Graw Hill Publication.
2. Satellite Communications systems- M.Richharia- 2<sup>nd</sup> edition, Mc Millan publication.

**UNIVERSITY OF MUMBAI  
(R-2001)**

Class: B.E.( <u>Electronics and Telecommunication Engg.</u> )		Semester VIII	
<b>Sub:- Optical Fiber Communication</b>			
Periods per week 1 period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	-	-
	Oral Examination	-	25
		Term Work	25
Detailed Syllabus			

1. **Overview Of Optical Fiber Communications:**  
Communication system applications in the electromagnetic spectrum, elements of on optical fiber transmission link, advantages of optical fiber communication.
2. **Light Propagation in Optical Fiber:**  
Fiber types, rays and modes, ray theory transmission, electromagnetic mode theory for optical propagation, single mode and multimode fibers, linearly polarized models.
3. **Fiber Optics Technology:**  
Fiber materials, fiber fabrication, fiber optic cables, couplers, splices, connectors.
4. **Signal Degradation in Optical Fibers:**  
Alternation, dispersion, bit rate and bandwidths, mode coupling.
5. **Optical Source and Detectors:**  
Related semiconductor physics, leight emitting diodes, laser diodes, their characteristics, modulation circuits, optical detection principles, quantum efficiency, responsively, response time photo detector noise, PIN and Avalanche photodiodes.
6. **Optical Receiver Operation:**  
Noise, Receiver capacitance, receiver structures, pre-amplifiers
7. **Optical Fiber Systems:**  
Link power budget, rise time budget, analog systems, digital systems, coherent systems-homodyne and heterodyne detection, multiplexing.
8. **Optical Fiber Measurements:**  
Measurement of attenuation, dispersion, refractive, refractive index profile, numerical aperture, fiber diameter, OTDR.

**List of Experiments:**

1. Analog fiber optic system
2. Digital fiber optic system
3. Measurement of numerical aperture
4. Measurement of attenuation
5. Measurement of pulse spreading
6. Multiplexing in fiber optic system
7. Light source characteristics
8. Measurements using OTDR

**Term Work:**

Each student has to appear for at least two written test during the term. Report on experiments (at least six from the list of suggested experiments ) along with a graded answer paper shall be submitted as term work

The distribution of term work will be as follows:  
Report on assignments –15 marks.  
Written Test- 10 marks

**Text Books:**

1. Optical Fiber Communication- John Senior  
Prentice Hall of India Publication
2. Optical Fiber Communication- Gred Keiser  
Mc-Graw Hill publication

**Reference Books:**

1. Fiber Optic Communication-Djafar K. Mynbarv, Lowell L. Schiener
2. Optical Fiber Communicaiton- Selvarajan, T. Srinivas  
Tata Mc-Graw Hill Publication.

**UNIVERSITY OF MUMBAI  
(R-2001)**

Class: B.E.( <u>Electronics and Telecommunication Engg.</u> )		Semester VIII	
<b>Sub:- Computer Communication Networks</b>			
Periods per week 1 period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	-	-
	Oral Examination	-	25
		Term Work	25
Detailed Syllabus			

1. **Communication networks and services:**  
Networks functions and network topology, basics of message switching, packet switching, circuit switching and cell switching.
2. **Application and layered architectures:**  
Layering architecture, the OSI reference model, unified view of layers, protocols and services, overview of TCP/IP architecture, TCP/IP protocol.
3. **Telephone Network:**  
Frequency division and time division multiplexing, synchronous optical network (SONET) and SONET multiplexing, space division and time division circuit switches, Telephone Network, integrated services digital network, network channel signaling and routing control.
4. **Peer to peer protocols:**  
Peer to peer protocols and service models, service models, end to end requirements and adaptation functions, end to end versus hop by hop. ARQ protocols, stop and wait ARQ, go-back-N ARQ, selective repeat ARQ, transmission efficiency of ARQ protocols, sliding windows flow control, timing recovery for synchronous services, reliable stream service, data link controls, HDLC data link control, point to point protocol, statistical multiplexing.
5. **Local area networks:**  
Multiple access communications, local area networks(LAN) structure, the medium access control sub layer, the logical link control layer, random access, ALOHA, slotted ALOHA, CSMA, CSMA/CD, scheduling approaches to medium access control, reservation system, polling, token passing rings, comparison of random access and scheduling medium access controls, IEEE 802.3 standards for 10 Mbps and 1000 Mbps LANs, repeaters and hubs, LAN bridges, transparent bridges, source routing bridges, mixed media bridges, LAN switches, spanning tree algorithm.

6. **Packet switching networks:**  
Network service and internal network operation, packet network topology, connectionless packets switching, virtual circuit packet switching, routing in packet networks, routing algorithm classification, routing tables, hierarchical routing, link state versus distance vector routing, shortest path algorithms, the Bellman-ford algorithm, Dejkstra's algorithm, other routing approaches.
7. **Frame relay and asynchronous mode(ATM):**  
Frame relay protocol architecture, frame relay call control, user data transfer network function, congestion control, ATM architecture, logical connection, ATM cells, transmission of ATM cells, ATM adaptation layers, ATM traffic management and Qos, FIFO and priority queues, fair queuing, congestion control, open loop control, closed loop control.
8. **TCP/IP:**  
The internet Protocol (IP) , IP packet, IP addressing, subnet mask, classless interdomain routing (CIDR), address resolution, reverse address resolution, IP fragmentation and reassembly, ICMP, User Datagram Protocol(UDP), Transmission Control Protocol(TCP), TCP Reliable stream service, TCP operation, TCP protocol Dynamic Host Configuration Protocol (DHCP), mobile IP IPv6, internet routing protocols, multicast routing, reverse path broadcasting, internet group management protocol, reverse path multicasting, distance vector multicast routing protocol.

**Term Work:**

Each student has to appear for at least one written test during the term. Report on six experiments along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments –15 marks.

Written Test- 10 marks

**Text Books:**

1. Communication Networks- Leon Garcia, Indra Widjaja  
Tata Mc-Graw Hill publication.
2. Data and Computer Communication – William Stallings  
Pearson Education Publication
3. Computer Network – Larry L. Peterson  
Morgan Kaufmann

**Reference Books:**

1. Data Communication and Networks – Forouzan,  
Tata Mc-Graw Hill Publication
2. Telecommunication Networks- Scwartz  
Addison Wesley Publication.

**UNIVERSITY OF MUMBAI  
(R-2001)**

Class: B.E.( <u>Electronics and Telecommunication Engg.</u> )		Semester VIII	
<b>Sub:- Elective II(1) Wireless Networks</b>			
Periods per week 1 period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	-	-
	Oral Examination	-	25
		Term Work	25
1. Detailed Syllabus			

**n overview of 2<sup>nd</sup> and 3<sup>rd</sup> generation air interfaces:**

Introduction, PCS Standardization, major attributes of CDMA systems, 3 G systems

**2. CDMA IS -95 Call Processing:**

Introduction, CDMA call procession state, CDMA registration, authentication.

**3. Soft handoff and power control in CDMA:**

Introduction, types of handoff, Pilot sets, search windows, handoff parameters, handoff message, handoff processing setup and end of soft handoff, pilot set maintenance

**4. Reverse and Forward link Capacity of a CAMA:**

Introduction, Reverse parameters in CDMA, multi-cell networks, inter-cell interference, reverse link capacity, cell loading, cell radius, Erlange capacity of a single cell, forward link capacity, CDMA cell size, Forward and reverse link balance, forward link budget.

**5. CDMA 2000 System:**

Introduction, layering structure, logical channels used by PLICF, physical layer, forward link physical channels, forward link features, reverse physical channels, media access control and LAC sub-layer data services, mapping of logical channels to physical channels, evolution of CDMA one to CDMA 2000 systems.

**5. Wireless Local Loop:**

Introduction, layering structure, logical channels used by PLICF, physical layer, forward link physical channels, forward link features, reverse physical channels, media access control and LAC sub-layer data services, mapping of logical channels to physical channels, evolution of CDMA one of CDMA 2000 systems.

**6. Wireless Local Loop:**

Introduction, user requirement for a WLL system, WLL systems, WLL architecture, capacity of a CDMA WLL, W-CDMA WLL, Air-loop WLL system.

**7. Wireless Application Protocol, Bluetooth:**

Introduction, Wireless Application protocol, goal of WAP, WAP programming model, WAP architecture, Bluetooth, Bluetooth protocol stack, Bluetooth link types, Bluetooth security, network connection establishment in Bluetooth, error connection in Bluetooth, network topology on Bluetooth, Bluetooth usage models, application of WAP and Bluetooth.

**Term Work:**

Each student has to appear for at least one written test during the term. Report on eight assignments on all topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments –15 marks.

Written Test- 10 marks

**Text Books:**

1. Wireless Network Evolution 2 G to 3 G – Vijay K. Garg  
Prentice Hall PTR publication.
2. Mobile and Personal Communication Systems and Services – Raj  
Pandya, Prentice Hall PTR publication.
3. Mobile Communications- Schiller  
Addison Wesley Publication

**UNIVERSITY OF MUMBAI  
(R-2001)**

Class: B.E.( <u>Electronics and Telecommunication Engg.</u> )		Semester VIII	
<b>Sub:- Elective II(2) Digital Voice Communication</b>			
Periods per week 1 period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	-	-
	Oral Examination	-	25
		Term Work	25
1. Detailed Syllabus			

**Telephony Background:**

Analogue networks, switching systems, transmission systems, modulation, multiplexing, signaling, subscriber loop design, calculating resistance Limit, calculating loss limit, voice digitization, pulse code modulation (PCM), time division multiplexing, high order PCM multiplex systems, traffic analysis, traffic characterization, arrival and holding time, loss systems, lost calls, network blocking probabilities, delay systems, measurement of traffic congestion, lost calls and grade of service, availability. Handling of calls, infinite and finite traffic sources, probability distribution curves, erlange and Poisson traffic formulas.

**2. Digital switching and networks:**

Space division switching, time division switching, time space time (TST) switch, space time space (STS) switch, comparison of TST and STS switches, network synchronization, control and management, timing, inaccuracies, network synchronization, network control, network management.

**3. Integrated service digital network (ISDN):**

ISDN overview, conceptual network, ISDN protocol structure and standards, ISDN interfaces and functions, transmission structure, user network interface, ISDN protocol architecture, ISDN connection, addressing, internetworking, ISDN physical layer: basic rate per user network interface, primary rate user network interface, U interface, ISDN data link layer; LPAD protocol, terminal adaptation, bearer channel data link control, ISDN network layer; basic call control, control of supplementary services, signaling system no.7(SS7): signaling data link level, signaling link level, network level, ISDN signaling connection control part, ISDN user port, ISDN user port, broadband ISDN (B-ISDN) standards, architecture protocol reference model, B-ISDN, physical layer.

**4. Access Technologies:**

High- speed digital subscriber loops (DSL), ADSL, HDSL, CDSI, Wireless local loop(WLL).

5. **Voice over IP:**  
TCP/IP protocol family, internet protocol (IP) header, IP addressing internet control message message protocol (ICMP) transport protocol, quality of service on IP, Ethernet frame, LAN queuing, resource reservation protocol (RSVP), multi protocol label switching, real time protocol(RTP), session initiation protocol(SIP), H.323 standard media gateway control protocol, voice over IP gateway case studies, voice coding, properties of speech, waveform coding, vocoding, hybrid coding, telephony, signaling call set up, local loop, PBX interfaces.
6. **Voice over other packet networks:**  
Voice over frame relay (VoFR), frame relay frame format, frame length handling, fragmentation, frame prioritization, frame loss handling, echo cancellation, silence suppression telephony signaling, VoFR standard, voice over ATM, ATM cell format, ATM protocol stack, ATM adaptation layer, IP over ATM, frame relay over ATM.

**Term Work:**

Each student has to appear for at least one written test during the term. Report on eight assignments on all topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments –15 marks.

Written Test- 10 marks

**Text Books:**

1. Digital Telephony- John C. Bellamy
2. ISDN and Broadband ISDN with Frame Relay and ATM- William Stalling, 4<sup>th</sup> Edition, Pearson education Asia publication
3. Voice & Data Interworking- Gil Held  
Tata McGraw Hill Publication.

**Reference Books:**

1. IP Telephony- Oliver Hersent, David Gurle & Jean- Pierre Petit.  
Edition:2001, Pearson Education Asia publication
2. Voice over packet networks- David J. Wright.  
John Wiley Publication

**UNIVERSITY OF MUMBAI  
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Class: B.E.( <u>Electronics and Telecommunication Engg.</u> )		Semester VIII	
<b>Sub:- Elective II(3) Telecommunication Network Management</b>			
Periods per week 1 period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	-	-
	Oral Examination	-	25
		Term Work	25
Detailed Syllabus			

**1. Network management examples:**

ATM integrated local management interface, ATM MIB, M1, M2, M3, M4, interfaces, ATM digital exchange interface management, digital subscriber loop (DSL) and asymmetric DSL (ADSL) technologies, ADSL configuration management, performance management.

**2. Network management tools:**

Network statistics management, network management system, management platform case studies: OPENVIEW, ALMAP.

**Term Work:**

Each student has to appear for at least one written test during the term. Report on eight assignments on all topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments –15 marks.

Written Test- 10 marks

**Text Books:**

1. Network Management: Principles and Practice- Mani Subramanian, Addison Wesley, Pearson Education Asia publication.
2. Fundamentals of Telecommunication Network Management – Lakshmi Raman IEEE Communication Society, Prentice Hall of India Edition 1999
3. Telecommunication Network Management: Technologies and Implementations- Airdarous Salah, Plevyak Thomas. Prentice Hall of India.

**Reference Books:**

1. Telecommunication Network Management – Haojin Wang. Mc-Graw Hill publication.

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Class: B.E.( <u>Electronics and Telecommunication Engg.</u> )		Semester VIII	
1.	S Periods per week L period of 60 min.	Lecture	4
		Practical	-
		Tutorial	2
P a r a m e	Evaluation System	Hours	Marks
		Theory Examination	3      100
		Practical	-      -
		Oral Examination	-      25
	Term Work	-      25	
Detailed Syllabus			

**ters:**

Definition and use with amplifiers

2. **Noise in linear 2 port:**
3. **Microwave transistor s-parameters and tuning elements:**  
Microwave bipolar transistor, DC Biasing, impedance matching, example of transistor s-parameters and noise parameters.
4. **Amplifier Design:**  
One stage
5. **High Power Amplifier Design:**  
Device modeling and characterization, optimum loading, single stage design, multistage design.
6. **Oscillator Design:**  
Compressed Smith chart, series and parallel resonance, resonator, 2-port oscillator design, Negative resistance from transistor model oscillator, Q and output power, noise in oscillators, analytical approach to optimum oscillator design S-parameters, non linear oscillator model, oscillator design using non linear CAD tools.
7. **Microwave Mixer Design:**  
Diode Mixer theory, single diode mixer, balanced mixer, FET mixer theory, balanced FET mixers
8. **Microwave Control Circuit Design:**
9. **Microwave Rectifier and detector design:**

**Term Work:**

Each student has to appear for at least one written test during the term. Report on eight assignments on all topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments –15 marks.

Written Test- 10 marks

**Reference Books:**

1. Microwave Circuit Design- George D. Vendelin, Anthony M. Pavio & Ulrich L. Rehde, John Wiley & Sons publication
2. Radio Frequency and Microwave Electronics – Matthew M. Radmanesh

**UNIVERSITY OF MUMBAI  
(R-2001)**

Class: B.E.( <u>Electronics and Telecommunication Engg.</u> )		Semester VIII	
<b>Sub:- Elective II(5) Optical Networks</b>			
Periods per week 1 period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	-	-
	Oral Examination	-	25
		Term Work	25
Detailed Syllabus			

1. **Optical Amplifiers:**  
Stimulated emission, Spontaneous emission, erbium- doped fiber amplifiers, praseodymium doped fiber amplifiers, semiconductor optical amplifiers, noise accumulation and network size restriction.
2. **Optical Filters:**  
Overview, Silica waveguide type filters, bulk type filters, another filters.
3. **Photonic Switches:**  
Time Division Switching (TDS), Wave Division Switching(WDS), fast-packet switching, multi dimensional switcheing system, OTDM, broadcast OTDM networks.
4. **First Generation Optical networks:**  
SONET/SDH, computer interconnects, metropolitan area networks, architecture, high dimenasional local area networks (LAN), single and multi-top optical FDM local area networks, WDM and DWDM.
5. **Broadcast and select networks:**  
Topologies, Media Access Control(MAC), protocols, testbeds
6. **Wavelength Routing Networks:**  
Optical layer, mode designs, network design and operation, optical layer cost trade offs, routing and wavelength assignment.
7. **Virtual Topology Design(VTD)**  
Virtual Topology design problems, combined SONET/WDM problem, integer linear programming formulation, regular virtual topologies, implementation in broadcast and select networks.
8. **Access Networks:**  
Network architecture overview, access networks- HFC & FTTC, Optical access network architecture.

**Term Work:**

Each student has to appear for at least one written test during the term. Report on eight assignments on all topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments –15 marks.

Written Test- 10 marks

**Reference Books:**

1. Optical Networks- Rajiv Ramaswami, Kumar N. Sivarajan  
Harcourt Asia PTE Limited publication.
2. Optical FDM Network technologies- Kiyoshi Nasu  
Artech House Inc. publication.
3. Photonics in switching, Vol II – Edited by John E. Midwinter.,  
Academic Press Publication.
4. Optical Networking & WDM- Walter Goralski  
Tat Mc-Graw Hill publication.

**UNIVERSITY OF MUMBAI  
(R-2001)**

Class: B.E.( <u>Electronics and Telecommunication Engg.</u> )		Semester VIII	
<b>Sub:- Elective II(6) Internet Communication Engineering</b>			
Periods per week 1 period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	-	-
	Oral Examination	-	25
	Term Work	-	25
Detailed Syllabus			

1. **Introduction to TCP /IP:**  
TCP /IP networking model, layer functions, TCP/IP protocols, services, sockets and ports, encapsulations, difference between ISO and internet layering.
2. **Internetworking layer:**  
Internet protocol (IP) datagram header fields and their functions, Internet control message protocol, IP address classes, broadcast, multicast and special addresses, network space and host space, subnets and supernets, private IP addresses, classless inter domain routing (CIDR), CIDR subnet addressing, variable length in CIDR subnet addressing.
3. **Transport layer:**  
User datagram protocol(UDP) header fields and their functions, pseudo header, transmission control protocol (TCP), need for stream delivery, properties of reliable stream delivery, TCP header fields, ports, connections, end points, passive and active open, segment, stream and sequence numbers, variable window size and flow control, out of band data, checksum, acknowledgement and retransmission, round trip samples, Karn's algorithm, timer back off, response to delay variation and congestion, TCP state machine, connection establishment.
4. **Domain name system (DNS):**  
Internet domain name, mapping domain name and address, domain name resolution, efficient translation, caching, DNS server message format, compressed name format, compressed name format, abbreviation of name, inverse mapping, pointer queries.
5. **Dynamic name system(DHCP):**  
IP address management with DHCP, standard address discovery process, address renewal process, address release process, DHCP packet structure.

6. **IP Routing:**  
Table driven routing, next hop routing, default routing, the IP routing algorithm, distance vector protocol, link state protocol, routing characteristics, convergence, split horizon, poison reverse, time to line, areas, autonomous system, border routers, routing information protocol (RIP), open shortest path first (OSPF), border gateway protocol (BGP), internet control message protocol (ICMP), ping, echo request and reply message format, congestion and datagram flow control, source quench, route discovery.
7. **TCP/IP Security:** IP security (IPSec) authentication header (AH), encapsulating security payload (ESP), mutable header fields, tunneling, firewalls and internet access, firewall implementation, packet filtering, proxy access through firewall, network address translation (NAT), port mapped NAT.
8. **IP Version 6 (IPv6):**  
IPv6 address format and types, routing considerations, packet header fields and their functions, auto configuration, quality of service, security, mobile users.
9. **Voice and Video over Internet:**  
Voice digitization standards for voice over IP, code excited linear predictive coders (CELP), G.729, G.723.1 and G.728 standards, telephony and internet approaches for voice over IP, digital video, MPEG-2, MPEG-4, MPEG-6, H.323 architecture H.323 protocol stack, gatekeeper, admission and status operations, internet multimedia protocols, RTP, Real time control protocol, RSVP, IP multicast, MBONE.

**Term Work:**

Each student has to appear for at least one written test during the term. Report on eight assignments on all topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments –15 marks.

Written Test- 10 marks

**Text Books:**

- 1) Internetworking with TCP/IP, Vol.I-Douglas Comer  
Prentice Hall of Indian publication
- 2) IP Telephony – Oliver Hersent, David Gurle & Jean  
Pierre Petit. Edition –2001

**Reference Books:-**

- 1) Advanced Internet Technologies-Uyless Black
- 2) Guide to TCP/IP-Laura A.Chappell,ED. Tittel  
Thomson Learning publication.