TELECOMMUNICATION AND COMPUTER NETWORKS

ENEX 352

Lecture : 3 **Year : III**
Tutorial : 1 **Part : II**
Practical : 3

Course Objectives:
The objective of this course is to provide students with a foundational understanding of telecommunications and computer networking, including data communication principles, network architectures, and communication protocols. The course aims to develop the ability to analyze network models, routing, congestion control, and security mechanisms, and apply key networking concepts in designing and evaluating modern communication systems.

1 Introduction (3 hours)

1.1 Definition and evolution of telecommunications
1.2 Elements of telecommunication
1.3 Transmission media and modes

2 Switching and Multiplexing (5 hours)

2.1 Switching systems: Manual, mechanical, electromechanical
2.2 Analog and digital multiplexing for telecommunications
2.3 FDM and TDM hierarchies
2.4 Space and time switching (ST, TS, TST, STS)
2.5 Signaling: Subscriber, interswitch, audible-visual, supervisory, address

3 Telephone Traffic (4 hours)

3.1 Network traffic load and parameters
3.2 Loss systems
3.3 Delay systems
3.4 Routing in telecommunication
3.5 Numbering plans and charging plans

4 Network Models (5 hours)

4.1 Basics of computer networks
4.2 Layered protocols
4.3 OSI reference model
4.4 TCP/IP protocol suite
4.5 Encapsulation and decapsulation
4.6 Protocols, standards, and services

4.7 Network devices and working layers (Repeater, hub, bridge, switch, router)

5 Physical and Data Link Layer (6 hours)

5.1 Multiplexing, switching techniques: Circuit, packet, datagram, virtual circuit
5.2 Data encoding techniques: Manchester, NRZI, MLT3, and their uses
5.3 Data link layer functions: Framing, error control, flow control, access control
5.4 Media access control (MAC) protocols: ALOHA, CSMA/CD, CSMA/CA
5.5 Ethernet standards and wireless LAN (Wi-Fi) basics

6 Network Layer (9 hours)

6.1 Network layer functions and services
6.2 Logical addressing and its importance
6.3 IPv4 addressing and classes, private and public IP addresses, subnetting and supernetting, VLSM, CIDR
6.4 Routing and types of routing
6.5 Routing algorithms: Distance vector (RIP), link state (OSPF), and BGP
6.6 Protocols and header structure: IPv4, ICMP, ARP
6.7 Network address translation (NAT)
6.8 IPv6 addressing, SLAAC, ICMPv6
6.9 IPv6 transition strategies

7 Transport Layer (4 hours)

7.1 Transport layer functions and services
7.2 Transport protocol: TCP and UDP
7.3 TCP state transition diagram
7.4 Traffic shaping and congestion control

8 Application Layer (5 hours)

8.1 Functions and services of application layer
8.2 Upper layer protocols: DHCP, HTTP, FTP, SMTP, POP, IMAP
8.3 Domain name system (DNS), its function, and queries
8.4 Network management tools and protocols (SNMP)
8.5 Proxy server and its use
8.6 VoIP, FoIP, and IP interconnection

9 Advanced Topics (4 hours)

9.1 Network security and its importance
9.2 Principles of cryptography
9.3 Basics of IoT, WSN, and SDN
9.4 5G/6G network fundamentals
9.5 Network virtualization
9.6 Future trends in networking

Tutorial **(15 hours)**

1. Communication models, basic components of data communication systems, and overview of signal types and transmission
2. Switching techniques including circuit, packet, and message switching, and multiplexing techniques such as TDM and FDM with applications
3. Telephone traffic concepts including traffic intensity, Erlang theory, and basic quality of service considerations
4. OSI reference model in detail, functions of each layer, and mapping of network devices (hubs, switches, routers, and gateways) to OSI layers
5. Digital encoding techniques and medium access control protocols including CSMA/CD and CSMA/CA
6. IP addressing, subnetting, VLSM, and CIDR with numerical problem-solving
7. Routing concepts, TCP vs UDP comparison, DNS operation, and HTTP request–response mechanism

Practical **(45 hours)**

1. Telecommunication lab illustrating course principles
2. Network simulation using Cisco Packet Tracer or NS2/NS3/Mininet
3. Network commands and their uses
4. IP address configuration and subnetting
5. Router configurations
6. Static routing configurations
7. Dynamic routing configurations
8. VLAN configurations and Inter-VLAN routing
9. Packet analysis using Wireshark
10. Web and DNS server configurations
11. Implementation of client-server models
12. Proxy server configuration

Final Exam

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks distribution*
1	3	4
2	5	7
3	4	5
4	5	7
5	6	8
6	9	12
7	4	5
8	5	7
9	4	5
Total	**45**	**60**

* There may be minor deviation in marks distribution.

References

1. Freeman, R. L. (2004). Telecommunication system engineering. Wiley.
2. Forouzan, B. A. (2013). Data communications and networking. McGraw-Hill Education.
3. Tanenbaum, A. S., Wetherall, D. J. (2011). Computer networks. Pearson.
4. Kurose, J. F., Ross, K. W. (2021). Computer networking: A top-down approach. Pearson.
5. Flood, J. E., Gnanasivam, P. (2007). Telecommunication switching and networks. Wiley.