Computer Network

Me lol
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Notes

- PYQs of BEX's CT657, BEI's CT613 and BCT's CT702 are combined.

- BEX's and BCT's are kept with normal font.

- BEI's are kept with `this styling to differentiate`.

- Regular exam's questions are kept as **bold** while back exam are kept as normal font.

- Months are marked as:

  - Ba: Baisakh

- Jth: Jestha
- Asa: Ashar
- Shr: Shrawan
- Bh: Bhadra
- Ash: Ashwin
- Ka: Kartik
- Mng: Mangsir
- Po: Poush
- Ma: Magh
- Ch: Chaitra

Contents

1 Introduction to Computer Network

(5 Hours/8 Marks)

1.1 Computer Network & Uses

1. What are the applications of computer networks? [2] (76 Ba)
2. What is computer network? [1] (76 Ba) [2] (71 Shr)
3. What are the advantages of computer network? [3] (72 Ma)
4. Explain five instances of how networks are a part of your life today. [5] (**72 Ch**)

1.2 Networking model: client/server, P2P, active network

1. Discuss Client-Server model and Peer-to-Peer model. [4] (81 Ba)
2. How does client-server model work? [3] (73 Ma)
3. What are the features of Client/Server Architecture? [4] (70 Ch, 76 Ash)
4. Draw the architecture for Client/Server network model. [2] (**75 Ch**)
5. Explain briefly the architecture for peer-to-peer network model with example. [3] (**77 Ch**)
   |→ How does P2P works? Explain. [6] (**80 Bh**)
   |→ Explain in details about P2P network model with supportive examples. [6] (**75 Ch**)
6. Distinguish between Client-Server network and Peer-Peer network. [3] (**74 Ch**) [5] (73 Ma)

1.3 Network Software, Protocols and Standards

1. Define protocol. [1] (**76 Ch**,**72 Ash**) [4] (bo79 Ch)
2. Explain about connection oriented and connection less service. [3] (**71 Bh**)
3. Mention service primitives for implementing connection oriented service. [2] (75 Ash)
4. What do you mean by network architecture? [2] (**71 Ch**)
5. Why do you need layering? [2] (**80 Bh**)
6. Why do we need layered protocol architecture? [2] (**72 Ash**)
7. What are the reasons for using layered network architecture? [2] (**76 Ch**) [3] (**73 Ch**, 75 Ba)
8. Why layering is important? [2] (**79 Bh**, 75 Ash) [4] (**73 Bh**)
9. What are the layer design issues? [3] (**71 Bh**)
10. Explain design issues for layers in detail. [4] (75 Ash)
11. Explain about the design issues of Computer Network software. [5] (**74 Bh**)

1.4 OSI model and TCP/IP model

1. Explain Open System Interconnection (OSI) model. [5] (**74 Ch**, 71 Ma)
   |→ Explain OSI reference model with suitable diagram. [6] (80 Ba)
   |→ Explain the different layers of OSI reference Model with appropriate figure. [5] (**76 Bh**)
2. What is the significance of OSI layer? [2] (74 Ash)
   |→ What are the reasons for using layered protocol? [3] (75 Bh)
3. Explain in which level of OSI layer following tasks are done. [3] (**72 Ch**)
   (i) Error detection and correction   (ii) Encryption and Decryption of data
   (iii) Logical identification of computer   (iv) Point-to-point connection of socket
   (v) Dialogue control   (vi) Physical identification of computer
4. Explain each layer of TCP/IP protocols architecture in detail. [5] (**72 Ash**)
5. List out the functions of physical lapyer in TCP/IP reference model. [2] (72 Ka)

6. Distinguish between physical channel and physical layer. [3] (**74 Bh**)

1.5 Comparison of OSI and TCP/IP model

1. Differentiate between TCP/IP and OSI Model.
[3] (**76 Bh**,**71 Ch**, 71 Ma) [4] (81 Ba) [5] (**77 Ch**,**76 Ch**,**72 Ch**, 76 Ba, 75 Ba, 73 Shr, 72 Ma) [6] (71 Shr)
|→Explain OSI model and compare OSI with TCP/IP reference model. [6] (**79 Bh**)
2. How do you differentiate OSI's network and transport layer with TCP/IP's Network and transport layer? [4] (**79 Ch**)

1.6 Data Encapsulation

1. What is data encapsulation? [2] (80 Ba)
2. How the process of data encapsulation occurs in transmission mode described by seven layers of OSI model. [5] (75 Bh)
3. What are headers and trailers and how do they get added and removed?
[4] (76 Ash, 70 Ch) [5] (**73 Ch**)

1.7 Example network: The Internet, X.25, Frame Relay, Ethernet, VoIP, NGN and MPLS, xDSL

1. Explain X.25 Network with its key feature. [3] (**71 Ch**)
2. Write short notes on: X.25. [4] (75 Ash)
3. Write short notes on: X25 network. [3] (**80 Ba**)
4. Define Frame Relay in detail. [3] (73 Shr)
5. What is Internet work? [2] (**71 Bh**)
6. You are assigned to design a network infrastructure for a 3-start hotel. Recommend a network solution with hardwares and softwares in current trend that can be used in the hotel. Make necessary assumptions and justify your recommendation with logical arguments where possible.
[8] (72 Ka)

2 Physical Layer

(5 Hours/8 Marks)

2.1 Network monitoring: delay, latency, throughput

1. Define:
   |→ Delay   [1] (**80 Bh**, 80 Ba)
   |→ Bandwidth   [1] (**80 Bh**,**76 Bh**)
   |→ MAC address   [1] **80 Bh**
   |→ Throughput   [1] (**76 Bh**, 80 Ba, 76 Ba)
   |→ Latency   [1] (76 Ba)
2. What are the causes of packet delay?   [2] (**76 Bh**, 74 Ash)

2.2 Transmission Media: TP, Coaxial, Fiber Optic, LoS, Satellite

1. What is transmission medium?   [1] (**76 Ch**,**71 Bh**) [2] (71 Shr) [3] (**74 Ch**)
2. Write down the transmission medium used for networking.   [4] (**72 Ash**)
3. What are the factors to be considered while selecting transmission media?   [2] (**79 Bh**, 81 Ba)
4. List guided and unguided media used in computer network.   [2] (73 Ma)
5. Explain different types of guided transmission media.   [6] (72 Ka)
6. Explain about any two guided transmission media in detail.   [6] (74 Ash)
7. Explain twisted pair cable with its practical applications.   [4] (**77 Ch**)
8. Explain optical fiber cable in detail with its advantages and disadvantages.   [6] (81 Ba)
9. Explain the characteristics of twisted pair, coaxial, and optical fiber cable.   [6] (76 Ba)
10. Compare among Twisted Pair, Coaxial cable, and Fiber optic.   [5] (**74 Ch**)
    |→ Compare different types of guided transmission media with appropriate figures.   [6] (80 Ba)
11. Why, nowadays, all communication media like twisted pair, co-axial pair even wireless media are replaced by optical fibre? Justify your answer with necessary diagram, working principle, and transmission mechanism.   [7] (**71 Bh**)
12. Differentiate between wired and wireless media with their benefits and drawbacks.   [3] (75 Ba)
13. Explain different transmission medium with their merits and demerits.   [6] (**76 Ch**)

2.3 Circuit switching and Multiplexing

1. What is switching?   [1] (**75 Ch**, 74 Ash) [2] (**74 Bh**, 73 Shr)[3] (**75 Bh**)
   |→ What do you mean by data switching?   [2] (**70 Ch**)
2. What are the various switching techniques?   [2] (**75 Ch**)
   |→ with practical implementation example.   [6] (**70 Ch**)
3. Elaborate packet switching with a proper diagram.   [5] (**75 Ch**)
4. Discuss how data or packets goes through switch to switch in Frame Relay Virtual-circuit network.   [5] (**80 Bh**)
5. Differentiate between datagram switching and virtual circuit switching approach.   [4] (**74 Ch**, 72 Ma) [6] (**79 Bh**)
   |→ with suitable diagram.   [6] (**74 Bh**, 74 Ash)
6. Write short notes on: Virtual circuit switching.   [3] (**79 Bh**) [4] (**76 Ch**)
7. Differentiate between circuit switching and packet switching.   [3] (**75 Bh**, 75 Ash) [4] (**77 Ch**,**76 Bh**,**72 Ash**,**69 Ch**) [5] (**69 Bh**)
   |→ Compare and which would you prefer and why?   [2+2] (71 Ma)

8. Discuss Packet and Circuit switching concepts with example. [5] (75 Ba)
9. Define switching and multiplexing. [4] (**69 Ch**)
10. Define multiplexing. [1] (74 Ash)
11. Explain different types of multiplexing used in communication system. [4] (72 Ma)
12. Compare switching with multiplexing. [2] (73 Shr)

2.4 Digital Telephony and ISDN

1. Explain the E1 Telephone hierarchy system. [4] (**73 Ch**, 73 Shr)
2. What is ISDN? [2] (**71 Ch**)
3. Explain about the ISDN architecture in detail with example. [6] (**71 Ch**)
   |→with interface and functional group. [6] (76 Ash)
   |→with architecture. [5] (75 Ash)
4. Why the telephone companies developed ISDN? [2] (76 Ash)

3 Data Link Layer

(5 Hours/8 Marks)

3.1 Data link layer: Functions and Services

1. What are the services provided by data link layer?

   [2] (**80 Bh, 79 Bh**,**71 Sh**) [3] (**77 Ch**,**72 Ka**) [4] (**74 Ch**)
2. State the various design issues for the data link layer? [3] (75 Ash)

3.2 Framing

1. What do you mean by Framing? [2] (**79 Ch**)

   |→Explain about framing in detail. [5] (71 Sh)
2. Compare Flag byte with byte stuff and bit stuffing in Framing. [2](81 Ba) [3] (**73 Ch**)
3. Describe the various framing techniques at data link layer. [2] (**75 Ch**) [5] (**69 Bh**) [6] (**75 Ch**)
4. What are the methodologies used in data framing? [4] (**72 Ash**) [6] (70 Asa)
5. How a complete link is established during the dialup connection? Explain. [4] (**72 Ash**)
6. Explain any one method of framing with example. [6] (**75 Ch**)

3.3 Error Control, Detection and Corrections

1. Explain Selective repeat and Go back N ARQ with example. [6] (80 Ba)
2. Write short notes on Go Back N ARQ. [3] (**79 Bh**)
3. How can CRC be used to detect error? [6] (**80 Bh**)

   |→Describe Cyclic Redundancy Check with example. [5] (70 Ma)
4. Write short notes on: CRC. [3] (**79 Bh**)
5. Explain difference between Error Correcting and Error detection process? [5] (**70 Ch**)
6. Write down the importance of error detection and correction bits. [3] (72 ma)

3.4 Flow Control

1. How does data link apply flow control technique in network communication? Explain with example.

   [6] (**79 Ch**)
2. (Assumed) What is piggybacking? [3] (75 Ash)
3. What are the difference between error control and flow control? [3] (70 Ma)
4. Explain different types of flow control mechanism in data link layer. [8] (**70 Bh**)
5. Write short notes in flow control in DLL. [4] (75 Ash, 74 Ash)

   |→Write short notes in flow control/mechanism of DLL. [3] (73 Ma) [4] (75 Ba)

3.5 Examples of Data Link Protocol, HDLC, PPP

1. What is PPP? [2] (**73 Ch**)
2. Write short notes on: PPP [4] (**76 Bh**, 76 Ba)
3. Write short notes on: HDLC [4] (73 Shr)

3.6 The Medium Access Sub-layer

1. What are the different sub-layers of data link layer? [2] (76 Ba)

2. Write short notes on Medium Access sub layer. [4] (**74 Bh**)
3. Explain the functions of each sub-layer. [6] (76 Ba)
   |→What are the functions of LLC and MAC sub-layer? [2+2] (70 Asa)
4. What is MAC's significance in data link layer? [2] (73 Shr)
5. (Assumed) Though we have MAC address, why do we use IP address to represent the host in networks? Explain your answer. [3] (**72 Ch**)
6. Why do you think that the issues of media access is very important in data link layer?
   [3] (**74 Bh**)

3.7   The channel allocation problem

1. Why do you think that static channel assignment is not efficient? [2] (**73 Ch**)
2. Explain the channel allocation problem with example. [5] (**72 Ka**)

3.8   Multiple Access Protocols

1. What are multiple access protocols? [2] (**76 Bh**,**75 Ch**,**71 Ch**, 73 Shr)

3.9   Networks: ALOHA, VLAN, CSMA/CD, IEEE 802.3(Ethernet), 802.4(Token Bus), 802.5(Token Ring), and 802.11(Wireless LAN), FDDI

1. What is ALOHA system? [2] (**79 Ch**)
2. Write short notes on: ALOHA. [3] (80 Ba) [4] (**77 Ch**, 75 Ashar)
3. Explain different types of ALOHA. [4] (75 Ba, 72 Ma)
   |→What is pure ALOHA and slotted ALOHA? Consider the delay of both at low load.Which one is less. [3+2] (**71 Bh**)
4. What is collission? How is it occured? [1+1] (**76 Ch**)
5. How does CSMA-CD works? Explain. [3] (**74 Bh**) [4] (**76 Bh**) [6] (**79 Ch**)
   |→with figure. [8] (76 Ash)
6. How can you make CSMA/CD operation more efficient? [5] (**74 Bh**)
7. Why is CSMA-CD not suitable for wireless medium? Explain. [2] (**76 Ch**)
8. Explain about operation of CSMA/CD. [6] (**73 Ch**)
9. Explain why CSMA/CD is better than CSMA? [5] (71 Ma)
10. Write Short notes on CSMA/CD. [4] (74 Ash)
11. Explain Ethernet frame with function of each field. [5] (**77 Ch**)
12. Explain Ethernet cable standards. [6] (73 Ma)
    |→Explain various cabling techniques used in IEEE 802.3 standard. [4] (71 Ma)
13. Explain IEEE 802.4. [3] (71 Ma)
14. Write short notes on: 802.4 Token Bus. [4] (**76 Ch**)
15. Differentiate between Token Bus and Token Ring networks. [4] (75 Ba)
16. How the possibility of collision is reduced in IEEE 802.3 and IEEE 802.11? Explain. [6] (**76 Ch**)
17. Write short notes on: 802.3 CSMA. [2] (**81 Bh**)
18. Explain how multiple access is acheived in IEEE 802.5. [6] (**71 Ch**)
19. Explain why token bus is also called as the token ring. [4] (73 Sh)
20. Write short notes on FDDI. [4] (**74 Ch**)
21. List the features of FDDI. [4] (**72 Ch**)
22. Explain fault tolerance mechanism of FDDI. [3] (**73 Ch**)

3.10 Numericals

1. A frame having size of 1000 bits is transmitted through a channel having capacity of 200 KB/Sec. Calculate the percentage of idleness of the channel assuming the round trip time of the channel to be 20ms. Is the channel efficient? What is your recommendation further?

    [5+1+4] (**73 Bh**)

2. A bit string 01101110111111111011111110 needs to be transmitted with flag 7E at the data linnk layer. What is the string actually transmitted after bit stuffing? [6] (80 Ba) [3] (**73 Ch**)

3. A bit string 0111101111101111110 needs to be transmitted at the data link layer. What is the string actually transmitted after bit stuffing? [2] (75 Ash)

4. A bit string 01111011111011111110 needs to be transmitted at the data link layer what is string actually transmitted at the data link layer what is string actually transmitted after bit stuffing, if flag patterns is 01111110. [3] (**70 Ch**)

5. Detect the error if any using CRC, if received frame is 0101101101 and generator polynomial is 1001. [6] (81 Ba)

4 Network Layer

(9 Hours/16 Marks)

1. What are the functions of network layer?   [2] (72 Ka)
2. Network layer is one of the key layers in OSI reference model, why?   [2] (**74 Bh**, 72 Ka)

4.1 Internetworking and devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway

1. Write short notes on: HUB, Switch, Routers.   [4] (75 ba)
2. Explain the function of following of following devices in brief: [6] (**73 Bh**)
   (i) Hub (ii) Bridge (iii) Router
3. Compare and contrast betweeen Hub, Switch, Bridge and Router.   [8] (71 Ma)
   |→also repeater.   [8] (**70 Ch**)
4. What are the interconnecting devices used for networking, explain in brief. [8] (**72 Ash**)

4.2 Addressing: Internet address, classful address

1. Write short notes on IP.   [4] (71 Shr)
2. What is phyiscal address?   [2] (73 Ma)
3. What are IPv4 address classes?   [2] (**79 Ch**)
4. What is classful and classless address?   [2] (74 Ash)
5. Show the classless IP with an example.   [4] (**73 Ch**)
6. Why do we think that there arised the need of classless IP address through class based IP address was in use?   [4] (**73 Ch**)
7. What is the Network address and broadcast address in IPv4 addressing?   [2] (81 Ba)
8. What is private IP address?   [2] (**80 Bh**,75 Bh)
9. What is the purpose of Time to live (TTL) and protocol field in header of IPv4 datagram.
                                                                             [4] (**76 Ch**)
10. What are the mechanisms adapted for optimization of uses of IP address. [4] (**73 Bh**)

4.3 Subnetting

1. Explain with example, the use of sub-netting showing network address, broadcast address and sub-net mask.   [6] (**73 Bh**)

2. What is subnet mask?   [1] (71 Ma)

4.4 Routing: techniques, static vs. dynamic routing , routing table for classful address

1. What is routing?   [1] (**77 Ch**, 76 Ba) [2] (76 Ash, 71 Shr, 70 Ma)
2. Why routing is essential in computer networking?   [3] (75 Ash)
   |→Explain importance of routing in computer networking?   [2] (73 Ma)
3. What are the criteria for good routing?   [2] (**74 Ch**, 81 Ba)
4. What is static and dynamic routing?   [3] (76 Ba)
5. What is dynamic routing?   [1] (**71 Bh**)
6. Why do we use dynamic routing?   [2] (**75 Bh**)

7. Write short notes on: DHCP. [3] (80 Ba) [4] (**73 Ch**)
8. What is the difference between routed and routing protocol? [2] (**79 Ch**)
9. What is routed and routing protocol? Give examples. [4] (**72 Ch**)

4.5 Routing Protocols: RIP, OSPF, BGP, Unicast and multicast routing protocols

1. Explain the general operation of RIP with timers. [6] (81 Ba)
2. Explain RIP, OSPF, BGP, IGRP and EIGRP. [6] (**74 Ch**)
3. Explain the working process of OSPF with an example. [6] (**774 Bh,0 Bh**)
4. Explain BGP protocol and clarify how routing works in the internet. [6] (70 Ma)
5. Write short notes on: BGP. [4] (76 Ba)
6. What do you mean by autonomous system? [2] (**75 Ch**)
7. Why are different inter-AS and intra-AS protocols used in the internet? [2] (80 Ba)
8. How does link state unicast routing work? Explain. [8] (**79 Ch**)
9. What is link state routing? [2] (**70 Bh**)
10. Explain the operation of Link State Routing Protocol. [5] (75 Ba)
11. Define unicast and multicast routing. [2] (**79 Bh**)
12. Briefly explain about multicast routing protocols and unicast routing protocols. [6] (72 Ka)
13. Which protocol is used in internet layer to provide feedback to hosts/routers about the problems in network environment? [1] (**76 Ch**)

4.6 Routing algorithms: shortest path algorithm, flooding, distance vector routing, link state routing; Protocols: ARP, RARP, IP, ICMP
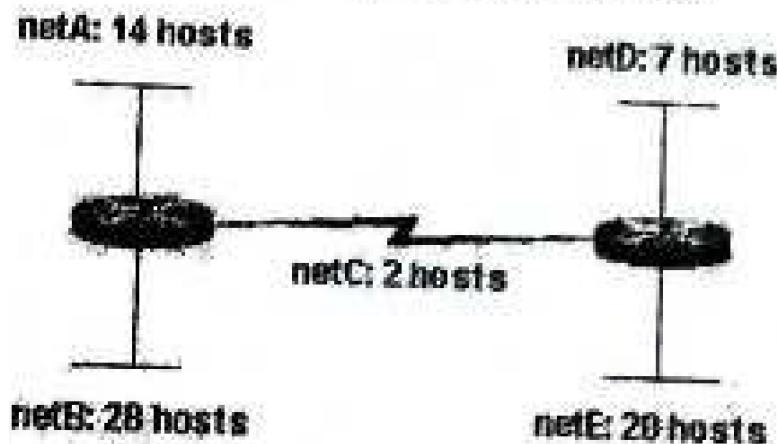
1. Describe flooding technique with its characteristics. [4] (**77 Ch**)
2. Explain algorithm with ways to minimize the duplication of packets. [4] (**80 Bh**)
3. Write down steps for Link State Routing Protocol. [4] (**80 Bh**)
4. Difference between link state and distance vector routing algorithms.
   [3] (**77 Ch,76 Bh**) [4] (76 Ba) [6] (81 Ba, 76 Ash, 74 Ash, 72 Ka, 71 Shr)
   |→with example. [6] (**79 Bh**)
   |→Compare working. [5] (75 Ash)
5. How routing loops are prevented in distance vector routing? Explain with examples.
   [5] (**76 Bh**) [6] (**75 Ch**)
   |→Explain with example how distance vector routing is used to route the packet and why count-to-infinity problem arises and how does it get solved. [6] (**75 Bh**)
6. What is count to infinity problem? [2] (**71 Bh**)
7. Explain how distance vector routing algorithm operates dynamically? [6] (73 Ma)
   |→What is its problem? [2] (73 Ma)
8. Write short notes on: Distance vector routing. [4] (**73 Bh**) [5] (**71 Bh**)
9. What is ARP and how does it work? [3] (**76 Ch**)
10. Write short notes on ARP. [4] (71 Shr)
11. Explain the following terminologies: Network Layer, Shortest Path Routing algorithm, link State Routing Protocol, Interior Gateway Routing protocol, ICMP. [8] (72 Ma)
12. Write short notes on ICMP. [4] (71 Shr)

4.7 Numericals

1. Company Allegro hired an IT expert. The expert was given task to perform logical design of the company with an IP block of 206.100.100.0/24. The company had 40, 20, 8, 100 and 5 employees in its sales, admin, finance, support and HR departments respectively. Show how he was able to perform subnetting with minimum IP wastage. [6] (**80 Bh**)

2. Design a network for a company having 5 departments with 60, 42, 30, 10 and 12 hosts. Specifiy the network address, valid host range, broadcast address and subnet mask for each department from the given address 207.17.11.0/24. [10] (**80 Ba**)

3. How do you subnetwork a class C network block to following subnets of 41,14,102, and 21 computers respectively? Explain with example. [8] (**79 Ch**)

4. Suppose an ISP has 200, 250, 500 and 100 customers in the four different places say, A, B, C and D and need fourr point-to-point links. Provided an IP 10.0.48.0/21, you are required to perform subnetting with minimum waste of IP. Find out the subnet masks, network address, broadcast address, usable IP range and unusable IP range for each location. [10] (**79 Bh**)

5. Perform the subnetting of IP address block 194.53.0.0/24 for six different departments having 2, 62, 120, 5, 14 and 16 hosts. List out the subnet mask, network address, broadcast address, useable host ranges and wasted IP addresses in each subnet. [8] (**77 Ch**)

6. How do you assign the sub-net IP addresses to three LANs each 12, 5 and 29 computers respectively? (Assume 202.35.91.32/25) [6] (**81 Ba**)

7. Suppose your company has leased the IP address of 222.70.94.0/24 from your ISP. Divide it far five different departments containing 50, 30, 25, 12, 10 no of hosts. Therefore are also two points to point links far Interconnection between routers. List out the network address, broadcast address, usable IP address range and subnet mask for each subnet. Also mention the unused range of IP addresses. [8] (**76 Ch**)

8. IOE has six departments having 16, 32, 61, 8, 6 and 24 computers. Use 192.168.1.0/24 to distribute the network. Find the network address, broadcast address, usable IP range and subnet mask in each department. [8] (76 Ash)

9. company has four departments having 20, 32, 60 and 24 computers in their respective departments. Assume an IPv4 class C public network address and design IP address blocks for each department from the assumed IP network using VLSM. Include network address, broadcast address, usable IP range and subnet mask for each of the subnet. [8] (**76 Bh**)

10. Suppose you are given the IP address block of 202.101.8.0/24 from your ISP. How can you divide this IP address for four different departments of your organization requiring 50, 10, 25, 100 number of hosts with minimal waste of IP address, in each department? List out the subnet mask, network address, broadcast address and usable host addresses for each subnet. [8] (76 Ba)

11. Suppose you are a private consultant hired by the large company to setup the network for their enterprise and you are given a large number of consecutive. UP address starting at 120.89.96.0/19. Suppose that four departments A, B, C and D request 100, 500, 800 and 400 address respectively, how the subnetting can be performed so, that adress wastage will be minimum? [8] (**75 Ba**)

12. Design a network for 5 departments containing 29, 14, 15, 23 and 5 computers. Take a network example IP 202.83.54.91/25. [8] (75 Ash)

13. You are given an IP address block of 201.40.58.0/24. Perform subnetting for four departments with equal hosts. [6] (**75 Bh**)

14. How can you dedicate 32, 65, 10, 21, 9 public IP address to the departments A, B, C, D and E respectively form the pool of class C IP addresses with minimum loss. Explain. [8] (**74 Ch**)

15. Suppose you are a private consultant hired by a company to setup the network for their enterprise and you are given a large number of consecutive IP address starting at 120.89.96.0/19. Suppose that four departments A, B, C and D request 100, 500, 800 and 400 addresses respectively, how the subnetting can be performed so that address wastage will be minimum? [8] (74 Ash)

16. IOM has 4 colleges. They need to be connected in same network. Allocate following numbers of IP address: 25, 68, 19 and 50 to those colleges by reducing the losses. The IP address provided to you to allocate is 202.61.77.0/24. List the range of IP addresses, their network address, broadcast address and corresponding subnet mask. [8] (**74 Bh**)

17. Suppose we have 4 departments A, B, C and D having 25 hosts, 16 hosts, 29 hosts and 11 hosts respectively. You are given a network 202.70.91.0/24. Perform the subnetting in such a way that the IP address wastage in each department is minimum and find out the subnet mask, network address, broadcast address and usable host range in each department. [8] (**73 Ch**)

18. You are given IP address block 201.40.58.0/24. Design the subnet for 49, 27, 1145 hosts group so that IP address wastage is minimum. Find subnet mask, network ID, broadcast ID, assigned IP and unassigned IP range in each department. [6] (73 Ma)

19. You are a private contractor hired by the large company to setup the network for their enterprise and you are given a large number of consecutive IP address starting at 202.70.64.0/19. Suppose that four department A, B, C and D request 100, 500, 800 and 400 addresses respectively, how the subnetting can be performed so that address wastage will be minimum? [8] (73 Shr, 70 Ma)

20. Explain how you can allocate 30, 24, 25 and 20 IP addresses to the four department of ABC company with minimum wastage. Specify the range of IP addresses, Broadcast Address, Network Address and Subnet mask for each department from the given address pool 202.77.19.0/24.
[8] (**72 Ch**)

21. Design IPv4 sub network for an organization having 16, 48, 61, 32 and 24 computers in each departments. Use 192.168.5.0/24 to distribute the network. [8] (72 Ma)

22. Design a network for the Institute of Engineering central campus, Pulchowk having 5 departments having 45, 35, 40, 23 and 30 computers in their respective network by allocating public IP to each computer with minimum losses. Assume IP by yourself. [8] (**72 Ash**)

23. You are given the following address space 10.10.10.0124. You have to assign addresses to 4 departments with the following hosts 5, 16, 23 and 27 respectively. Perform the subnetting in such a way that the IP address wastage in each department are minimum. Also find out the subnet mask, network address, broadcast address and unassigned range in each department.
[10] (**71 Ch**)

24. If there are 5 departments which require 27, 28, 7, 12, 8 hosts respectively, design the subnet with minimum loss of IPs and write the starting and ending address of each subnet. [7] (71 Ma)

25. Given the class C network of 204.15.5.0/24, subnet the network in order to create the network in figure below with the host requirements shown. [8] (**71 Bh**)

netA: 14 hosts

netD: 7 hosts

netC: 2 hosts

netB: 28 hosts

netE: 20 hosts

26. How can you dedicate 10, 12, 8, 14 public IP address to department A, B, C and D respectively from the pool of class C with minimum losses of IP? Explain. [8] (**70 Ch**)

27. A large number of consecutive IP addresses are avialable starting at 193.122.2.1. Suppose that four organizations Pulchowk, Thapathali, WRC and ERC request 6000, 2000, 4000 and 2500 address respectively. Design the network and find the first valid IP address, last IP address and mask in w.x.y.z/s notation for each organization. [8] (**70 Bh**)

16

5 Transport Layer

<div align="center">(5 Hours/8 Marks)</div>

5.1 The transport service: Services provided to the upper layers

1. Why do we need a transport layer? [2] (81 Ba)
2. What are the major task of transport layer? Explain. [3] (**75 Bh**) [5] (**76 Ch**)

5.2 Transport protocols: UDP, TCP

1. Draw the segment of UDP. [2] (81 Ba)
2. Define UDP with its header structure. [4] (73 Ma)
3. Compare TCP with UDP. [2] (75 Ba) [3] (75 Ash) [4] (**73 Ch**, 81 Ba, 80 Ba)
4. Explain the TCP datagram format in detail. [5] (75 Ash)
5. Explain TCP with its Header format. [6] (75 Ba, 74 Ash)
6. Explain TCP segment structure. [4] (**76 Ch**) [6] (**75 Bh**)
   |→Draw the segment structure of TCP and explain briefly. [5] (**76 Bh**)
7. Explain TCP three way handshaking process. [4] (**74 Bh**)
8. For client-server application over TCP, why must the server program be executed before the client program? [3] (**73 Ch**)
9. Why TCP is known as reliable protocol and also describe how reliability is provided by TCP?
   [4] (**76 Ch**) [5] (**73 Ch**)

5.3 Port and Socket

1. What is port addressing? [2] (**79 Ch**)
2. What is significance of port address? [1] (**79 Bh**)
   |→What is the importance of addressing at transport layer? [2] (76 Ba)
3. Discuss about different classes of port addresses defined by IANA. [3] (**79 Bh**)
4. Why port number is used in networking? [2] (**77 Ch**)
5. How do you implement TCP socket for network communication. Explain [6] (**79 Ch**)
6. Differentiate between port and socket. [2.5] (**74 Bh**)
7. Define socket. [1] (**73 Bh**, 74 Ash)
8. Explain socket's importance. [2] (74 Ash)

5.4 Connection establishment, Connection release

1. Explain the TCP connection establishment, data transfer and connection termination process with necessary diagrams. [6] (76 Ba)
2. Explain connection establishment and termination in TCP. [4] (**75 Ch**,**74 Ch**)
3. Explain Connection management of TCP. [7] (**73 Bh**)

5.5 Flow control and buffering

1. What is congestion? [1] (**74 Bh**)
2. What are hte techniques for congestion control? [3] (**74 Bh**)
3. (Assumed) How do you implement packet congestion control for better QoS? [4] (80 Ba)
4. What are the factors affecting congestion? [3] (75 Ba)

5. Explain connection management of TCP with necessary figures. [6] (**77 Ch**)
6. How is flow control is addressed by TCP? [3] (**76 Bh**)

5.6 Multiplexing and de-multiplexing

1. Discuss how multiplexing and de-multiplexing is achieved in Transport Layer with examples.
[4] (**81 Bh**)

5.7 Congestion control algorithm: Token Bucket and Leaky Bucket Transport Layer

1. What are the factors affecting Congestion? [3] (75 Ba)
2. Explain Token Bucket algorithm. [3] (**76 Ch**) [4] (**74 Ch**,**73 Ch**,**72 Ch**)
   |→Write short notes on: Token bucket traffic shaping algorithm. [2] (81 Ba) [3] (**79 Ch**)
3. How can traffic congestion be controlled by token bucket method? [4] (**79 Bh**,**73 Ch**, 73 Ma)
4. How is token bucket better than leaky bucket in context with packet loss? Explain. [4] (**81 Bh**)
5. Explain briefly about Leaky-Bucket algorithm. [4] (**75 Ch**)

6 Application Layer

(5 Hours/8 Marks)

6.1 Web: HTTP and HTTPS

1. Write short notes on: Web Server [3] (73 Ma)
2. Write short notes on: HTTP methods. [2] (81 Ba)
3. Write short notes on: HTTP. [2] (**77 Ch**) [3] (73 Ma)
4. How a request initiated by a HTTP client is served by an HTTP server? [3](75 Ba)
5. Explain how HTTPS works? [2] (75 Ba)
6. Why is HTTPS not used for all web traffic? [2] (**81 Bh**)
7. What is the difference between HTTP and HTTPS? [2] (**76 Bh**)

6.2 File Transfer: FTP, PuTTY, WinSCP

1. What is TFTP? [2] (**76 Ch**)
2. How does FTP work? Explain. [6] (**81 Bh**,**75 Bh**)
   |→Write short notes on: FTP server working principle. [3] (**79 Ch**)
   |→Explain working principle of FTP with data transfer process including proper port connection. Use proper diagram to justify your answer. [6] (**76 Ch**)
3. (Assumed) How web server communication and file server communication are possible in network. Explain with used protocols. [6] (75 Ash)

6.3 Electronic Mail: SMTP, POP3, IMAP

1. Draw the architecture of Email Agent. [2] (81 Ba)
2. Write short notes on SMTP. [2] (**77 Ch**)
3. Compare IMAP and SMTP. [3] (**74 Bh**, 75 Ba)
4. Write short notes on: SMTP and POP. [4] (74 Ash)
5. Compare IMAP and POP3 protocols. [3] (**79 Bh**,**76 Ch**,**74 Ch**,**73 Bh**)
6. Explain working principle of E-mail system with a proper diagram. [6] (80 Ba)
7. How can you transfer mail over internet? [4] (73 Ma)
8. Which protocols are used in sending and receiving an email? [3] (73 Ma)
   |→Illustrate with figures. [5] (**74 Ch**)
9. What are mail agents? [4] (**79 Ch**)
10. Discuss functionalities of mail agents. [4] (**79 Ch**)

6.4 DNS

1. What is DNS? [1] (**79 Bh**,**76 Ch**, 76 Ba, 73 Ma)
2. Discuss the DNS records. [2] (74 Ash)
3. Write short notes on DNS. [4] (**73 Ch**)
4. Write short notes on: DNS queries. [4] (**74 Bh**)
5. Explain DNS servers and its query types. [5] (**73 Bh**)
6. Explain the working principle of DNS with a proper diagram. [4] (**79 Bh**) [4] (**76 Ch**)
   |→Explain the working of DNS in detail. [6] (**76 Bh**)
7. Why is DNS distributive in nature? [2] (81 Ba)

8. Explain iterative query and recursive query of DNS with examples and diagrams. [4] (81 Ba) [5] (76 Ba) [6] (74 Ash)
9. What are the importance of DNS and HTTP(S) while you are browsing any website? [6] (**75 Ch**)
10. Differentiate HTTP and DNS. [2.5] (**74 Bh**)

6.5   P2P Applications

6.6   Socket Programming

1. What is port address and socket address? [2] (80 Ba)
2. Define socket programming. [2] (75 Ash)
   |→Write short notes on Socket programming. [4] (**74 Ch**)

6.7   Application server concept proxy caching, Web/Mail/DNS server optimization

1. Why do we need proxy servers? [2] (**75 Ch**)
   |→function of proxy server? [2] (**75 Bh**)

6.8   Concept of traffic analyzer: MRTG, PRTG, SNMP, Packet tracer, Wireshark.

1. Write short notes on: SNMP. [2] (**77 Ch**)
2. Write short notes on: Packet tracer. [2] (**77 Ch**)

7 Introduction to IPV6

<div align="center">(4 Hours/8 Marks)</div>

7.1 IPv6- Advantages

1. List the advantages of IPv6 over IPv4.   [2] (**76 Ch**,**76 Bh**) [4] (74 Ash)
2. What are the factors that lead to deployment of IPv6?   [2] (**79 Bh**)
3. Why the world has decided to migrate to new internet addressing scheme IPV6?   [3] (**73 Ch**)
4. What are the problems of IPv4?   [1] (**77 Ch**)
5. How IPv6 reduce problems of IPv4?   [2] (**77 Ch**)
6. Difference between IPv6 and IPv4.   [4] (**75 Bh**) [6] (73 Ma)
7. What are the factors that lead to the speedy development of IPv6?   [4] (**74 Ch**)

7.2 Packet formats

1. What are the features of IPv6 header.   [3] (80 Ba)
   |→unique features?   [2] (**79 Ch**)
2. Explain IPV6 with its frame format.   [4] (**74 Bh**)
3. Show IPv6 datagram format.   [2] (75 Ash)
4. Explain IPV6 Headers with its features.   [2] (73 Ma)
5. Compare header fields of IPv4 and IPv6.   [4] (75 Ba)
6. Explain about the process to simplify the writing address of IPV6?   [4] (75 Ba)

7.3 Extension headers

1. How extension header is used in IPv6?   [3] (**81 Bh**)

7.4 Transition from IPv4 to IPv6: Dual stack, Tunneling, Header Translation

1. Why do we need to migrate the current IPv4 to IPv6 network?   [2] (**79 Ch**)
2. Explain about tunneling in IPv6.   [4] (**75 Bh**)
3. Explain header translation and tunneling approach used for migrating IPV4 and IPV6.   [4] (74 Ash)
4. If there are IPv4 networks in between two IPv6 endpoints, what type of transition strategies will you suggest? Explain with examples and diagrams.   [6] (81 Ba)
5. Define the transition process from IP4 to IP6.   [4] (**74 Ch**)
6. Explain dual stack transition mechanism from IPv4 to IPv6.   [5] (**81 Bh**)
7. List out different strategies to transit from IPv4 to IPv6.   [1] (**77 Ch**)
8. Explain the strategies used for transition from IPv4 to IPv6.   [5] (80 Ba)
   |→Explain briefly about the process involved in transition of IPv4 to v6.   [6] (**79 Bh**)
   |→Explain any one suitable transition approach.   [2] (**77 Ch**) [4] (**79 Ch**)
   |→Explain any two.   [6] (**76 Ch**)
   |→Explain various.   [6] (**76 Bh**)
9. Explain what address family translation means in IPv4/v6 migration process with an apt figure.   [5] (**75 Ch**)
10. Which method do you suggest for the migration of IPv4 to IPv6 and why?   [5] (**73 Ch**)
11. "IPv4 and IPv6 coexistence" what does this mean?   [3] (**76 Ch**,**75 Ch**,**73 Ch**)

12. What methods are used to interoperate IPv6 and IPv4. [4] (**74 Bh**) [6] (75 Ash)
13. Explain dual stack approach with an appropriate figure. [5] (**76 Ch**,**73 Ch**)

7.5   Multicasting

1. Discuss any-cast and multi cast addresses in IPv6 with use cases. [2] (81 Ba)

8 Network Security

(7 Hours/16 Marks)

8.1 Properties of secure communication

1. What is netowrk security?   [3] (76 Ba)
2. Why network security is very important?   [2] (**75 Bh**)
3. What are the properties of secure communication?
    [2] (**79 Bh**,**76 Ch**,**74 Bh**,**73 Ch**) [4] (**76 Ch**,**76 Bh**,**75 Ch**, 74 Ash)
4. When can you say your network is comprised? And, how is it caused?   [2+2] (80 Ba)
5. What are the different measures we can apply for network security?   [2] (**79 Ch**)
6. Define type of Encryption used in security.   [5] (**74 Ch**)
7. What are the attributes of information security?   [4] (**73 Ch**)

8.2 Principles of cryptography: Symmetric Key and Public Key

1. What do you mean by cryptography?   [2] (**75 Bh**, 73 Ma)
2. Draw the block diagram of DES algorithm.   [3] (**81 Bh**)
3. Explain the operation of Data Encryption Standard algorithm.   [6] (75 Ba)
4. Write short notes on: Deffie Hellman Algorithm.   [2] (**81 Bh**) [4] (74 Ash)
5. How Deffie Hellman algorithm negotiate a shared key between receiver and transmitter. Explain with example.   [6] (73 Ma)
6. How can you make your network secure using public key cryptography?   [4] (80 Ba)
7. Write short notes on: Symmetric key cryptography.   [4] (**76 Bh**,**75 Ch**)
8. Explain the symmetric key and public key cryptography.   [5] (76 Ba)
9. Compare symmetric key encryption with asymmetric key encryption.   [3] (75 Ba)

8.3 RSA Algorithm

1. Explain RSA with examples.   [5] (**81 Bh**) [6] (**79 Ch**)
    |→Explain operation of RSA algorithm.   [4 (**73 Ch**)] [5] (75 Ba)
2. Encrypt the plain text "MACHINE" using RSA algorithm.   [6] (81 Ba)
    |→message "network".   [6] (75 Ash)
    |→message "MISCELLANEOUS"   [6] (**75 Bh**)
3. Encrypt and decrypt the message "BEIE" using RSA algorithm.   [6] (**79 Bh**)
    |→message "RANDOM"   [8] (**77 Ch**)
    |→message "HELLO"   [6] (**76 Ch**)
    |→message "ROSE"   [6] (**76 Ch**)
    |→message "BEX"   [6] (**74 Bh**)
    |→message 'OIE'"   [7] (**73 Ch**)

8.4 Digital Signatures

1. How does a Digital Signature work?   [2] (**76 Ch**)
2. Write short notes on: Digital Signature.   [4] (**75 Ch**)
3. What are digital signatures?   [2] (75 Ba)

8.5 Securing e-mail (PGP)

1. Write short notes on: PGP.   [2] (**81 Bh**) [3] (**79 Ch**)
2. How PGP can secure email communication?   [3] (**74 Ch**)

8.6 Securing TCP connections (SSL)

8.7 Network layer security (IPsec, VPN)

1. What is IPSEC?   [2] (81 Ba)
2. Write short notes on: VPN.   [2] (81 Ba) [4] (**77 Ch**,**76 Bh**,**75 Ch**)
3. What is VPN?   [2] (75 Ash)

8.8 Securing wireless LANs (WEP)

1. Write short notes: WEP.   [4] (76 Ba)

8.9 Firewalls: Application Gateway and Packet Filtering, and IDS

1. Write short notes on: IDS.   [2] (81 Ba)
2. Write short notes on: Firewall.   [4] (**77 Ch**,**74 Bh**,**73 Ch**)
   |→Write short notes on: Firewall and types.   [4] (**76 Ch**,**74 Ch**, 75 Ba)
   |→Explain how firewall works.   [4] (**76 Ch**)
3. Explain how Packet filtering firewall works.   [4] (**76 Bh**,**75 Ch**, 74 Ash)
4. Explain different types of firewall that can be used to secure the network.   [6] (**75 Bh**)