F – 54362

Register No. | | | | | | | | |

BTech Degree Examination December 2022

Fifth Semester

Information Technology

20ITT51 – COMPUTER NETWORKS

(Regulations 2020)

Time: Three hours | Maximum: 100 marks

Answer all Questions

Part – A (10 × 2 = 20 marks)

1. Assume nine devices are arranged in a mesh topology. How many cables are needed? How many ports are needed for each device? [CO1,K2]
2. Difference between parallel and serial transmission modes. [CO1,K2]
3. Bit-stuff the following frame payload: [CO2,K3]
   0001111100001111101000111111011110000111
4. Name the three kinds of connecting devices in the Internet Model and mention its purpose. [CO2,K1]
5. Find the class of the following classified IP addresses: [CO3,K3]
   a. 139.35.54.10
   b. 202.35.2.3
   c. 246.34.21.20
   d. 192.35.22.15
6. We say that OSPF is a hierarchical intradomain protocol, but RIP is not. What is the reason behind this statement? [CO3,K2]
7. Define piggybacking technique. [CO4,K1]
8. Recall the four types of data-flow characteristics. [CO4,K1]
9. Show an example of a HTTP non persistent connection and list the steps in this strategy. [CO5,K2]
10. Write the purpose of SNMP. [CO5,K1]

Part – B (5 × 16 = 80 marks)

11. a. i) We have two computers connected by an Ethernet hub at home. Is this a LAN or a WAN? Explain the reason and draw a network model/diagram. (8) [CO1,K3]

    ii) With neat diagram, explain the TCP/IP protocol suite. Write the responsibilities of individual layers. (8) [CO1,K2]

    (OR)

    b. i) Draw the graph of the NRZ (L and I), RZ and Manchester schemes using each of the following data streams. (8) [CO1,K3]
       a. 0100111100
       b. 0100111

    ii) Elaborate the functions and advantages of the twisted-pair, coaxial and fiber-optic cables. (8) [CO1,K2]

12. a. i) Given the dataword 101001111 and the divisor 10111, show the generation of the CRC codeword at the sender and receiver site. (8) [CO2,K2]

ii) Discuss different types of frames and configuration usage in HDLC protocol. (8) [CO2,K2]

(OR)

b. Draw a neat flow diagrams, describe the following random access methods in detail: (16) [CO2,K2]

i) ALOHA ii) CSMA iii) CSMA/CD

13. a. An organization is granted the block 132.58.0.0/16. The network administrator wants to create 1024 subnets. (16) [CO3,K3]

i) Find the number of addresses in each subnet.

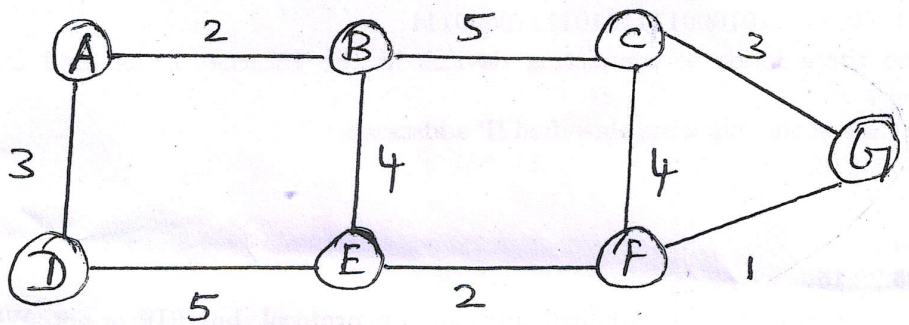
ii) Find the subnet prefix

iii) Find the first and the last address in the first subnet.

iv) Find the first and the last address in the last subnet.

(OR)

b. Demonstrate the distance-vector routing algorithm for a node to find routing table. Also find the routing table for the given network scenario. (16) [CO3,K3]



14. a. i) Examine the process of stop-and-wait protocol with neat diagram. (8) [CO4,K1]

ii) Point out the features of TCP in transport layer. Draw the TCP segment format and explain the fields. (8) [CO4,K1]

(OR)

b. Define quality-of-service. Illustrate the various techniques to improve QoS in networks. (16) [CO4,K1]

15. a. i) Identify the architecture and working of electronic mail (8) [CO5,K2]

ii) Summarize the operations and basic model of FTP (8) [CO5,K2]

(OR)

b. i) Illustrate how the DNS protocol is used in the Internet. (10) [CO5,K2]

ii) In DNS, Which of the following are FQDNs and which are PQDNs? Explain in detail. (6) [CO5,K2]

a) xxx b) xxx.edu c) xxx.yyy.net d) zzz.yyy.xxx.edu

Bloom's Taxonomy Level	Remembering (K1)	Understanding (K2)	Applying (K3)	Analysing (K4)	Evaluating (K5)	Creating (K6)
Percentage	22	49	29	-	-	-

B.Tech Degree Examination December 2022
Fifth semester
Information Technology
20ITT51-Computer Networks
(Regulations 2020)
Answer key

PART – A (10 × 2 = 20 marks)

1. Mesh topology: **[CO1,K2]**

a. Cable links: n (n – 1) / 2 = (9 × 8) / 2 = 36
b. Number of ports: (n – 1) = 8 ports needed per device

2. Parallel and serial transmission modes: (Any two)[CO1,K2]

Parallel transmission mode	**Serial transmission mode**
Bits in a group are sent simultaneously, each using a separate link	Transmission of data one bit at a time using only single link
n wires are used to send n bits at a time	Methods: synchronous and asynchronous
High speed	Requires conversion devices
Costly, limited to a short distance	Reduced cost

3. Bit-stuffing: **[CO2,K3]**

00011111 01000011 11101010 001111101 10111100 00111

4. Three kinds of connecting devices and its purposes: **[CO2,K1]**

- **Hub (or repeater)** operates in physical layer and forwards the packet from all outgoing ports except the one from which the signal was received.
- **Link-layer switch (or switch)** operates in both physical and data-link layers. It checks the destination address of a frame and decide from which outgoing port the frame should be sent.
- **Routers** operates in physical (regenerates the signal it receives), data-link (checks the physical address contained in the packet) and network (checks the network-layer addresses) layers

5. Classful addressing: **[CO3,K3]**

a. 139.35.54.10 - **Class B address**
b. 202.35.2.3 - **Class C address**
c. 246.34.21.20 - **Class E address**
d. 192.35.22.15 - **Class C address**

6. OSPF and RIP: **[CO3,K2]**

Open Shortest Path First (OSPF) is a routing protocol based on Link-state routing. A router running OSPF needs to know the cost to every other router in the network. This requires lots of packets to be sent between routers and take up a lot of bandwidth. So OSPF further separates an AS into smaller parts called areas and is called a hierarchical intra-domain protocol.

7. Piggybacking technique: **[CO4,K1]**

When a packet is carrying data from A to B, it can also carry acknowledgement about arrived packets from B and vice versa is called **Piggybacking**. To improve the efficiency of bidirectional communication, this technique is used.

8. Four types of data-flow characteristics: **[CO4,K1]**

- Reliability
- Delay
- Jitter
- Bandwidth

9. HTTP non-persistent connection and its steps: **[CO5,K2]**

Request a file and image are sent with two different connections i.e., need 2 separate connection establishment and termination handshakes.

Steps:

1. The client opens a TCP connection and sends a request
2. The server sends the response and closes the connection
3. The client reads the data until it encounters an end-of-file marker and then it closes the connection

10. Purpose of SNMP: **[CO5,K1]**

SNMP is a application-level protocol for monitoring devices made by different manufacturers and installed on different physical networks.

PART – B (5 × 16 = 80 marks)

11.a.i) Local Area Network: **[CO1,K3]**

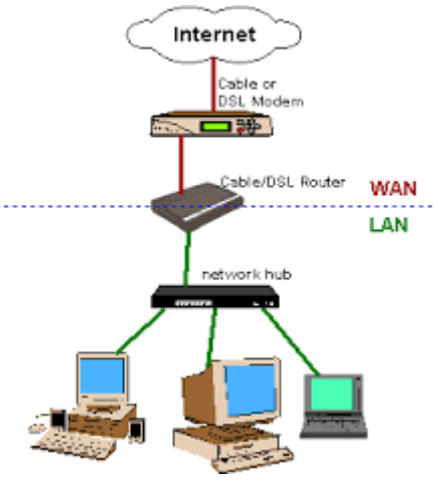
Two Computers connected by an Ethernet Hub at home is a LAN. Ethernet is a LAN.

- **(2)**

All small sized office networks and in-house networks are LANs.

Directly connecting two such computers requires a special cable called a crossover Ethernet cable to replace/bypass the hub/switch. Otherwise the two computers will not be able to communicate with each other. Newer Ethernet adapters can identify the sending and receiving lines in a cable.

- **(2)**



- **(4)**

-

11.a.ii) TCP/IP protocol suite and responsibilities of layers: **[CO1,K2]**

- Physical Layer
  - ➢ To move data in the form of electromagnetic signals across a transmission medium.

Encoding/ decoding

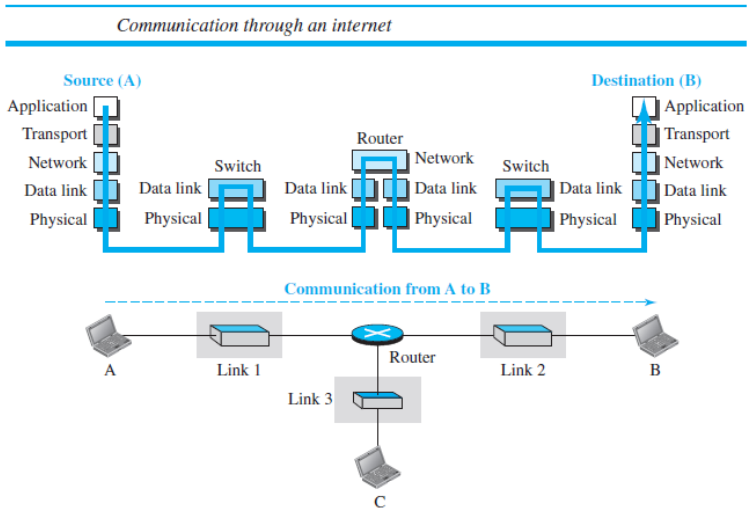
- Data Link Layer
  - Hop-to-hop delivery:
  - Physical addressing,
  - Framing,
  - Medium access control (MAC),
  - Error control,
  - Flow control

- Network Layer
  - Source-to-destination delivery:
  - IP addressing,
  - Routing & Forwarding

- Transport Layer
  - Process-to-process communication:
  - Socket/port addressing,
  - Flow control,
  - Error control,
  - Congestion control,
  - Segmentation and reassembly

- Application Layer
  - Supporting network applications
  - Generates messages
  - Encryption/decryption, translation
  - Session maintenance

- **(6)**

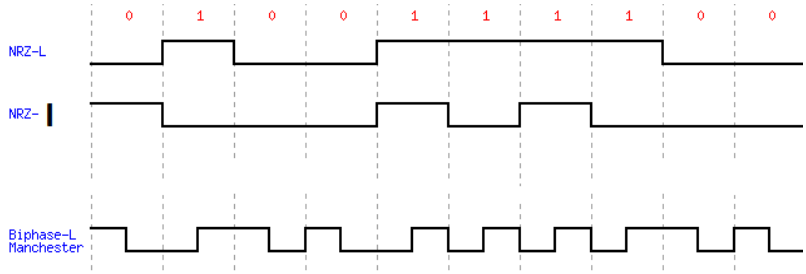


- **(2)**

(or)

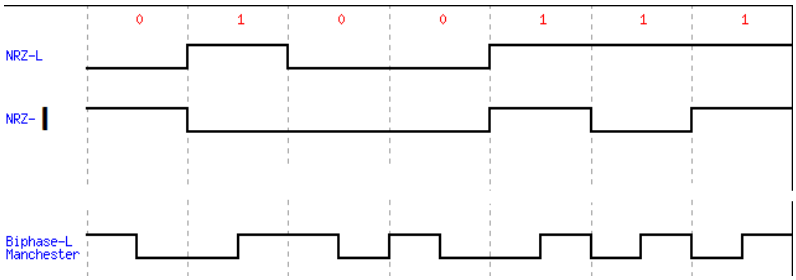
11.b.i) NRZ (L and I) and Manchester schemes: [CO1,K3]

a. 0100111100



- **(4)**

b. 0100111



- **(4)**

11.b. ii) Functions and advantages of twisted-pair, coaxial and fiber-optic cables: [CO1,K2]

Twisted-pair and coaxial cables use metallic (copper) conductors that accept and transport signals in the form of electric current.

In **Twisted-pair**, one is used to carry signals to the receiver, the other is used only for ground reference. The receiver uses the difference between the two.

Advantages

- Inexpensive and readily available
- Flexible and light weight
- Easy to work with and install

- **(2)**

Conductors share a common center axial, hence the term "**co-axial**".

Advantages

- Higher bandwidth
- Can be tapped easily
- Much less susceptible to interference than twisted pair

- **(3)**

Optical fiber is a cable that accepts and transports signals in the form of light.

Advantages

- greater capacity
- smaller size and lighter weight
- lower attenuation
- immunity to environmental interference
- highly secure due to tap difficulty and lack of signal radiation

- **(3)**

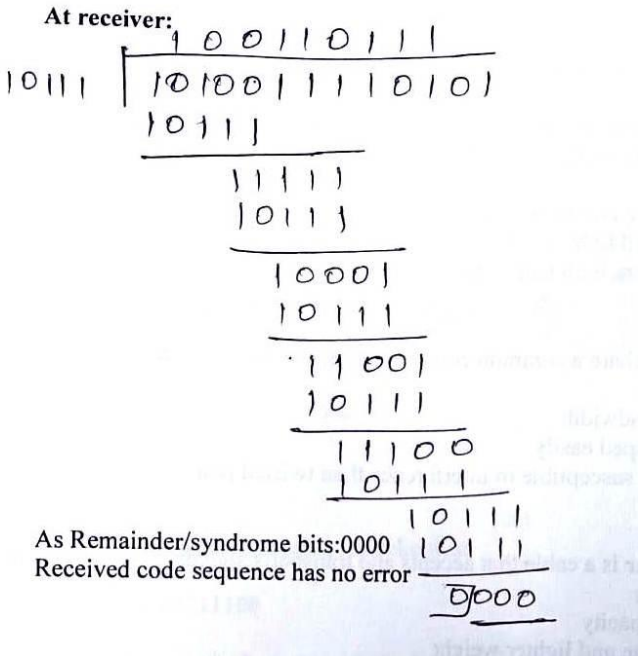
12.a.i) **CRC codeword:** **[CO2,K2]**

At sender:

```
          100110111
10111 | 1010011110000
        10111
         11111
         10111
          10001
          10111
           11000
           10111
            11110
            10111
             10010
             10111
              101
```

Remainder / CRC bits: 0101
Data 1010011110101 is sent - **(4)**

At receiver:

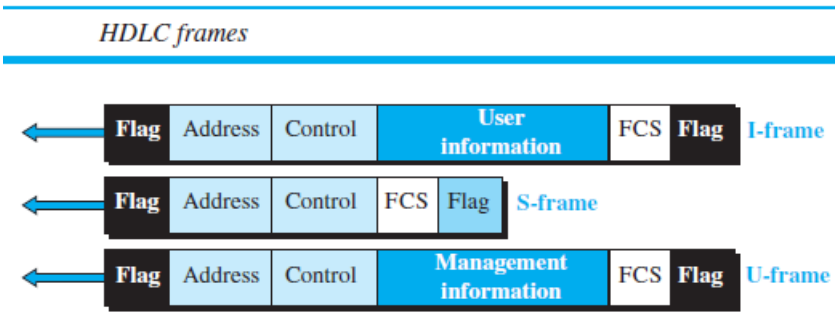


- **(4)**

12.a.ii) **Different types of frames and configuration usage in HDLC:** **[CO2,K2]**

High-level Data Link Control (HDLC) is a bit-oriented protocol for communication over point-to-point and multipoint links. It implements the Stop-and-Wait protocol.

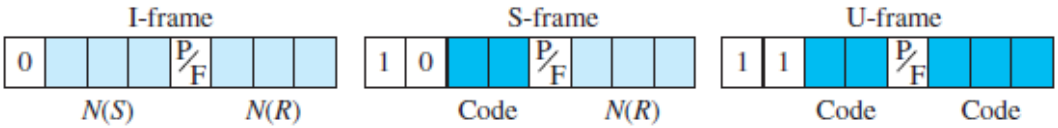
Types of frames:



❑ Flag field
❑ Address field
❑ Control field
❑ FCS field

- **(2)**

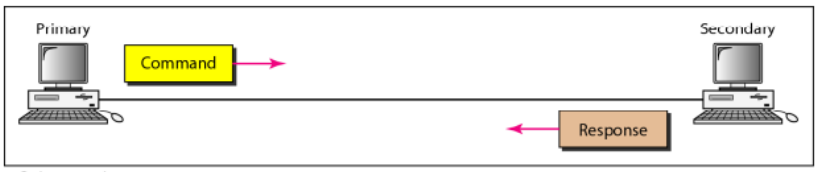
Control field format for the different frame types



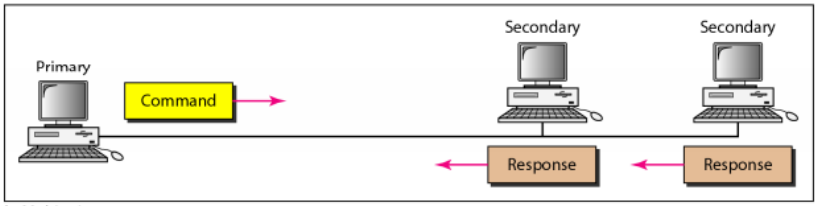
- **(2)**

Configuration usage:

Normal response mode



a. Point-to-point



b. Multipoint

- **(2)**

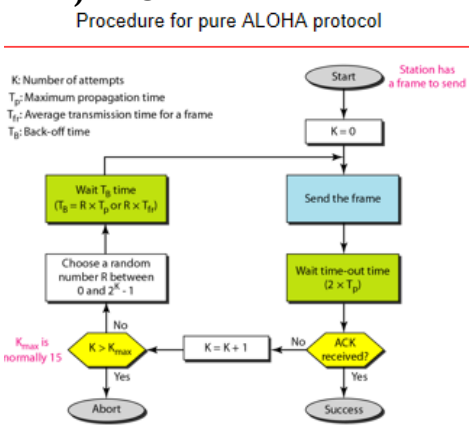
Asynchronous balanced mode

- **(2)**

(or)

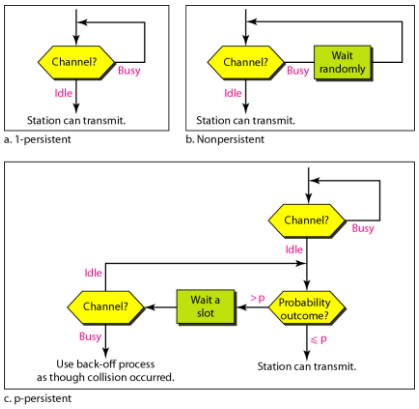
12.b. Random Access Methods: **[CO2,K2]**

i) ALOHA



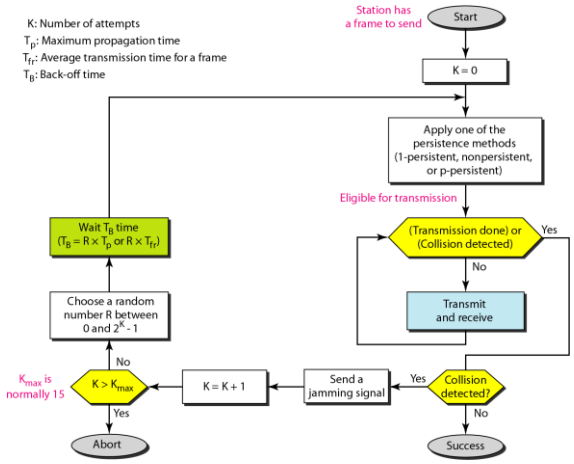
- (5)

ii) CSMA



- (5)

iii) CSMA/CD



- (6)

13.a. Subnetting Technique: **[CO3,K3]**

i) 62 valid addresses can exist in each subnet

The rest of the bits must be used for the addressed i.e. there will be 32 - 26 = 6 bits available for the address component.

So, a total of 2^6=64 bits shall be available. Also, 2 bits per subnet cannot be allocated and subnet mask will be able to maintain 62 valid addresses. - **(4)**

ii) 255.255.255.192 will be the subnet mask

2^n = 1024

Therefore, n = 10.

The address is here is a Class B ,

so, the default mask is /16. 10 bits are necessary for subnets and

hence the correct subnet mask is /(16+10) = /26.

In the format of dotted decimal format, it shall be 192 and therefore, the subnet mask will be 255.255.255.19 - **(4)**

iii) First address in subnet 1 will be 130.56.0.1 and last address is subnet 1 will be 130.56.0.62

The first address can be estimated by ANDing the address 130.56.0.0 with the subnet mask /26 like below: 10000010 00111000 00000000 00000000 (130.56.0.0)

This address cannot be allocated, so we will consider the next address: 10000010 00111000 00000000 00000001 (130.56.0.1).

In similar manner, the last address that can be allocated before the broadcast address will be 130.56.0.62. - **(4)**

iv) First address is the subnet 2 will be 130.56.255.193 and last address in subnet 2 will be 130.56.255.254. - **(4)**

(or)

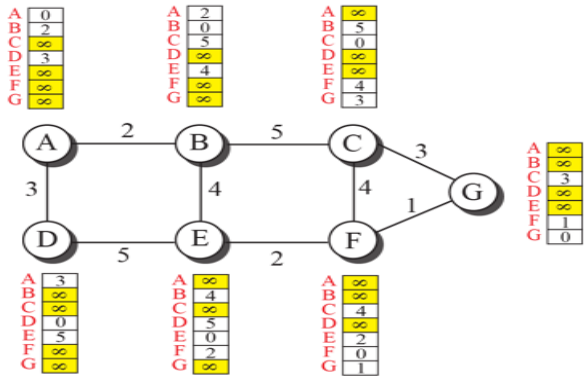
13.b. Distance vector routing algorithm: **[CO3,K3]**

1. A router transmits its distance vector to each of its neighbors in a routing packet.
2. Each router receives and saves the most recently received distance vector from each of its neighbors.
3. A router recalculates its distance vector when:
    - It receives a distance vector from a neighbor containing different information than before.
    - It discovers that a link to a neighbor has gone down.

The DV calculation is based on minimizing the cost to each destination

- **(8)**

Routing tables at each node:

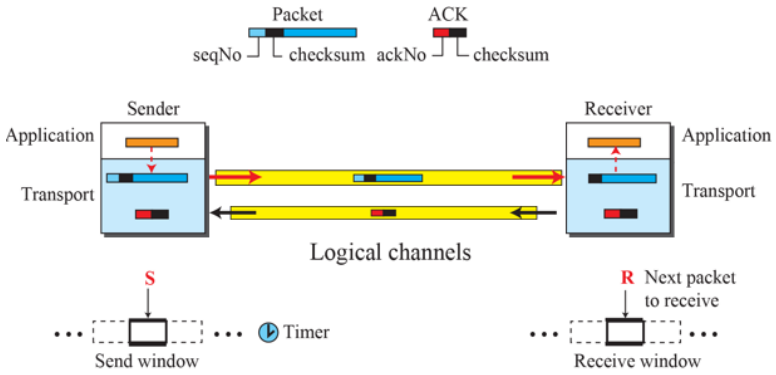


- **(8)**

14.a.i) Process of stop-and-wait protocol: **[CO4,K1]**

Connection-oriented protocol called the Stop-and-Wait protocol, which uses both flow and error control. Both the sender and the receiver use a sliding window of size 23. The sender sends one packet at a time and waits for an acknowledgment before sending the next one. To detect corrupted packets, we need to add a checksum to each data packet. When a packet arrives at the receiver site, it is checked. If its checksum is incorrect, the packet is corrupted and silently discarded.

- **(4)**



- **(4)**

14.a.ii) Features of TCP in transport layer: **[CO4,K1]**

Byte Number:

The bytes of data being transferred in each connection are numbered by TCP. The numbering starts with a randomly generated number.

- (2)

The following shows the sequence number for each segment:

Segment 1	→	**Sequence Number: 10,001 (range: 10,001 to 11,000)**
Segment 2	→	**Sequence Number: 11,001 (range: 11,001 to 12,000)**
Segment 3	→	**Sequence Number: 12,001 (range: 12,001 to 13,000)**
Segment 4	→	**Sequence Number: 13,001 (range: 13,001 to 14,000)**
Segment 5	→	**Sequence Number: 14,001 (range: 14,001 to 15,000)**

- (2)

Sequence Number:

The value in the sequence number field of a segment defines the number of the first data byte contained in that segment.

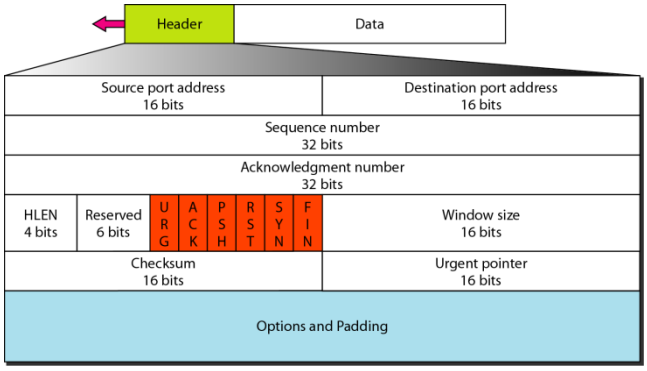
- (2)

Acknowledgement Number:

The value of the acknowledgment field in a segment defines the number of the next byte a party expects to receive. The acknowledgment number is cumulative.

- (2)

TCP segment format and its fields



- (4)

Fields explanation **- (4)**

(or)

14.b. Quality of Service and various techniques to improve QoS in networks: [CO4,K1]

Quality-of-Service (QoS) refers to traffic control mechanisms that seek to either differentiate performance based on application or network-operator requirements or provide predictable or guaranteed performance to applications, sessions, or traffic aggregates.

- (2)

To control the amount and the rate of traffic.

- **Traffic Shaping** is to control the traffic when itleaves the network.
- **Traffic Policing** is to control the traffic when it enters the network.

- (2)

Two techniques can shape or police the traffic:

Leaky bucket: A water bucket leaks (outputs) in a constant rate of water regardless of the input flow of water. Hence, a network can regulate the output data rate of its bursty input traffic rate.

Diagram **- (2)**

Token bucket: Since the Leaky Bucket is not fair for idle host for long times then gets bursty data, it still transmits the average rate ignoring its long idle time. Hence Token Bucket (TB) is used.

Diagram **- (2)**

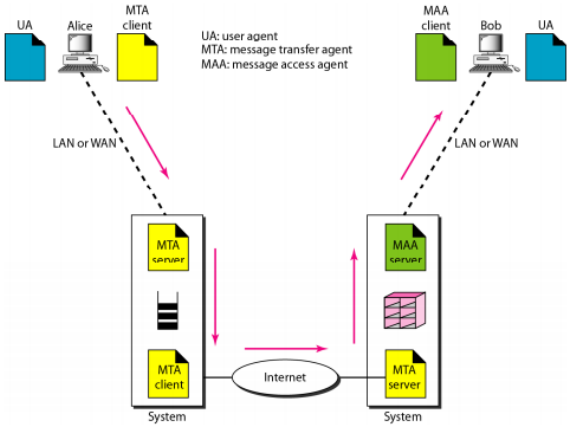
Scheduling (traffic shaping):

At a router that a packet may be delayed, suffer from jitters, be lost, or be assigned the required BW. FIFO, priority and weighted fair queuing techniques are used.

- (2)

FIFO, priority and weighted fair queuing diagrams **- (6)**

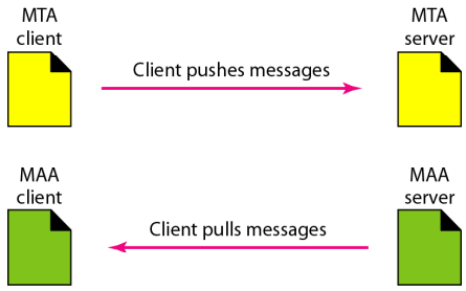
15.a.i) Architecture and working of e-mail: **[CO5,K2]**



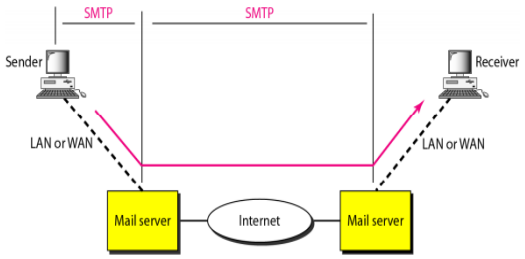
- **(2)**

When the sender is connected to the mail LAN WAN server via a LAN or a WAN, two UAs and two pairs of MTAs (client and server) and a pair of MAAs are needed.

- **(2)**



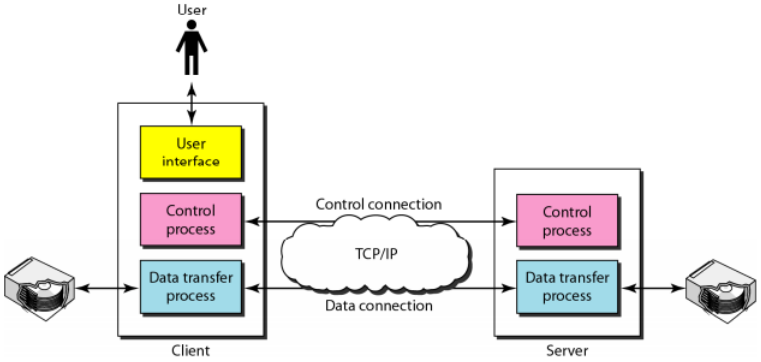
- **(2)**



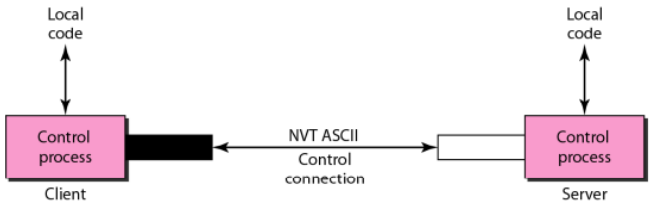
- **(2)**

15.a.ii) Operations and basic model of FTP: **[CO5,K2]**

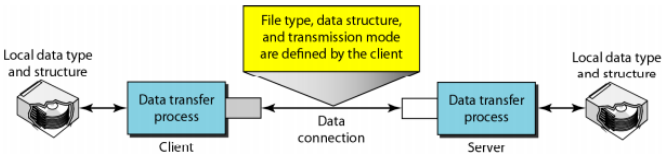
- FTP uses the services of TCP. It needs two TCP connections.
- The well-known port 21 is used for the control connection and the well-known control connection and the well-known port 20 for the data connection.



- **(4)**



- (2)



- (2)

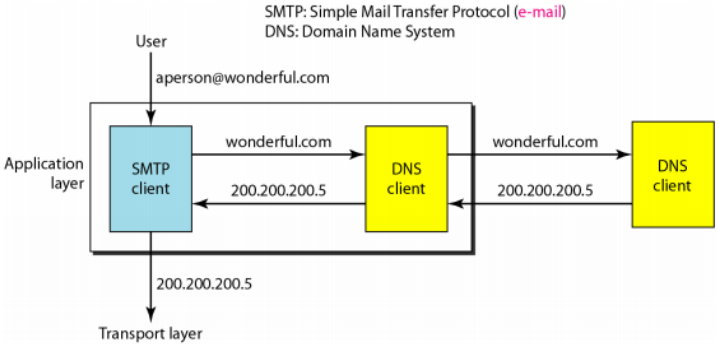
Explanation **- (8)**

(or)

15.b.i) DNS protocol: **[CO5,K2]**

To be unambiguous, the names assigned to machines must be carefully selected from a namespace with complete control over binding between the names and IP addresses.

- (2)



- (2)

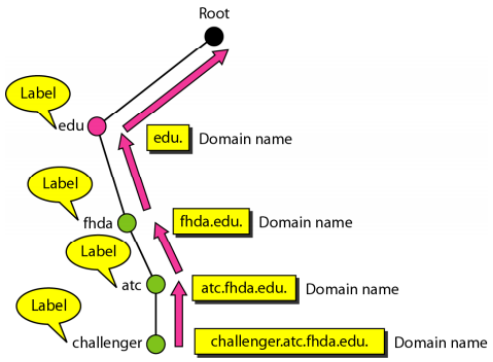
Techniques used:

- Flat Name Space
- Hierarchical Name Space

- (4)

15.b.ii) FQDNs and PQDNs in DNS: **[CO5,K2]**

To have hierarchical namespace, a domain name space was designed. The names are defined in an inverted-tree structure with the root at the top.



- (2)

a) xxx - PQDN
b) xxx.edu - FQDN
c) xxx.yyy.net - FQDN
d) zzz.yyy.xxx.edu - FQDN

- (4)

Bloom's Taxonomy Level	Remembering (K1)	Understanding (K2)	Applying (K3)	Analysing (K4)	Evaluating (K5)	Creating (K6)
Percentage	22	49	29	--	--	--