

Solution for Mid Semester Exam M.Tech Computer Science and Engineering

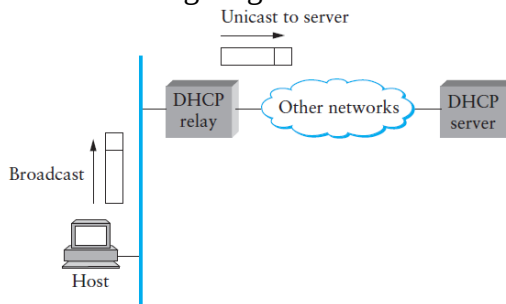
Subject & Subject Code: **MTCE1103 Advanced Computer Network**

Q1a.

- Need(any two) **1Mark**
 - IP addresses needed to be dynamically configured,
 - added pieces of information is also required during configuration like router information
 - It is not possible to configure all systems manually if network has large number of nodes
 - Manual process is error prone
- Working of DHCPDISCOVER (evaluate only key points) **2-3Mark**
 - To contact a DHCP server, a newly booted or attached host sends a DHCPDISCOVER message to a special IP address (255.255.255.255) that is an IP broadcast address.
 - This means it will be received by all hosts and routers on that network.
 - As Routers do not forward such packets onto other networks, it prevents broadcast to the entire Internet.
 - In the simplest case, one of these nodes is the DHCP server for the network.
 - The server would then reply to the host that generated the discovery message .All the other nodes would ignore it.
 - However, it is not really desirable to require one DHCP server on every network because this still creates a potentially large number of servers that need to be correctly and consistently configured.
 - Thus, DHCP uses the concept of a *relay agent*. There is at least one relay agent on each network, and it is configured with just one piece of information: the IP address of the DHCP server.
 - When a relay agent receives a DHCPDISCOVER message, it unicasts it to the DHCP server and awaits the response, which it will then send back to the requesting client.

- Following diagram

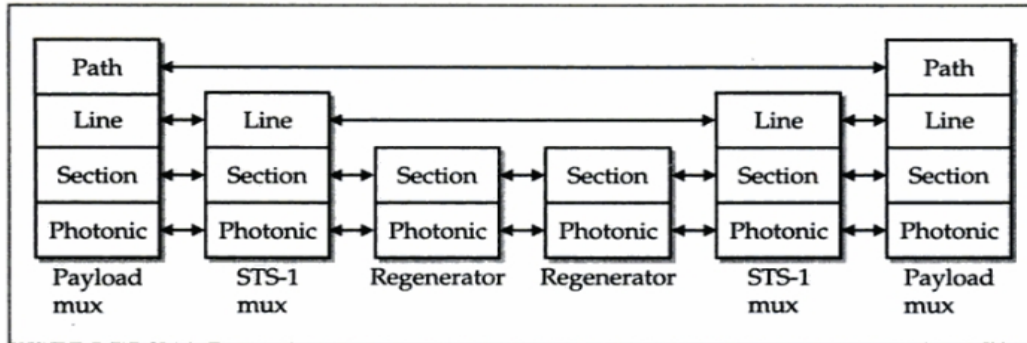
(optional) 1Mark



Q1b.

- Below diagram
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2 Marks



Description of each layer covering any two of following points **4Marks(1 Mark for each layer)**

- Photonic Layer –
 - optical Properties of transmission path
 - Sending, receiving 0's and 1's
 - Lasers, LED's and their paired receiving devices
 - Transport of bits across physical medium
 - Conversion of STS electrical frames into optical OC bits
- Section Layer –
 - Also called Regenerator Section –as 0's and 1's are to be regenerated regularly every 10 kilometers on a 100 km SONET Link
 - Every segment between regenerator forms a section of SONET
 - Manage Transport of STS Frames, error monitoring , framing, signal scrambling, transport of section layer overhead
- Line Layer
 - Important for maintenance and protection –also called maintenance span
 - Manage transport of entire SONET payloads i.e. STS frames
 - Multiplexing and synchronization
- Path Layer
 - End to end transmission /customer to customer transmission
 - Bits originate from one end and terminate at other end
 - May be actual end user devices like desktop or server
 - Most of the time SONET multiplexing devices
 - Combine bit stream from many end user devices to send to other end
 - Data streams are broken out into companion SONET CPE(Customer Premises Equipment)
 - Path layer transports actual networking service between SONET multiplexing equipments like DS-1 DS-3, ATM
 - Maps the components into format required by Line layer

Below description of overhead either separately or within above description **2Marks (0.5 marks each)**

Photonic layer-

- No overhead

Section Layer-

- Section Overhead (SOH): Section layer overhead-nine bytes-required for section layer to perform its function-generated by SONET's Section Terminating Equipment STE

Line Layer-

- Line Over Head (LOH):
 - Line layer overhead 18 bytes
 - To help line layer perform its functions
 - To communicate with other layers
 - For protection and maintenance features
 - This overhead is created by SONET Line Terminating Equipment (LTE)

Path Layer-

- Path Overhead (POH):
 - Path Overhead POH is considered a part of Payload Envelope (SPE)
 - POH remains unchanged through all other layers
- SOH+LOH=Transport Overhead (TOH)

Q2a.

- Following calculation **2Marks**

$$\frac{20(\text{hard disks}) \times 8 \times 10^{12}(\text{capacity of hard disk each} \in \text{bytes}) \times 8 \text{ bits}}{2 \text{ hrs} \times 60 \text{ minute} \times 60 \text{ seconds}} = 177.77 \text{ Gbps}$$

- Below any one justification **2Marks**
 - Fiber optic cable will have one time installation cost and life time maintenance cost so data transfer cost will reduce with time where as carrying data via roads will require cost of petrol/diesel/gas, cost of road toll, driver charges that will change regularly and mostly continue to increase
 - Such solution lacks uniformity of implementation on various geographical areas.

Q2 b.

Following table with all correct entries **4Marks**

Node	Distance to reach Node			
	A	B	C	D
A	0	2	5	∞
B	2	0	∞	∞
C	5	∞	0	2
D	∞	∞	2	0

Q2 c.

Explanation of SONET building Blocks OC, STS, STM, line rate, payload and overhead **1Mark**

Explanation of SONET basic speed as below **1Mark**

$$(9 \times 90 \text{ bytes per frame} \times 8 \text{ bits per byte} \times 8000 \text{ frames per second} = 51.840 \text{ Mbps})$$

Explanation that all higher speeds are multiple of basic speeds with example **1Mark**

Following explanation **1Mark**

The OC-12 frames are $12 \times 90 = 1080$ columns of 9 rows. Of these, $12 \times 3 = 36$ columns are taken up by line and section overhead. This leaves an SPE of 1044 columns.

One SPE column is taken up by path overhead, leaving 1043 columns for user data.

Since each column holds 9 bytes of 8bits, an OC-12 frame holds 75,096 user data bits. With 8000 frames/sec, the user data rate is **600.768 Mbps**.

Q2d.

- Diagram of ATM cell header **1Mark**

GFC(4)	VPI(8)	VCI(16)	Type(3)	CLP(1)	CLP(CRC-8)	Payload(48 bytes)
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- Description of any two of following **2Marks**
 - Virtual path Identifier (VPI)
 - Virtual circuit identifier (VCI)
 - Header Error check (HEC)
- **Similar networks:**
- X.25/Frame Relay/SONET. All are connection oriented networks **1Mark**