



MALAYSIAN INSTITUTE OF INFORMATION TECHNOLOGY

---

**FINAL EXAMINATION**  
**JANUARY 2016 SEMESTER**

---

**SUBJECT CODE** : INB48203  
**SUBJECT TITLE** : HIGH SPEED NETWORK (BROADBAND)  
**LEVEL** : BACHELOR  
**TIME / DURATION** : 2.00PM – 4.00PM  
( 2 HOURS )  
**DATE** : 23 MAY 2016

---

**INSTRUCTIONS TO CANDIDATES**

---

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. This question paper consists of TWO (2) sections only: Section A and Section B.
4. Answer all questions in Section A and TWO (2) questions from Section B.
5. Please write your answers on the answer booklet provided.
6. Answer all questions in English.

---

THERE ARE 10 PAGES OF QUESTIONS, INCLUDING THIS PAGE

---

**SECTION A (Total: 50 marks)****INSTRUCTION: Answer ALL questions.****Please use the answer booklet provided.****Question 1**

a) High-speed broadband technologies are developed to support communication of data over Wide Area Networks (WANs). WAN is a data communication network that operates beyond the geographic scope of a LAN.

i. Explain THREE (3) major characteristics of a WAN. (6 marks)

ii. Most early broadband technologies implement the virtual circuit packet switching technique for data transmission. Discuss the aim of this technique. (7 marks)

iii. In order to increase performance of network, most early broadband technologies opt for statistical (asynchronous) TDM as the method of multiplexing. Differentiate between the original TDM and statistical TDM. (4 marks)

b) SONET is a set of standard interfaces in an optical synchronous network of elements (NE) that conform to these interfaces.

i. SONET NEs may receive signals from a variety of facilities and network topologies. Determine the requirement of SONET NEs to support this function. (2 marks)

ii. Hierarchical process is required to allow non-SONET signals to use SONET. Elaborate the process. (6 marks)

[25 marks]

**Question 2**

a) Leaky bucket algorithm is commonly being used in determining if an incoming cell conforms to traffic parameter.

- i. Clarify the effect that may occur if a client sends number of cells:
  - a. more than the Peak Cell Rate.
  - b. less than the Sustainable Cell Rate.

(4 marks)

- ii. The following parameters are given:
  - Peak Cell Rate = 250 cells/sec
  - Sustainable Cell Rate = 70 cells/sec
  - Maximum Burst Size = 100 cells

Using suitable formula, calculate the bucket size.

(3 marks)

- iii. Assume that a client tries to send 83 cells continuously at Peak Cell Rate. Based on the result derived in b(ii), determine the number of:
  - a. Cells that are already leaked out when the bucket is full.
  - b. Compliant cells.
  - c. Noncompliant cells.

(3 marks)

b) Figure 1 shows a simple architecture of an MPLS domain. Observe the architecture and answer the following questions.

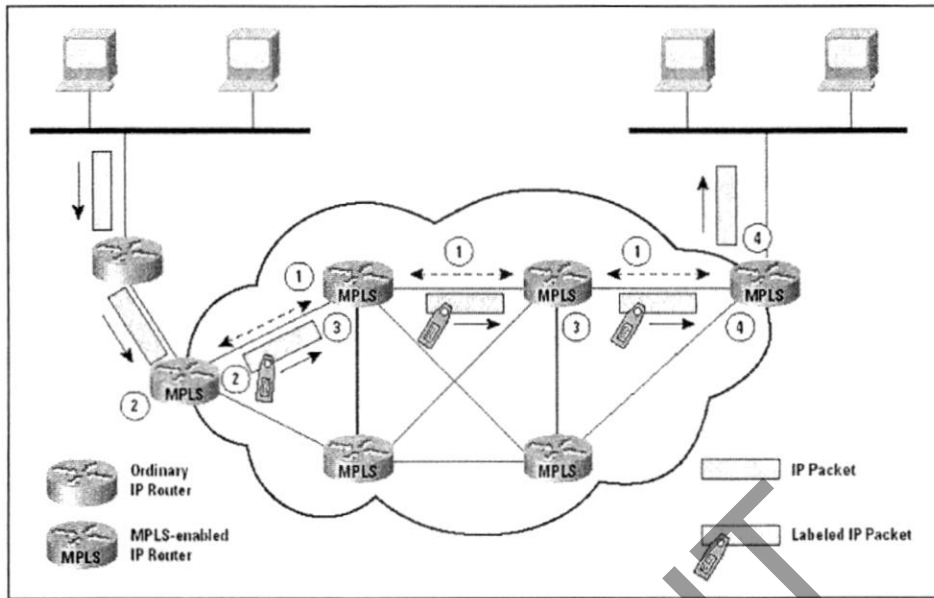


Figure 1: Architecture of MPLS Domain

- i. Prior to the routing and delivery of packets in a given FEC, a path through the network, known as a Label Switched Path (LSP), must be defined, as indicated by Operation 1. Discuss TWO (2) processes needed to accomplish these tasks. (4 marks)
- ii. Identify the devices that are responsible for Operation 2, Operation 3 and Operation 4 respectively. (3 marks)
- iii. List the processes involved in Operation 3. (4 marks)
- iv. Differentiate between Operation 2 and Operation 4. (4 marks)

[25 marks]

SECTION B (Total: 50 marks)

INSTRUCTION: Answer TWO (2) questions ONLY.

Please use the answer booklet provided.

Question 1

- a) Figure 2 indicates the map between X.25 key protocols and the OSI reference model. Examine the figure and answer the following questions:

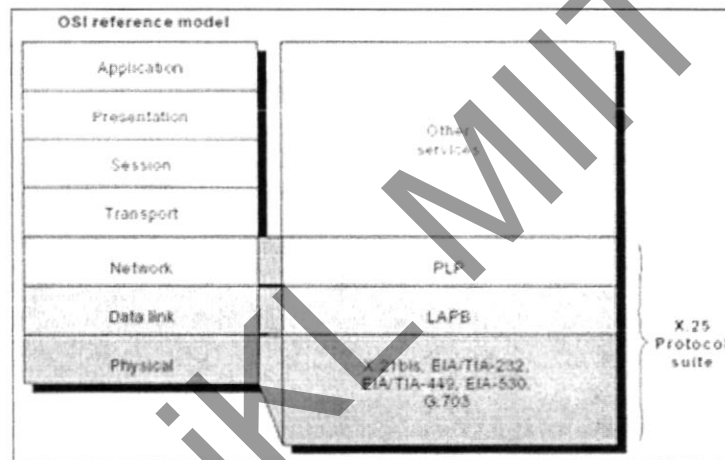


Figure 2: Map between X.25 Protocols and OSI Model

- i. Discuss the functions of Link Access Procedure, Balanced (LAPB) of X.25. (4 marks)
- ii. Packet Layer Protocol (PLP) is the X.25 network layer protocol. It operates in FIVE (5) modes. Explain the flow of PLP operation. (10 marks)

b) Frame Relay is the improvement of X.25, where it includes more advanced digital and fiber optic connections. Frame Relay was originally designed for use on ISDN and it provides permanent virtual and switched virtual circuit connections.

- i. Because of the shared resources of a virtual circuit, congestion can cause loss of packets when buffers become full. This lead to communication problems and due to this, congestion control mechanism is required. Explain the function of the following address-field bits for congestion control.
  - a. FECN bit
  - b. BECN bit
  - c. DE bit

(6 marks)

- ii. Frame Relay virtual circuits are identified by data-link connection identifiers (DLCIs). DLCIs have local significance. Define 'local significance' in this context.

(3 marks)

- iii. Unlike X.25, frame relay does not provide error checking or require ACK in data link layer. Explain how error checking function is being supported in a frame relay network.

(2 marks)

[25 marks]

**Question 2**

a) Wavelength-division multiplexing (WDM) is a method of combining multiple signals on laser beams at various infrared (IR) wavelengths for transmission along fiber optic media. Each laser is modulated by an independent set of signals.

- i. Wavelength Division Multiplexing (WDM) multiplexes multiple optical carrier signals on a single optical fiber. Explain how WDM differentiate between one carrier signals to another.

(3 marks)

- ii. There are two types of WDM: Coarse Wavelength Division Multiplexing (CWDM) and Dense Wavelength Division Multiplexing (DWDM). An individual fiber optic cable that applied DWDM has the capacity of 100 to 1000 Gbps, whereas the capacity of a CWDM fiber optic cable is between 20 and 40 Gbps only. Discuss the features of DWDM that allow the high capacity transmission.

(6 marks)

- iii. Multiplexing a single low rate data connection onto a wavelength is very inefficient. If a FastEthernet connection is transported on a WDM wavelength, only 4% of the bandwidth is used. This assumes the wavelength is capable of transporting 2.5 Gbps. Discuss the solution for this wastage issue.

(6 marks)

b) Examine Table 1 and answer the following questions:

Table 1: Bit Rate for Fiber Cables

<i>STS</i>	<i>OC</i>	<i>Rate (Mbps)</i>
STS-1	OC-1	51.840
STS-3	OC-3	155.520
STS-9	OC-9	466.560
STS-12	OC-12	622.080

- i. Discuss how SONET allows STS-3 to achieve 155.520 Mbps. (7 marks)
- ii. Calculate the user data rate for STS-3 signal. (3 marks)
- [25 marks]

Unikl MIT



## Question 3

a) WiMAX (Worldwide Interoperability for Microwave Access) is a wireless industry coalition dedicated to the advancement of IEEE 802.16 standards for broadband wireless access (BWA) networks. Like other BWA technologies, WiMAX is also suffering from multipath signal. The occurrence of multipath signal is common especially at hilly areas, or areas with lots of high-rise building.

- i. Define multipath signal in NLOS environment. (2 marks)
- ii. Explain the problem with multipath signal. (3 marks)
- iii. One of the technology solutions for the issue of multipath signal in Non-Line of Sight (NLOS) in WiMAX is to have Adaptive Antenna System (AAS). Briefly explain the implementation of AAS. (2 marks)
- iv. Discuss THREE (3) benefits of AAS implementation. (6 marks)

b) Long Term Evolution (LTE) refers to a standard for smooth and efficient transition toward more advanced leading-edge technologies to increase the capacity and speed of wireless data networks.

- i. Specify THREE (3) key features of LTE-Advance that are improved from the previous LTE releases.

(6 marks)

- ii. Determine THREE (3) reasons behind the selection of Orthogonal Frequency Division Multiplexing (OFDM) as the multicarrier modulation technique used for downlink data transmission in LTE.

(6 marks)

[25 marks]

UNIKL MITT  
END OF EXAMINATION PAPER