



Strathmore
UNIVERSITY

STRATHMORE UNIVERSITY
SCHOOL OF COMPUTING AND ENGINEERING SCIENCES
BACHELOR OF SCIENCE IN COMPUTER NETWORKS AND CYBER SECURITY
END OF SEMESTER EXAMINATION
CNS 3101 – WAN TECHNOLOGIES

DATE: 30th July, 2024

Time: 08:00-10:00 Hours

Instructions

1. This examination consists of **FIVE** questions.
2. Answer **Question ONE (COMPULSORY)** and any other **TWO** questions.

QUESTION ONE [30 Marks]

- a. ISDN is a digital communications technology.
 - i. Give two differences between BRI and PRI ISDN. **[2 Marks]**
 - ii. Give two main advantages of using ISDN over traditional analog telephone lines. **[2 Marks]**
 - iii. Which layer of the OSI model does ISDN operate in? **[1 Mark]**
- b. Asymmetric Digital Subscriber Line (ADSL) offers fast data transfer on a pair of telephone lines.
 - i. Explain the asymmetric nature of ADSL. **[2 Marks]**
 - ii. Explain the role of the Digital Subscriber Line Access Multiplexer (DSLAM) in ADSL technology. **[2 Marks]**
 - iii. Describe the primary frequency ranges used by ADSL for data transmission, and explain how ADSL avoids interference with traditional telephone service. **[2 Marks]**
- c. Asynchronous Transfer Mode (ATM) is a virtual circuit packet switching technology.
 - i. Explain the structure of an ATM. **[2 Marks]**
 - ii. Describe the role of Virtual Path Identifier (VPI) and Virtual Channel Identifier (VCI) in ATM networking. **[2 Marks]**

- d. SONET and SDH are standards for synchronous data transmission over optical fibers.
 - i. List 5 SONET STS levels and their corresponding data rates. **[5 Marks]**
 - ii. List 4 SDH stm levels and their corresponding data rates. **[4 Marks]**
 - iii. Calculate the effective bit rate of VT2 in STS-1 signal. **[2 Marks]**
- e. Describe the differences in the typical data rates and maximum reach between BPON and EPON networks. **[4 Marks]**

QUESTION TWO [15 Marks]

- a. Use a diagram to illustrate key components of an ADSL network **[5 Marks]**
- b. List and explain three characteristics of the Asynchronous Transfer Mode (ATM). **[3 Marks]**
- c. Explain why ATM transport would be preferred over IP transport for SCADA applications. **[2 Marks]**
- d. Describe the main components of an ISDN network. **[5 Marks]**

QUESTION THREE [15 Marks]

- a. Using a diagram explain how the media access control for downstream frames in TDM PON works **[5 Marks]**
- b. Name three types of BPON grants and explain their uses **[3 Marks]**
- c. Using a signalling diagram, explain the operation of Multi-Point Control Protocol (MPCP) auto configuration mode in EPON. **[7 Marks]**

QUESTION FOUR [15 Marks]

- a. Using a diagram, explain the structure of a SONET STS-1 frame. **[5 Marks]**
- b. Apart from VT2, list the different types of SONET VTs and their corresponding data rates. **[3 Marks]**
- c. Describe a floating SPE with respect to an STS-1 SONET frame and explain how pointers are used to facilitate the technology. **[3 Marks]**
- d. In a SONET frame with a pointer value of 0x17E, what is the byte position of the first byte of the SPE? **[2 Marks]**
- e. A stream of data is being carried by STS-1 frames. If the data rate of the stream is 49.540 Mbps, how many STS-1 frames per second must let their H3 bytes carry data? Note: Consider existence of transport and path overhead only **[2 Marks]**

QUESTION FIVE [15 Marks]

- a. A router receives packets and organises them into three classes of service as shown in table 1 before queuing them to be forwarded through one output port. At the start, queues for all classes are empty. Assume all packets arrive before any are sent.

Packet ID	Length*	Class of Service
1	100	1
2	100	1
3	100	1
4	100	1
5	190	2
6	200	2
7	110	3
8	50	3

Determine the order in which packets are transmitted by the router if:

- i. Fair queuing is used. **[5 Marks]**
 - ii. Weighted fair queuing, with flow 2 having weight 2, and the other two with weight 1. **[5 Marks]**
- b. Assume RTT of 75 ms through a link with available bandwidth of 1 Gbps and segment size of 576 bytes. Determine the window size needed to keep the pipe full and the time it will take to reach that window size after timeout occurrence. **[5 Marks]**