BIRLA INSTITUE OF TECHNOLOGY AND SCIENCE, PILANI
FIRST SEMESTER 2016-2017
BITS F372/EEE F346 DATA COMMUNICATION AND NETWORKS

MID-SEMESTER TEST {Closed-Book} **October 8, 2016**

Note: TEST Duration is 90 minutes. Each question carries 4 marks. Answer questions in sequence. Use blue/black ink only.

1. (a) How many point-to-point WANs are needed to connect n LANs if each LAN should be able to directly communicate with any other LAN? (b) Two computers are connected by an Ethernet hub at home. Is this a LAN or WAN? Explain with a reason.

2. Assume a system using five protocol layers. If the application program creates a message of 150 bytes and each layer adds a header of 20 bytes to the data unit, what is the overhead efficiency of the system?

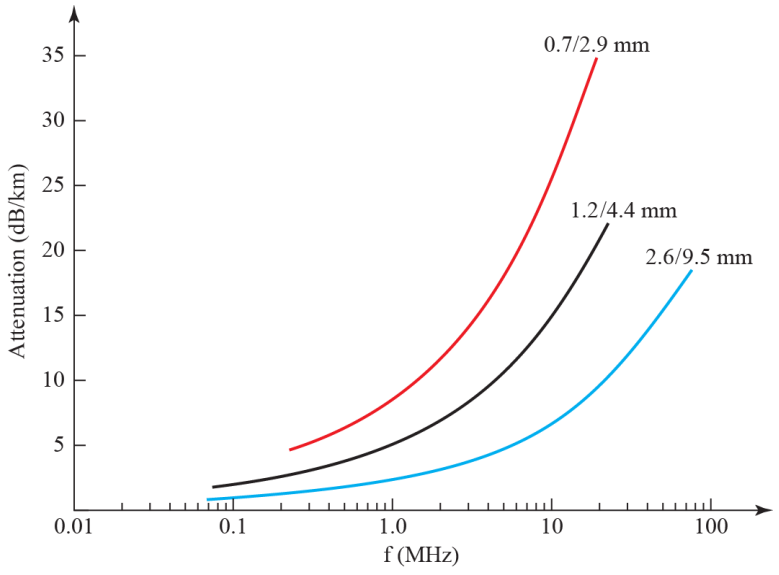
3. What is the total delay for a frame of size 5 million bits that is being sent on a link with 10 routers each having a queuing time of 2 μs and a processing time of 1 μs. The length of link is 2000 km. The speed of light inside the link is 2×10^8 m/s. The link has a bandwidth of 5 Mbps. Which component of the total delay is dominant? Which one is negligible?

4. What is the data rate for a baseband channel of 2 MHz bandwidth if line coding schemes of NRZ-L, Manchester, MLT-3 and 2B1Q are used?

5. A corporation has a medium with a 1-MHz bandwidth (low-pass). The corporation needs to create 10 separate independent channels each capable of sending at least 10 Mbps. The company has decided to use QAM technology. What is the number of points in the constellation diagram for each channel?

6. Four channels, two with a bit rate of 300 kbps and two with a bit rate of 150 kbps, are to be multiplexed using multiple-slot TDM with no synchronization bits. (a) What is the size of frame in bits? (b) What is the frame rate? (c) What is the duration of a frame? (d) What is the data rate?

7. If the power at the beginning of a 1 km 2.6/9.5 mm coaxial cable is 300 mW, what is the power at the end for frequencies, 10 kHz and 100 kHz?



8. Five equal size datagrams belonging to the same message leave for the destination one after another. However they travel through different paths as shown in Table below:

Datagram	Path Length	Visited Switches
1	32,000	1, 3, 5
2	11,700	1, 2, 5
3	12,200	1, 2, 3, 5
4	10,200	1, 4, 5
5	10,700	1, 4, 3, 5

Assume that the delay for each switch (including waiting and processing) is 3, 10, 20, 7, and 20 ms respectively. Assuming that the propagation speed is 2×10^8 m, find the order the datagrams arrive at the destination and the delay for each. Ignore any other delays in transmission.

9. (a) Why does a host or a router need to run the ARP program all of the time in the background? (b) Are network and data link layers needed in network where all hosts are connected in mesh topology?

10. Given the data word 101001111 and the divisor 10111, show the generation of the CRC codeword at the sender site (using binary division).

11. Assume that Stop-and-Wait Protocol now includes a NAK, which is used when a corrupted frame arrives and is discarded. Draw flow diagram for the protocol.

12. In a bus CSMA/CD network with a data rate of 10 Mbps, a collision occur 20 μs after the first bit of the frames leaves the sending station. What should be the length of frame so that the sender can detect the collision?

13. Assume the length of 10Base5 cable is 2500 m. if the speed of propagation in a thick coaxial cable is 2×10^8 m/s, how long does it take for a bit to travel from the beginning to the end of the network? Assume there is a delay in the equipment.

14. What are the services provided by telephone companies using DSL? Distinguish between a DSL Modem and a DSLAM.

15. (a) An access point (AP) in a wireless network plays the role of a link layer switch in a wired network, but link layer switch do not have a MAC address, but AP needs a MAC address. Explain. (b) An AP may connect a wireless network to a wired network. Does the AP need to have two MAC addresses in this case? Give reasons to justify your answer.