Total number of printed pages–5

53 (IT 302) DTCM

2021

DATA COMMUNICATION

Paper : IT 302

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* How can OFDM achieve high data rates ? Explain in details. 10

   (b) Describe step index and graded-index optical fibers. Why is single mode propagation impossible with graded-index optical fibers ? 10

2. *(a)* Briefly describe broadcast and point-to-point computer networks. List and briefly describe the transmission modes. 5+5=10

Contd.

(b) Draw a hybrid topology with a ring backbone and three bus networks. 5

(c) Assume we want to transmit the following binary string : 1101001. Show the resulting signal using the following line coding techniques :

(i) Unipolar NRZ

(ii) Unipolar RZ

(iii) Manchester NRZ. 5

3. (a) What is a MAC address ? What is the difference between a MAC address and an IP address ? Consider sending a packet from a source host to a destination host over a fixed route. List the delay components in the end-to-end delay. Which of these delays are constants and which are variables ? Explain. 5+5=10

(b) What are some of the possible services that a link layer protocol can offer to the network layer ? Which of these link layer services have corresponding services in IP, in TCP ? 10

4. *(a)* Show that two-dimensional parity checks can correct and detect a single-bit error. Show, (give an example of) a double-bit error can be detected but not be corrected. 10

(b) In sliding window protocol, compute approximate optimal window size when packet size is 53 bytes, RTT is 60*msec* and bottleneck bandwidth is 155*Mbps*. 5

(c) Consider all links in the network, use TDM with 24 slots and have a data rate of 1·536*Mbps*. Assume that host *A* takes 500*msec* to establish an end-to-end circuit with host *B* before begin to transmit the file. If the file is 512 kilobytes, then how much time will it take to send the file from host *A* to host *B*? 5

5. *(a)* A bit stream 10011101 is transmitted using standard CRC method. The generator polynomial is $x^3 + 1$.

(i) What is the actual bit string transmitted?

(ii) Suppose the third bit from the left is inverted during transmission. How will the receiver detect this error? 5+5=10

(b) Consider a 10 *Mbps* Ethernet LAN that has stations attached to a 2·5 *km* long coaxial cable. Given that the transmission speed is $2 \cdot 3 \times 10^8 m/sec$, the packet size is 128 bytes out of which 30 bytes are overhead, find the effective transmission rate and maximum rate at which the network can send data. 5

(c) On a wireless link, the probability of packet error is 0·2. A stop and wait protocol is used to transfer data across the link. The channel condition is assumed to be independent from transmission to transmission. What is the average number of transmission attempts required to transfer 100 packets? 5

6. (a) Four channels, two with a bit rate of 200 *kbps* and two with a bit rate of 150 *kbps* are to be multiplexed using multiple slots TDM with no synchronisation bits.

Answer the following questions :

Assume 4 bits from the first 2 sources and 3 bits from the second 2 sources.

(i) What is the size of a frame in bits?

(ii) What is frame rate?

(iii) What is the duration of a frame?

(iv) What is the data rate? 10

(b) Write short notes on : 5×2=10

(i) Quadrature Amplitude Modulation

(ii) Hamming Code.