53 (IT 302) DTCM

2017

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) Assume eight devices are arranged in a mesh topology. How many cables are needed ? How many ports are needed from each device ?   2+2=4

   (b) Why are protocols needed ? What are some advantages of layering ?

                                              2+2=4

   (c) Explain with a diagram OSI protocol stack. Describe the functions of each layer.   12

2. (a) 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 $2\mu s$ and a processing time of $1\mu s$? The length of the link is $2000\,km$. The speed of light inside the link is $2\times10^8 m/s$. The link has a bandwidth of $5Mbps$. Which component of the total delay is dominant ? Which one is negligible ? 5

(b) What is the function of twisting in the twisted pair cable ? Name the advantages of optical fibre over twisted pair and coaxial cable. 5

(c) Suppose that a digitized TV picture is to be transmitted from a source that uses a matrix of 480×500 picture elements (pixels), where each pixel can take on one of 32 intensity values. Assume that 30 pictures are sent per second. 10

(i) Find the source rate R (bps).

(ii) Assume that TV picture is to be transmitted over a channel with $4.5MHz$ bandwidth and a $35dB$ SNR. Find the capacity of the channel.

(iii) Discuss how the parameters given in part (i) could be modified to allow transmission of color TV signals without increasing the required value of R.

3. (a) Explain QAM technique in details with a diagram. 10

(b) What are different line coding schemes? Explain *any two* with diagram. 10

4. (a) What is the purpose of NAV in CSMA/CA? 3

(b) Check to see if the following set of chips can belong to an orthogonal system. 2

$[+1,+1,+1,+1]$, $[+1,-1,-1,+1]$
$[-1,+1,+1,-1]$ $[+1,-1,-1,+1]$

(c) There are only three active stations in a slotted Aloha network : A, B and C. Each station generates a frame in a time slot with the corresponding probabilities $P_A = 0.2$, $P_B = 0.3$ and $P_C = 0.4$ respectively.

(i) What is the throughput of each station?

(iii) What is the throughput of the network ? 5

(d) What is OFDM ? How does OFDM work ? Explain in details. 10

5. (a) Two neighboring nodes A and B use a sliding window protocol with a 3 bit sequence number. As the ARQ mechanism, Go-back-N is used with a window size of 4, Assuming A is transmitting and B is receiving, show the window positions for the following succession of events

    (i) Before A sends any frame.

    (ii) After A sends frames 0,1,2 and receives acknowledgement from B for 0 and 1.

    (iii) After A sends frames 3,4,5 and B acknowledges 4 and ACK is received by A. 5

(b) Differentiate between error control and flow control. 5

(c) Byte stuff the following frame payload in which E is the escape byte, F is the flag byte, and D is the data byte other than an escape or a flag character.

5

D	E	D	D	E	D	D	D	E	F	D	F

(d) Compare and contrast HDLC and PPP.

5

6. *(a)* What is forward error correction ? Given the dataword 101001111 and the divisor 10111, show the generation of the CRC codeword at the sender site.

2+5=7

(b) What is Hamming Distance ? If we want to detect two bit errors, what should be the minimum hamming distance ?

2+2=4

(c) Give comparison among Hubs, Switches and Bridges.

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7. Write short notes on : 10×2=20

(a) Transmission Impairment

(b) Frame Relay.

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