B.E. COMPUTER SCIENCE & ENGINEERING 3RD YEAR 1ST SEMESTER EXAM- 2018

DIGITAL COMMUNICATION SYSTEM

Time: 3 hours

Full Marks: 100

Answer question 1 and any four questions
All questions carry equal marks

1. Answer any ten   10X2=20
    i.   Why protocols are needed?
    ii.   What are the advantages of multipoint connection over a point-to-point connection?
    iii.   Distinguish between baseband transmission and broadband transmission. Give examples.
    iv.   Why speed of an EM wave is less than c (3 X 10^8 m/s)?
    v.   Why a single frequency sine wave is not useful in data communications? Explain with an example.
    vi.   What are the differences between parallel and serial transmission?
    vii.   Distinguish between data rate and signal rate.
    viii. Define digital-to-analog conversion.
    ix.   Distinguish between forward error correction versus error correction by retransmission.
    x.   Describe the goals of multiplexing
    xi.   What is the significance of twisting in twisted pair cable?
    xii.   What is framing? Why it is required?

2. a) How do the layers of the TCP/IP model correlate to the layers of the OSI model? Explain with layered architecture of both the models. What are the main responsibilities of physical layer? Explain them.   5+5

    b) Which layer is responsible for node-to-node delivery? Besides, what are the other responsibilities of this layer? Explain them. How many levels of addresses are used in TCP/IP? Explain the relationship of the layers and addresses in TCP/IP with a suitable layered diagram.   (2+3)+(2+3)

3. a) How Fourier series is used to decompose a composite signal? Differentiate the decomposition of a composite periodic signal and non-periodic signal. What is the effect of decomposition of digital signal (periodic and non-periodic) on frequency, amplitude and bandwidth explain with a diagram (time domain and frequency domain).   2+2+(3+3)

    b)   Explain the case of low-pass channel with limited bandwidth in baseband communication. Does the Nyquist theorem bit rate agree with the intuitive bit rate described in baseband transmission? Assume that a channel has 1MHz bandwidth. The SNR for this channel is 63. What are the appropriate bit rate and signal level?   3+2+5

4. a) What are the issues in Unipolar encoding scheme? –Explain them. Explain the Manchester and Differential Manchester schemes. How they overcome the problems associated with polar schemes?   3+5+2

b) What is single sideband (SSB) modulation? What are the main benefits of SSB? How one can determine if a particular FM signal will be wide or narrow? Explain how Bessel functions are used to determine the amplitude of the carrier. 2+2+2+4

5. a) Explain the bandwidth requirement of FSK. Show that the bandwidth with d=0 in multilevel FSK is B=L X S. Assume that the available bandwidth is 100 kHz, which spans from 200 to 300 kHz. What should be the carrier frequency and the bit rate if data is modulated using FSK with d = 1? 3+4+3

b) "In synchronous TDM, the data rate of the link is n times faster, and the unit duration is n times shorter."- Explain it. Assume that there are four sources, each creating 250 characters per second. If the interleaved unit is a character and 1 synchronizing bit is added to each frame, find (i) the data rate of each source, (ii) the duration of each character in each source, (iii) the frame rate, (iv) the duration of each frame, (v) the number of bits in each frame, and (vi) the data rate of the link. 4+6

6. a) Explain the working procedure of CRC encoder and decoder. Which of the following g(x) values guarantees that a single bit error is caught? In each case, what is the error that cannot be caught? (i) x+1 (ii) x^3 (iii) 1. 4+(3+3)

b) What kind of error is undetectable by the checksum? Explain with an example. A sender needs to send a list of five 4-bit numbers (8,11,13,6,7), answer the following. (i) Find the checksum at the sender site. (ii) Find the checksum at the receiver site if there is no error. (iii) Find the checksum at the receiver site, if the second item is changed to 10. (iv) Find the checksum at the receiver site, if the second item is changed to 10 and the third item is changed to 14. 2+8

7. a) Describe the services provided by the data link layer. Explain the Stop-and-Wait ARQ protocol with an illustration of the mechanism. 3+7

b) Define piggybacking and its usefulness. Assume that, in a Stop-and-Wait ARQ system, the bandwidth of the line is 1Mbps, and 1 bit takes 20ms to make a round trip. What is the bandwidth-delay product? If the system data frames are 1000 bits in length, what is the utilization percentage of the link? What is the bandwidth-delay product and the utilization percentage of the link if a protocol can send up to 15 frames before stopping and worrying about the acknowledgements? 2+(2+2+(2+2))