M.Sc./II Sem. - 2015

INFORMATICS - Paper IT-21

Voice and Data Communication

Time: 3 hours *Maximum Marks: 75*

(Write your Roll No. on the top immediately on receipt of this question paper)

Attempt five questions in all. Question No. **1** *is compulsory*

Q.1(a)Define *digital transmission* and *digital modulation* and describe the difference between them. (3)

(b) Describe the relationship between bit rate, bandwidth and baud for ASK. (3)

(c) What is the relationship between *bandwidth* and *information capacity*? (3)

(d) Why is single-mode propagation impossible with graded-indexed optical fibers? (3)

(e) List the advantages and disadvantages of WDM. (3)

Q.2 (a) Distinguish between *single bit error* and *burst error* (3)

(b) Draw a schematic diagram for the structure of encoder and decoder in error correction. In the following (Table:1)

Table : 1

Datawords	*Codewords*
00	000
01	011
10	101
11	110

the sender sends dataword 10. A 3-bit burst error corrupts the code word. Can the receiver detect the error? Defend your error. (4)

(c) Which of the following CRC generators guarantee the detection of a single bit error? (5)

(*i*) $x^4 + x^2$, (ii)$x^3 + x + 1$, (iii)$x^2 + 1$, (iv)1

(d) We need a dataword od at least 16 bits. Find the values of k and n in the Hamming code $C(n, k)$ with $dmin = 3$. (3)

Q.3 (a) What is the polynomial representation of 101010? What is the result of shifting 101010 three bits to the left and also four bits to the right? IC1521 (4)

(b) Obtain the results in the following operation: (4)

(*i*) $(x^3 + x^2 + x + 1) + (x^4 + x^2 + x + 1)$

(*ii*) $(x^3 + +x^2 + x + 1)/(x^2 + 1)$

(c) A sender needs to send the four data items 0x3456, 0xABCC , 0x02BC , and 0xEEEE. Answer the following: (7)

(*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 data item is changed to 0xABCE.

Q.4 (a) Give one line definition of a satellite. (2)

(b) Which would have a higher velocity: an LEO satellite or a GEO satellite? Give reasons for your answer. (2)

(c) According to Kepler's law, what is the period of a satellite that is located at an orbit approximately 35, 786km above the earth? Given that the radius of the earth as 6378km. (4)

(d) Define the (*i*) acceptance angle (θ_A) and (*ii*) Numerical aperture of a fiber (NA). Deduce a relation between the θ_A and NA. (4)

(e) An optical fiber system is provided with the following data: (3)

(*i*) Fiber diameter = 5.5μm

(*ii*) Refractive index of core = 1.55

(*iii*) Cladding refractive index = 1.52

(*iv*) Propagating wavelength = 1.2μm

Find out the number of modes propagated inside the fiber?

Q.5(a) Assume that a page has 24 lines and in each line there are 80 characters. Further assuming that we need to download text documents at the the rate of 100 pages per minute, what is the required bit rate of the channel?

(2)

(b) We have low-pass channel with bandwidth 100kHz. What is the maximum bit rate of this channel? (3)

IC1525

(c) The loss in a cable is usually defined in decibels per kilometer (dB/km). If the signal at the beginning of a cable with $-0.3dB/km$ has a power of $2mW$, what is the power of the signal at $5km$? (3)

(d)List the various line coding schemes. Draw the graph of the NRZ-L scheme using each of the following data streams, assuming that the last signal level has been positive. From the graphs, guess the bandwidth for this scheme using the average number of changes in the signal level. (7)

(*i*) 11111111

(*ii*)00110011

(*iii*)01010101

Q.6 (a) Draw a schematic diagram to describe FDM- Multiplexing and Demultiplexing process. (4)

(b) Five channels, each with a $100kHz$ bandwidth, are to be multiplexed together. What is the minimum bandwidth of the link if there is a need for a guard band of $10kHz$ between the channels to prevent interference? (4)

(c) Explain the time division multiplexing (TDM) process. (3)

(d) Four channels are multiplexed using TDM. If each channel sends 100bytes/s and we multiplex 1 byte per channel, show the frame traveling on the link, the size of the frame, the duration of a frame, the frame rate, and the bit rate for the link. (4)