M.Sc. (INFORMATICS)/ II Sem – 2019
Paper IT 21 – Voice and Data Communication

TIME: 03 hours **Max 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

1. Attempt any five :
   a) Explain digital signal as a composition of analog signals.
   b) Why decibel unit is used to measure the changes in the strength of a signal?
   c) What is Shannon Capacity? A telephone line having bandwidth of 3000Hz is assigned for data communications. The signal to noise ratio is 3162. What is the channel capacity?
   d) Data needs to be send 3 bits at a time at a bit rate of 3Mbps. The carrier frequency is 10MHz. Calculate the number of levels (different frequencies), the baud rate, and the bandwidth.
   e) (i) What will be the number of sequences in CDMA technique if we have 90 stations in our network?
   (ii) Prove that a receiving station can get the data sent by a specific sender if it multiplies the entire data on the channel by the sender's chip code and then divides it by the number of stations.
   f) The apogee and perigee distances of a certain elliptical satellite orbit are 42000km and 8000Km , respectively. If the velocity at perigee point is 9.12 Km/s , what would be the velocity at the apogee point?

2. a) What is CDMA? Explain with example. How chip sequence is generated? (6)
   b) Explain statistical time division multiplexing. (4)
   c) A satellite launched with an injection velocity v_1 from a point above the surface of the Earth at a distance P from the centre of the Earth attains an elliptical orbit with an apogee distance A_1. The same satellite when launched with an injection velocity v_2 from the same perigee distance attains an elliptical orbit with an apogee distance A_2. Derive the relationship between v_1 and v_2 in terms of P, A_1 and A_2. (5)

3. a) Explain multilevel line coding scheme. (6)
   b) Explain B8ZS and 000VB0VB scrambling techniques. (5)
   c) Draw the graph of the NRZ-L scheme using each of the following data streams assuming that the last signal level has been positive.
   (i) 11111111
   (ii) 00000000
   (iii) 00110011
   (iv) 01010101 (4)

4. a) Discuss Hamming Codes. Calculate values of k and n that satisfies dataword of at least 7 bits. (6)

b) What is syndrome? Explain simple parity check code C(5,4) (5)

c) How does a single bit error differ from a burst error? What kind of error is undetectable by the checksum? (4)

5. a) Explain quadrature PSK (QPSK). Show the constellation diagrams for an ASK, BPSK, and QPSK signals. (9)

b) The telephone line has 4kHz bandwidth. What is the maximum number of bits that can be send using each of the following techniques? Let d = 0.

(i) ASK

(ii) QPSK

(iii) 64-QAM (6)

6. a) Explain Pulse Code Modulation (PCM). (9)

b) How many bits can fit on a link with a 3ms delay if the bandwidth of the link is

(i) 2Mbps?

(ii) 15Mbps?

(iii) 150 Mbps? (6)