Paper Code: IC2116

M.Sc. (INFORMATICS) II Sem – 2016
Paper IT-21 – Voice and Data Communication

(Attempt 5 Questions in ALL. Question 1 is compulsory)

Time: 3 hours Maximum Marks: 75

1. Attempt any five :

a) How can we represent the number -6 in one's complement arithmetic using only four bits?

b) Define single bit error and burst error.

c) A complex low pass signal has a bandwidth of 200 KHz. What is the minimum sampling rate of this signal?

d) In a digital transmission, the receiver clock is 0.1% faster than the sender clock. How many extra bits per second does the receiver receive if the data rate is 1Kbps? How many if the data rate is 1Mbps?

e) The power of a signal is 10mW and the power of the noise is 1μW; What are the values of SNR and SNR_{dB} ?

f) A digitized voice channel is made by digitizing a 4-KHz bandwidth analog voice signal. The signal needs to be sampled at twice the highest frequency. Assuming each sample requires 8 bits, what is the required bit rate?

g) A non-periodic composite signal has a bandwidth of 200 KHz, with a middle frequency of 140 KHz and peak amplitude of 20V. The two extreme frequencies have amplitude of zero. Draw the frequency domain of the signal. (5×3)

2.. a) Explain Data Rate for noiseless channel and noisy channel. (5)

b) Explain the concept of bandwidth delay product with suitable example. (5)

c) What is scrambling? Explain B8ZS and HDB3 scrambling technique. (5)

3. a) Explain various polar line coding scheme. (8)

   b) Explain satellite trajectories in terms of Injection velocity. (5)

   c) We need to send data at a 2Mbps rate. What is the minimum required bandwidth, using a combination of 4B/5B and NRZ-I or Manchester coding? Write the merits and demerits of both the coding in above case. (2)

4. a) Explain the concept of Hamming distance. Explain how it can be used for error detection and error correction. (6)

   b) What is CDMA? Explain with example. How chip sequence is generated? (6)

   c) Differentiate between step index and graded index fibres. Define numerical aperture. (3)

5. a) Explain with example CRC encoder and decoder. (6)

   b) A channel has a band width of 3000Hz. If the signal to noise ratio is 3162, find the channel capacity. (5)

   c) The elliptical orbit of a satellite has its semi-major and semi-minor axes as 25000Km and 18330 Km, respectively. Determine the apogee and perigee distance. (4)

6. a) Describe with example pulse code modulation (PCM) technique. (8)

   b) Explain frequency division multiplexing and time division multiplexing technique. (4)

   c) Apply the following operations on the corresponding polynomials:

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

   (ii) $(x^3 + x^2)x(x^4 + x^2 + x + 1)$

   (iii) $(x^3 + x^2 + x + 1)/(x^2 + 1)$ (3)