COURSE CODE: 10B11EC514   MAX.MARKS: 35
COURSE NAME: COMMUNICATION SYSTEMS   MAX. TIME: **2 Hrs**
COURSE CREDITS: 4

Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means.

1(a) Define Sampling Theorem. Prove it by deriving an expression of sampled signal in frequency domain.   **(1+3=4)**

1(b) The binary data **01101011** has to be transmitted over the communication channel. Draw the line codes using the following techniques:

(i) UNRZ   **(ii)** BRZ   **(iii)** Manchester   **(1+1+1=3)**

2(a) Discuss the modulation and demodulation of Pulse Position Modulation (PPM).   **(2+2=4)**

2(b) 25 voice signals are uniformly sampled and time division multiplexed. The highest frequency component of each voice signal is 4 KHz.

(i) If the signals are pulse amplitude modulated (PAM) at Nyquist sampling rate, what would be minimum channel bandwidth required?

(ii) If the signals are pulse code modulated (PCM) with 8 bit encoder, what would be the sampling rate? The bit rate of the PCM system is 1.5×10^6 bits/sec.   **(1.5+1.5=3)**

3(a) What is the need of Delta Modulation (DM)?   **(1)**

3(b) Explain the working principle of transmitter and receiver of delta modulation using block diagrams.   **(1.5+1.5=3)**

3(c) Discuss the limitation of Delta Modulation (DM). Discuss the methods to overcome these limitations in brief.   **(2+1=3)**

4(a) A 1 KHz signal is flat top sampled at a rate of 1800 samples/sec and samples are applied to an ideal rectangular LPF with cut-off frequency of 1100 Hz. Determine the frequencies present in the output of the filter.   **(2)**

4(b) Explain the working of transmitter and receiver of Binary Frequency Shift Keying (BFSK) with the help of block diagram. **(3)**

4(c) Compute the channel capacity for a telephone line of bandwidth 3 KHz at 30dB SNR. **(2)**

5(a) In an FM system, a 5 KHz modulating signal modulates a 105 MHz carrier wave so that the frequency deviation is 50 KHz. Find:

(i) Carrier swing in FM and modulation index of FM.

(ii) The highest and lowest frequencies attained by FM signal. **(1.5+1.5=3)**

5(b) The message signal $m(t) = 2 \cos\left(10t + \frac{\pi}{4}\right) + 4\sin\left(20t - \frac{\pi}{4}\right)$ is used to generate an SSB signal (carrier frequency is 100 rad/sec). Write the time domain expression for the SSB signal. Sketch its spectrum also. **(1+1=2)**

5(c) The spectrum of transmitted AM signal is given in fig.1. Find:

(i) Power Efficiency

(ii) Determine whether the message signal is envelope detectable or not. **(1+1=2)**

(Fig. 1)