USN | | | | | | | | | | |

10EC61

Sixth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Digital Communication

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions, selecting at least TWO questions from each part.***
2. ***Assume any missing data.***

PART – A

1 a. Show that time shifted Sinc function used in reconstruction of sampled signals i.e Sinc (2Wt – n) are mutually orthogonal. **(06 Marks)**

b. Explain the quadrature sampling with related block diagram, spectra and equations. **(06 Marks)**

c. A Signal g(t) consists of two frequency components f_1 = 3.9KHz and f_2 = 4.1 KHz in such a relationship that they just cancel each other g(t) is sampled at the instants t = 0, T, 2T, ...

Where T = 125μs. The signal g(t) is defined by $g(t) = \text{Cos}\left(2\pi f_1 t + \frac{\pi}{2}\right) + A\ \text{Cos}\ (2\pi f_2 t + \phi)$

Find the values of amplitude A and ϕ of the second frequency component. **(08 Marks)**

2 a. Explain TDM technique with a neat block diagram and relevant waveforms. **(06 Marks)**

b. The information in an analog signal voltage waveform is to be transmitted over a PCM system with an accuracy of ±0.1% (full scale)
The analog voltage waveform has a bandwidth of 100Hz and an amplitude range of -10 to +10 volts.
i) Determine the maximum sampling rate required
ii) Determine the number of bits in each PCM word
iii) Determine the minimum bit rate required in the PCM signal
iv) Determine the minimum absolute channel bandwidth required for the transmission of the PCM signal. **(08 Marks)**

c. What is the need for non-uniform quantization? Explain μ-law companding. **(06 Marks)**

3 a. With the block diagrams, explain the Adaptive delta modulation system. **(07 Marks)**

b. A Delta modulation system is tested with a 10-KHz Sinusoidal signal with 1V peak to peak at the input. It is sampled at 10 times the Nyquist rate
i) What is the step size required to prevent slope over load?
ii) What is the corresponding SNR? **(07 Marks)**

c. Present the data 100111010 using the following digital data formats.
i) Unipolar RZ ii) Split phase Manchester ii) M-ary system where m = 4. **(06 Marks)**

4 a. Define intersymbol interference and explain ideal solution for zero ISI with a mathematical scheme. **(08 Marks)**

b. A binary PAM wave is to be transmitted over a low-pass channel with an absolute maximum bandwidth of 75KHz. The bit duration is 10μSec. Find the raised Consine spectrum that satisfies these requirements. **(06 Marks)**

c. Write a note on Adaptive equalization. **(06 Marks)**

PART – B

5 a. With a block diagram, explain the coherent binary FSK – transmitter and receiver. **(10 Marks)**

b. Sketch the inphase and quadrature components of a QPSK signal for the binary sequence 110010111. Assume carrier frequency f_c to be equal to 1/Tb. Draw signal space diagram and QPSK waveform for the given sequence. **(10 Marks)**

6 a. Prove the Gram – Schmidt orthogonalization procedure. **(12 Marks)**

b. Explain geometric interpretation of signals in detail. **(08 Marks)**

7 a. Show that the probability of bit error of a matched filter receiver is given by $P_e = \frac{1}{2}\text{erfc}\sqrt{\frac{E_b}{N_o}}$. **(08 Marks)**

b. Explain the maximum likelihood detector. **(06 Marks)**

c. For the signal s(t) shown below in figure Q7(c)

i) Determine the impulse response of a filter matched to s(t)

ii) Plot the matched filter output as a function of time

iii) Determine the peak value of the output.

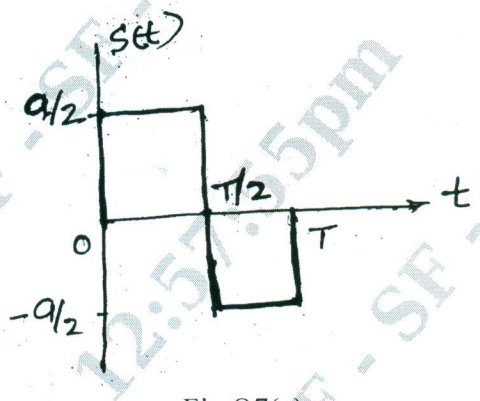

Fig Q7(c) **(06 Marks)**

8 a. Explain fast frequency hop spread spectrum system. **(10 Marks)**

b. The DSSS spread spectrum has following parameters. Data sequence bit duration T_b = 4.095ms PN chip duration, T_c = 1μs, $\frac{E_b}{N_o} = 10$ for average probability of error < 10^{-5}.

Calculate processing gain and jamming margin. **(06 Marks)**

c. Explain applications of spread spectrum modulation technique. **(04 Marks)**

* * * * *