Paper Code: EC- 602	Roll No.									

B.Tech.
(SEM VI) EVEN SEMESTER EXAMINATION, 2015-16
DIGITAL COMMUNICATION

[Time: 3 hrs.] **[Max. Marks: 100]**

Note- Attempt All Questions. All Questions carry equal marks.

1. Attempt any ***four***of the following questions: **[5x4 = 20]**

(a) Find PSDs for polar, on-off, and bipolar signaling, where p(t) is a full-width rectangular pulse, that is, p(t) = rect(t/T_b).

(b) A scrambler shown in fig.1 Design the corresponding descrambler. If a sequence S=**101010100000111** is applied to the input of this scrambler, determine the output sequence T. Verify that is this T is applied to the input of descrambler, the output is the sequence S.

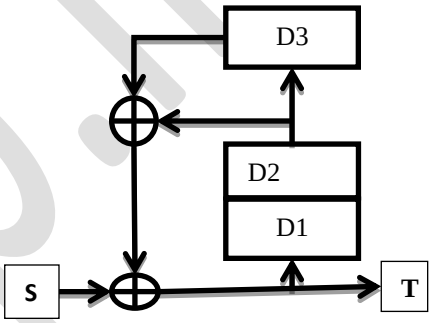

Fig. 1

(c) What is pulse shaping? Explain the effect of ISI and Nyquist's first criterion for zero ISI.

(d) Explain the importance of Eye Diagrams in Digital Communication with example.

(e) What is M-ary communication? What do you understand by 16- ary QAM?

(f) Explain the modulation and demodulation of phase-shift keying (PSK).

2. Attempt any ***four*** of the following questions: **[5x4 = 20]**

(a) For a certain binary non-symmetric channel it is given that $P_{y/x}(0/1)=0.1$ and $P_{y/x}(1/0)=0.2$ where x is a transmitted digit and y is the received digit. if$P_x(0)=0.4$, determine $P_y(1)$ and $P_y(0)$.

(b) Explain Cumulative Distribution Function (CDF). In a random experiment, a trial consists of three successive tosses of a coin. If we define an RV x as the number of heads appearing in a trial, determine $P_x(x)$ and $F_x(x)$.

(c) The PDF of amplitude x of a certain signal $x(t)$ is given by $p_x(x) = 0.5\ |x|e^{-|x|}$. Find the probability for:
i) $x \geq 1$, ii) $-1 < x \leq 2$, and iii) $x \leq -2$.

(d) Determine the mean and the mean square value of RV x is given by

$$p_x(x) = \frac{1}{2\sqrt{2\pi}} e^{\frac{(x-4)^2}{18}}$$

(e) For a Gaussian PDF $p_x(x) = (1/\sigma_x\sqrt{2\pi})e^{-x^2/2\sigma_x^2}$, show that

$$\overline{x^n} = \begin{cases} (1)(3)(5)\dots(n-1)\sigma_x^n & n\ even \\ 0 & n\ odd \end{cases}$$

(f) Ten regular dice are thrown. The sum of the numbers appearing on these 10 dice is an RV x. Find $\bar{x}$, $\bar{\bar{x}}$, and σ_x^2.

3. Attempt any ***two*** of the following questions: **[10x2 = 20]**

(a) What is binary threshold detection? Derive the expressionof transfer functions *H(f)*for Matched filter.

(b) In a binary transmission, a raised-cosine roll-off factor 0.2 is used for baseband polar transmission. the ideal low-pass channel has a bandwidth of $f_o = 5000Hz$.

i) If the channel noise is AWGN with spectrum $N/2$, find the optimum receiver filter.

ii) if the channel noise is Gaussian with spectrum

$$S_n(f) = 0.5\,\mathrm{N}\left(\frac{1}{1+\left(\frac{f}{f_o}\right)^2}\right)$$

find the optimum receiver filter.

(c) For white Gaussian noise derives the expression of BER for optimum binary linear receiver.

4. Attempt any ***two*** of the following questions: **[10x2 = 20]**

(a) Explain Frequency Hopping Spread Spectrum(FHSS) systems and its applications.

(b) Write a short note on Direct Sequence Spread Spectrum (DSSS).

(c) What is CDMA? Discuss the CDMA in Cellular Phone Networks.

5. Attempt any ***two*** of the following questions: **[10x2 = 20]**

(a) A (6, 3) code is generated according to the generating matrix G. the receiver receives r = 100011. Determine the corresponding data word if the channel is a single bit error.

$$G = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 \end{bmatrix}$$

(b) Construct a symmetric (7, 4) cyclic code using a generator polynomial $(x) = x^3 + x + 1$.

(c) For the convolutional encoder shown in fig. 2 draw the state and trellis diagrams and determine the output digit sequence for the data digits **11010100**.

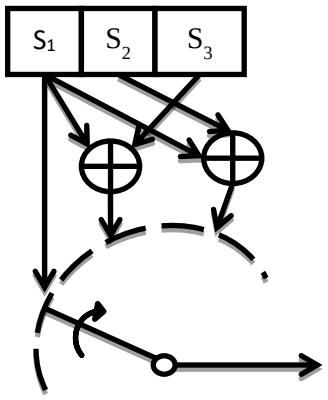

Fig. 2