JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- December 2017

B.Tech Semester Fifth

COURSE CODE: 10B11EC511   MAX. MARKS: 35

COURSE NAME: Digital Communications

COURSE CREDITS: 4   MAX. TIME: 2Hrs

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

1. [14 marks] Short answers type questions (answer within a few lines only).

   a. Draw constellation of 9-PSK and justify that it can be used in digital data transmission. 3

   b. Plot signal constellations of QPSK and 8-QAM with decision boundaries.   2

   c. What are the advantages of using OOK over BPSK?   2

   d. The signal constellation for a modified bandpass QPSK modulation is shown in the Figure-1. Compute the average energy of the signals with equal-probability.   2

   e. Which carrier modulation out of BASK, BPSK and BFSK is more power efficient?   1

   f. Which modulation technique is also known as fast FSK and why.   1

   g. Draw transmitter block diagram of quadrature-carrier multiplexing?   1

   h. Let P_{eI} and P_{eQ} denote the probabilities of symbol error for the in-phase and quadrature channels of a narrowband digital communication system. Find the average probability of correct symbol reception for the overall system.   1

   i. Draw the code vectors of odd-parity check 3-bit codes visualized in 3-D code space.   1

2. [6 marks] During the transmission, assume that bit errors occur with correlation (burst errors). Following are the probabilities for the burst error case. The probability Pcc=0.9 that current bit is correctly received if the previous bit was correctly received. The probability Pce=0.1 that current bit is received in error if the previous bit was correctly received. Similarly, the probability Pee=0.9 that current bit is received in error if the previous bit was received in error. The probability Pec=0.1 that current bit is correctly received if the previous bit received was in error. If a packet containing 100 bits is transmitted, find the probability that only initial 10 bits in the received packet are corrupted by the burst error.

3. [3 marks] Consider a (7,4) cyclic code with generator polynomial $g(D)=1+D^2+D^3$. Find the code word for message sequence (1001). Draw the encoder for this scheme using flip-flops.

4. [3 marks] Let $X(t)=A\cos(2\pi f_0 t+\Theta)$ be a continuous-time waveform where A is a random variable uniformly distributed over [0, x_{max}] and Θ is a random variable uniformly distributed over [0, 2π) and independent of A.

   a. Determine the power spectral density (psd) of $X(t)$.   1.5

   b. Let $X(t)$ be transmitted through a bandlimited channel such that the received signal is given by $Y(t)=aX(t)+bX(t-T)+N(t)$ where a, b are constants, $T>0$, $N(t)$ is AWGN with zero mean and psd $\frac{N_0}{2}$ W/Hz and is uncorrelated with $X(t)$. Determine the psd of $Y(t)$.   1.5

5. [2 marks] Consider an IID binary source and v(t) be the PAM signal NRZI as shown in the figure-2. Determine PSD, $S_v(f)$ of v(t) assuming rectangular pulse shaping.   (

6. [2 marks] Show that, with a uniform quantizer, the SQNR in dB of the PCM is approximately equal to $6n-7.2$ where n is the number of bits of the encoder used.

7. [2 marks] In delta modulation, distortions affect the choice of design parameter δ. Derive design expressions to choose δ value which you think is optimal to minimize distortions.

8. [2 marks] For triple repetition code, find the Generator matrix G, and Parity check matrix H and evaluate the syndrome s for "All possible single-error patterns".

9. [1 mark] Using the trellis below, find the convolutional code for message sequence (11011).
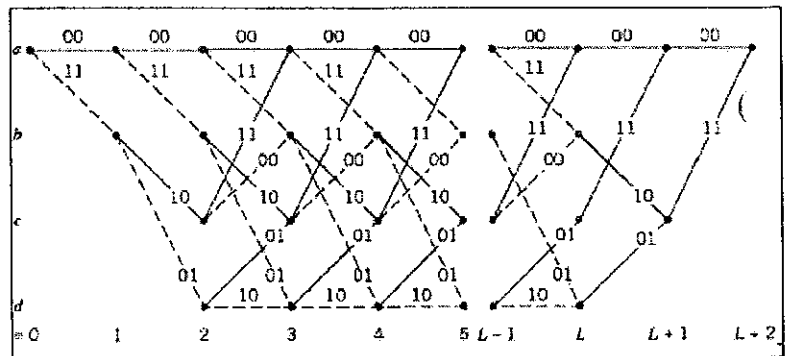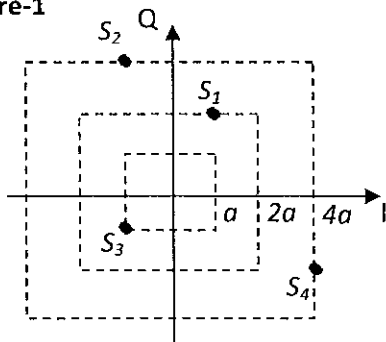
Figure-1

Figure-2

END