6E 6078

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B.Tech. VI Semester (Main&Back) Examination, May-June 2015

Electrical & Electronics Engineering

6EX6.3A Digital Communication and Information Theory

EE,EX

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt any **five** questions, selecting **one** question from **each unit**. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Unit - I

1. a) What is matched fieter? Write down the expression for the transfer function and the impulse response of a matched fieter for the signal p(t) which is of T-second duration. **(10)**

b) ADM system id designed to operate at 3 times the Nyquist rate for a signal with a 3khz bandwidth. The quantizing step size is 250mv. Calculate the maximum amplitude of a 1khz sinusoid for which the delta modulator does not show slope overload. **(6)**

OR

1. a) Describe the North American digital multiplexing hierarchy. What is the need for "frame synchronization"? How is it achieved? **(10)**

b) A message signal, bandlimited to 4khz is to be transmitted using a PCM system. If the quantization error of any sample is to be at the most ±1% of the dynamic range of the message signal, determine the minimum value of n, the minimum sampling rate and the corresponding bit rate of transmission. **(6)**

Unit - II

2. a) Draw the block diagram of an MSK transmitter and receiver and explain its operation. **(10)**

b) For the input binary sequence 1100110011, sketch the QPSK waveform. **(6)**

OR

2. a) With the help of a block diagram, explain the operation of noncoherent & coherent BFSK receivers. **(8)**

b) What is QPSK? Draw the signal space diagram and write the expression for the signal set and show the signal constellation. **(8)**

Unit - III

3. a) Derive an expression for calculating. Probability of bit error rate for QPSK system and draw the power spectrum of a QPSK signal. **(8)**

b) A binary bandpass system transmits binary data at the rate of 2.5×10^{6} bit/sec. During the course of transmission, zero mean AWGN of 2 sided PSD equal to 10^{-14} w/Hz is added to the signal in the absence of noise, the amplitude of the received sinusoidal wave for '1' or '0' is 1mv. Find the average probability of symbol error for the coherent BFSK. **(8)**

OR

3. a) Derive an expression for Pe_{min} of continuous phase binary FSK. in coherent detection. **(8)**

b) Determine the transmitted power needed to transmit binary data at a rate of IMbps over a channel with zero mean AWGM of two sided PSD equal to 10^{-12} W/Hz and a total transmission loss of 40dB if the system used is noncoherent ASK. In all the cases Pe should not exceed 10^{-4}. **(8)**

Unit - IV

4. a) Write down the shannon - Hartley law and explain its implications. What is shannon limit with reference to an AWGM power limited gaussian channel? **(8)**

b) Verify the equations.

i) $H(X,Y) = H(X/Y) + H(Y)$

ii) $I(X!Y) = I(Y!X)$ **(8)**

OR

4. a) Consider an AWGM channel with 5-khz Bandwidth and the noise power spectral density $\eta/2 = 10^{-12}$W/Hz. The signal power required at the receiver is 0.2 mw calculate the capacity of this channel. **(8)**

b) A DMS 'x' (Discrete memoryless source) has five symbols x_1, x_2, x_3, x_4, x_5 with $P(x_1) = 0.4$, $P(x_2) = 0.19$ $P(x_3) = 0.16$, $P(x_4) = 0.15$ $P(x_5) = 0.1$. Calculate the efficiency of shannon - fano code for x. **(8)**

Unit - V

5. a) For the (7,4) Hamming code, Determine the 'H' matrix and the decoded code word if the received code word is 0111011. The generator

$$\text{Matrix } G=\begin{bmatrix} 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 1 \end{bmatrix}$$ **(9)**

b) Write short note on cyclic and convolutional codes. **(7)**

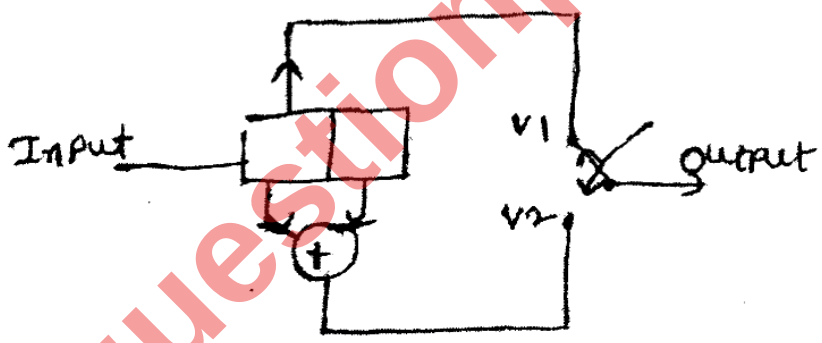
OR

5. a) Taking x^3+x+1 as the generator polynomial for the (7,4) cyclic linear block code, determine the code vectors in systematic form for the following message sequences:

i) 1011

ii) 1111 **(10)**

b) Consider the convolutional encoder shown in figure



i) Find the impulse response

ii) Using the impulse response determine the output code word for data d = (101) **(6)**