

6E3089

Roll No. _____

Total No of Pages: **4**

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B. Tech. VI Sem. (Main & Back) Exam., May/June-2014

Electronics & Comm. Engg.

6EC4 Digital Communication

Common with AI

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 may suitably be assumed and stated clearly.

Units of quantities used/ calculated must be stated clearly.

Use of following supporting material is permitted during examination.

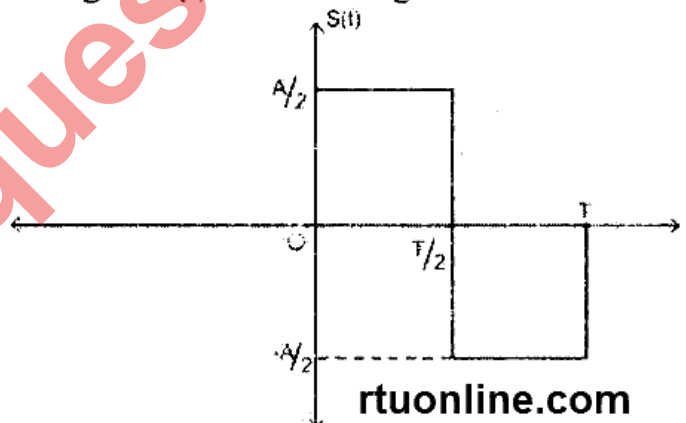
1. _____ Nil _____

2. _____ Nil _____

UNIT-I

Q.1 (a) Describe Matched Filter and its significance. [8]

(b) Consider the signal $s(t)$ shown in fig.



(i) Determine the impulse response of filter matched to this signal and sketch it as a function of time.

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

(iii) What is the peak value of the output? [8]

OR

- Q.1 (a) Explain PCM with block diagrams of transmitter and receiver and find out the error probability in PCM system. [8]
- (b) A PCM system uses a uniform quantizer followed by a 7-bit binary encoder. The bit rate of the system is equal to 50×10^6 b/sec.
- (i) What is the maximum message bandwidth for which the system operates satisfactorily?
- (ii) Determine the output signal-to-quantization noise ratio when a full-load sinusoidal modulating wave of frequency 1 MHz is applied to the input. [8]

UNIT-II

- Q.2 (a) Describe various signaling formats with suitable examples. [8]
- (b) Sketch the transmitted sequence of pulses for data stream 1110010100 for the following line codes:-
- (i) Unipolar NRZ
- (ii) Polar Plot
- (iii) Bipolar RZ
- (iv) Split phase Manchester [8]

OR

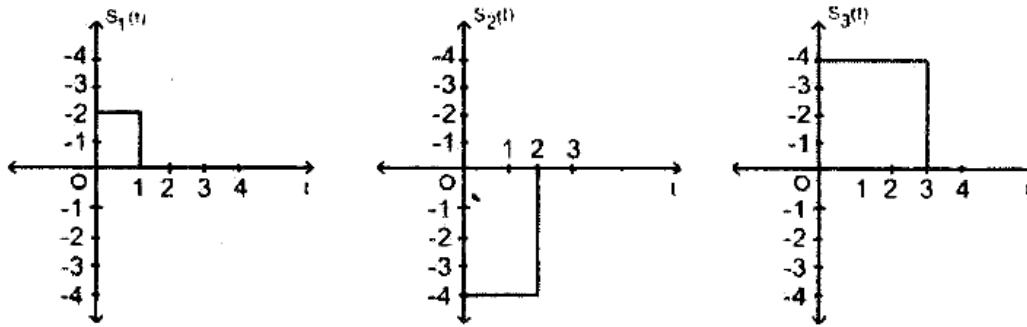
- Q.2 (a) Explain the Nyquist Criterion for Distortionless Baseband Binary transmission. How can we overcome the practical difficulties encountered with ideal nyquist channel? [12]
- (b) A communication channel of bandwidth 75 KHz is required to transmit binary data at a rate 0.1 Mbps using raised cosine pulses. Determine roll-off factor α . [4]

UNIT-III

- Q.3 (a) Sketch the waveforms for the inphase and quadrature components of MSK signal in response to the input binary sequence 110100010. [8]
- (b) Sketch the MSK waveforms itself for the binary sequence specified in part (a). [8]

OR

- Q.3 (a) Using the Gram-Schmidt orthogonalization procedure, find a set of orthonormal basis functions to represent the three signals $s_1(t)$, $s_2(t)$ and $s_3(t)$ shown in figure below. [8]



- (b) Express each of these signals in terms of the set of basis functions found in Part (a). Construct the corresponding signal space diagram. [8]

UNIT-IV

Q.4 (a) Verify the following expression:-

$$0 < H(X) < \log_2 m$$

Where, m is the size of alphabet of X . [8]

(b) A discrete memory less source X has four symbols x_1, x_2, x_3 and x_4 with probabilities $P(x_1) = 0.4, P(x_2) = 0.3, P(x_3) = 0.2, P(x_4) = 0.1$.

(i) Calculate $H(X)$.

(ii) Find the amount of information contained in messages $X_1 X_2 X_1 X_3$ and $X_4 X_3 X_3 X_2$ and compare with $H(X)$ obtained in part (i). [8]

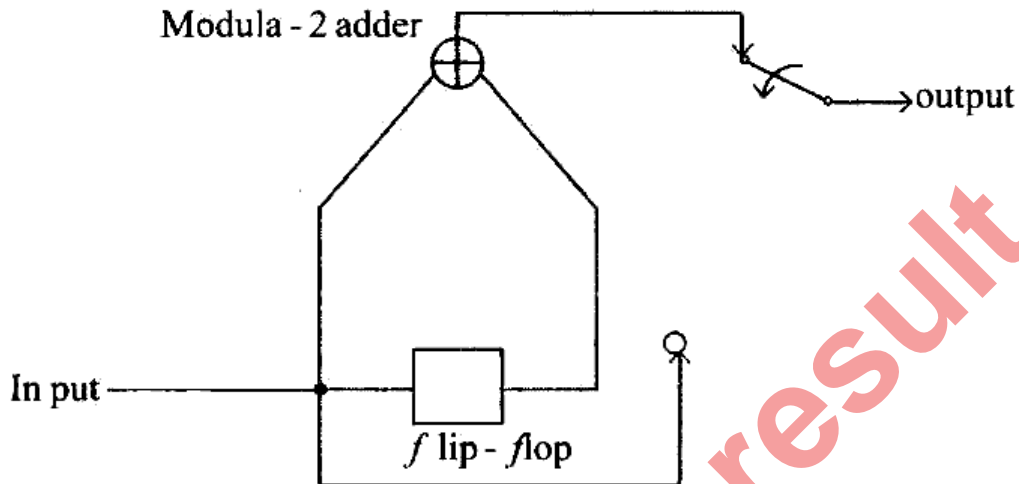
OR

Q.4 (a) A discrete memory less source X has four symbols X_1, X_2, X_3 and X_4 with probabilities $P(x_1) = 1/2, P(x_2) = 1/4, P(x_3) = P(x_4) = 1/8$. Construct a Shannon-Fano Code for X : Show that this code has the optimum property that $n_1 = 1(x_1)$ and that code efficiency is 100%. [8]

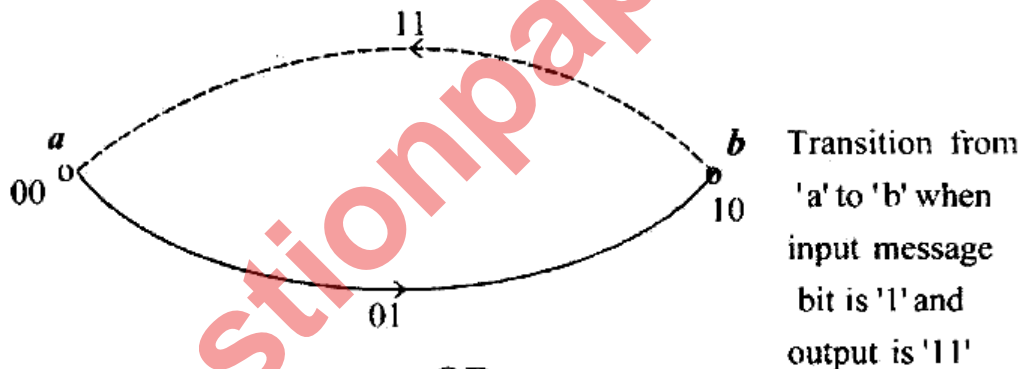
(b) Consider an AWGN channel with 4 KHz bandwidth and noise power spectral density $\eta/2 = 10^{-2}$ W/Hz. The signal power required at the receiver is 0.1 mW. Calculate the capacity of this channel. [8]

UNIT-V

- Q.5 (a) Consider the rate $r = 1/2$. Constraint length $K = 2$ convolutional encoder of the figure given below. The code is systematic. Find the encoder output produced by message sequence 10111.... [8]



- (b) Sketch the code tree for a convolutional encoder of rate $r = 1/2$. Constraint length $K=2$ given below:-



OR

- Q.5 (a) For the (7,4) Hamming code. The parity check H is given by

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

- (i) Construct the Generator matrix.
 - (ii) Find the code word that begins with 1010.
 - (iii) If the received codeword Y is 0111100, then decode this received codeword. [8]
- (b) Find the generator matrix corresponding to $G(p) = p^3 + p^2 + 1$ for a (7,4) cyclic code and find out the code vectors. [8]