

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination, Nov.-Dec. 2015

B. Tech. in Electronics & Communication Engineering, Semester VI

Roll No.....

ECE602: DIGITAL COMMUNICATION

Time: 3.0 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.
4. Use of Non-Programmable calculator is allowed.

Q.1A Objective type multiple choice questions (10 questions @ 1 mark) 10

- i. If f_b and f_c are the bit frequency of the data and the chip frequency respectively in a DSSS system, then
 - a) $f_c \gg f_b$
 - b) $f_c \ll f_b$
 - c) $f_c = f_b$
 - d) No specific relation
- ii. The envelope of bandpass noise is
 - a) Uniformly distributed
 - b) Rayleigh distributed
 - c) Ricean distributed
 - d) Gaussian distributed
- iii. Express the BFSK signal mathematically.
- iv. The dimensions of signal space of MSK signal is
 - a) 1
 - b) 2
 - c) M
 - d) 3
- v. Why do we use **plot** command in MATLAB?
- vi. What are the different windows in MATLAB?
- vii. The transfer function of the matched filter for a triangular pulse that is symmetric about $t = T/2$ is
 - a) A sinc function
 - b) A sine function
 - c) A sinc square function
 - d) A rectangular function
- viii. The and are the two noise effects in Delta modulation.
- ix. What do you understand with VSB modulation?
- x. What do you understand with GMSK?

Q.2 Each Question is of 2.5 marks

10

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- i. How can we reduce the granular distortion? Explain.
- ii. Write a MATLAB program to generate BPSK signal.
- iii. What is difference between Multiple Access and Multiplexing?
- iv. Explain the generation of adaptive delta modulation.

Q.3A In a DSSS CDMA system, the data rate $f_b = 6$ kbps and the chip rate $f_c = 12$ Mbps. 05
What is the jamming margin if an output SNR of 10 dB is required for a $P_e = 10^{-5}$? Assume a system loss of 1.5 dB owing to imperfections in tracking and detection.

Q.3B How is tracking performed in FHSS system? 05

Q.4A A binary baseband long haul transmission system using polar NRZ signals has 20 repeaters. If the input SNR at each repeater is 22 dB. Find the probability of error assuming the repeaters to be regenerative. What will be the P_e if the repeaters are non-regenerative? 05

Q.4B Explain the QPSK detection with suitable diagrams. 05

Q.5A A Binary PCM uses NRZ signaling has error probability of 10^{-6} . Assume that the signaling rate is doubled, and then find new value of the average probability of error. 05

Q.5B Binary data is transmitted at the rate of 56 kbps using a baseband binary PAM system designed to have a raised cosine spectrum. What is the transmission bandwidth required if the roll off factor is 0.25 and 0.5? 05

Q.6A A message signal with a dynamic range of -8V to +8V is non-uniformly quantized using a μ law compressor with $\mu = 255$ and 64 quantization levels. Determine the smallest and largest step size obtained. Assume the quantizer is fully loaded. 05

Q.6B Explain the following : 05

- i. Processing Gain
- ii. Probability of Error
- iii. Equalization

OR

Q.6B Assume that you are required to transmit $f_b = 90$ Mbps data in an authorized bandwidth of 20 MHz. Which modulation technique would you consider and Why? 05

Q.7 Consider a Binary sequence 1 0 0 1 1 1 0 0 0 1 1 1 0 0 1 0. Draw the waveform for this sequence using the following signaling formats: 10

- i. Polar RZ
- ii. Polar NRZ
- iii. AMI RZ
- iv. Unipolar NRZ

Q.8 A signal space consists of four signals $s_1(t)$, $s_2(t)$, $s_3(t)$ and $s_4(t)$ shown in figure. Use the Gram-Schmidt orthogonalization procedure to find an orthogonal basis for the set of signals 10

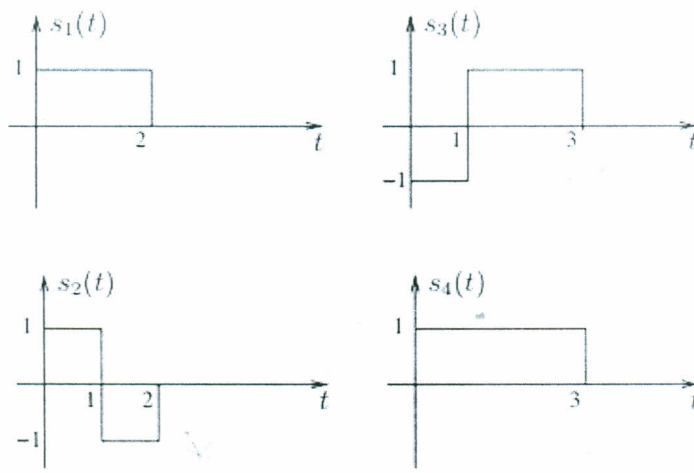


Figure
OR

Q.8 , A binary transmission system with a transmitted power of 200 mW uses a 10 channel with zero mean AWGN of two sided PSD equal to 10^{-15} W/Hz and a total transmission loss of 90 dB. If the probability of error is not to exceed 10^{-4} , what is the maximum allowable bit rate using non coherent ASK?

Q.9 During each time slot of 1 msec, a baseband binary communication system 10 transmits either a rectangular pulse of amplitude V volts, or a triangular pulse of amplitude $-V$ volts. If $V=10$ mV and the white noise on the channel has a PSD (two sided) of 5×10^{-9} W/Hz. Find the bit error probability, assume matched filter reception.

OR

Q.9 For an Integrate and Dumb Filter receiver, calculate the maximum signal to 10 noise ratio. Assume that the input signal is rectangular pulses of amplitude A and duration T .

Q.10 A sinusoidal signal of frequency f_0 hz is sampled at $15f_0$ Hz and the samples are 10 given to a first order linear predictor. Determine the weight w_1 of this predictor that would minimize the prediction error variance. Also determine the minimum prediction error.