E&TC

College of Engineering, Pune.

End Semester Examination

Digital Communication Systems (ET 302)

Program: Third Year B. Tech. (Electronics & Telecommunication)
Year: 2012-13 Semester: Autumn
Duration: 3 hours Maximum Marks: 50

Instructions:

1. **Attempt ALL questions.**
2. Draw neat figures wherever required.

Q 1 a) Derive the general expression for maximum output signal-to-quantization-noise ratio of a PCM system. Modify the expression for sinusoidal input signal. State both expressions in dB also. **5**

b) Explain the concept and role of matched filter in digital communication receiver. State the expressions for output-signal-to-noise ratio and optimum transfer function of the matched filter in time domain and frequency domain. **5**

Q.2 a) Explain the Direct Sequence Spread Spectrum (DS-SS) technique. Explain how the features of Secure Communication, Jamming Resistance and Multiple Access are achieved in DS-SS? **5**

b) A 7-bit PCM system employing uniform quantization has an overall signaling rate of 56 kbps. Calculate the signal to quantization noise ratio that would result when its input is a sine wave with peak to peak amplitude equal to 5 V. Calculate the dynamic range for the sine wave inputs in order that the signal to quantization noise ratio may be less than 30 dB. What is the theoretical maximum frequency that this system can handle? **5**

Q 3 a) Explain the Frequency Hopping Spread Spectrum (FH-SS) system. What are the advantages of FH-SS over DS-SS system? **5**

b) Compare the system performance of FSK (coherent and non-coherent), PSK, DPSK and QPSK from the point of view of probability of error vs. E_b/N_o and their bandwidth requirement. **5**

Q.4 a) Explain the process of FSK generation.
An FSK system transmits binary data at the rate of 2.5 Mbps. During the course of transmission, white Gaussian noise of zero mean and power spectral density 10^{-20} W/Hz is added to the signal. In the absence of noise, the amplitude of the received sinusoidal signal for digit 1 or 0 is 1 μV. Determine the average probability of error assuming coherent detection.
Note: Use approximation $erfc(x) = \left(\frac{1}{x\sqrt{\pi}}\right) e^{-x^2}$ **5**

b) A Television signal with a bandwidth of 4.2 MHz is transmitted using binary PCM. The number of quantization levels is 512. Calculate the following:
i) Number of bits per sample
ii) transmission bandwidth
iii) Final output bit-rate
iv) Output signal-to-quantization-noise ratio in dB. **5**

Q.5 a) Derive the expressions for detection error probability for the three formats of baseband pulses namely i) polar, ii) on-off (unipolar) pulses and iii) AMI type pulses. State clearly the meanings of the symbols used and assumptions if any. **5**

b) An analog signal of bandwidth 20 KHz is sampled at a rate of 40 KHz, and quantized into 16 levels. The resultant digital signal is transmitted using M-ary PSK with raised cosine pulses (roll-off = 0.3). A channel with a 110 KHz bandwidth is available to transmit this data.
i) Determine the bit rate.
ii) Determine the smallest acceptable value of M.
iii) Determine the baud rate. **5**

* * *