Code No: 56026 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD
B. Tech III Year II Semester Examinations, December-2014/January-2015
DIGITAL COMMUNICATIONS
(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

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1.a) What are the advantages and disadvantages of digital transmission?

b) A signal $f(t)=\text{sinc}^2(5\pi t)$ is sampled (using uniformly spaced impulses) at a rate of 7 Hz; 12 Hz; and 20 Hz. For each of the three cases:
i) Find out the signal bandwidth and its nyquist rate. Sketch the sampled signal.
ii) Sketch the spectrum of the sampled signal.
iii) Explain whether you can recover the signal f(t) from the sampled signal.
iv) If the sampled signal is passed through an ideal low pass filter of bandwidth 5 Hz, sketch the spectrum of the output signal.

2.a) Discuss the comparison of PCM vs. delta modulation with respect to SNR and bandwidth. Draw the necessary plots.

b) Information in an analog waveform with a maximum frequency f_m = 3 kHz, is to be transmitted using PCM. The quantization distortion is specified not to exceed ± 1% of the peak-to-peak analog signal.
i) What is the minimum required sampling rate?
ii) What is the minimum number of bits per sample or bits/PCM word that should be used in digitizing the analog waveform?
iii) What is the resulting bit transmission rate?
iv) What is the transmission Bandwidth?

3.a) Briefly explain BPSK and DPSK with the help of appropriate diagram wherever necessary and compare it? In which case bit error probability is higher and why?

b) Consider a binary digital modulation system, where the carrier amplitude at the receiver is 1 V, and the white Gaussian noise has standard deviation 0.2. Assume that symbol 0 and symbol 1 occur with equal probabilities.
i) Compute the bit error rates for ASK, FSK, and PSK with coherent detection. Use the following approximation to the Q-function

$$Q(x) \le \frac{1}{\sqrt{2\pi}.x} e^{-x^2/2},\ x \ge 0$$

ii) Compute the bit error rates for ASK, FSK, and DPSK with noncoherent detection.

4. Differentiate coherent and noncoherent methods. What is M-ary coding? What are the advantages of M-ary signaling scheme? Under what circumstances M-ary signaling schemes are preferred over binary schemes? Compare bandwidth efficiency of M-ary PSK signals and FSK signals. What happens to the probability of error in M-ary FSK as the value of M-increase?

5.a) What is entropy? Derive its expression. Define information rate. Write down the derivation for average information H for case of two messages P and 1-P and also find out the maximum value of H.

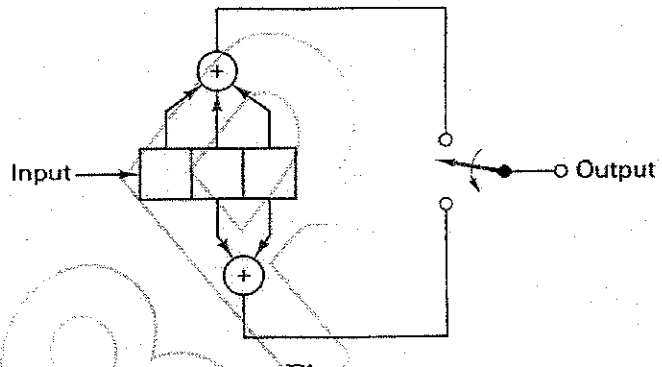
b) A continuous signal is band limited to 5 KHz. The signal is quantized in 8 levels of a PCM system with probabilities 0.25, 0.2, 0.2, 0.1, 0.1, 0.05, 0.05 and 0.05. Calculate the entropy and rate of information?

6.a) What do you mean by algebraic code? Give one example for generating such code.

b) Explain the method of coding and decoding for cyclic code. Write down the advantage of cyclic code.

c) The generator polynomial of a (7, 4) cyclic code is $g(x) = 1+x+x^3$. Find the 16 code words of this code.

7. What is convolution coding? The encoder for a convolution code is as shown in the figure:



Figure

a) What are the connection vectors?
b) What are the polynomials?
c) What is the impulse response?
d) Draw the state Diagram.
e) Write the output for an input of {1 1 0 1 0 0 1 0 0}.
f) Draw the trellis diagram up to depth 4.
g) What is the minimum difference?

8. Write short notes on:
a) Eye Diagram.
b) Delta Pulse Code Modulation.
c) Frequency hopping spread spectrum.

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