Code No: NR310405 **NR**

III B.Tech I Semester Supplementary Examinations, May 2005
DIGITAL COMMUNICATIONS
(Common to Electronics & Communication Engineering and Electronics & Telematics)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the different types of Sampling
   (b) Obtain the Nyquist rate and Nyquist interval for the signal 10 Cos (2000πt) Cos (4000πt) based on
      i. low pass sampling theory, and
      ii. band pass sampling theory.

2. (a) Sketch and explain the typical waveforms of PWM signals, for leading edge, trailing edge and symmetrical cases.
   (b) Compare the analog pulse modulation schemes with CW modulation systems.
   (c) Show that a PAM signal can be expressed as the convolution of an instantaneously sampled signal, and a rectangular pulse p(t) of the form
   $$p(t) = \begin{cases} 1, & |t| \le \tau/2 \\ 0 & elsewhere \end{cases}$$

3. (a) Define and explain different pulse modulation schemes.
   (b) For the data stream 101101, find the duo-binary encoding output sequence. The data sequence to be transmitted is b_k. The pre-coded sequence $a_k = b_k \oplus a_{k-1}$. The first bit of a_k is selected arbitrarily as 0. $c_k = a_k + a_{k-1}$ is duo-binary coder sequence.

4. (a) Why equalization is necessary is Base band transmission? Give the block diagram of adaptive filter and explain about each element.
   (b) The unequalized pulse in a PAM system has the following values at sampling times:
   $$p_r(kT_b) = p_r(k) = \begin{cases} 0.2 & k = 1 \\ 0.8 & k = 0 \\ 0.2 & k = -1 \end{cases}$$
   $$p_{r(k)} = 0 \, for \, |k| > 1$$
      i. Design a three-tap zero forcing equalizer so that the equalizer output is 1 at k = 0 and 0 at k = ±1
      ii. Calculate P_{eq} (k) for k = ±2, ±3.

5. A signal band limited to 1MHz is sampled at a rate of 50% higher than Nyquist rate and quantized into 256 levels using a μ-law quantizer with μ=255.
   (a) Determine the signal to quantization noise ratio.

(b) The SNR found in was unsatisfactory. It must be increased at least by 10dB.Would you be able to obtain the desired SNR without increasing the transmission bandwidth, if it was found that a sampling rate 20% above the Nquist rate is adequate. If so, explain how. What is the maximum SNR that can be realized in this way.

6. In a single-integration DM system, the voice signal is sampled at a rate of 64kHz.The maximum signal amplitude is Amax=1.

   (a) Determine the minimum value of the step size σ to avoid slope over load error.

   (b) Determine the granular noise power if the voice signals bandwidth is 3.5 kHz.

   (c) Assuming that the voice signal is sinusoidal, determine output signal power and SNR

   (d) Determine the minimum transmission bandwidth.

7. (a) Compare all the binary digital modulation scheme in detail.

   (b) Compare the average power requirements of binary non coherent ASK coherent PSK , DPSK & non coherent FSK signaling schemes operating at a data rate of 1000 bits/sec over a band pass channel having a band width of 3000 Hz, $\eta/2$ 10^{-10} watt /Hz and probability of error=10^{-5}.

8. (a) Compare the linear block codes, Cyclic codes and the convolutional codes ?

   (b) Draw an (n-k) syndrome calculation circuit for an (n, k) cyclic code?

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