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Total Number of Pages: 2

**B.Tech**  
**PCEC4305**

**6<sup>th</sup> Semester Regular / Back Examination 2016-17**  
**DIGITAL COMMUNICATION TECHNIQUES**

**BRANCH(S): ECE, ETC**

**Time: 3 Hours**

**Max Marks: 70**

**Q.CODE: Z177**

**Answer Question No.1 which is compulsory and any five from the rest.**  
**The figures in the right hand margin indicate marks.**

**Q1 Answer the following questions: (2 x 10)**

- a) What is aliasing? What are its effects on transmission and reception of digital signal? How it can be avoided?
- b) What is the effect of multiplying a sequence of impulses with a low pass signal? Explain mathematically.
- c) If an audio signal with maximum frequency component 4 KHz is quantized with 8 bit encoder. Calculate the minimum bandwidth required to transmit the signal.
- d) Determine the Nyquist rate and Nyquist interval for the given signal:  
$$x(t) = \frac{1}{2\pi} \cos(4000\pi t) \cdot \cos(1000\pi t).$$
- e) How much bandwidth is needed to transmit the T1 speech?
- f) Give the Euclidean distance between the signals in BFSK. Compare it with that in BPSK.
- g) Plot the spectrum of BPSK and BFSK signals. Which one requires more channel bandwidth and by how much?
- h) What is meant by an optimum filter? Why is it called so?
- i) Explain Shannon-Hartley theorem.
- j) An information source produces one of four possible symbols having probabilities  $P(x_1) = 1/2, P(x_2) = 1/4, P(x_3) = P(x_4) = 1/8$ . Find Entropy of the information source?

**Q2 a) What is Sampling theorem? (2)**  
**b) Prove the Sampling theorem. A signal  $x(t) = 2 \cos(400\pi t) + 6 \cos(640\pi t)$  is (8)**  
ideally sampled at  $f_s = 500$ Hz. If the sampled signal is passed through an ideal low pass filter with cut-off frequency of 400Hz. What frequency component will appear in the output?

- Q3** a) Derive the expression for quantization noise power in PCM system. (5)  
 b) A PCM system uses a uniform quantizer followed by a “v” bit encoder. (5)  
 Show that root mean square signal to quantization noise ratio is approximately given as  $(1.8+6v)$  dB.
- Q4** a) Explain in detail with mathematical expressions about power spectra of BFSK signal and also plot it. (5)  
 b) What is minimum in MSK? Explain generation and reception of MSK signals. (5)
- Q5** a) Find out the bit error probability in case of BFSK modulation scheme. (5)  
 b) A delta modulator system is designed to operate at five times the Nyquist rate for a signal having a bandwidth equal to 3KHz. Calculate the maximum amplitude of a 2KHz input sinusoid for which the delta modulator does not have slope over-load. Given that the quantizing step size is 250mvolt. (5)
- Q6** a) What do you mean by Integrate and Dump Filter? Calculate signal to noise ratio (SNR) of this filter. (5)  
 b) What is ISI? Explain the Nyquist criteria for zero ISI. (5)
- Q7** Consider binary memory less source X with two symbols  $x_1$  and  $x_2$ . (10)  
 Prove that  $H(X)$  is maximum when both the symbols are equiprobable.  
 Show that the channel capacity of an ideal AWGN channel with infinite bandwidth is given by  $C_\infty = 1.44 \frac{S}{\eta}$  b/s.
- Q8** Write short answer on any TWO: (5 x 2)  
 a) Differential PCM  
 b) Quantization noise in delta modulation  
 c) Companding  
 d) Correlator receiver