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Total number of printed pages – 2

B. Tech
PCEC 4305 (New)

Sixth Semester (Back) Examination – 2013
DIGITAL COMMUNICATION TECHNIQUES

BRANCH : CSE, IT

QUESTION CODE : B244

Full Marks – 70

Time : 3 Hours

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

1. Answer the following questions : 2 × 10
- Find the Nyquist rate for $\text{sinc}(50 \pi t) \text{sinc}(100 \pi t)$.
 - If a signal is sampled at 50 kHz then what will the bandwidth of the channel to transmit the signal.
 - What are the properties of line code ?
 - What is aperture effect ?
 - Write the transfer function of a sample and hold circuit.
 - If $m(t) = A \tanh(\beta t)$ where A and β are constants, determine the minimum step size Δ for delta modulator of this signal to avoid slope overloading.
 - Give the constellation of 8-PSK.
 - What is Shannon's theorem ?
 - What do you mean by information ? How is it related to probability of occurrence ?
 - What are the bandwidth of BPSK and BFSK ?
2. (a) Show that, PWM demodulation can be achieved by simple time averaging of PWM pulses by an averaging low pass filter. 5
- (b) What do you mean by interpolation ? Derive an expression for interpolation when sampling is done at Nyquist rate. 5
3. A signal is band-limited to 1 MHz is sampled at a rate 50% higher than the Nyquist rate and quantized into 256 levels using μ -law quantizer with $\mu = 255$.
- (a) Determine the SNR. 4

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- (b) The SNR found in (i) above was unsatisfactory. It must be increased at least by 10 dB. Is it possible to obtain the desired SNR without increasing the transmission bandwidth if it was found that a sampling rate 20% above the Nyquist rate is adequate? If so explain how and find out the maximum SNR in this way. 6
4. (a) Draw the signal constellation for a binary phase-shift keying signal set if the signals are 5
- $$S_1(t) = \sqrt{\frac{2E_b}{T}} \cos\left(w_c t - \frac{\pi}{4}\right), 0 \leq t \leq T \text{ and}$$
- $$S_2(t) = \sqrt{\frac{2E_b}{T}} \cos\left(w_c t + \frac{\pi}{4}\right), 0 \leq t \leq T$$
- (b) What is quantization? Show that the quantization error is $S^2/12$, where S is the step size. 5
5. Design an offset QPSK transmitter and receiver. Show the waveforms for offset and non-offset QPSK transmitter. Also prove that the distance between the two symbols in QPSK is same as BPSK. 5+3+2
6. (a) What is a correlator? Show that the performance of Matched filter and correlator is identical. 5
- (b) Compare PCM and DM in context with the Signal to noise ratio. 5
7. (a) A source generates messages with probabilities 0.1, 0.25, 0.15, 0.05, 0.1, 0.05, 0.15, 0.15
- (i) What is the average information?
- (ii) Find the code efficiency if they are source coded using Shannon-Fano algorithm. 5
- (b) Explain the optimum threshold for a detector if the a priori probabilities are unequal. 5
8. Write short notes on any **two** of the following : 5×2
- (a) Eye diagram
- (b) Bandwidth – S/N Trade off
- (c) Scrambling
- (d) Line coding.

