Registration No. :

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B. Tech.

PCEC 4305

Sixth Semester Examination – 2013

DIGITAL COMMUNICATION TECHNIQUES

BRANCH : EC / ETC

QUESTION CODE : A 173

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

(a) Sketch the sampled waveform when a 1 kHz sinusoid is sampled at the rate of 0.5 kHz and 2 kHz respectively.

(b) Draw the TDM diagram when two sinusoids each of 1 kHz are sampled at 2 kHz.

(c) Give the transfer function of a sample and hold circuit.

(d) What is (are) the disadvantages of a higher order PSK ?

(e) Bring out two differences between DPCM and DM.

(f) Suggest at least two kinds of pulses suitable for transmission over bandlimited channels.

(g) Is the matched filter same as a low pass filter ? Justify.

P.T.O.

(h) Explain in two sentences the physical reason for SNR improvement using an integrate-and-dump circuit.

(i) What is a Gaussian channel ? Where do you encounter such a channel ?

(j) For what kind of channels, do you normally compute the probability of bit error ? Why ?

2. (a) A TDM system is used to multiplex four signals given as, $m_1(t) = \cos \omega_0 t$, $m_2(t) = 0.5 \cos \omega_0 t$, $m_3(t) = 2 \cos 2\omega_0 t$ and $m_4(t) = \cos 4\omega_0 t$. If each signal is sampled at the same sampling rate,

   (i) Compute the minimum sampling rate f_s .

   (ii) What is the commutator speed in revolutions per second ?   5

   (b) Show a complete scheme for implementing this four channel TDM.   5

3. (a) Show that the response of a rectangular low pass filter, with a bandwidth f_c,

   to the impulse function $I\delta\left(t - \dfrac{k}{2f_c}\right)$ is $S_R(t)\dfrac{I\omega_c}{\pi}\dfrac{\sin \omega_c\left(t - \dfrac{k}{2f_c}\right)}{\omega_c\left(t - \dfrac{k}{2f_c}\right)}$ 5

   (b) Draw an AMI waveform corresponding to a binary bit stream 1 0 0 1 1 0 0 1. You may consider an arbitrary polarity for the first pulse. List two advantages of such a line code.   5

4. Derive and sketch the PSD of a BPSK waveform when the baseband signal is an NRZ pulse train. List four salient features of such a PSD.   6+4

5. (a) A signal bandlimited to 4 kHz, is sampled at twice the Nyquist rate and the samples transmitted by PCM. An output SNR of 47 dB is required. Find the number of bits and the minimum value of $\dfrac{S_i}{\eta}$ if operation is to be above threshold.   5

(b) Derive an expression for the quantization error power in a DM system. 5

6. (a) Discuss Nyquist first criterion for zero ISI. Is it realized in practice ? 5

(b) Derive the probability of bit error for BPSK when it is detected by a correlator.

5

7. (a) Derive an expression for channel capacity. What does it mean physically ?

5

(b) How can you attain Sahnnon's limit through the use of orthogonal signals? Explain. 5

8. Write short notes on any **two** of the following : 5×2

(a) Companding

(b) MSK

(c) Equalizers

(d) Optimum receiver.

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