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B.Tech
PCEC4305

6th Semester Regular / Back Examination 2015-16
DIGITAL COMMUNICATION TECHNIQUES
BRANCH: ECE, ETC
Time: 3 Hours
Max Marks: 70
Q.CODE: W195

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) 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.

c) What is Delta Modulation and give the comparison between DM and DPCM.

d) Write the geometrical representation of BPSK signal in terms of orthonormal signal.

e) Give the Euclidean distance between the signals in BFSK. Compare it with that in BPSK.

f) Draw the signal space diagram of 8-PSK and 16-QAM.

g) Give the comparison between DM and PCM.

h) What is Equalization?

i) What is meant by an optimum filter? Why is it called so?

j) What is the relation between information content measured in nats and in bits?

Q2 a) State and prove the Sampling theorem. **(5)**

b) Ten telemetry signals, each of bandwidth 2KHz, are to be transmitted simultaneously by binary PCM. The maximum tolerable error in sample amplitudes is 0.2% of the peak signal amplitude. The signals must be sampled at least 20% above the Nyquist rate. Framing and synchronizing requires an additional 1% extra bits. Determine the minimum possible data rate and the minimum transmission bandwidth. **(5)**

Q3 a) With the help of neat block diagram explain the working operation of PCM-TDM system. **(5)**

b) Twenty-four voice signals sampled uniformly and then time-division multiplexed. The sampling operation uses flat-top sampling with 1 μ sec duration. The multiplexing operation includes provision for synchronization by adding an extra pulse of appropriate amplitude and 1 μ sec duration. The highest frequency component of each voice signal is 3.4KHz. Assuming a sampling rate of 8KHz, calculate the spacing between successive pulses of the multiplexed signal. **(5)**

Q4 Explain the operation of QPSK transmitter and receiver and also find out its probability of error expression. What are the advantages of MSK over QPSK? Draw spectrums to verify the answer. **(10)**

Q5 **a)** Derive an expression for signal to quantization noise ratio for a PCM system which employs linear (i.e. uniform) quantization. Given that input to the PCM system is a sinusoidal signal. **(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 is the need for pulse shaping? Explain how ISI is avoided in Nyquist's criterion. **(5)**

b) What is matched filter? Derive the expression for probability of error (P_e) for the matched filter. **(5)**

Q7 **a)** Verify the following expression: **(5)**

$0 \le H(X) \le Log_2 m$, where 'm' is the size of the alphabet of X?

b) **(5)**

x_i	x_1	x_2	x_3	x_4	x_5	x_6
$p(x_i)$	0.3	0.25	0.2	0.12	0.08	0.05

For the given messages and with their probabilities, find out its Huffmann coding.

Q8 Write short notes on any two: **(5 x 2)**

a) Companding

b) Eye Diagram

c) Signal reconstruction of a sampled signal

d) Adaptive delta modulation