Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH/ECE(O)/SEM-5/EC-502/2012-13

2012

DIGITAL COMMUNICATION

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

$10 \times 1 = 10$

i) The output SNR in a DM system for a 1 kHz sinusoid, sampled at 32 kHz, without slope overload and followed by a 4 kHz post reconstruction filter is

a) 2·45 dB b) 2·5 dB

c) 2·6 dB d) 2·7 dB.

ii) The Nyquist rate of the composite signal $f(x) = 5\cos 1000\pi t \cos 3000\pi t$ is

a) 3000 Hz b) 1000 Hz

c) 4000 Hz d) 2000 Hz.

iii) The entropy of information source is maximum when symbol occurrences are

a) equiprobable b) of different probability

c) both (a) and (b) d) none of these.

iv) Measure of information $I(m_k)$ of a massage m_k with probability p_k is given by

a) $\log_b\left(\frac{1}{p_k}\right)$ b) $\log_b(p_k)$

c) $\log_b(1-p_k)$ d) $\log_b\left(\frac{1}{1-p_k}\right)$.

v) PCM generation requires low-pass filter at the beginning to

a) eliminate aliasing effect

b) eliminate quantization noise

c) eliminate decoding noise

d) none of these.

vi) The length of PN sequence for a 8 stage feedback shift resistor is

a) 127 b) 256

c) 255 d) 128.

vii) The channel capacity under the Gaussian noise environment for a discrete memoryless channel with a bandwidth of 4 MHz and SNR of 31 is

a) 20 mbps b) 4 mbps

c) 8 mbps d) 4 kbps.

viii) In a PCM system, the number of quantization levels are 16 and the maximum signal frequency is 4 kHz, the bit transmission rate is

a) 64 bps b) 16 kbps

c) 32 kbps d) 32 mbps.

ix) The type of modulation used with direct sequence spread spectrum is

a) PSK b) ASK

c) FSK d) DPSK.

x) Spectral density express

a) average voltage

b) average current

c) average power in a waveform as a function of frequency

d) none of these.

xi) PAM signal can be demodulated by using

a) a lowpass filter b) a bandpass filter

c) a highpass filter d) none of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following $3 \times 5 = 15$

2. State sampling theorem and explain its importants. What is Nyquist rate of sampling ? 4 + 1

3. What is channel capacity theorem ? State Hartley-Shannon's law. 2 + 3

4. To transmit a bit sequence 10011011, draw the resulting waveform using

i) unipolar RZ

ii) Polar NRZ

iii) Bipolar/AMI RZ

iv) Split phase Manchester coding.

5. Define pseudonoise sequence. Draw and explain about the spread-spectrum modulation system. 1 + 4

6. Consider a sinusoidal signal $m(t) = A\cos\omega_m t$ applied to a delta modulator with step size Δ. Show that the slope overload distortion will occur if $A > \left(\frac{\Delta}{2\pi}\right)\left(\frac{f_s}{f_m}\right)$, where $f_s = \frac{1}{T_s}$ is the sampling frequency.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) Show that for a full scale sinusoidal modulating signal with amplitude *A* in a PCM system, the output signal to quantizing ratio is given by $\left(\frac{S}{N_q}\right)\text{dB} = 1\cdot 76 + 20\log L$, where *L* is the number of quantization level.

   b) A compact disc (CD) recording system samples each of the two stereo signals with a 16 bit analog to digital converter at 44·1 kHz.

      i) Determine the output signal to quantization noise ratio for full-scale sinusoid.

ii) The bit stream of digitized data is augmented by the addition of error correcting bits, clock extraction bits, and display and control bit fields. These additional bits represent 100% overhead. Determine the output bit rate of the CD recording system.

iii) If the CD can record an hours worth of music determine the No. of bits record on a CD. 8 + 7

8. a) Draw ASK, FSK, PSK signals to transmit data stream 1111000111.

b) With the help of block diagram and waveforms, explain QPSK scheme and derive an expression for probability of error P_e for this scheme. 7 + 8

9. a) What is matched filter ?

b) Derive an expression for probability of error of a matched filter.

c) State and explain Nyquist criterion for zero ISI.

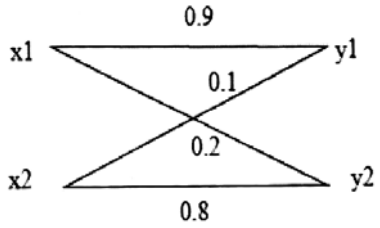
d) What is the roll of an equalizer ? 3 + 5 + 4 + 3

10. a) A DMS X has five equally likely symbols.

i) Construct Shannon-Fano code for X and calculate the efficiency of the code.

ii) Repeat for the Huffman code and compare the result.

b) A binary channel is shown in the figure.



i) Find the channel matrix of the channel.

ii) Find $P(y_1)$ and $P(y_2)$ when $P(x_1) = P(x_2) = 0 \cdot 5$.

8 + 7

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