Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH (CSE(IT)NEW)/SEM-4/CS-401/2012

2012

COMMUNICATION ENGINEERING AND CODING THEORY

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 the following : $10 \times 1 = 10$

   i) Intermediate frequency of standard AM receiver system is

   a) 500 kHz b) 555 kHz

   c) 455 kHz d) 450 kHz

   ii) An analog signal is quantized using L levels, the signal to quantization noise ratio varies

   a) directly with L b) directly with L^2

   c) directly with L^3 d) none of these.

iii) If a source produces five symbols with probabilities $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$ and $\frac{1}{16}$, then the source entropy $H(x)$ is

a) 3 b/symbols b) 5·5 b/symbols

c) 2·875 b/symbols d) 1·875 b/symbols.

iv) If maximum frequency present in one TDM signals is f_m, then for proper detection the message signals sampling rate f_s should follow the relation

a) $f_s = f_m$ b) $f_s > f_m$

c) $f_s = 2f_m$ d) $f_s \geq 2f_m$.

v) Maximum efficiency in AM is

a) 25% b) 50%

c) 33% d) 83%.

vi) Efficiency of coding will be maximum when average code length (L) and entropy [$H(m)$] is

a) $L = H(m)$ b) $L > H(m)]$

c) $(L < H(m)]$ d) none of these.

vii) If a signal band - limited f_mHz is sampled at a rate less than $2f_m$ the reconstructed signal will be

a) Smaller in magnitude

b) Higher in magnitude

c) Have higher frequency suppressed.

d) Distorted.

viii) If the step size of quantization in PCM is 36 mv, the quantization noise is

a) 36 μw b) 72 μw

c) 108 μw d) 18 μw.

ix) In law μ-law compression, μ=0 corresponds to

a) Non-uniform quantization

b) No quantization

c) Better S/N ratio

d) Uniform quantization.

x) The modulation index of an AM wave is changed from 0 to 1. The transmitted power is

a) unchanged

b) halved

c) doubled

d) increased by 50 per cent.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. What is companding used in PM ? Mention μ-law and A-law. 2 + 3

3. Explain the principle of ISI and Nyquist criterion for distortionless base-band binary transmission. 3 + 2

4. Explain natural and flat-top sampling. What do you mean by aliasing effect ? 2 + 2 + 1

5. Define information and average information. A source produces four symbols with probabilities 0·5, 0·25, 0·125 and 0·125. Calculate the source entropy. 2 + 3

6. Explain the coherent and non-coherent detection of BFSK signal. 2 + 3

GROUP – C

(Long Answer Type Questions)

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

7. a) Explain the working principle of envelope detector.

   b) What do you mean by synchronous detection ? What is pilot carrier transmission ?

c) Determine the power content of the carrier and each of the side bands for an AM signal with m = 0·8 and total power of 2500 W. 5 + 3 + 2 + 5

8. a) Show that we may generate FM signal using phase modulator and vise versa .

b) Starting from the expression of WBFM derive the expression of NBFM.

c) A carrier is frequency modulated by a sinusoid modulating signal of frequency 15 kHz resulting in a frequency deviation of 75 kHz. What is the bandwidth occupied ?

9. a) Define random error and burst error ? 2

b) A (6, 3) linear block code is generated according to the generator matrix

$$G = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 \end{bmatrix}$$

For a particular code word transmitted, the received code word is 100011. Find the corresponding data transmitted. 6

c) What is QPSK ? Explain a QPSK modulator. 5

d) What is Cyclic Redundancy Check (CRC) for error detection ? 2

10. a) Explain the term entropy. 4

b) A source produces 4 symbols A, B, C and D with probabilities $\frac{1}{6}, \frac{1}{3}, \frac{1}{4}, \frac{1}{4}$.

Find entropy of the source. 4

c) What is meant by channel capacity ? How is it dependent on SNR ? 4

d) Encode the bit sequence 0100101 in the following form :

(i) Unipolar NRZ

(ii) Bipolar RZ

(iii) AMI RZ. 3

11. Write Short notes on any *three* of the following : 3 × 5

a) Shanon-Franco algorithm for encoding

b) Manchester coding

c) Companding

d) Carson's rule

e) Adaptive deltamodulation.