Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(EE)/SEM-8/EE-802A/2012

2012

COMMUNICATION ENGINEERING

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 × 1 = 10

i) PCM is preferred to PAM because of the

a) Resistance to quantizing error

b) Simplicity

c) Lower cost

d) Superior noise immunity.

ii) A superheterodyne receiver with an IF of 450 kHz is tuned to a signal at 1600 kHz. The image frequency is

a) 1150 kHz b) 900 kHz

c) 2050 kHz d) 2500 kHz.

iii) The modulation index of an FM receiver is given by

a) δ/f_m b) f_m/δ

c) δ^*/f_m d) none of these.

The symbols having their usual meanings.

iv) In AM system, what is the ratio of modulating power to the total power at 100% amplitude modulation ?

a) 1 : 3 b) 1 : 2

c) 2 : 3 d) none of these.

v) Which modulation scheme is used in television broadcasting ?

a) AM b) DSB-SC

c) SSB d) VSB.

vi) Which diode is a popular microwave oscillator ?

a) Impatt b) Gunn

c) Varactor d) Schotky.

vii) The bandwidth of NBFM is identical with

a) PM b) SSB-SC

c) VSB d) AM.

viii) In a communication system, noise is most likely to affect the signal

a) in the channel

b) at the transmitter

c) in the information source

d) at the destination.

ix) Which of the following pulse modulation systems is analog ?

a) PWM b) DPCM

c) PCM d) DELTA.

x) AM is the process of

a) superimposing a low frequency on a high frequency

b) carrier interruption

c) superimposing a high frequency on a low frequency

d) frequency shift & phase shift.

xi) The envelope detector is

a) synchronous detector

b) band-pass filter

c) asynchronous detector

d) balanced modulator.

xii) Average information of entropy is maximum when all the message are

a) equiprobable b) not equiprobable

c) (a) or (b) is possible d) none of these.

GROUP – B

(Short Answer Type Questions)

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

2. a) Prove that the total power required to transmit an amplitude modulated wave is $P_1 = P_C (1 + m^2/2)$.

b) Show that for single tone AM, η_{max} is 33% for $m = 1$

where symbols have their usual meanings. 3 + 2

3. A modulating signal $m(t)$ is applied to a DSB-SC carrier system modulator operating at f_c = 50 kHz. Determine and sketch the modulated signal if

a) $m(t) = 2 \cos (4000 \pi t) + 5 \cos (6000 \pi t)$

b) $M(f) = \{ [1 + \cos ((\pi f)/1000)]/2\}$ for $|f| < 1000$ and 0 elsewhee.

4. A binary data sequence is 0110110001

   Plot the data sequence in Unipolar NRZ, Bipolar NRZ, Unipolar RZ-Bipolar RZ, Manchester signalling formats.

5. Show that the maximum output signal-to-quantization noise ratio in a Delta modulated system under the assumption of no slope overload is given by

   $(SNR)_o = (S/N_q)_o = 3f_s^3 / (8\pi^2 f_m^2 f_M)$ where f_s is sampling frequency and f_M is the cut-off frequency of a low-pass filter at the output end of the receiver.

6. Define the following terms in AM receiver :

   i) Sensitivity

   ii) Selectivity

   iii) Image frequency.

GROUP – C

(Long Answer Type Questions)

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

7. a) Explain the working principle of a BPSK system (both transmitter and receiver). 7

   b) Explain the operation of delta modulator and demodulator. 6

   c) What is the advantage of QPSK over BPSK ? 2

8. a) What is noise figure ? What is its significance ? 3

b) Calculate $\frac{S}{N}$ ratio in SSB-SC scheme. 6

c) Explain the operation of PCM transmitter and receiver. 6

9. a) What is thermal noise and how are the RMS value of the noise voltage and current expressed ? 2 + 3

b) Two resistors of 30 k.ohm and 50 k.ohm are at room temperature of 30°C. For a BW of 2 MHz, determine the thermal noise voltage of

i) each resistor

ii) two resistors in series

iii) two resistors in parallel. 4

c) Derive an expression for maximum channel capacity of a communication channel in the presence of Gaussian noise.

A Gaussian channel has a BW of 100 kHz. If the signal power to noise power spectral density (S/N) is 10^6 Hz, find the channel capacity. 3 + 3

10. a) Explain SSB generation and demodulation with block diagram.

b) Explain the generation of narrow band frequency modulation system. Compare betweeen AM & FM systems relative to bandwidth requirement, power requirement and performance of noise. (4 + 4) + 3 + 4

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

a) Vestigial Sideband modulation (VSB)

b) Comparative study among AM, DSB-SC and SSB-SC

c) Pre-emphasis and De-emphasis in FM

d) Balanced Modulator

e) PLL

f) Block code.