Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (ECE)/SEM-4/EC-403/2010

2010

ANALOG 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 × 1 = 10

i) In FM sound broadcasting system, the maximum frequency deviation is usually

a) 15 kHz b) 75 kHz

c) 200 kHz d) 5·2 kHz.

ii) A superheterodyne receiver with an I.F. of 450 kHz, is tuned to a signal at 1200 kHz. The image frequency is

a) 750 kHz b) 900 kHz

c) 1650 kHz d) 2100 kHz.

iii) The Fourier transform of real valued time signal has

a) odd symmetry

b) even symmetry

c) conjugate symmetry

d) no symmetry.

iv) The most suitable method for detecting a modulated singal ($2{\cdot}5 + 5 \cos w_m t$) $\cos w_c t$ is

a) Envelope detector

b) Synchronous detector

c) Ratio detector

d) both (a) and (b).

v) In a commercial radio receiver, a PLL can be used to demodulate

a) an AM signal b) a PCM signal

c) an FM signal d) a PM signal.

vi) The main advantage of TDM over FDM is that it

a) needs less power

b) needs less bandwidth

c) needs simple circuitry

d) gives better SNR.

vii) Flat-top sampling leads to

a) an aperture effect

b) aliasing

c) loss of signal

d) none of these.

viii) Quantization noise occurs in

a) PAM b) PWM

c) DM d) none of these.

ix) Companding is used in PCM to

a) reduce bandwidth

b) reduce power

c) increase SNR

d) get almost uniform SNR.

x) The aperture effect in flat top pulses is reduced using

a) Predictor b) Integrator

c) Equalizer d) Compander.

xi) SNR in dB for PCM linear quantization with n as no. of bits is

a) $n^2 / 12$ b) $6 (1 + n)$

c) $(6{\cdot}8 + 4n)$ d) $(4{\cdot}8 + 6n)$.

xii) IF frequency for FM receiver is

a) 10·7 MHz b) 12·7 MHz

c) 13·71 MHz d) 10·3 MHz.

xiii) Zero crossing detectors are used to detect

a) SSB-SC b) DSB-SC

c) FM d) none of these.

xiv) An ideal ramp signal is a/an

a) energy signal

b) power signal

c) both of these

d) none of these.

xv) Bandwidth required for PM is

a) same as FM signal

b) greater than FM signal

c) less than FM signal

d) less than SSB-SC signal.

GROUP – B

(Short Answer Type Questions)

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

2. A single tone FM signal is given by

$e_{FM} = 10 \sin (16\pi \infty 10^6 t + 20 \sin 2\pi \infty 10^3 t)$ volts.

Determine the modulation index modulating frequency, frequency deviation and carrier frequency.

3. Explain the elements of a communication system with suitable block diagram.

4. What is a slope detector ? What are the problems of slope detectors and how is it overcome using a balanced detector ? 2 + 3

5. Explain pre-emphasis and de-emphasis in FM.

6. Determine the Fourier transform of $x (t)$:

Dia.

GROUP – C
(Long Answer Type Questions)

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

7. a) What is meant by autocorrelation ? Explain with power expressions. 3

   b) State and prove time convolution theorem. 3

   c) Find the transfer function of a system for distortionless transmission. 3

   d) Given transfer function for a channel with ideal amplitude response and non-ideal phase response :

$$| H (\omega) | = 1$$

$$\theta_h(\omega) = - \omega t_0 - k \sin \omega T \quad k << 1$$

   Then show that output for an input $g (t)$

$$y (t) = g (t - t_0) + (k/2) [g (t - t_0 - T) - g (t - t_0 + T)]$$

6

8. a) What are sensitivity and selectivity of radio receiver ? 3

   b) Explain with proper circuit diagram how DSB-SC signal is obtained using ring modulator. 5

   c) What is meant by synchronous detection of DSB-SC signal ? 2

   d) Discuss the effect of phase and frequency error in synchronous detection. 5

9. a) Considering a message signal $e_m = E_m \cos W_m t$ and a carrier signal by $e_c = E_c \sin (W_c t + \theta)$, find the expression of the resultant FM wave. 7

   b) Explain FM stereo *Tx* / *Rx* system with block schematic diagrams. 8

10. a) Justify how FM can be obtained from PM and vice versa. 8

    b) Describe a method of indirect way of FM generation. 7

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

    a) VSB modulation

    b) QAM system

    c) Pre-emphasis and de-emphasis

    d) S/N of DSB-SC system

    e) Envelope detector.