ANALOG COMMUNICATION
(ECEN 2203)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) In phasor representation of an AM signal (undermodulated), the resultant and the carrier phasor are
(a) always in phase quadrature (b) always out of phase
(c) in any phase relationship (d) always in phase.

(ii) In undermodulated signal the value of μ ranges between
(a) 0 to 1 (b) -1 to +1
(c) $-\infty$ to $+\infty$ (d) none of these.

(iii) The Hilbert transform of $\cos\omega_1 t + \sin\omega_2 t$ is
(a) $\sin\omega_1 t - \cos\omega_2 t$ (b) $\sin\omega_1 t + \cos\omega_2 t$
(c) $\cos\omega_1 t - \sin\omega_2 t$ (d) $\sin\omega_1 t + \sin\omega_2 t$.

(iv) The Intermediate frequency used for AM in superheterodyne receiver is
(a) 10.7 MHz (b) 455 KHz
(c) 900 KHz (d) 950 KHZ.

(v) In commercial FM broadcasting, the maximum frequency deviation is normally
(a) 5kHz (b) 15kHz (c) 75kHz (d) 200kHz.

(vi) A 10MHz carrier is frequency modulated by a sinusoidal signal of 500Hz, the maximum frequency deviation being 50kHz. The bandwidth required as given by the Carson's rule is
(a) 105 kHz (b) 115 kHz
(c) 101 kHz (d) 99 kHz.

(vii) In angle modulation, the information signals modify the
(a) phase angle (b) frequency
(c) amplitude of the carrier (d) none of these.

(viii) By comparing frequency divison and time divison multiplexing systems it can be shown that
(a) FDM requires a lower bandwidth, but TDM has greater noise immunity
(b) FDM has greater noise immunity and requires lower bandwidth than TDM
(c) FDM requires channel synchronization while TDM has greater noise immunity
(d) FDM requires more multiplexing while TDM requires bandpass filter.

(ix) For Square-law diode detector the input signal voltage should be
(a) < 1volt (b) > 0.6volt
(c) > 0.2 volt (d) > 0.1 volt.

(x) Preemphasis circuit is used in the
(a) modulator section (b) transmitter section
(c) receiver section (d) band pas filters.

Group – B

2. (a) Define Modulation Index. Derive the expression for total modulation index if a carrier is modulated by several sine waves.

(b) Modulating signal 10 sin ($2\pi 10^3 t$) is used to modulate a carrier 20 sin ($2\pi 10^4 t$). Determine modulation index, % modulation, frequencies and amplitudes of the sideband components and modulated signal bandwidth.

(2 + 5) + 5 = 12

3. (a) Draw the phasor diagrams of a DSB-SC modulated signal and a SSB-SC modulated signal.

(b) A transmitter radiates 10KW with carrier unmodulated and 12KW when carrier is sinusoidally modulated. Calculate the modulation index. If another sine wave corresponding to 50% modulation is transmitted simultaneously, determine the total radiated power.

6 + 6 = 12

Group – C

4. (a) How AM signal can be generated using Non linear modulator (Balanced modulator)?

(b) How the values of R and C are decided to design an envelope detector without diagonal clipping at the output?

6 + 6 = 12

5. (a) Explain the process of SSB generation by phase shift method.

(b) What is the limitation of the frequency discrimination method?

(c) Discuss Coastas loop of carrier regeneration at the receiver in DSB SC modulation system.

4 + 2 + 6 = 12

Group – D

6. (a) Explain FM demodulation scheme using PLL.

(b) Compare narrow band FM with AM signal.

(c) Draw the phasor diagram of NBFM signal.

6 + 3 + 3 = 12

7. (a) Explain the principle of detection of FM signal using balanced slope detector with proper sketch.

(b) Describe the process of FM generation using varactor diode modulator.

6 + 6 = 12

Group – E

8. (a) Draw the block diagram of a Superheterodyne Receiver.

(b) Define Selectivity, Sensitivity and Fidelity of a Superheterodyne Receiver.

(c) Define signal to noise ratio and Figure of Merit in a communication system.

3 + 6 + 3 = 12

9. (a) Why Pre-emphasis and De-emphasis are required in FM broadcasting?

(b) Derive signal to noise ratio of SSB-SC system.

6 + 6 = 12