B.Tech/ECE/4thSem/ECEN 2203/2016

2016

ANALOG COMMUNICATION

(ECEN 2203)

Time Alloted : 3 Hours   **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and <u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> 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 alternatives 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 synchronous detection, Quadrature Null Effect takes place if the phase of the carrier used for detection is

   (a) zero and no error in angular frequency

   (b) 90° and no error in angular frequency

   (c) 90° and error in angular frequency

   (d) none of these

   iii) A superheterodyne raido receiver with an intermediate frequency of 455kHz is tuned to a station operating at 1200kHz. The associated image frequency is

   (a) 1900kHz   (b) 2110kHz

   (c) 1200kHz   (d) 1655kHz

   iv) In commercial FM broadcasting, the maximum frequency deviation is normally

   (a) 5kHz   (b) 15kHz

   (c) 75kHz   (d) 200 kHz

   v) For Square-law diode detector the input signal voltage should be

   (a) < 1 volt   (b) > 0.6 volt

   (c) > 0.2 volt   (d) > 0.1 volt

   vi) The band limited AM signals can be transmitted without distortion if the system bandwidth is at least equal to the

   (a) signal bandwidth

   (b) twice the signal bandwidth

   (c) half the signal bandwidth

   (d) thrice the signal bandwidth

vii) The transmission bandwidth of a WBFM signal with 75KHZ modulation and 15 KHZ modulating frequencey is

(a) 150 KHz

(b) 30 KHZ

(c) 180 KHZ

(d) 120 KHZ

viii) A comparison of frequency divison and time divison multiplexing systems shows 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) An FM signal with modulation index m is passed through a frequency tripler. The modulation index of the output signal will be

(a) m_f

(b) $3\ m_f$

(c) $9\ m_f$

(d) $7\ m_f$

x) Preemphasis circuit is used in the

(a) Modulator section

(b) transmitter section

(c) receiver section

(d) band pas filters

GROUP - B

2. (a) Draw the phasor diagrams of an Amplitude Modulated (AM) signal and a DSB-SC modulated signal.

(b) A modulating signal given by $V_m = 20\cos(2\pi*500t)$ amplitude modulates a carrier signal given by $V_c = 10\cos(2\pi*10^6t)$. Determine

(i) modulation index

(ii) frequency present in the mudulated signal

(iii) total transmitted power.

6+6 = 12

3. (a) Show that transmission efficiency of AM cannot exceed 33.33%.

(b) Draw the time and frequency domain representation of a single tone modulated AM signal.

The antenna current of an AM transmitter is 8A when only carrier is sent, but it increases to 8.96A when the carrier is modulated by a single tone sinusoid. Find the percentage modulation. Find the antenna current when the depth of modulation changes to 0.8.

(6)+(2+4) = 12

GROUP - C

4. (a) With neat diagram show how DSB-SC signal can be generated using ring modulator.

(b) Show for the envelope detector output to follow the envelope at all times, it is required that

$$RC \leq \frac{\sqrt{(1-\mu^2)}}{\mu-\omega_m} \text{ where } \mu = \text{Modulation Index}$$

6+6 = 12

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

(b) Show that in single sideband transmission Envelope detection can be done with very poor transmission efficiency.

$$6+6 = 12$$

Group - D

6. (a) Write Carson's rule to determine FM signal Bandwidth.

(b) Find the bandwidth of commercial FM signal transmission assuming frequency deviation of 75 KHz and modulating signal bandwidth of 15 KHz.

(c) 'FM and PM are basically same'—comment on the statement and justify.

(d) A FM wave is represented by the following equation $v = 10 \sin[5\times10^8 t + 4\sin1250t]$.

Determine :

(i) carrier and modulating frequencies

(ii) Modulation index and maximum deviation

$$1+2+3+6 = 12$$

7. (a) Compare narrow band FM with AM signal.

(b) In a FM system when the audio frequency is 400 Hz and the AF voltage is 2.5V the frequency deviation is 3.6 kHz. If the AF voltage is raised to 7.5V what is the new deviation? Find modulation index in each case.

$$6+6= 12$$

GROUP - E

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

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

(c) "In the Superheterodyne receiver the local oscillator frequency is always kept higher then the signal frequency" – justify the statement.

$$3+6+3 = 12$$

9. (a) Explain the process of FDM using suitable block diagram.

(b) Why Pre-emphasis and De-emphasis are required in FM broadcasting?

$$6+6 = 12$$