Roll No.: .....

National Institute of Technology, Delhi

Name of the Examination: B.Tech

Branch : ECE
Semester :IV
Title of the Course : Analog Communication
Course Code : ECB 253

Time: 3 Hours
Maximum Marks: 50

Note:

- **Questions are printed on BOTH sides. Answers should be CLEAR, TO THE POINT AND LEGIBLE.**
- **In total there are Nine(9) questions with their marks shown individually. All questions are compulsory.**
- **All parts of a single question must be answered together and in the same sequence as given in question paper. ELSE QUESTION SHALL NOT BE EVALUATED.**
- **NOTE: ALL QUESTIONS ARE COMPULSORY.**

Section –A (10 Marks)

Q.1 Explain the following terms along with its application. **(5×1)**

(a) Frequency Multiplier
(b) Power Spectral Density
(c) Hilbert Transform
(d)Amplitude Limiter
(e) SSB modulation

Q.2 Three signals each band limited to 2Khz,3Khz,4Khzare multiplexed using FDM . Guard Band is 0.5 khz. Find Multiplexed signal Bandwidth if Modulation schemes used is
(a) DSB-FC (b) DSB-SC (c) SSB-SC (d)For first DSB-SC and for remaining SSB-SC. **(1+1+1+2)**

Section – B (20 Marks)

Q3 For an AM total Sideband power is 100 W with 50% of modulation. Find Pc and Pt. **4**

Q4. An AM modulator has output x(t) = A cos 400pt + B cos 380 pt + B cos 420 pt. The carrier power is 100W and the efficiency is 40 %.Find the value of A and B. **4**

Q.5 If $c(t)= 5 \cos(2\pi * 10^6)t$, $m(t)= \cos(4\pi * 10^3)t$. If frequency deviation of FM is 3 times transmission bandwidth of AM,What is the value of coefficient of term $\cos(2\pi*1008* 10^3)t$ in FM signal in terms of Bessel coefficient.
4

Q.6 An FM signal is given by

$$S(t) = 10 \cos (4\pi \times 10^6 t + 8\sin 6\pi \times 10^3 t)$$

Find:
(a) Find all the parameters of FM
(b) Repeat above ,if message signal frequency is doubled. **(1+2+1)**

Q-7
A receiver is tuned to 600K and Intermediate frequency is given by 500K.
(1) Find oscillator frequency and Image frequency.
(2)Find Image rejection ratio if two tuned amplifier of quality factor 60 and 80 are connected in cascade.
(2+2)

Section-C (20 Marks)

Q.8 Design an Armstrong indirect FM modulator to generate an FM signal with carrier frequency 97.3Mhz and Δf=10.24Khz. A NBFM generator of f_{c_1} =20Khz and Δf =5Hz is available. Only frequency doublers can be used as multipliers. Additionally, a local oscillator(LO) with adjustable frequency between 400 and 500 Khz is readily available for frequency mixing.
10

Q.9 What is the difference between WBFM and NBFM .Derive the expression for the general equation of WBFM expressed in terms of Bessel's Function. **10**

OR

Design a communication system in which you need to transmit a message signal from transmitter to receiver. Explain every element in detail used by use in designing the communication system. **10**