Roll No.:.....

National Institute of Technology, Delhi

Name of the Examination: B. Tech.

Branch	**: ECE**	**Semester**	**: 4th**
Title of the Course	**:Analog communication**	**Course Code**	**:ECB253**

Time: 2 Hours **Maximum Marks: 25**

Note :

Guidelines:

The question paper for B. Tech. to be prepared as per following guidelines:

1. **Maximum marks for the Mid Term Examination is 25.**
2. **The maximum time is two hours.**

Q1. A signal $v(t)=[1+m(t)]\cos w_c t$ is detected using a square law detector whose input-output relationship is $v_o=(v_{in})^2$ followed by a LPF with cut of frequency f_m. If the Fourier transform of the signal m(t) is constant at the value M_o from $-f_m$ to f_m, sketch the Fourier transform of the output of the square-law detector in the frequency range $-f_m<f<f_m$. **5**

Q2. An AM wave has a power content of 800W at its carrier frequency. Determine the power content of each of the sidebands for a 90% modulation. **2**

Q3. A single sideband- suppressed carrier wave is having power 50kW each and carrier wave amplitude $A_c=900$. Calculate the modulation index m_a. **2**

Q4. An AM modulation is having carrier current of 16A and total current of 18. Calculate the modulation index in percentage. **1**

Q5. Consider the wave obtained by adding a non-coherent carrier $A_c\cos(w_c t + \emptyset)$ to the DSB-SC wave, $m(t)\cos(w_c t)$, where m(t) is the message waveform. This waveform is applied to an ideal envelop detector. Find the resulting detector output. Evaluate the output for **5**

i. $\emptyset = 0$ and ii. $\emptyset \neq 0$ And $|m(t)| \ll A_c/2$

Q6. Design an Armstrong indirect FM modulator to generate an FM signal with carrier frequency 97.3 MHz and $\Delta f = 10.24$ kHz. A NBFM generator of fc1=20 kHz and Δf=5 Hz 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. **5**

Q7. An FM transmitter radiates 100W when no modulation is present. The carrier is now frequency modulated by sinusoidal signal so that the amplitude of first order side band is zero in the spectrum. Under this condition calculate the power at

a. F_c
b. In all remaining side bands
c. In second order side band

5

Given that $J_0(0)=1$, $J_0(2.4)=0$, $J_0(3.8)=-0.4$, $J_0(5.1)=-0.16$,
$J_1(2.4)=0.53$, $J_1(3.8)=0$, $J_1(5.1)=-0.33$
$J_2(2.4)=0.43$, $J_2(3.8)=0.41$, $J_2(5.1)=0$