53 (EC 402) ANCM

2014

ANALOG COMMUNICATION

Paper : EC 402

Full Marks : 100

Pass Marks : 30

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* What is meant by modulation ? Why it is needed ? What is the difference between Linear and non-Linear modulation ? 10

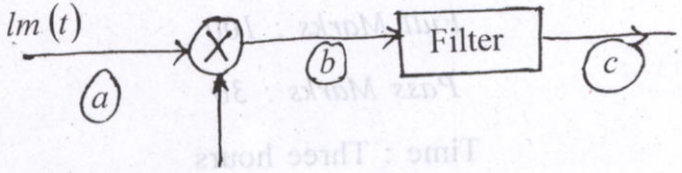
   (b) Derive the power equation of DSB-AM. The antenna current of an AM transmitter is $8A$ when only carrier is sent, but it increases to $8{\cdot}96A$ when the carrier is modulated by a single tone sinusoid. Find the percentage modulation. Find the antenna current when the depth of modulation changes to ·9.

   3+7

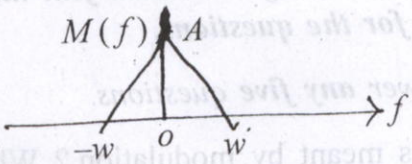
2. *(a)* *(i)* The following figure shows a DSB-SC modulator. The available carrier is a distorted sinusoid given by

$$a_1 \cos(2\pi f_c t) + a_2 \cos^2(2\pi f_c t).$$

The baseband signal $lm(t)$ has a spectrum shown in second figure



Distorted Carrier



Determine the signals at the points b and c and sketch the spectra at these points.

(ii) What kind of filter is required for extracting the DSB-SC signals ?

(iii) What is the minimum value of f_c required for the scheme to work ?

6+3+3

(b) Describe the effects of phase and frequency discrepancy in synchronous detection of DSB-SC signal. 8

3. (a) Show that if $g(t)$ and $\hat{g}(t)$ is hilbert transform pair then 5

$$G(f) = -j\,sgn(f)G(f)$$

(b) Let $Su(t)$ denote the SSB-SC wave obtained by transmitting only the USB, and $\hat{Su}(t)$ it's hilbert transform. Show that 7

$$\hat{Im}(t) = \frac{2}{A_c}\left[\hat{Su}(t)cos(2\pi f_c t) - Su(t)sin(2\pi f_c t)\right]$$

(c) Find the expression of envelope and phase of Narrow Band FM and show that it is similar to AM. 8

4. (a) State advantage of generation of WB≠M by Indirect method compared to direct method. 5

(b) Describe with mathematical support, the method of demodulation of FM using PLL. 10

(c) AN FM commercial broadcast transmitter (Freq-deviation = 75*kHz*) is modulated 40% by a 5 *kHz* test tone. When the percentage of modulation is doubled, what is the frequency swing of the transmitter ? 5

5. (a) Explain how reactance modulator generates FM. Draw the basic FET reactance modulator and show that its transconductance varies with input message signal. 10

(b) Find out noise figure in DSB-SC modulatation system. 10

6. (a) Draw the block diagram of super heterodyne receiver and explain its operation. 10

(b) What is the difference between TDM and FDM ? Six independent message sources of bandwidth W, W, 2W, 2W, 3W and 3W *Hz* are to be transmitted on a time division multiplexed basis using a common communication channel.

(i) Set up a scheme for accomplishing the multiplexing requirement, with each message signal sampled at Nyquist rate.

(ii) Determine the minimum transmission bandwidth of the channel. 5+5

7. Write short notes on : ***(any two)*** 10×2

(a) Ring Modulator

(b) AGC

(c) PWM

(d) QAM
