Total number of printed pages–5

53 (EC-402) ANCM

2015

ANALOG COMMUNICATION

Paper : EC 402

Full Marks : 100

Time : Three hours

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

*Answer **any five** questions.*

1. *(a)* What is meant by continuous wave (CW) modulation and why it is required ?

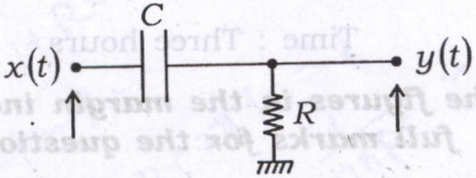
   (b) What is modulation index in context with amplitude modulation ? What happens if it is greater than unity ?

   (c) Show that it is not possible to amplitude modulate by adding the message signal to the carrier.

   (d) Prove that the system bandwidth and the rise time are related by $tr \simeq \frac{0{\cdot}35}{B}$; where the symbols have their usual meaning. 2+3+5+4+6

Contd.

2. *(a)* $x(t) = e^{-t/\tau}u(t)$ is applied as input to an L-section high-pass RC filter with a time constant of 'τ' seconds. Find the energy spectral density (ESD) at the output of the filter. Also express the O/P signal energy as a percentage of the input signal energy.



(b) The efficiency (η) of conventional AM is defined as the percentage of the total power carried by the sidebands, that is

$\eta = \frac{P_S}{P_T} \times 100\%$; where 'P_S' is the total sideband power and 'P_T' is the total power of the AM.

(a) Find η for 50% modulation ($\mu = 0{\cdot}5$),

(b) Show that for a single-tone AM, $\eta/_{max} = 33{\cdot}3\%$ when $\mu = 1$.

10+10

3. *(a)* What condition is to be satisfied for diagonal clipping not to occur in envelope detector? Hence prove that diagonal clipping can be avoided if

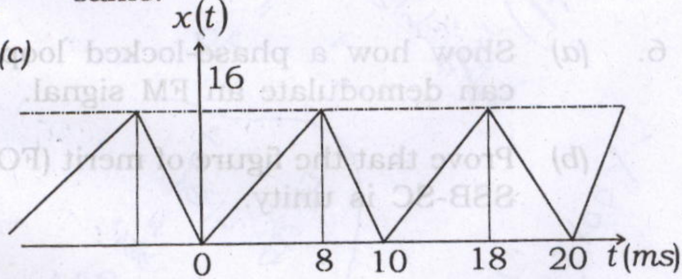
$$R_L.C \le \frac{\sqrt{1-m^2}}{m.W_m}$$; where the symbols have their usual meaning.

(b) Derive the condition on the filter transfer function necessary to demodulate a VSB signal. Hence draw the filter transfer function. 1+9+8+2

4. *(a)* What is capture effect in FM?

(b) Show that any narrow band angle modulation is equivalent to AM; you may take the case only for PM or FM. Hence draw the phasor diagram for the same.

(c)



The message signal shown above phase modulates a carrier signal $Ac\cos(w_{ct})$, where $f_c = 1MHz$. If a max. frequency deviation of $80kHz$ is needed, determine the value of the phase constant 'K_p' to be used by the modulator. With this value of K_p, what will be the range of variation of the carrier frequency?

2+8+10

5. *(a)* Define 'effective bandwidth' of an angle modulated signal.

(b) Explain the working of a Foster-Seeley detector for FM.

(c) Show that the output of the balanced zero-crossing detector is approximately proportional to the amplitude of the normalized modulating signal $x(t)$.

3+10+7

6. *(a)* Show how a phase-locked loop (PLL) can demodulate an FM signal.

(b) Prove that the figure of merit (FOM) for SSB-SC is unity. 10+10

7. Write short notes on ***any two*** from the following : 10+10

(a) Super-heterodyne receiver

(b) Pre-emphasis and De-emphasis

(c) Low and high level transmitters

(d) PAM.
