Total number of printed pages–4

53 (EC 402) ANCM

2021

ANALOG COMMUNICATION

Paper : EC 402

Full Marks : 100

Time : Three hours

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

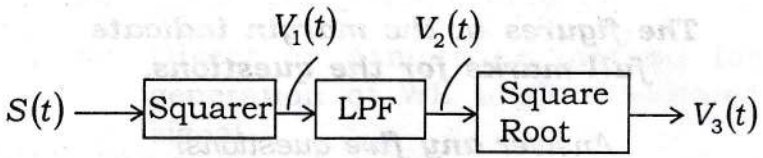
*Answer **any five** questions.*

1. *(a)* Establish the relation between the output and the input power spectral density of an LTI system. 10

   (b) A power signal $x(t)$ whose spectral density is a constant 'K', applied to a low-pass RC circuit. Find the mean square value of the output. 10

Contd.

2. *(a)* The AM signal $S(t)=Ac\left[1+kam(t)\right]Cos(2\pi fct)$ is applied to the system shown below. Assuming that $|ka.m(t)|<1$ for all 't' and the message signal '$m(t)$' is limited to the interval $-W<f<W$, and that the carrier frequency $fc>2W$, show that $m(t)$ can be recovered from the output $v_3(t)$. 15



(b) A DSB-SC modulated signal is demodulated by applying it to a coherent detector. Evaluate the effect of a frequency error (Δf) in the local carrier signal of the detector, measured with respect to the carrier frequency of the incoming DSB-SC signal. 5

3. *(a)* Consider the modulated wave

$S(t) = Ac\,Cos(2\pi\,fct) + m(t)\,Cos(2\pi\,fct) - \hat{m}(t)Sin(2\pi\,fct)$

which represents a carrier plus an SSB signal, with '$m(t)$' as the message signal and '$\hat{m}(t)$' as the Hilbert transform. Find the conditions for which an envelope detector (ideal) with $S(t)$ as input would produce a good approximation to the message signal. 12

(b) Show the relationship between the transmission bandwidth 'B_T' and the modulation depth 'β' using Carson's rule. 8

4. *(a)* Explain the working principle of a Foster-Seeley discriminator. 14

(b) Show that a linearised PLL can demodulate an FM signal. 6

5. *(a)* Assuming sinusoidal modulation, derive the expression for output signal-to-noise ratio and figure of merit in an FM system. 14

(b) Show that for an AM system with envelope detector, the figure of merit, i.e. the ratio of destination SNR to the channel SNR is given by 6

F.O.M = $\frac{m^2.\overline{x}^2}{1+m^2\cdot\overline{x}^2}$, where '$m$' is the modulation depth and 'x' is the AM signal.

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

(a) Quadrature FM demodulator

(b) Direct or Armstrong method for generation of WB angle modulated signal.

(c) Carson's rule for bandwidth.