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328452(28)

B. E. (Fourth Semester) Examination, April-May 2021

(New Scheme)

(ET&T Engg.)

ANALOG COMMUNICATION

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Part (a) of each question is compulsory. Attempt any* ***two*** *parts from (b), (c) & (d). Attempt all questions. All questions carry equal marks.*

Unit-I

1. (a) Show theat the squaring circuit will not permit the generation of a locak oscillator signal capable of demodulating a SSB-SC signal. 2

(b) Explain the working of a diode-demodulator / envelope detector. Specify the conditions in terms of modulation index so that the message signal can be perfectly recovered from the AM signal using this method. 7

(c) The signal

$$v(t) = \left[1 + 0 \cdot 2 \cos \left(\omega_M / 3 \right) t \right] \cos \omega_c t$$

is demodulated using a square-law demodulator having the characteristics $v_0 = v^2$. The output $v_0(t)$ is then filtered by an ideal low-pass filter having a cut-off frequency at f_M Hz. Sketch the amplitude frequency characteristics of the output waveform in the frequency range $0 <= f <= f_M$. 7

(d) Draw a block diagram of super-heterodyne radio reciever. Explain the function of each block. 7

Unit-II

2. (a) Distinguish beween narrow band FM and wide band FM. 2

(b) Explain the direct method of frequency modulation in detail. 7

(c) Show that $v(t)$ given by

$$v(t) \cos \left(2 \pi 10^6 t \right) + 0 \cdot 02 \cos \left[2 \pi \left(10^6 + 10^3 \right) t \right]$$

represents a carrier which is modulated both in amplitude and frequency by drawing a phasor diagram. Find value of m and β. 7

(d) In an Armostrong modulator the crystal oscillator frequency is 200 kHz. It is desired in order to avoid distortion, to limit the maximum angular deviation to $\phi_m = 0 \cdot 2$. The system is to accommodate modulation frequencies down to 40 Hz. At the output of modu-lator the carrier frequency is to be 108 MHz and the frequency deviation 80 kHz. Select multiplier and mixer oscillator frequencies to accomplish this end. 7

Unit-III

3. (a) Define white noise. 2

(b) A signal (within 4000 Hz) of strength 0·001 W passes through a distorting channel defined as :

$$H(f) = \frac{4000}{j\,4000 + f}$$

The channel is also corrupted with additive white gaussian noise of magnitude 10-8 W/Hz. At the receiver end there is an equalizer which exactly matches the channel within frequency of interest (within 4000 Hz). Find SNR at the output of the equalizer. 7

(c) The auto-correlation function of noise signal is triangular and defined as

$$R_n(\tau) = \begin{cases} 1-|\tau| & \text{for } |\tau|<1 \\ 0 & \text{for } |\tau|>1 \end{cases}$$

Find it's noise spectrum. 7

(d) Find the effect of Linear filtering of White Noise by filtering through a RC low pass filter. 7

Unit-IV

4. (a) Define the figure of merit. What is the figure of merit of DSB-SC system and a SSB-SC system? 2

(b) Determine the output signal to noise ratio for a SSB-SC system. 7

(c) An audio signal of 4 kHz Bandwith is to be transmitted through a channel that introduces 30 dB loss and white noise of PSD 10^{-9} W/Hz. Calculate the minimum required transmitted power if the message is sent by SSB-SC, DSB-SC and DSB-C modulation methods. The received output SNR should be at least 40 dB. For DSB-C energy in the sideband is half of that of the carrier. 7

(d) Determine the signal to noise ratio for an AM systerm using a Square Law demodulator. 7

Unit-V

5. (a) What is an Amplitude limiter? Explain it's significance in demodulation of a FM signal. 2

(b) Explain the need and effect of Pre-emphasis and De-emphasis networks used in commercial FM systems. 7

(c) Find the output SNR of an FM limiter-Demodulator when input signal strength is 0·5 W, maximum frequency deviation 60 kHz, baseband signal cut-off frequency 15 kHz, received white Gaussian noise PSD 10^{-10} W/Hz And average power of the

modulating signal 0·1 W. Find the required transmitted power for above if channel has 20 dB loss and required output SNR is at least 40 dB. 7

(d) Compare the effect of noise in FM and AM in terms of the figure of merits. 7