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328514 (28)

BE (5th Semester)

Examination, Nov.-Dec., 2021

Branch : Et & T

COMMUNICATION SYSTEM - I

Time Allowed : Three Hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : Assume suitable data wherever necessary. Section (a) is compulsory in all questions. Solve any two sections out of (b), (c) and (d) in each question. All question carry equal marks.

Q. 1. (a) Measurements on a voltage amplifier indicate a gain of 20 dB. If the input voltage is 1 volt, calculate the output voltage. **2**

(b) Find the Fourier transform of $\sin\omega_0 t$. Compare with the transform of $\cos\omega_0 t$. Plot and compare the power spectral densities of $\cos\omega_0 t$ and $\sin\omega_0 t$. **2+2+3**

(c) A waveform m(t) has a Fourier transform M(f) whose magnitude is as shown in figure 1-C.

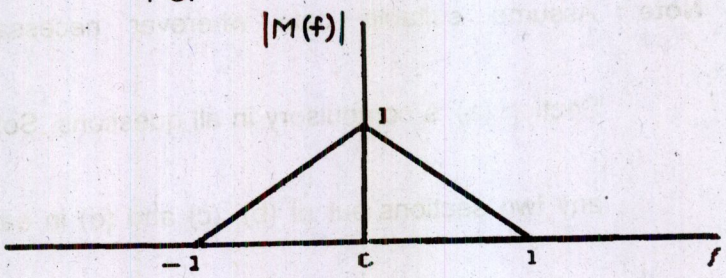

Figure 1-C

(i) Find the normalized energy content of the waveform. 3

(ii) Calculate the frequency f_1 such that one-half of the normalized energy is in the frequency range - f_1 to f_1. 4

(d) Determine an expression for the correlation function of a square wave having the values 1 or 0 and a period T. 3+4

Q. 2. (a) Define QAM. 2

(b) (i) Draw the frequency spectrum diagram of DSB-FC amplitude modulated signal for Periodic and Non-periodic modulating signal (baseband signal). 3

(ii) The baseband signal m(t) in the frequency translated signal $v(t) = m(t) \cos 2\pi f_c t$ is recovered by multiplying v(t) by the waveform $\cos 2\pi(f_c + \Delta f)t$. The product waveform is transmitted through a low-pass filter which rejects the double-frequency signal. Find the output signal of the filter. 4

(c) The input to the envelop detector of a tone modulated signal is given as $v(t) = A_c\{1+m \cos\omega_m t) \cos\omega_c t$. Find the maximum value of the time constant RC of the detector that can always follow the message envelop. 7

(d) In the SSB generating system of figure II-d the carrier phase-shift network produces a phase shift which differs from 90° by a small angle α. Calculate the output waveform and point out the respects in which the outputs no longer meets the requirements for an SSB waveform. Assume that the input is a single spectral components $\cos\omega_m t$. 7

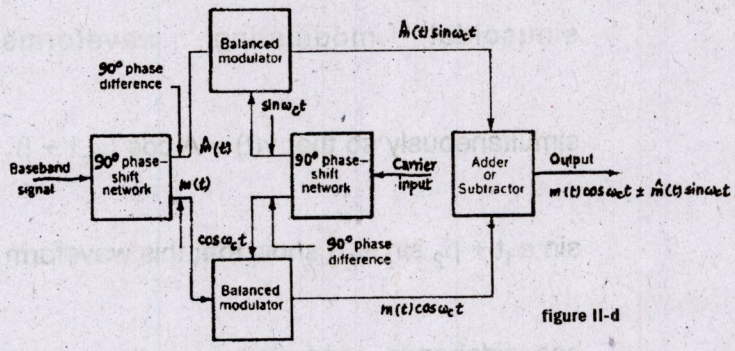

figure II-d

Q. 3. (a) What is pre-emphasis and de-emphasis ? **1+1**

(b) Consider the signal $\cos[\omega_c t + \varphi(t)]$ where $\varphi(t)$ is a square wave taking on the values $\pm \pi/3$ every $2/f_c$ sec.

(i) Sketch $\cos[\omega_c t + \varphi(t)]$. **3**

(ii) Plot the phase as a function of time. **4**

(c) A carrier is angle-modulated by two sinusoidal modulating waveforms simultaneously so that $v(t) = A \cos(\omega_c t + \beta_1 \sin \omega_1 t + \beta_2 \sin \omega_2 t)$ show that this waveform has sidebands separated from the carrier

not only at multiples of ω_1 and of ω_2 but also has sidebands as well at separations of multiples of $\omega_1 + \omega_2$ and of $\omega_1 - \omega_2$. 7

(d) In figure III-d the voltage variable capacitor is a reversed biased pn junction diode whose capacitance is related to the reverse biasing voltage v by $Cv = (100/[1+2v]^{1/2})$ pF. The capacitance C_0 = 200 pF and L is adjusted for resonance at 5 MHz when a fixed reverse voltage v = 4 volts is applied to the capacitor Cv. The modulating voltage is

$m(t) = 4 + 0.045 \sin 2\pi \times 10^3 t$. If the oscillator amplitude is 1 volt, write an expression for the angle modulated output waveform which appears across the tank circuit. **7**

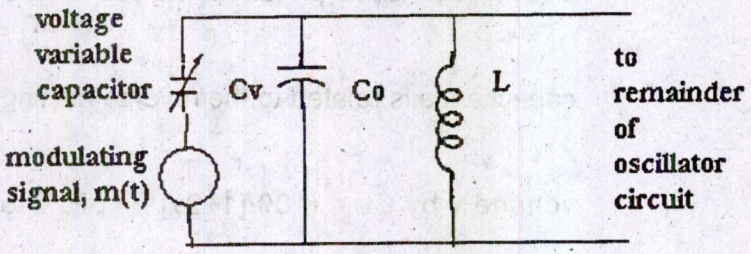

Figure III-d

Q. 4. (a) Define radio transmitter and receiver. **1+1**

(b) Explain High-level transistor collector modulator with neat diagram. **3+4**

(c) With the help of neat diagram explain indirect (Armstrong) FM transmitter. **3+4**

(d) Draw a block schematic of super heterodyne radio receiver and explain why it is called so. Explain the function of each block. **3+1+3**

Q. 5. (a) Define signal to noise ratio. **2**

(b) Explain various noise sources in detail with example. **7**

(c) Explain noise in DSB-SC with mathematical equation and diagram. **7**

(d) Discuss threshold in FM. Derive the expression for the same. 7

OR

A 4-MHz TV signals, and one thousand 4-kHz audio signals, are multiplexed onto a single FM carrier (the audio signals are SSB-modulated to obtain this goal; the TV signal is left at baseband and is therefore channel 1). The power spectral density of the composite signal is constant over its entire spectral range.

(i) Find the spectral range of the composite signal. 2

(ii) Calculate the output SNR for channel 1. the TV signal, in terms of the input SNR. 2

(iii) Calculate the output SNR for the top channel. 3