SCHOOL OF ELECTRONICS ENGINEERING
VIT Vellore

VIT

Principles of communication Engineering (ECE-2024)

B.Tech
Slot: C1
Aug 2019

Time: 1.5 hour

Continous Assessment test - I

Maximum Marks: 50

Note: Answer all parts of the questions. The marks for each part is given.Draw a neat diagram where necessary.

1.(a) For square law modulator shown in Figure 1 , the square law device is characterised by $V_2 = (V_1 + 0.1V_1^2)$. The carrier $c(t)$ is comprising of $A_c = 20$ V $f_c = 1000Hz$ and the message signal $m(t)$ has $A_m = 2$ V, $f_m = 100Hz$.

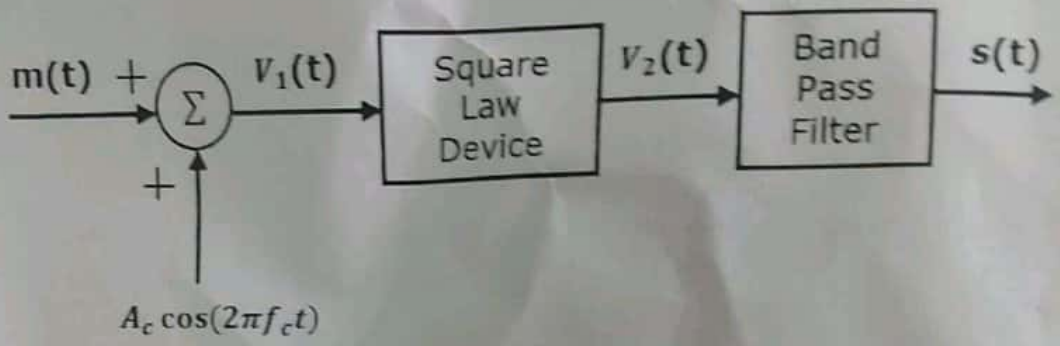

Figure 1: Square law modulator for AM

If the passband of the band pass filter (BPF) ranges from 800Hz to 1200Hz.Then determine the following:

i The mathematical expression for the AM wave after the filtering. [6 marks]
ii Side band power(P_{SB}), carrier power (P_c)& modulation index (μ). [2 marks]
iii Efficiency of the modulation scheme(η). [2 marks]

(b) An SSB AM signal is generated by modulating an 800 kHz carrier by the message signal $m(t) = [\cos(2000\pi t) + 2\sin(2000\pi t)]$. Assume that the amplitude of the carrier is sinusoidal having $A_c = 100$ V.

i Determine the Hilbert transform of the message signal. [2 marks]
ii Find the time domain expression for the lower sideband SSB AM signal [4 marks]
iii Determine the spectrum of the lower side band of SSB AM signal. [4 marks]

2. (a) A carrier signal $c(t) = \cos(2\pi 10^6 t)$ is modulated by a message signal of $m(t) = \cos(2\pi 10^4 t)$. Then determine the following parameters-

i Find A_m, A_c, f_m & f_c. [2 marks]
ii Total power (P_t) and modulation index (μ). [2 marks]
iii Plot AM spectrum and identify the spectral components(viz . frequencies and magnitudes in the spectrum). [4 marks]

(b) An AM signal is given by $s(t) = [4\cos(3200\pi t) + 10\cos(4000\pi t) + 4\cos(4800\pi t)]$ then determine BW, Total power (P_t), efficiency (η) & modulation index. [2 marks]

3. (a) Derive the equation for SSB signal when only lower side band (LSB) is being transmitted. [2 marks]

   (b) Discuss the effect of phase offset in coherent detection in DSB-SC scheme. Why does this offset occur? Explain with suitable example. [4 marks]

   (c) The message signal is $m(t) = \cos(2\pi f_m t)$ and the carrier signal is $c(t) = \cos(2\pi f_c t)$. Explain the generation of USB in SSB-SC modulation using Hartley modulator with the help of spectrum. [4 marks]

4. The signal $V(t) = [1 + 0.2\cos(2(\frac{\omega_m}{3})t)]\cos(\omega_c)t$ is demodulated using a square law demodulator having characteristics $V_o = (V_i + 2)^2$. The output $V_0(t)$ is filtered through a LPF having cut-of frequency f_m Hz. Sketch the amplitude characteristics of the output waveform in the frequency range $0 < f < f_m$. [5 marks]

5. An antenna transmits a 10kW power at 95% modulation using conventional AM. Determine the amount of power saving if single sideband transmission is used for the same intelligibility. [5 marks]
