PAC 2023BEE-008 | Tutorial - 1

Instructor - Dr. Somesh Kr.

POC, AC, EDSC, Electromagnetic

Q1. Consider an Energy Signal $x(t)$ over the range -3 to 3. with energy $E = 12$ J. Calculate the energy of signal

$x_1(t) = x(3t)$

Q2:- Consider a periodic signal $x(t)$ with fundamental period $T = 6$ with power $P = 4$W. Calculate the power of signal $x_1(t) = x(4t)$.

Q3:- Calculate Energy & power of the below Signals

(i) $x(t) = e^{2t}\,u(t)$ (ii) $x(t) = A$ (iii) $x(t) = 2e^{j\omega t}$

(iv) $x(t) = e^{-t^2/5}$

Q4:- Calculate fourier Transform

(i) $x(t) = e^{-at}\,u(t)$ (ii) $x(t) = e^{+at}\,u(-t)$ (iii) $x(t) = \delta(t)$

(iv) $x(t) = \delta(t-2)$ (v) $\delta(t+2)$ (vi) $x(t) = e^{-a|t|}$

(vii) $x(t) = \delta(t-1) + \delta(t+1)$

(viii) $x(t) = \delta(t+2) - \delta(t-2)$

Dup.

(Q3)(iv) Hint: Gaussian function $= \int_{-\infty}^{\infty} e^{-\pi t^2} = 1$

Note: if $\mathcal{E}(x(t)) = \mathcal{E}_0$ ↘.

$\mathcal{E}[x(kt)] = \dfrac{\mathcal{E}_0}{k}$.

$x(t) = e^{-t^2/5} \Rightarrow \therefore$ Energy $= \dfrac{1}{5\pi}$.

21/03/24

Tutorial -3

Dr Somesh Kumar

2023BEE-003

Q1:- A 10 kW AM system, if the P_t = 600W & P_c is 400W then modulation index is ?

Q2:- For an AM wave max voltage is 10V, min voltage is 5V then modulation index is ?

Q3:- For a broadcast transmitter the RF output represented as $e(t) = 50(1 + 0.8 \cos 5000t + 0.3 \sin 3000t) \cos(6 \times 10^6 t)$ what are sidebands of the signals in radians.

Q4:- A modulated signal is given by $s(t) = m_1(t) \cos(2\pi f_c t) + m_2(t) \sin(2\pi f_c t)$ where the base band signal $m_1(t)$ & $m_2(t)$ have bandwidth of 10 kHz & 15 kHz. The BW of modulated signal is ?

Q5:- For an AM signal the BW is 10kHz & highest freq. component is 7.5 kHz the $\frac{1}{2}$ is ? Double/singleton.

Q6:- For AM the modulation envelope has a peak value which is double the unmodulated carrier wave. What is the value of modulation index.

Q7. For AM voltage signal s(t) with carrier frequency of 1.15 GHz has a complex envelope g(t) = $A_c[1 + m(t)]$. A_c = 500 V & the modulation is a 1 kHz sinusoidal test tone described by m(t) = 0.8 sin($2\pi \times 10^3 t$) appears across a 50Ω resistive load. What is the actual power dissipated in the load.

$1.6 \times 1 \times 10^{-6}$

28/May/20

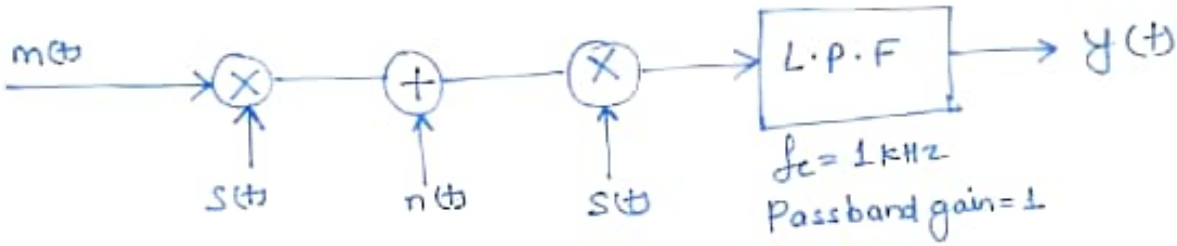
Tutorial - 4

Dr. Hemant Kumar

Q1:- A carrier Voltage has a peak amp of 10V at a freq of 10^6 Hz. A Sinusoidal signal of 1 KHz Varies the amplitude of r.f. 7.5 & 12.5 V. The peak amp of modulating signal is ____.

Q2:- The A.M. waveform $s(t) = A_c[1 + k_a m(t)] \cos \omega_c t$ is ~~greater than~~ fed to envelope detector. The max. magnitude $k_a m(t)$ is greater than 1. what is detector output

Q3:- In a fig $m(t) = \frac{2.5 \sin 2\pi t}{t}$, $s(t) = \cos 200\pi t$ & $n(t) = \sin \frac{199\pi t}{t}$. The o/p $y(t)$ will be



Q4:- A AM broadcast station transmits an average carrier power o/p of 40 KW and uses a modulation index of 0.707 for sine wave modulation. What is the max. amp of the o/p if the antenna is represented by 50Ω Resistive load.

Q5:- A RF Carrier of 10 KV at 1 MHz is AM by a 1 KHz signal of 6 KV peak. The modulation pattern is observed. The voltage indicated will be ____.

Date 14/8/24

Tutorial -2

Dr. Somesh Kumar.

Q1:- A Signal $x(t)$ is known to be zero for $t<3$, let $y(t) = x(1-t)$. for what Range of t, $y(t)$ is guranted to be zero.

Q2:- Consider a periodic signal with fundamental period $T=8$ and fourier Series coff. $a_1 = a_{-1} = 2$, $a_3 = 4j$, $a_{-3} = -4j$ calculate fourier Series.

Q3:- Consider a cont. time periodic signal with fundamental period $T=8$ and fourier Series coff. $a_1 = j$, $a_{-1} = -j$, $a_5 = a_{-5} = 2$. Calculate fourier Series.

Q4:- Calculate fourier Transform of $x_1(t) = x(2t-3)$. where $x(t) = e^{-2|t|}$

Q5:- Calculate fourier transform of

a) $x(t) = \frac{2}{1+t^2}$ b) $x(t) = \text{Sgn}(t)$ c) $x(t) = \frac{1}{\pi t}$ d) $x(t) = \frac{1}{jt}$