Total No. of Pages: 1

Roll No.: 1620

**B. TECH. (COE) SEMESTER II**

**MID SEMESTER EXAMINATION MARCH 2017**

**COURSE CODE: CEC04 COURSE TITLE: ANALOG AND DIGITAL COMMUNICATION**

Max Time: 1:30 Hrs

Max. Marks: 25

Attempt all Questions. Assume suitable missing data, if any.

1. A time domain signal $g(t)$ is defined as $g(t) = t[u(t) - u(t-1)]$, then [2+3]

   (a) Find the Fourier transform of $g(t)$.

   (b) Using the Fourier transform properties, obtain the Fourier transform of $g(-0.5t - 1)$.

2. Calculate the energy of the signal $s(t) = 2e^{-3t}u(t)$. Also show that the energy of scaled signal $s(\alpha t)$, with $\alpha > 1$, is reduced by a factor of $\alpha$. [2+3]

3. For a radio FM transmitter, a single tone sinusoid message with $A_m = 1$ produces a wide band FM output given as [2+2+1]

$$z(t) = 2\sum_{n=-\infty}^{\infty} J_n(\beta)\cos[2\pi(f_c + 500n)t],$$

   where $\beta$ is a constant.

   (a) Calculate $\beta$ such that bandwidth $B_T = 6000$ Hz (Using Carson's rule).

   (b) Write down the expression for the spectrum of $z(t)$ and calculate the value of spectrum impulse at $f = f_c$ for the value of $\beta$ obtained in part (a). [You may leave your answer in terms of $J_n(\cdot)$].

   (c) If $f_m$ is reduced from 500 Hz to 100 Hz, find a value of $k_f$ such that the output bandwidth is still $B_T = 6000$ Hz according to Carson's rule.

4. An amplitude modulated (AM) signal has the following form [2+2+1]

$$x(t) = 2[1 + 0.5\cos(2000\pi t) - 0.2\cos(4000\pi t)]\cos(2 \times 10^6 \pi t),$$

   (a) Sketch the spectrum of AM signal $x(t)$.

   (b) Calculate the lower side band and upper side band powers.

   (c) Also compute the transmission efficiency of the AM signal.

5. Explain *Any ONE* of the following in detail with the help of suitable diagram [5]

   (a) Envelope Detector

   (b) Direct Method of FM generation

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B.E. (IT) IV Semester
B.E. MID SEMESTER EXAMINATION March, 2015
IT-212: ANALOG & DIGITAL COMMUNICATION

**Time: 1.30 hrs** **Max. Marks: 20**

**Note: All questions carry equal marks.**
**Assume suitable missing data, if any.**

**Q1.** Explain the block diagram of phase shift method for the SSB generation. Also give the advantages and disadvantages of this method. **(4)**

**Q2.** If X is uniformly distributed in (0,1). Find the pdf of $Y = \frac{1}{(2X+1)}$. **(4)**

**Q3.** A one-dimensional random variable 'X' is distributed over the interval [0,1] with pdf $ax^2 + b$, where $a$ and $b$ are constants. If the arithmetic mean of 'X' is 0.5, find the values of $a$ and $b$. **(4)**

**Q4.** A sinusoidal carrier has amplitude of 10 V and frequency 30 kHz. It is amplitude modulated by a sinusoidal voltage of amplitude 3V and frequency 1 kHz. Modulated voltage is developed across a 50 ohm resistance.

i. Write the equation for modulated wave.
ii. Plot the modulated wave showing maxima and minima of waveform.
iii. Draw the spectrum of modulated wave.
iv. Calculate the total average power and the power carried by sidebands. **(4)**

**Q5.** A 20 MHz carrier is modulated by a 400 Hz modulating signal. The carrier voltage is 5V and the maximum deviation is 10 kHz. Write down the mathematical expressions for the FM and PM waves. If the modulating frequency is increased to 2 kHz keeping everything else constant, write down the expressions for the FM and PM waves. **(4)**

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Roll No. 722/

**B.E. (IT) MID SEMESTER EXAMINATION March 2014**
**IT-212: Analog and Digital Communication**

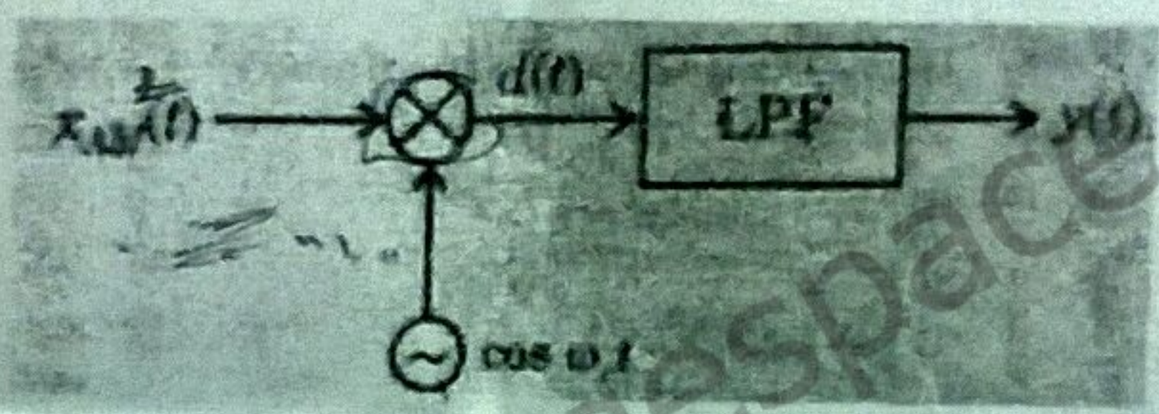
**Time: 1:30 Hours** **Max. Marks: 20**

**Note: All Question carry equal marks.**
**Assume suitable missing data, if any.**

**Q1.** Compute the Hilbert transform and pre-envelope of $\mathbf{x(t)= sinc(2t)}$ (4)

**Q2.** Explain the Time domain and frequency domain mathematical analysis of AM signal. Also draw its frequency spectrum. (4)

**Q3.** Show that an AM signal with large carrier can be demodulated by squaring it and then passing the resulting signal through a low-pass filter as shown in fig.




(4)

**Q4.** A sinusoidal carrier has amplitude of 10 V and frequency 30 kHz. It is amplitude modulated by a sinusoidal voltage of amplitude 3V and frequency 1 kHz. Modulated voltage is developed across a 50 ohm resistance.

i. Write the equation for modulated wave.
ii. Plot the modulated wave showing maxima and minima of waveform.
iii. Draw the spectrum of modulated wave.
iv. Calculate the total average power.
v. Calculate the power carried by sidebands. (4)

**Q5.** An angle modulated signal is described by $\mathbf{x(t)=10\cos[2\pi(10^6)t + 0.1\sin(10^3)\pi t]}$

(i) Considering x(t) as a PM signal with $\mathbf{k_p = 10}$, obtain m(t).
(ii) Considering x(t) as a FM signal with $\mathbf{k_f = 10\pi}$, find m(t). (4)

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MID SEMESTER EXAMINATION

**Paper Code: IT-212** **Subject: Analog and Digital Communication**

Time: 1.5 Hours Maximum Marks: 20

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***Note:** Attempt ALL the questions. Assume suitable data if necessary.*

**Q.1** The message signal $m(t) = 2\cos(400\pi t) + 4\sin(500\pi t)$ modulates the carrier signal $c(t) = \cos(8000\pi t)$, using DSB-SC amplitude modulation. Find the time domain and frequency domain representation of the modulated signal and plot the spectrum of the modulated signal. What is the power content of the modulated signal?

**Q.2** Consider a random process X(t) having an auto-correlation function given by $R_X(\tau) = 20 + 5\cos 2\tau + 10\exp[-4|\tau|]$. Calculate the following:

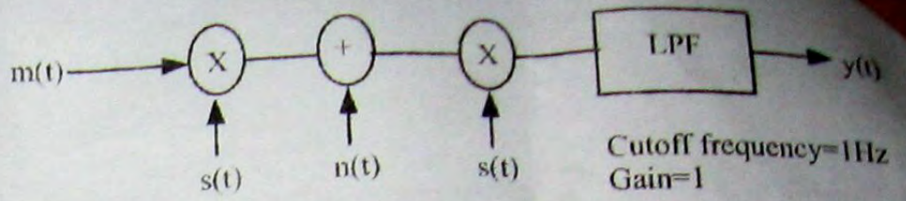
i. Total average power

ii. Mean and variance

iii. RMS value of the random process.

**Q.3 (a)** A modulated signal is given by $s(t) = e^{-at}\cos[(\omega_c + \Delta\omega)t]u(t)$, where $\omega_c$ and $\Delta\omega$ are +ve constants and $\omega_c >> \Delta\omega$. Find the preenvelope and complex envelope of s(t).

**(b)** In the figure below $m(t) = \frac{2\sin(2\pi t)}{2}$, $s(t) = \cos 200\pi t$ and $n(t) = \frac{\sin(199\pi t)}{t}$. Find the output y(t)?




**Q.4** Consider a random process X(t) given by $X(t) = A\cos(2\pi f_c t + \theta)$, where $\theta$ is a random variable uniformly distributed between 0 to $2\pi$ and A, $f_c$ are constants. Plot the power spectral density of X(t)?

**Q5** Determine the fourier transform of signal shown in figure below.