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TEC-501

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 3085   Roll No.

B. Tech.

(SEM. V) EXAMINATION, 2007-08
PRINCIPLES OF COMMUNICATION

Time : 3 Hours]   *[Total Marks : 100*

Note :   *Attempt **all** questions.*

1   Attempt any **two** of the following :

(a)   The band pass signal   10

$x(t) = \sin c(t) \cos 2\pi f_0 t$ is passed through a band pass filter with impulse response

$h(t) = \sin c^2(t) \sin 2\pi f_0 t$. Find the canonical representation of output in terms of low-pass equivalents.

(b)   Show that the Hilbert transform of an even   10
signal is odd and the Hilbert transform of odd signal is even.

(c)   (i)   Show that the signal   5+5

$$x(t) = \begin{cases} k\,t^{-1/4} & , t > 0 \\ 0 & , t < 0 \end{cases}$$

is neither energy type nor power type.

(ii)   Show that the signal sin c (t) is energy type.

2   Attempt any **two** of the following :

   (a)   The output signal from an AM modulator is   5+5

$$\Delta(t) = 5\cos 1800\,\pi t + 20\cos 2000\,\pi t + 5\cos 2200\,\pi t.$$

        (i)   Determine the modulating.
            signal m(t) and carrier c(t).

        (ii)   Determine the modulation index and ratio
            of power in the side bands to the power
            in the carrier.

   (b)   Discuss how the VSB modulation is used in   10
        commercial TV signal. Discuss its merits and
        demerits.

   (c)   Find expressions for the in phase and   10
        quadrature phase components $x_c(t)$ and $x_s(t)$
        and evelope and phase v(t) and $\theta(t)$ for SSB
        and LSSB.

3   Attempt any **two** of the following :

   (a)   An angle - modulated signal is given as   6+4

$$s(t) = 100\cos\left[2000\,\pi t + \phi(t)\right] \text{ where}$$

     (a) $\phi(t) = 5\sin 20\,\pi t$ and

     (b) $\phi(t) = 5\cos 20\,\pi t$:

        (i)   Determine and sketch the amplitude and
            phase spectra for (a) and (b).

        (ii)   Can you differentiate between FM and PM
            signals. – Explain.

   (b)   The carrier $(A) = 100\cos 2\pi f_c t$ is PM   5+5
        modulated by the signal $m(t) = 5\cos 2000\,\pi t$.
        The peak phase deviation is $\pi/2$ and
        $f_c = 10^8\ Hz$:

    (i)   Determine the magnitude spectrum of the sinusoidal components and sketch the results.

    (ii)   Determine the bandwidth of PM signal using Carson's rule.

  (c)   Discuss the use of PLL as FM demodulator.   **10**

4   Attempt any **two** of the following :

  (a)   The noise voltage in an electric circuit is   **4+6**
modelled as zero mean Gaussian noise with
variance 2×10^{-8} :

    (i)   What is the probability that noise voltage magnitude does not exceed 5×10^{-4} ?

    (ii)   This noise is passed through a full wave rectifier. Find the mean value of the rectified noise.

  (b)   Discuss the threshold effect in FM receiver.   **10**
How can it be countered ?

  (c)   Write short notes on in following :   **5+5**

    (i)   Effective noise temperature

    (ii)   Noise figure in cascaded systems.

5   Attempt any **two** of the following :

  (a)   Determine expressions for figure of merit of   **10**
SSB and PM with modulation index β_p .

  (b)   Discuss the trade-off between BW and SNR   **10**
in PCM systems.

  (c)   What is Shannon-Hartley law ? Determine the   **10**
limiting channel capacity as SNR is kept fixed and
BW is increased to infinity.