(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 signal is odd and the Hilbert transform of odd signal is even. 10

(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 commercial TV signal. Discuss its merits and demerits. 10

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

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

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

$s(t) = 100\cos\left[2000\,\pi t + \phi(t)\right]$ 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 modulated by the signal $m(t) = 5\cos 2000\,\pi t$. The peak phase deviation is $\pi/2$ and $f_c = 10^8\ Hz$ : 5+5

(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 modelled as zero mean Gaussian noise with variance $2\times10^{-8}$ : **4+6**

(i) What is the probability that noise voltage magnitude does not exceed $5\times10^{-4}$ ?

(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. How can it be countered ? **10**

(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 SSB and PM with modulation index $\beta_p$. **10**

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

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

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