

(90)

(c) Discuss the use of FM discriminator as FM demodulator.

4 Attempt any **two** parts of the following : $10 \times 2 = 20$

(a) The noise voltage in an electric circuit is modelled as a zero mean Gaussian random variable with variance of 10^{-8} .

(i) What is the probability that noise magnitude exceeds 10^{-4} ?

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

(b) Discuss the purpose and use of Pre-emphasis and De-emphasis filters in FM system.

(c) Write short notes on following :

(i) Equivalent noise bandwidth

(ii) Noise figure.

5 Attempt any **two** parts of the following : $10 \times 2 = 20$

(a) Determine the expressions for figure of merit in DSB-SC and FM with modulation index β_f .

(b) Discuss the trade-off between BW and SNR in FM system.

(c) Discuss the efficiency of PCM systems.



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

PAPER ID : 3085

Roll No.

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B. Tech.

(SEM. V) EXAMINATION, 2008-09
PRINCIPLES OF COMMUNICATION

Time : 3 Hours]

[Total Marks : 100

Note : Attempt all questions.

1 Attempt any **two** parts of the following : $2 \times 10 = 20$

(a) Derive the canonical representation of a narrow band pass signal in terms of low pass equivalents.

(b) Show that the Hilbert transform of the derivative of a signal is equal to the derivative of its Hilbert transform.

(c) Show that if the input to an LTI system is energy type and the impulse response is also energy type, then output is also energy type.

2 Attempt any **two** parts of the following : $2 \times 10 = 20$

(a) An AM signal is generated by modulating the carrier of frequency $f_c = 800$ kHz by the message signal.

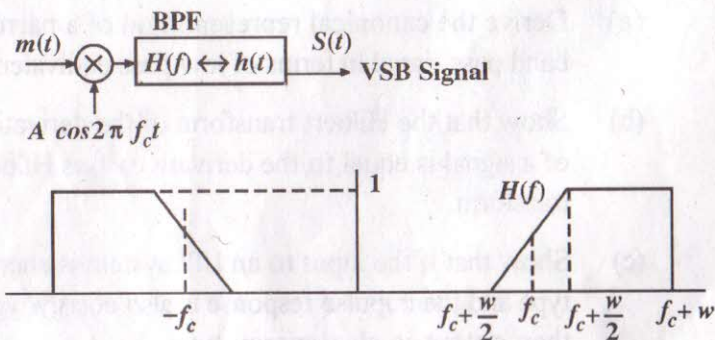


$$m(t) = \sin 2000\pi t + 5 \cos 4000\pi t. \quad \text{The}$$

AM signal is $s(t) = 100[1 + m(t)] \cos 2\pi f_c t$.

- (i) Determine the spectrum of the AM signal.
- (ii) Determine the average power in the carrier and in the side bands.

- (b) A vestigial sideband modulation system is shown below along with the transfer function of the bandpass filter. The message signal $m(t)$ has bandwidth of w .



- (i) Determine the low pass equivalent $h_e(t)$ of $h(t)$.
- (ii) Derive an expression for the VSB signal $s(t)$.

- (c) Find expressions for the inphase and quadrature components, $x_e(t)$ and $x_s(t)$ and envelope and phase $V(t)$ and $\theta(t)$ for DSB-SC signal. 10

3 Attempt any **two** parts of the following : 10×2=20

- (a) An angle modulated signal has the form

$$s(t) = 100 \cos(2\pi f_c t + 4 \sin 2000\pi t)$$

where $f_c = 10 \text{ MHz}$.

- (i) Determine the average transmitted power.
 - (ii) Determine the peak frequency and phase deviation.
 - (iii) Is this an FM or a PM signal? - Explain.
- (b) The carrier $c(t) = 100 \cos 2\pi f_c t$ is FM modulated by the signal $m(t) = 5 \cos 20000\pi t$

where $f_c = 10^8 \text{ Hz}$.

- (i) Determine the amplitude and frequency of all signal components that have power level of at least 10% of the power of the unmodulated carrier.
- (ii) Find the bandwidth of the FM signal using Carson's rule.

