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

PAPER ID : 2118 Roll No. | | | | | | - | | | | |

B.Tech.

(SEMESTER-V) THEORY EXAMINATION, 2012-13

PRINCIPLES OF COMMUNICATIONS

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

Section – A

1. Attempt **all** questions. $2 \times 10 = 20$

(a) Is it true that amplitude of transmitted carrier does not carry any message information in phase modulation ? Explain with answer.

(b) Define the term sensitivity, selectivity and image frequency in a radio receiver.

(c) What is pre-emphasis ? Why is it used ?

(d) Find transmission power efficiency for a tone modulated signal when modulation index is 0.25.

(e) What is meant by "threshold" in DSC-C reception ?

(f) List the factors influencing the choice of the intermediate frequency for a radio receiver.

(g) Find the nyquist rate and nyquist interval for signal

$G(t) = \sin c(200t) + \sin c^2(200t)$

(h) For white noise interference, is it true that noise power spectral density does not vary with frequency at receiver output for phase modulated system while increases in quadratic manner for FM system ?

(i) A single tone modulated DSB signal has a peak envelope voltage of 200 V across a 50 Ohm resistive load. Determine peak envelope power.

(j) Does the reduction in frequency range improve SNR of both SSB and DSB-SC reception ? Explain with answer.

Section – B

Attempt any **three** questions : **10 × 3 = 30**

2. (a) A signal m(t) of bandwidth B = 4 KHz is transmitted using a binary companded PCM with modulation index $\mu = 100$. Compare the case of L = 64, with the case of L = 256 from the point of view of transmission bandwidth and the output SNR.

(b) Consider the DSB-SC signal $s(t) = A_c \cos(2\pi f_c t)m(t)$ where $A_c\cos(2\pi f_c t)$ is the carrier wave and m(t) is the message signal. This modulated signal is applied to a square-law device characterized by $y(t) = s^2(t)$ the output y(t) is next applied to a narrowband filter with a pass band magnitude response of one, mid band frequency $2f_c$, and Bandwidth Δf is small enough to treat the spectrum of y(t) as essentially constant inside the pass band of filter. Show that the filter output y(t) is approximately sinusoidal, given by $v(t) = A_c^2 E\Delta f \cos(4\pi f_c t)$E is the energy of message signal m(t).

(c) Estimate the essential Bandwidth ω rad/s of the signal $e^{-at}u(t)$ if the essential band is required to contain 95% of the signal energy.

(d) Single-side band may be viewed as a Hybrid form of amplitude modulation and frequency modulation. Evaluate the instantaneous frequency of an SSB wave for following two cases :

(i) When only the upper side band is transmitted.

(ii) When only the lower side band is transmitted.

(e) Consider a test, signal m(t) defined by a hyperbolic tangent function $m(t) = A \tanh(\beta t)$. Where A & β are constants. Determine the minimum step size Δ for delta modulation of the signals which is required to avoid slope overload ?

Section – C

Attempt **all** questions. **10 × 5 = 50**

3. The time average of the square of a modulating message signal of 60 KHz bandwidth is calculated as 0.1 Watt. The signal is used in DSB-SC modulation with carrier power 10 Watt. If additive white noise power spectral density is 10^{-6} W/Hz, find the output SNR for a square demodulator. Also find output SNR if carrier power is reduced by 100 times.

OR

Show that weak sinusoidal interferences on carrier has negligible effect on angle modulated systems.

4. Explain T1 digital system with block diagram and also explain TDM hierarchy.

OR

What determine the bandwidth used by any given FM Communication System ? Explain adjacent channel interferences and capture effect in FM.

5. Explain Delta-Sigma Modulation with Block diagram and summarize the important advantages of PCM.

OR

Show that DSB-SC amplitude modulation is linear while phase modulation is not.

6. Give a generalized representation of bandwidth for a single tone sinusoidal modulating signal of amplitude A_m, frequency w_m, carrier amplitude A_c, carrier frequency W_c for both FM and PM. Assume proportionality constant for phase modulation K_p and proportionality constant for frequency modulation K_f.

OR

Show that, PWM can be achieved by simple time averaging of PWM pulses by an averaging low pass filter.

7. The autocorrelation function of a noise signal is triangular and defined as

$$R_n(\tau)=\begin{cases}1-|\tau| & \text{for } |\tau|<1\\ 0 & \text{for } |\tau|>1\end{cases}$$

Find its noise spectrum.

OR

An angle-modulated signal with carrier frequency $w_c = 2\pi \times 10^5$ is described by equation

$\Phi_{EM}(t) = 10 \cos (w_c t + 5 \sin 3000t + 10 \sin 2000 \pi t)$

(i) Find the power of modulated signal.

(ii) Find the frequency deviation.

(iii) Find the deviation ratio.

(iv) Find the phase deviation.

(v) Estimate the bandwidth of $\phi_{EM}(t)$.
