EEC-502

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

PAPER ID : 131502

Roll No.

B. Tech.

(SEM. V) (ODD SEM.) THEORY
EXAMINATION, 2014-15
PRINCIPLE OF COMMUNICATION

Time : Hours]   [Total Marks :

1   Attempt any FOUR parts :

(a)   Discuss the basic needs of modulation for the communication over a channel.

(b)   An amplitude modulated signal is given by

$$\Psi_{AM}(t) = 10\cos(2\pi.10^6 t) + 5\cos(2\pi.10^6 t)$$

$$\cos(2\pi.10^3 t) + 2\cos(2\pi.10^6 t)\cos(4\pi.10^3 t) \text{ Volt}$$

i)   Find various frequency components present and the corresponding modulation indices.

ii)   Calculate power contained in the signal and efficiency of the signal.

(c) Draw the phasor diagram of AM modulated signal and also draw the spectrum of AM modulated signals.

(d) Draw the block diagram of generating SSB signals using balance modulator and explain each block.

(e) Describe the working principle of ring modulator to generate DSB-SC amplitude modulated signal.

(f) An AM commercial broadcast-band receiver (535kHz - 1605 kHz), an input filter is used with Q-factor of 54. Determine its bandwith at low and high ends of RF spectrum. Comment on the received signal quality.

2 Attempt any FOUR parts :

(a) An angle-modulated signal with carrier frequency $\omega_c = 2\pi \times 10^5$ is described by the equation

$$\Psi_{FM}(t) = 10\cos(\omega_c t + 5\sin 3000t + 10\sin 2000\pi t)$$

i) Find the power of the modulated signal.

ii) Find the frequency deviation Δf.

iii) Estimate bandwidth of the FM signals.

(b) A PM modulator has a phase deviation sensitivity of 2.5 radians/V, and a modulating signal of $m(t) = 2\cos(2\pi \times 2000t)$. Determine the peak phase deviation and phase-modulation index.

(c) Explain the working of FM signal modulator using indirect method (Armstrong's method) to obtained FM signal having carrier frequency 91.2 MHz.

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(d) Explain the working of ratio detector used to demodulate the FM signal with neat sketch.

(e) Derive the expression for narrow band frequency modulated (NBFM) signal. Draw the phasor diagram of NBFM signal.

(f) Consider a frequency modulated signal is given by

$$v_{FM}(t) = 20\cos[2\pi \times 10^6 t + 0.1\sin(10^4 \pi t)].$$ Given $k_f=10\pi$, derive the expression for the modulating signal.
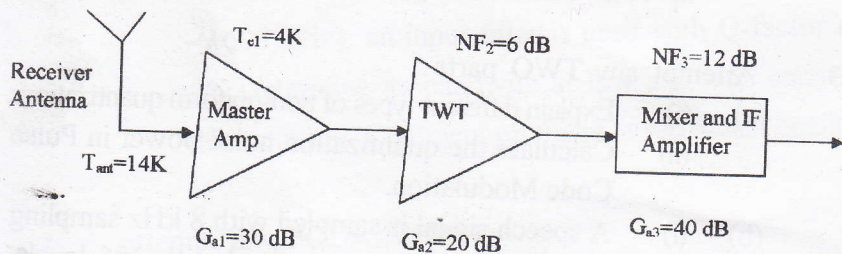
3   Attempt any TWO parts :

(a) (i) Explain different types of non-uniform quantization.
    (ii) Calculate the quantization noise power in Pulse Code Modulation.

(b) (i) A speech signal is sampled with 8 kHz sampling frequency and then quantized with 256 levels. Calculate the data rate and bandwidth required to transmit this signal.
    (ii) Three signals m_1, m_2 and m_3 are to be multiplexed. m_1 and m_2 have a 5-KHz bandwidth and m_3 has a 10 KHz bandwidth. Design a commutator switching system so that each signal is sampled at its Nyquist rate.

(c) Explain the different types of pulse modulation. Explain with the waveforms how PWM and PPM can be derived from PAM signal. Compare among them.

4   Attempt any TWO parts :

(a) What is delta modulation? How delta modulation defers from PCM and PAM? Explain the noises introduced in delta modulation. How can they be reduced?

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(b) Draw and explain the block diagram of transmitter and receiver of DPCM system. Write down the objectives of design of vocoders.

(c) (i) Show that the equivalent noise bandwidth of a low-pass filter is 1.57 time of its 3 dB bandwidth f_c.

(ii) A typical satellite microwave communication receiver is shown in figure below.

Calculate the overall noise figure of the receiver, neglecting effect of receiving antenna.

5 Attempt any TWO parts :

(a) Derive the output SNR of AM envelop detector. Also calculate figure of merit.

(b) Calculate the signal to noise ratio of frequency modulation. Also calculate noise figure. Explain the scheme to reduce the noise in FM system.

(c) (i) Write the short note on Pre-emphasis and De-emphasis.

(ii) Explain the functional blocks of phase lock loop (PLL)

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