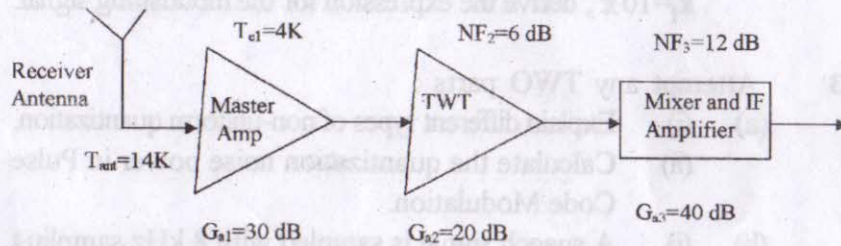


- (b) Draw and explain the block diagram of transmitter and receiver of DPCM system. Write down the objectives of design of vocoders.
- (c) (i) Show that the equivalent noise bandwidth of a low-pass filter is 1.57 time of its 3 dB bandwidth  $f_c$ .
- (ii) A typical satellite microwave communication 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)



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

PAPER ID : 131502

Roll No.

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## 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
- $$\Psi_{AM}(t) = 10 \cos(2\pi \cdot 10^6 t) + 5 \cos(2\pi \cdot 10^6 t) \cos(2\pi \cdot 10^3 t) + 2 \cos(2\pi \cdot 10^6 t) \cos(4\pi \cdot 10^3 t) \text{ Volt}$$
- 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 bandwidth 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  $\Delta f$ .
  - 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 obtain FM signal having carrier frequency 91.2 MHz.

- (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 differs from PCM and PAM? Explain the noises introduced in delta modulation. How can they be reduced?