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No. of Printed Pages—4

EC-503

B. TECH

**FIFTH SEMESTER EXAMINATION, 2002-2003
ANALOG COMMUNICATION SYSTEM**

Time : 2 Hours

Total Marks : 50

Note : Attempt ALL questions.

1. Attempt any FOUR of the following :— (3×4)

- (a) What is a base band signal ? Why is modification of signal required for transmission over the channel ?
- (b) What is noise ? Explain various types of noise which are external to a communication system.
- (c) What is available noise power and available signal power at the output of a two-port device ?
- (d) Explain the concept of Noise Equivalent Band-width of a low-pass filter.
- (e) An amplifier with a noise temperature of 125 K and gain 20 dB is connected to another amplifier with a noise figure 10 dB and gain 80 dB. Calculate overall noise temperature of cascaded system.
- (f) Explain experimental determination of noise figure.

2. Attempt any FOUR of the following :— (3×4)

- (a) Amplitude modulated wave is formed by a base-band signal which is band-limited to the interval $(-W, W)$. What is band-width of base-band signal and transmission band-width ?

- (b) DSB-SC modulated signal is demodulated by applying it to a coherent detector. Evaluate the effect of a frequency error Δf in the local carrier frequency of the detector, measured with respect to carrier frequency at incoming DSB-SC signal.
- (c) Using the message signal

$$m(t) = \frac{t}{1+t^2},$$

determine and sketch the modulated wave for the single side-band modulation with only the upper side-band transmitted.

- (d) Explain the working of a demodulator for detection of AM wave.
- (e) Draw the block diagram of filter method for generating SSB signal for an audio base-band signal. What are the frequency requirements of the filter ?
- (f) Explain sensitivity and selectivity of AM receiver. Sketch the selectivity and sensitivity curves for a typical receiver.
3. Attempt any TWO of the following :— (6.5×2)
- (a) What do you understand by instantaneous frequency, frequency deviation and band-width of FM wave ? A carrier wave of frequency 100 MHz is frequency modulated by a sinusoidal wave of amplitude 20V and frequency 100 KHz. The frequency sensitivity of the modulator is 25 KHz per volt. Determine approximate band-width of FM signal.

- (b) What is the difference between direct and indirect methods of FM generation ? Explain the working of a balanced frequency discriminator with the help of circuit diagram.
- (c) A modulating signal $A_m \sin(2\pi f_m t)$ plus a bias V_b is applied to a pair of varactor diode connected across the parallel combination of 200 μH inductor and 100 pF capacitor as

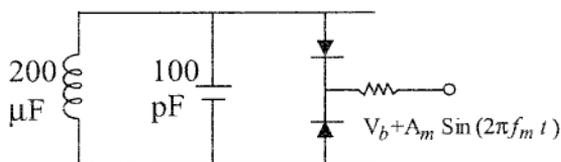


Fig. 1

shown in Fig. 1. The capacitor of each varactor diode is related to voltage (in volts) applied across its electrode by

$$C = 100 V^{-2} \text{ pF}$$

The output is applied to a frequency multiplier to produce FM signal with a carrier frequency 64 MHz and modulation index of 5. Find the bias voltage V_b and amplitude A_m of modulating wave. Given that the unmodulated frequency of oscillation is 1 MHz and $f_m = 10 \text{ KHz}$.

4. Attempt any TWO of the following :— (6.5×2)

- (a) Let a message signal $m(t)$ be transmitted using SSB modulation. The power spectral density $S(f)$ is

$$S_M(f) = \frac{a|f|}{W}, \quad |f| \leq W$$

$$= 0, \quad \text{elsewhere}$$

where a and W are constants, while Gaussian noise is of zero mean and power spectral density $N_0/2$ is added to SSB modulated wave at the receiver input. Find the output signal to noise ratio of receiver.

- (b) Prove that in a FM system, an increase in carrier power has noise quieting effect.
- (c) What are pre-emphasis and de-emphasis in angle modulated system? A phase modulated system uses a pre-emphasis filter defined by the transfer function

$$H_{pe}(f) = 1 + \frac{jf}{f_0}$$

Derive the expression for the improvement in output signal to noise ratio. Assume that the message band-width is W .