B. Tech Third Year : 5th Semester

ANALOG COMMUNICATION, DEC., 2012

(FOR 5 EC 4 BRANCH OF ENGINEERING)

Times : 3 Hours **Min. Passing Marks : 24** **Total Marks : 0**

Instructions to Condidates : *Attempt overall five questions selecting **one** question from **each** unit. All questions carry eq marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitable be assumed and sta clearly. Units of quantities used/calculated must be stated clearly.)*

UNIT-I

1. (a) Explain the shot noise. [7]

(b) Two resistor, 22 kΩ and 47 kΩ are at room temperature (300 K). Calculate for a bandwidth of 100 KHz, the thermal noise voltage

(i) for each resistor

(ii) for the two resistor in series and

(iii) for the two resistor in parallel. [9]

OR

1. (a) Explain effective noise temperature. [6]

(b) A mixer stage has a noise figure of 9 dB and an available power gain of 15 dB. Calculate the overall noise figure referred to the in put. [10]

UNIT-II

2. (a) The signal m (t) = 3 cos (200πt) + sin (600πt) is used to modulate the carrier $c(t) = \cos(2\times10^5 t)$. The modulation index is a = 0.85. Determine the power in the carrier component and in the sideband components of the modulated signal. [8]

(b) Suppose that the modulating signal is a sinusoid of the form

$m(t) = \cos 2\pi f_m t, \quad f_m << f_c$

Determine the two possible SSB-AM signals. [8]

OR

2. (a) Show that in a DSB - modulated signal, the envelope of the resulting band pass signal is proportional to the absolute value of the message signal. This means that an envelope detector can be employed as a DSB demodulator if we know that the message signal is always positive. [8]

(b) Show that an AM signal with large carrier can be demodulated by squaring it and then passing the resulting signal through a low pass filter, as shown in fig. This type of detector is known as a Square-Law detector. [8]

UNIT-III

3. (a) An angle-modulated signal is described by -

$xc(t) = 10\cos[2\pi(10^6)t + 0.1\sin(10^3)\pi t]$

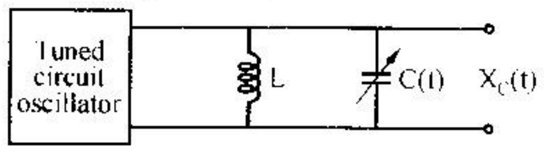
(i) Considering xc (t) as a PM signal with Kp = 10, find m(t) [4]

(ii) Considering xc (t) as an FM signal with Kf = 10π, find m (t) [4]

(b) At low carrier frequencies it may be possible to generate an FM signal by varying the capacitance of a parallel resonant circuit. Show that the out put x_c (t) of the tuned circuit shown in fig is an FM signal if the capacitance has a time dependence of the form [8]

C (t) = Co - Km (t)

and $\left|\frac{K}{Co} m(t)\right| << 1$



OR

3. (a) A 20 MHz Carrier is frequency modulated by a sinusoidal signal such that the maximum frequency deviation of 100 KHz. Determine the modulation index and the appropriate band width of the FM signal if the frequency of the modulating signal is- [9]

(i) 1 KHz, (ii) 100 KHz, and (iii) 500 KHz

(b) Determine the in-phase and quadrature components as well as the envelope and the phase of FM and PM modulated signals. [7]

UNIT-IV

4. (a) Assuming sinusoidal modulation, show that in an AM system with envelop detection the out put SNR is given by

$$\left(\frac{S}{N}\right)_0 = \frac{\mu^2}{2+\mu^2}\gamma \quad [8]$$

Where μ is the modulation index

(b) Find the SNR in a baseband system with a bandwidth of 5 KHz and with $\frac{No}{2} = 10^{-14}$ W / Hz. The transmit power is one Kilowatt and chan attenuation is 10^{-12}.

OR

4. (a) Show that narrowband FM offe no improvement in SNR over AM [8]

(b) Design an FM system that achieve an SNR at the receiver equal to 4 dB and requires the minimum amount of transmitter power. The bandwidth of the channel is 120 KHz; the message bandwidth is 10 KHz; the average to peak power ratio for the message

$P_{m_0} = \frac{P_m}{(\max|m(t)|)^2}$ is 1/2

and the (one-sided) noise power spectral density is $N_0 = 10^{-8}$ W/Hz. What is the required transmitted power if the signal is attenuated by 40 dB in transmission through the channel? [8]

UNIT-V

5. (a) Assume x(t) has a bandwidth of 40 KHz

(i) What is the minimum sampling rate for this signal?

(ii) What is the minimum sampling rate if a guard band of 10 KHz is required?

(iii) What is the maximum sampling interval for the signal $x_1(t) = x(t)\cos(80{,}000\pi t)$ [9]

(b) A TDM system is to be designed to multiplex four signals.

$em_1(t) = \cos(2\pi fot)$, $em_2(t) = 0.5\cos(2\pi fot)$,

$em_3(t) = 2\cos(2\pi 2fot)$, and $em_4(t) - 2\cos(2\pi 4fot)$,

(i) If each signal is Sampled at the same rate, calculate the minimum sampling rate f_s. [4]

(ii) What is the commutator speed in revolutions per second? [3]

OR

5. (a) Describe the PPM modulation and demodulation. [8]

(b) Draw the circuits and waveform for natural and flat-top sampling. [8]