II B.Tech. II Semester Regular Examinations, April/May -2005
COMMUNICATION THEORY
(Electronics & Communication Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Prove that amplitude modulation is a linear modulation technique.
   (b) What is the percentage of power saving if DSB-SC wave is used instead of DSB-FC.
   (c) How would you recover the message signal from an AM wave that is over modulated?Justify your answer.

2. (a) Derive the condition for demodulation of AM wave using Envelope detector.
   (b) Consider a base band signal m(t) with the spectrum shown below the bandwidth W=1KHz. This signal is applied to a product modulation together with a carrier wave A_c Cos$W_c t$, producing the DSBSC modulated wave S(t). This modulated wave is next applied to a coherent detector. Assume perfect synchronism between the carrier waves in the modulator and detector. Determine the spectrum of the detector output when
      i. carrier frequency f_c=1.25 KHz and
      ii. carrier frequency f_c=0.75 KHZ.

3. (a) Explain Filter method of generation of SSB wave.
   (b) Compare and contrast different AM systems.

4. (a) Derive the expression for VSB wave.
   (b) What is the effect of frequency and phase error in demodulation of DSB-SC wave using Synchronous Detector?

5. (a) The sinusoidal modulating wave m(t)=A_mCosW_{mt} is applied to a phase modulator with phase sensitivity k_p. The unmodulated carrier wave has frequency f_c and amplitude A_c.
      i. Determine the spectrum of the resulting phase modulated wave, assume maximum phase deviation $\beta_p = K_p A_m \leq 0.3$ radians.
      ii. Construct a phasor diagram for this modulated wave and compare it with that of corresponding NBFM.
   (b) Compare FM and PM waves.

6. (a) Give the circuit diagram of reactance modulator and explain its operations.
   (b) Explain the spectrum of FM in terms of Bessel functions in detail.

7. (a) Draw the block diagram of balanced slope detector and explain its operation.

(b) Sketch the AM,PM andj FM wave for saw tooth modulating signal.

8. Derive the equation for noise figure of:

(a) FM

(b) AM for small noise case and compare.

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Code No: RR220401 **Set No.2**

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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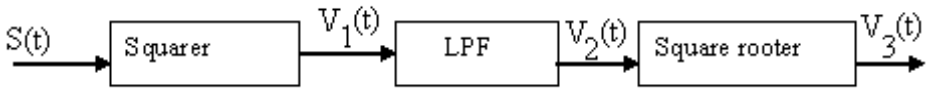
1. (a) Explain the need for modulation.
   (b) Draw the spectrum ans phasor diagram of AM wave4 if modulating signal vc (t)=A_c Sin w_c t.
   (c) Derive the equation for DSB-SC wave form if message is m(t) and carrier is A_c Cos w_c t.

2. (a) Draw the block diagram of square law Modulator and explain its operation in detail.
   (b) The AM wave S(t)=A_c[1+k_am(t)] Cosw$_c$t is applied to the system shown below. Assuming that ?K_am(t) ?< 1 for all t & baseband signal m(t) is limited in the interval -W≤ f ≤ W, & carrier frequency is f_c >2W, show that m(t) can be obtained from the square rooter output.



3. (a) Consider the modulated wave S(t) = A_cCosw$_c$t + m(t)Cosw$_c$t− $\hat{m}$ Sinw$_c$t
   Which represents SSB-FC wave, with m(t) denoting the message signal and $\hat{m}$ (t) is the Hilbert transformation. Determine the conditions for which an ideal envelop detector, with S(t) as input would produce good approximation to the message signal m(t).
   (b) Explain with block diagram the Filter method of generation of SSB wave.

4. (a) Draw the block diagram of phase shift method of generation of VSB wave form.
   (b) What is the effect of phase and frequency error in demodulation of SSB wave using synchronous detector.

5. (a) Derive the expression for FM wave in terms of Bessel functions if message signal is Cos$w_m t$ and carrier is Cos $w_c t$.
   (b) Derive the expression for NBFM if message is m(t) and carrier is AcCoswct. Draw the corresponding phasor diagram of NBFM and compare it with AM wave.

6. (a) Draw the FM and PM waveforms if the message signal is

i. Square wave

ii. Triangular wave.
Assume carrier C(t)=A_c Cos$w_c t$.

(b) Consider the signal
S(t)=Cos$w_c t$+0.2 Cos$w_m t$ Sinwc_t.

i. Show that S(t) is a combination of AM-FM signal.

ii. Sketch the phasor diagram at t=0.

7. (a) Draw the circuit diagram of Foster Seeley discriminator and explain its operation with the help of phasor diagram.

(b) Draw the block diagram of Armstrong method of generation of FM wave.

8. Derive the expression for Noise figure of the following for small noise case and compare

(a) DSB-FC

(b) Phase modulation system.

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Code No: RR220401 **Set No.3**

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. (a) Give the applications of different AM systems.
   (b) Derive the equation for total power of AM wave in terms of its modulation index.
   (c) Prove that DSB-SC is a linear Modulation technique.

2. (a) The signal S(t)=$\left[1+0.2\text{Cos}\left(\frac{2\pi f_m t}{3}\right)\right]$ Cosw$_c$t Cos$w_c t$ is demodulated using a square law demodulator having the characteristics $S_0(t) = (S(t)+2)^2$ The output is then filtred by sn ideal LPF having cutoff frequency f_mHz. Determine the spectrum of the demodulated signal and plot it in the frequency range $-f_m \leq f \leq f_m$.
   (b) Draw the block diagram of squaring loop and explain how it is used to generate the carrier from the DSB-SC wave at the receiver.

3. (a) Consider the SSB wave $s(t) = m(t)\cos w_c t - \hat{m}(t)\sin w_c t$
   Where w_c: carrier frequency. m(t) : Message signal, $\hat{m}(t)$: Hilbert transformation. This modulated wave is applied to a square law device characterized by $y(t) = S^2(t)$ Show that the output y(t) contains a frequency Component at twice the carrier frequency but that it has a time-varying phase, which makes it impractical to recover the carrier by squaring.
   (b) Compare different SSB modulation techniques.

4. (a) Explain the modulation and demodulation of VSB wave using Filter method with neat block diagram.
   (b) Using the message signal $m(t) = \frac{t}{1+t^2}$,determine the SSB-USB wave.

5. (a) Compare NBFM and WBFM.
   (b) Show that NBFM is a linear modulation technique and WBFn is a non-linear modulation technique.

6. (a) Explain the generation of FM using Armstrong Method.
   (b) Explain Foster Seeley discriminator in detail.

7. (a) Compare AM and FM Modulation technique.
   (b) Derive the noise figure of Fn wave.

8. Write short notes on:-

(a) Coherent Detection.

(b) Switching Modulator.

(c) Narrow band Noise.

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Code No: RR220401 **Set No.4**

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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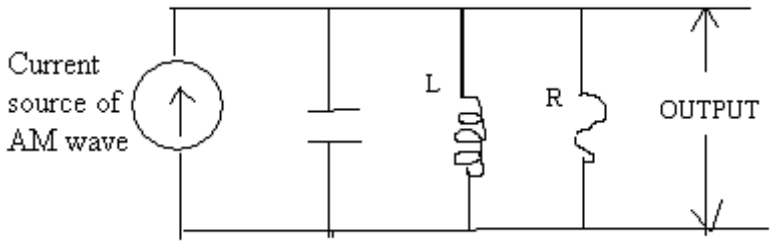
1. (a) Derive the expression for AM wave and draw its spectrum and phasor diagram if message signal is AM Sin$w_m t$ and carrier is AcCos$w_c t$.
   (b) Find the percentage of power saving by transmitting SSB wave with respect to DSB-FC wave.

2. (a) Draw the circuit diagram of ring modulator & explain its operation in detail.
   (b) A sine wave of frequency 5KHz is applied to a product modulator, together with a carrier frequency of 1MHz. The modulator output is applied to the resonant circuit shown below. Determine the modulated wave after transmission through this circuit. The resonant circuit is tuned to carrier frequency with a factor of 175.



3. (a) What is the effect of phase and frequency error in the demodulation of DSB-SC wave using synchronous detector.
   (b) Explain the Filter Method of generation of VSB wave with block diagram and draw the spectrum of frequency response of VSB filter.

4. (a) Consider a baseband signal m(t) containing frequency components at 100,200 and 400 Hz. This signal is applied to an SSB modulator together with a carrier at 100KHz,with only the upper sideband retained. In the coherent detector used to recover m(t), the local oscillator supplier a sine-wave of frequency 100.02 KHz.. Determine the frequency components of the detected output. Repeat your analysis, assuming that only the lower sideband is transmitted.
   (b) With neat block diagram explain the third method of generation of SSB wave.

5. (a) Derive the expression and draw the spectrum and phasor diagram of NBPM if message is $A_m Sinw_m t$ and carrier is A_cCoswct.
   (b) Show the WBFM modulation is a non-linear modulation technique.

6. A modulating signal 5Cos 2π x15x10^3t, angle modulates a carrier A_cCosw_ct
   (a) Find the modulation index and Bandwidth for FM and PM.
   (b) Determine the change in bandwidth and modulation, index for both FM and PM if f_m is reduced to 5KHz. Assume $K_p = K_f$ = 15KHz/volt.
7. (a) With neat circuit diagram explain the operation of ratio detector. Explain how amplitude limiting takes place in this circuit.
   (b) Draw the circuit diagram of varactor diode modulator and derive the expression for frequency deviation and modulation index interms of the diode parameters.
8. (a) What do you mean by threshold effect in FM and explain how it is overcome.
   (b) Compare the noise performance of DSB-SC and SSB-SC systems by deriving their output SNR's.

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