

**II B.Tech. II Semester Supplementary Examinations,
November/December -2005
COMMUNICATION THEORY**

(Electronics & Communication Engineering)

Time: 3 hours

Max Marks: 80

**Answer any FIVE Questions
All Questions carry equal marks**

1. (a) Explain the need for modulation
(b) Explain with neat circuit diagram the operation of square Law modulator & Demodulator. [6+10]
2. (a) Derive the expression & draw the DSB-SC wave if both modulating signal & carrier are both sinusoidal.
(b) Prove that $P_t = P_c \left(1 + \frac{m^2}{2}\right)$. P_c : carrier power, P_t : Total power of AM wave. [8+8]
3. (a) Explain the effect of frequency & phase error in synchronous demodulation of SSB-SC wave.
(b) Explain the applications of different AM systems. [8+8]
4. (a) Explain with neat block diagram the operation of phase shift method of generation of SSB wave.
(b) Draw the block diagram of NBFM system & explain its operation. [8+8]
5. (a) Derive the expression for FM wave in terms of its Bessel function & explain it.
(b) Draw the FM & PM waves for square wave modulating signal. [8+8]
6. (a) An angle modulated signal is described by

$$x_C(t) = 10 \cos [2\pi \times 10^6 t + 0.1 \sin 10^3 \pi t]$$
 - i. Considering $x_c(t)$ as PM wave with $K_P=10$ find $m(t)$
 - ii. Considering $x_c(t)$ as FM wave with $K_f= 10 \pi$ find $m(t)$
(b) Explain the parametric method of generation of FM using FET. [4+4+8]
7. Derive the expression for noise figure of AM wave for both small & large noise & compare its performance with DSB-SC. [16]
8. Write short notes on:
 - (a) VSB
 - (b) Noise triangle in FM
 - (c) NBPM. [16]

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1. (a) Explain the need for modulation.
(b) An amplitude modulated signal is given by $V_{AM}(t) = 10 \cos 2\pi \times 10^6 t + 5 \cos 2\pi \times 10^6 t + 2 \cos 10^6 t \cdot \cos 4\pi \times 10^3 t$. Find the various frequency components & the corresponding modulation indices. Draw the spectrum bandwidth modulated power, sideband power & modulation index. [4+12]
2. (a) Draw the circuit diagram of Envelope detector & explain its operation.
(b) Explain the effect of phase & frequency error in synchronous detector. [6+10]
3. (a) Draw the block diagram of phase shift method of generation of SSB wave & explain its operation.
(b) Explain the need & operation of VSB modulation. [8+8]
4. (a) Draw the FM & PM wave if the modulating signal is square wave & the carrier is a sine wave.
(b) Consider an angle-modulated signal $x_c(t) = 10 \cos (W_C t + 3 \sin W_m t)$. Assume PM & $f_m = 1 \text{ KHz}$. Calculate the modulation index & find the bandwidth when f_m is doubled. [6+10]
5. (a) Draw the block diagram of Armstrong method of FM generation & explain.
(b) Compare NBFM, FM & AM. [8+8]
6. (a) Explain with circuit diagram the Foster Seely discriminator.
(b) When the modulating frequency in a FM system is 400Hz & the modulating voltage is 2.4V, the modulation index is 60. Calculate the maximum frequency deviation. What is the modulation index when modulation frequency is reduced to 250Hz & the modulating voltage is raised to 3-2V. [8+8]
7. (a) Derive the equation for noise figure in DSB-SC receiver.
(b) Compare noise performance of AM & FM. [10+6]
8. Write short notes on:
 - (a) NBPM
 - (b) Pre-emphasis & de-emphasis
 - (c) DSB-SC wave. [16]

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1. (a) Prove that $P_t = P_C \left[1 + \frac{m^2}{2} \right]$ for AM wave.
(b) Explain the need for modulation. [8+8]
2. (a) Draw the circuit diagram of Envelope detector & explain its operation.
(b) Calculate the % of power saving by transmitting SSB-SC wave instead of DSB-SC for modulation index of 80%. [8+8]
3. (a) Draw the block diagram of phase shift method of generation of SSB wave & explain.
(b) A complex modulating wave consisting of a sinewave of amplitude 3V and frequency 1KHz plus a cosine wave of amplitude 5V and frequency 3KHz is amplitude modulated by a carrier of 500KHz & 50V peak. Determine the average power when the wave is fed to a 50Ω load. [8+8]
4. (a) Draw the block diagram of square law modulator & demodulator & explain its operation.
(b) An amplitude modulated signal is given by $U_{AM}(t) = 10 \cos 2\pi \times 10^6 t + 5 \cos 2\pi \times 10^6 t \cos 2\pi \times 10^3 t + 2 \cos 2\pi \times 10^6 t \cdot \cos 4\pi \times 10^3 t$. Find the various frequency components & the corresponding modulation indices. Draw the spectrum & find the bandwidth, side band power & modulation index. [8+8]
5. (a) Obtain the expression for NBFM & NBPM for sinusoidal modulating signal & carrier.
(b) Compare AM, FM & PM Modulations. [8+8]
6. (a) An angle modulated wave is described by the equation $\phi(t) = 10 \cos(2 \times 10^6 \pi t + 10 \cos 2000 \pi t)$. Find
 - i. The power of the modulated signal.
 - ii. The maximum frequency deviation
 - iii. Maximum phase deviation
 - iv. The bandwidth of the signal.
(b) Draw the circuit diagram of ratio detector & explain its operation. [8+8]
7. (a) Derive the equation for Noise figure of FM receiver.

(b) Compare the noise performance of DSB-SC, SSB-SC & AM waves. [10+6]

8. Write short notes on:

(a) VSB Modulation

(b) Pre-emphasis & De-emphasis

(c) Balanced Modulator. [6+4+6]

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1. (a) Explain the principle of operation of balanced modulator for generating DSB-SC & also explain how the same circuit can be used for generating AM with carrier.
(b) Certain transmitter radiates 9kW with carrier unmodulated & 10.125kW when the carrier is sinusoidally modulated. Calculate the modulation index. If another sinwave, corresponding to 40% modulation is transmitted simultaneously, determine the total power. [8+8]
2. (a) Draw the circuit diagram of ring modulator & explain its operation.
(b) Write short notes on VSB generation & demodulation. [8+8]
3. (a) With neat block diagram explain the principle & operation of Weaver's method of generation of SSB-SC wave. [8]
(b) An amplitude modulated signal is represented by $V(t) = 0.1 [1 + 0.1 \cos 2512t + 0.5 \cos 6280t] \sin [10^7 t + 45^\circ]$ Volts. Find
 - i. Modulating signal frequencies & side band frequencies
 - ii. Modulation index
 - iii. Amplitudes of side bands
 - iv. Spectrum of $V(t)$. [4×2=8]
4. (a) Explain the applications of different AM systems.
(b) Explain the effect of frequency & phase error in synchronous detection of DSB-SC wave. [8+8]
5. (a) With neat block diagram explain the indirect method of FM generation.
(b) Find the carrier frequency, modulating frequency, modulation index & maximum deviation of FM wave represented by the equation $e_{FM}(t) = 12 \sin (6 \times 10^8 t + 5 \sin 1250t)$. What power will FM wave dissipate in a 10Ω resistance. [8+8]
6. (a) Obtain the expression for single tone NBPM & explain with block diagram its operation.
(b) Compare & contrast NBFM & AM. [8+8]
7. (a) With neat circuit diagram explain how frequency demodulations can be performed using Foster Seeley discriminator.

- (b) Derive the equation for Noise figure of DSB-FC wave for large & small noise case. [8+8]

8. Write short notes on:

- (a) Reactance Tube modulator
- (b) Noise triangle
- (c) Switching modulator. [5+6+5]
