

CENTURION UNIVERSITY OF TECHNOLOGY & MANAGEMENT

SCHOOL OF ENGINEERING & TECHNOLOGY

WEEK-01

**OBJECTIVE QUESTIONS:**

1. The process of varying the parameters of the high-frequency signal according to the low-frequency signal is \_\_\_\_
2. The Bandwidth of Amplitude Modulation is \_\_\_\_  
a)  $\omega_m$  b)  $\omega_m/2$  c)  $\omega_m/4$  d)  $2\omega_m$
3. The total transmitted power of Amplitude Modulation is \_\_\_\_
4. The efficiency of AM is \_\_\_\_
5. The AM is useful for \_\_\_\_
6. The disadvantage of AM is \_\_\_\_

**SHORT QUESTIONS:**

1. List the need for modulation before transmission of a signal?
2. Two base band signals  $m_1(t) = A_m1 \cos \omega_1 t$  and  $m_2(t) = A_m2 \cos \omega_2 t$  simultaneously amplitude modulated by a carrier signal  $e_c(t) = A_c \cos \omega_c t$ . Find the effective modulation index.

**LONG QUESTIONS:**

1. Draw the spectrum of a DSB with carrier signal. Give the expression for this signal. How do you demodulate it? Explain with the help of a neat diagram.
2. When the message signal or modulating signal changes the amplitude of carrier signal the resultant signal is said to be an Amplitude Modulated (AM) Signal. Explain the generation of AM signal using Switching Modulator or Square Law Modulator?  
Any scheme that can be used to generate DSB-SC can also generate AM. State whether the statement is true (T) or false (F)? Support your answer with an explanation.

WEEK-02

OBJECTIVE QUESTIONS:

- By suppressing carrier component from AM wave, we have \_\_\_\_
  - SSB
  - VSB
  - DSB-SC
  - None
- The most useful detection method for the Detection of Modulating signal from AM is \_\_\_\_
- AM is compared with following FM technique
  - NBFM
  - WBFM
  - Both
  - None
- If the Modulation index 'm' of AM is 0.4 then what is the % of Modulation is \_\_\_\_
  - 50%
  - 80%
  - 20%
  - 40%
- Two modulating signals are modulated simultaneously with modulation indices 0.4 and 0.6 then the resultant Modulation index of AM is \_\_\_\_
  - 0.72
  - 0.73
  - 0.5
  - 0.6

SHORT QUESTIONS:

- What is meant by recovery of baseband signal? How do you recover a DSB with carrier AM signal?
- Is carrier acquisition is essential in envelope detection? Justify?
- Can you use square law detection for demodulating DSB with carrier AM signals? Justify?
- Draw the waveform of an over modulated amplitude-modulated signal. How to recover the modulating signal?

LONG QUESTIONS:

- The signal  $g(t) = m(t)\cos(2\pi f_c t)$  is detected by multiplying it by a waveform  $\cos(2\pi f_c t + \alpha)$  and passing the product through a low pass filter that rejects the double frequency signal. What is the output signal of the filter?
- The input into a envelope detector is a single-tone AM signal  $s_{AM}(t) = A[1 + m \cos w_m t] \cos w_c t$ , where m is constant,  $0 < m < 1$  and  $w_c \gg w_m$ 
  - Show that the detector output is to follow the envelope of  $s_{AM}(t)$ . It is required that at any time,  $t_0$

$$\frac{1}{RC} \geq W_m \left( \frac{m \sin w_m t_0}{1 + m \cos w_m t_0} \right)$$

- b. If the detector output is to follow the envelope at all-time then show that
- $$RC \leq \frac{1}{w_m} \sqrt{\frac{1-m^2}{m}}$$
3. Consider a square-law detector, using a nonlinear device whose transfer characteristic is defined by  $v_2(t) = a_1 v_1(t) + a_2 v_1^2(t)$   
Where  $a_1$  and  $a_2$  are constants,  $v_1(t)$  is the input and  $v_2(t)$  is the output. The input consist of the AM wave  $v_1(t) = A_c [1 + k_a m(t)] \cos(2\pi f_c t)$
- Evaluate the output  $v_2(t)$
  - Find the condition for which the message signal  $m(t)$  may be recovered from  $v_2(t)$ .
4. Write Short notes on Costa's Loop Detector.

### WEEK-03

#### OBJECTIVE QUESTIONS:

- For generation of SSB which method is very useful
  - Filter method
  - Phase Method
  - Weavers Method
- SSB is used for \_\_\_ communication
- The bandwidth of SSB is \_\_\_
  - $\omega m$
  - $2 \omega m$
  - $\omega m/2$
  - $\omega m/4$
- The carrier and modulating signals are  $A_c \cos \omega_c t$  and  $A_m \cos \omega_m t$  then SSB signal is
  - $\frac{1}{2} A_c A_m \cos \omega_c t$
  - $A_c A_m \cos (\omega_c + \omega_m)t$
  - $\frac{1}{2} A_c A_m \cos \omega_m t$
  - $\frac{1}{2} A_c A_m \cos (\omega_c + \omega_m)t$
- The power saving due to SSB is \_\_\_
- The total transmitted power due to SSB with Modulation index 'ma' and carrier power  $P_c$  is \_\_\_
- The carrier signal frequency is 100KHz and modulating signal frequency 1 KHz the upper sideband frequency is \_\_\_
  - 100 KHz
  - 101KHz
  - 99 KHz
  - 98 KHz

#### SHORT QUESTIONS:

- Write one advantage of and one disadvantage of SSB modulated signal.
- Draw Spectra of SSB Signal

#### LONG QUESTIONS

- Explain the generation of SSB-SC AM signals. Draw its spectrum when the modulating signals  $m(t) = \cos w_m t$  ?
- Analyze how power is distributed in different signal components in AM system.  
Thus show that SSB-SC signals can be received at longer distances compared to AM signals with carrier.

5. Show that output of the phase-shift modulator is an SSB signal
  - a. The difference of the signal at the summing junction produces the upper sideband SSB signal.
  - b. The sum of the signal at the summing junction produces the lower sideband SSB signal

WEEK-04

OBJECTIVE QUESTIONS:

1. Bandwidth of VSB\_\_\_\_\_
2. For Television signal broad casting the following modulation is useful
  - a) SSB    b)DSB-SC    c)VSB    d)AM
3. VSB can be used to transmit
  - a) audio signal    b)video signal    c) both    d) neither 'a' nor 'b'
4. The total bandwidth of VSB is 5.5KHz , then modulation signal bandwidth is 5 KHz then the vestigial band is \_\_\_\_
  - a)1KHz    b) 0.5KHz    c)1.5KHz    d)2KHz

SHORT QUESTIONS:

1. Why VSB-SC type of AM signal is transmitted for TV?
2. Draw Spectra of VSB signal
3. Compare VSB & SSB

LONG QUESTIONS

4. Explain the generation of VSB-SC AM signals. Draw its spectrum?

WEEK-05

OBJECTIVE QUESTIONS:

1. A 10 MHz carrier is frequency modulated by a sinusoidal signal of 500 Hz, the maximum frequency deviation being 50 KHz. The bandwidth required, as given by the Carson's rule is \_\_\_\_\_
2. A carrier  $\cos$  is frequency modulated by a signal  $\cos$ . The modulation index is  $m_f$ . The expression for the resulting FM signal is \_\_\_\_\_
3. Commercial frequency deviation and bandwidth of FM are \_\_\_\_\_
4. Consider an angle modulation signal  $s(t) = 6 [2 \times 10^3 + 2\sin(8000t) + 4\cos(8000t)]$ . The average power of  $s(t)$  is \_\_\_\_\_
5. According to Carson's rule, Bandwidth  $B$  and modulating frequency  $f_m$  are related as \_\_\_\_\_

SHORT QUESTIONS:

1. For commercial broadcasting of FM signals the specified frequency deviation is  $\Delta f = 75$  KHz for high audio frequency transmitted is 15 KHz. Find the Bandwidth of the FM system and the number of significant sidebands?
2. What is the most attractive feature of FM? Explain in two sentences.
3. What is the power of an FM signal? Justify.
4. What do you mean by narrowband and wideband FM?
5. Give the frequency spectrum of narrowband FM?
6. Differentiate between narrow band and wideband FM.?
7. What are the advantages of FM.?

LONG QUESTIONS

1. An angle-modulated signal with carrier frequency  $\omega_c = 2\pi \times 10^5$  is described by the equation  $V(t) = 10\cos(\omega_c t + 2\sin 2500t + 10\sin 3500\pi t)$ 
  - a. Find the power of the modulated signal.
  - b. Find the frequency deviation  $\Delta f$ .
  - c. Find the deviation ratio  $\beta$ .
  - d. Find the phase deviation  $\Delta\Phi$ .
  - e. Estimate the bandwidth of  $V(t)$ .
2. Write down the expression for an FM and a PM signal. Compare the two expressions. Explain how you can generate an FM signal from a PM signal and vice-versa. Compute the power in both the signals?

WEEK-06

OBJECTIVE QUESTIONS:

1. Drawbacks of using direct method for generation of FM signal are \_\_\_\_\_
2. The FM signal with frequency deviation of 90 KHz and modulating signal bandwidth of 5 KHz is applied to this device. The bandwidth of the output signal is \_\_\_\_\_
3. The FM signal with a modulation index 9 is applied to a frequency tripler. The modulation index in the output signal will be \_\_\_\_\_
4. Disadvantages of FM over AM is \_\_\_\_\_
5. The effect on the deviation  $d$  of an FM signal when it is passed through a mixer \_\_\_\_\_

SHORT QUESTIONS:

6. Why Armstrong method is superior to reactance modulator.
7. Define frequency deviation in FM?
8. State Carson's rule of FM bandwidth?
11. Define PM.
12. What is meant by indirect FM generation?
13. Write the expression for the spectrum of a single tone FM signal.
14. Define modulation index of FM and PM

LONG QUESTIONS

15. Explain the Armstrong method of generating FM signal. Draw a clear figure and label it properly. Give the necessary equation. What is achieved by the use of frequency multiplier?

WEEK-07&08

OBJECTIVE QUESTIONS:

1. Pre-emphasis is the process of \_\_\_\_\_
2. De-emphasis is the process of \_\_\_\_\_
3. IF is \_\_\_\_\_
4. RF to IF conversion is done for \_\_\_\_\_
5. Crystal Oscillator is used for \_\_\_\_\_

SHORT QUESTIONS:

1. Why pre-emphasis filter is used at the transmitter side and de-emphasis filter at the receiver side in a FM system are provided? What is the relationship between their filter functions?
2. Radio signals received from FM radio stations are of better reception quality than received from AM radio stations? Why?

LONG QUESTIONS:

1. What are the applications of phase locked loop? Explain with a neat diagram, how an FM detector is realized by using a cascade of a hard-limiter and BPF whose center frequency is  $f_0$ ?
2. Write notes on: A suitable FM demodulator, Performance comparison of AM & FM system.

WEEK-09

1. State Central Limit Theorem?
2. What do you mean by auto-correlation and cross-correlation
3. What is PDF & CDF
4. What do you mean by mean and moments
5. What do you mean by Co-variance
6. Find mean and variance of sum of two independent variables X & Y.
7. A random process obeys Poisson's distribution. It is given that mean of the process is 5. The variance of the process is\_\_\_\_\_
8. Briefly explain different PDFs?
9. What is conditional probability?
10. What do you mean by random variable?



**WEEK-10**

**Objective Questions:**

1. The noise temperature at a resistor depends upon
  - a. Resistance value
  - b. Noise power
  - c. Both a and b
  - d. None of the above
2. Transit time noise is
  - a. Low frequency noise
  - b. High frequency noise
  - c. Due to random behavior of carrier charges
  - d. Due to increase in reverse current in the device
3. Low frequency noise is
  - a. Transit time noise
  - b. Flicker noise
  - c. Shot noise
  - d. None of the above
4. Noise is added to a signal in a communication system
  - a. At the receiving end
  - b. At transmitting antenna
  - c. In the channel
  - d. During regeneration of the information

**Short Questions:**

1. List the common sources of noise usually encountered in modern communication system?
2. Noise is a random signal. Draw its power spectrum. Define power spectral density. What is its utility?
3. Sketch the autocorrelation of white noise? What is its corresponding PSD?
4. Sketch the magnitude response of simple RC LPF. Show the necessary equation?
5. What is the correlation function of LPF filtered white noise?

**Long Questions**

1. Show that noise  $n(t)$  is Gaussian, ergodic and random process
2. Write short notes on Noise Temperature

**Week-11**

**Short Questions:**

1. Calculate output noise power when white noise of PSD  $\eta/2$  is passed through RC LPF with 3 dB cutoff frequency  $f_c$ .
2. For what kind of communication system, noise immunity in envelope detection? Justify.
3. A white noise having power spectral density  $\eta/2$  is applied to integrating filter. Find the output power of that filter?
4. Calculate the output noise power when white noise of power spectral density  $\eta/2$  is passed through a RC low pass filter of 3-dB cutoff frequency  $f_c$ .

**Long Questions:**

1. What is superposition of noises? Explain the consequence of mixing noise with a sinusoidal signal. How do you do physically? What is the variance of the noise and hence the resulting SNR?
2. Write Short Note: a) Noise Figure b) Noise Equivalent Bandwidth c) AWGN

**WEEK-12**

1. Standard intermediate frequency used for AM receiver is \_\_\_\_\_
2. Function of RF mixer is \_\_\_\_\_
3. If a receiver has poor capacity of blocking adjacent channel interference then the receiver has \_\_\_\_\_
4. Advantage of using a high frequency carrier wave is \_\_\_\_\_
5. TRF receiver and super heterodyne receiver are used for \_\_\_\_\_
6. The image channel selectivity of super heterodyne receiver depends upon
  - a. IF amplifiers only
  - b. RF and IF amplifiers only
  - c. Pre selector, RF and IF amplifiers
  - d. Pre selector and RF amplifiers

**Short Questions:**

1. What is figure of merit in FM system? Why?
2. The pre-modulating filter in the transmitter, to raise the power spectral density of baseband signal in its upper frequency range is called \_\_\_\_\_. The filtering at the receiver to undo signal pre-emphasis and to suppress noise is called \_\_\_\_\_.
3. What is the super heterodyne principle? Give two applications

**Long Questions:**

1. Draw a super heterodyne AM receiver and explain each block. What is the need for working in the IF domain? What you mean by the baseband.
2. Derive the output S/N in DSB-SC scheme?
3. Explain the SNR improvement through by pre-emphasis?
4. Explain the concept of threshold in FM system. Plot  $S_o/N_o$  versus  $S_i/N_i$  for linear coherent demodulation of SSB and also in FM system. Indicate on the plot the threshold in FM system. How the threshold settings affect the performance of FM system?
5. Draw the block diagram of an FM demodulator consisting of limiter and discriminator. The input to the limiter stage is a band-limited FM signal along with white noise. Derive an expression for signal power at the output of the FM demodulator. Plot variation of PSD of noise with frequency at the output of demodulator.