

## UNIT 2:

### Short answer questions:

1. What is meant by Carson's rule? Problem on calculation of Bandwidth of FM signal using Carson's rule.(imp)
2. Distinguish between NBFM and WBFM.(imp)
3. Problems on instantaneous phase and frequency.
4. What is the basic principle involved in Phase discriminator?
5. Define capture range and lock range of a PLL.
6. Problem on Armstrong method of generation of a WBFM signal?(imp)
7. Capture effect and threshold effects in FM (very very imp).
8. Problems on carrier swing, frequency deviation, BW, modulation index etc(imp).
9. Phasor diagrams of NBFM and AM.
10. What is the need for limiter in FM receivers? (Very very imp).
11. Find the maximum Frequency deviation of Frequency Modulated signal given by
$$S_{FM}(t) = 10 \cos(1000000\pi t + 5 \sin(2000\pi t))$$
12. A carrier signal  $10 \cos(8X 10^6\pi t)$  is modulated by a modulating signal  $5 \cos(30X 10^3\pi t)$ 
  - i. Find the Band width of Frequency Modulated signal assuming,  $k_f = 15 \text{ KHz}$  .
  - ii. Calculate Hignett Frequency and lowest Frequency of FM signal.
  - iii. Find Modulation index of FM signal.
13. Compare Frequency Modulation with Phase Modulation.

### Long answer questions:

1. Explain the operation of slope detector OR Simple Slope Detector in detail.
2. Explain the operation of balanced slope detector in detail.
3. Explain in detail about frequency spectrum of WBFM signal using Bessel functions.
4. write in detail about generation methods of FM signal
  - i. Direct method of generation
  - ii. Indirect method of generation (Armstrong method).(very very imp)
5. What is ratio detector? Explain its working in detail with neat circuit diagram. Explain how ratio detector provides amplitude limiting?
6. What is amplitude limiter? Draw its circuit diagram explain its working. Why amplitude limiter is needed in FM receivers justify.(very very imp)
7. Compare and contrast foster-seeley discriminator with ratio detector.
8. What is PLL? What are the applications of PLL? Explain the working of PLL with neat block diagram.(imp)
9. How audio frequency signal is demodulated by using PLL? Explain in detail.
10. Write about pre-emphasis and de-emphasis circuits in detail. Give the significance of pre-emphasis and de-emphasis.(imp)

11. In an FM system if the AF is 500 Hz and its amplitude is 2.4V with a frequency deviation of 4.8 KHz. If the AF voltage is increased to 7.2V then find the modified frequency deviation calculate BW in above two cases.
12. Design Armstrong FM generator for the generation of WBFM signal with frequency deviation=75 KHz and  $f_c = 100\text{MHz}$  using the NB carrier as 100 KHz and second carrier as 10 MHz Find the suitable multiplying factors. Assume the message signal is defined in the range 100Hz-15 KHz.
13. Draw the block diagram of single-tone NBFM signal if message signal is  $A_m \sin 2\pi f_m t$ .
14. Derive an expression for an FM signal with carrier frequency  $f_c$  and a modulating signal  $A_1 \cos \omega_1 t + A_2 \cos \omega_2 t$ . Obtain an expression for its spectrum.
15. Why an FM system is preferred over an AM system?

## Unit 2

### Assignment 2(CO2) 2015-2016

1. Explain the generation techniques of FM signal using Direct and Indirect methods in detail. 10M.
2. Explain the working of the following demodulator circuits of FM
  - i. Balanced slope Detector for FM modulation. 5M.
  - ii. Foster-Seeley discriminator. 5M.
  - iii. Ratio-detector. 5M.
3.
  - i. Explain the detection of FM signal using PLL. 5M.
  - ii. Explain in detail about pre-emphasis and De-emphasis circuits in FM. 5M.

## Unit 2

### Assignment 2(CO2) 2016-2017

1. Outline the working of the following demodulator circuits of FM in detail. 10M.
  - i. Balanced slope Detector for FM modulation. 5M.
  - ii. Foster-Seeley discriminator. 5M.
2.
  - i. Illustrate the working of PLL using a Block Diagram. Define capture range and Lock range in PLL. 5M.
  - ii. Sketch the circuit diagram of Ratio-detector and explain working of it in detail. 5M.
3. Sketch the frequency response curves & compare the working of pre-emphasis and De-emphasis circuits in FM communication System. 10M.

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## TUTORIAL TEST 2

### Answer any three of the following

1. In an FM system if the AF is 500 Hz and its amplitude is 2.4V with a frequency deviation of 4.8 KHz. If the AF voltage is increased to 7.2V then find the modified frequency deviation calculate BW in above two cases. 10M.
2. Explain in detail about frequency spectrum of WBFM signal. 10M.
3. Draw the block diagram of single-tone NBFM signal if message signal is  $A_m \sin 2\pi f_m t$  10M.
4. Write any four differences between NBFM and WBFM. 10M.

BY  
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## UNIT-2 QUIZ (CO2)

1. Angle modulation is a technique in which the ----- of the ----- is varied with respect to instantaneous values of ----- by keeping ----- as constant. 2M.
2. Write the expression for Angle Modulated signal----- . 1M.
3. An Angle Modulated signal is given as  $x(t) = 100 \cos(2\pi f_c t + 4 \sin(1000\pi t))$  where  $f_c = 10 \text{ MHz}$ . 6M.
  - A. The Peak frequency deviation is (    )
    - a. 2K                      b. 4000                      c.  $4\pi$                       d.  $8\pi$ .
  - B. The Peak- phase deviation is (    ).
    - a. 4                      b. 6                      c. 0                      d. None of the above.
  - C. The power of the Modulated signal is (    ).
    - a. 10KW.                      b. 5 W                      c. 5 KW                      d. 50W.
4. The amount of change in carrier frequency produced by modulating signal is known as (    ). 1M.
  - a. phase deviation                      b. amplitude deviation
  - c. Frequency deviation                      d. none of the above.
5. The total Transmitted power in FM is equal to the power of (    ) 1M.
  - a. An AM signal.                      b. an unmodulated carrier
  - c. Message signal                      d. all of the above.
6. A 20 MHz carrier is frequency modulated by a sinusoidal signal with frequency 1KHz such that peak frequency deviation is 100KHz what will be the modulation index (    ) 2M.
  - a. 100                      b.101                      c. 99                      d.200.
7. The bandwidth for above FM system will be(    ) 2M.
  - a. 101 KHz                      b. 202 KHz                      c. 99 KHz                      d. 100 KHz.
8. Which one of the following is an indirect method of generating FM (    ) 1M.
  - a. Armstrong method                      b. Varactor diode modulator
  - c. Reactance BJT modulator.                      d. Reactance FET Modulator.

9. In which of the Modulation system when the modulating frequency is doubled the modulation index reduces to half while modulating voltage remains constant ( ) 2M.  
 a. Phase                      b. Amplitude                      c. Frequency                      d. None of the above.
10. In FM, the frequency deviation is ( ) 2M.  
 a. Proportional to modulating frequency.  
 b. Proportional to amplitude of modulating signal.  
 c. Constant.  
 d. Zero.
11. In indirect method of FM generation FM is obtained from ( ) 1M.  
 a. AM      b. PM      c. DSB      d. FM
12. Write Carson's rule-----, 1M.
13. The Bandwidth of NBFM is given as-----, 1M.
14. A 25 MHz carrier is modulated by a 400Hz audio sine wave. The carrier voltage is 4V and the maximum deviation is 10 KHz. The modulation index will be( ) 2M.  
 a. 2.5                      b. 5                      c. 15                      d. 25
15. For the above problem write the expression of FM wave will be-----  
 -----,1M.
16. For the problem in 14 write the expression of PM wave-----  
 -----,1M.
17. Standard FM broadcast stations uses a maximum bandwidth of ( ) 1M.  
 a. 150 KHz                      b.75KHz.                      c. 200KHz                      d. 15KHz.
18. Which type of oscillators are preferred for carrier generation because of their good frequency stability ( ) 1M.  
 a. LR                      b.LC                      c. Crystal                      d. RC.
19. The oscillator whose frequency is varied by an input voltage is called as -----  
 -----, 1M.
20. Maximum deviation results at what point on modulating signal if the system is FM( ) 1M.  
 a. Zero crossing of  $m(t)$   
 b. Peak negative amplitude and peak positive amplitude of  $m(t)$ .  
 c. None of the above.  
 d. Both a and b.