BETCE EXAMINATION, 2018

(2nd Year 2nd Semester)

Analog Communication Systems

Time: Three hours | Full Marks: 100

Unit – 1
Answer any one question (1x10)

1. Describe the terms Power Efficiency and Bandwidth Efficiency in relation to a communication system. How do they affect the performance of a particular modulation scheme? (5+5)

2. State the condition for distortion-less transmission through a Linear Time Invariant (LTI) system. Describe how the multi-path channel leads to non-ideal characteristics in magnitude as well as phase response of the channel. (3+7)

Unit – 2
Answer any three questions (3x10)

3. a) Discuss the need for suppressing the carrier signal in case of Amplitude Modulation (AM). (3)

   b) Apply the frequency shifting property of Fourier transform to demonstrate the modulation and demodulation principles of Double Side Band Suppressed Carrier (DSB-SC) technique. (7)

4. Find the expression of Frequency Modulated (FM) wave. Hence calculate the bandwidth of Narrow Band Frequency Modulated (NBFM) signal. (5+5)

5. a) Examine the effect of the variation of amplitude and frequency of the modulating signal on FM spectrum. (6)

   b) How will you assess the bandwidth of FM signal? (4)

6. a) Sketch and explain the phasor diagrams of NBFM and AM signals. (5)

   b) Sketch the Vestigial Side Band (VSB) spectrum for TV signal and calculate its bandwidth. (5)

Unit – 3
Answer any three questions (3x10)

7. Draw the neat sketch of Double Balanced Modulator circuit and explain its operation. Why is it named so? (8+2)

8. a) Describe the method of recovering the message signal from AM wave using coherent demodulation. (7)

b) Sketch the output waveforms of an envelope detector under the conditions of over modulation as well as under modulation. (3)

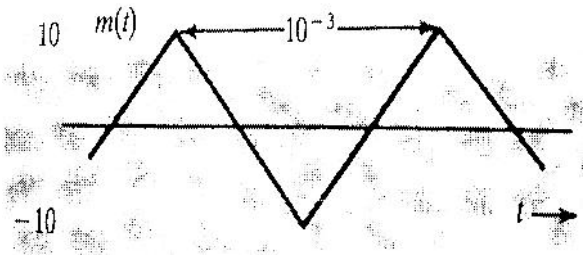
9. Illustrate the operation of Phase Locked Loop (PLL) with necessary diagrams and mathematical derivations. (10)

10. a) Identify the problem of selectivity associated with Tuned Radio frequency Receiver (TRF). (3)

b) How does the process of heterodyning solve the above problem in case of a Superheterodyne receiver? (7)

Unit – 4
Answer any two questions (2x10)

11. a) An AM signal has the following message signal m(t) and modulation index m = 0.8. (5)



i) Find the amplitude and power of the carrier.

ii) Find the side band power and the power efficiency.

b) A DSB-SC signal is given by m(t) cos (2π) 10^6 t. The carrier frequency of this signal, 1 MHz, is to be changed to 400 KHz. The only equipment available consists of one ring modulator and a bandpass filter centered at the frequency of 400 KHz, and one sine wave generator whose frequency can be varied from 150 to 210 KHz. Show how you can obtain the desired signal c m(t) cos (2π x 400 x 10^3 t) from m(t) cos (2π) 10^6 t. Determine the value of c. (5)

12. a) Consider an angle modulated signal s(t) = 10 cos [$\omega_c t$ + 3 sin $\omega_m t$]. Calculate the modulation index and bandwidth both for PM and FM, when the frequency of the modulating signal is1 KHz. (5)

b) A Superheterodyne receiver has been designed to receive radio stations in the frequency band 108 – 157 MHz. (5)

i) If Intermediate Frequency f_{IF} is chosen to be 12 MHz, then show that the image frequency band overlaps the RF band.

ii) Determine the minimum required f_{IF} such that the image frequencies fall outside the 108-157 MHz region. Assume that $f_{LO} < f_C$.

13. Design an Armstrong indirect FM modulator to generate FM signal with carrier 108 MHz and frequency deviation of 40.96 KHz. A Narrow Band FM generator with carrier 200 KHz is available. The maximum phase deviation is limited to 0.2 to avoid the distortion in the phase modulator. The audio signal frequency lies in the range of 50 Hz – 15 KHz. Only a limited number of frequency doublers are available as frequency multiplier. In addition, an oscillator with adjustable frequency from 14 – 16 MHz is also available for frequency mixing. (10)

Unit – 5
Answer the following question (1x10)

14. Investigate the effect of Pre-emphasis – De-emphasis filter on the performance of FM system under noisy environment. (10)