PART – C

Answer the following **1 x 20 = 20 Marks**

17. (a) Discuss the method to generate Double Side Band-Full Carrier signal using a transistor which works in the linear region with a neat diagram. (6)
    (b) Prove that the bandwidth of narrowband FM is the same as the AM. (3)
    (c) Sketch the block diagram of the transmitter to transmit the Double Side Band-Full Carrier signal using high-level modulation. (4)
    (d) Derive the figure of merit of the transmitted Double Side Band-Suppressed Carrier signal with a suitable diagram. (7)

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SASTRA DEEMED UNIVERSITY

(A University under section 3 of the UGC Act, 1956)

End Semester Examinations

July 2022

Course Code: **ECE202**

Course: **ANALOG COMMUNICATION**

Question Paper No. :**U0043** Duration: **3** hours

Max. Marks:**100**

PART - A

Answer all the questions **10 x 2 = 20 Marks**

1. The final RF power amplifier has a supply voltage of 12V. For 100 percent AM using a high-level modulator, what is the peak ac output of the modulation transformer?

2. Explain the flywheel effect.

3. In an FM signal, the modulating frequency is a 1.5 kHz sine wave and the carrier frequency are 1000 kHz. Find the frequencies of the third significant sidebands.

4. Suggest a circuit using a transistor to increase the high-frequency signal in FM so that they become stronger than the high-frequency noise components and thereby improve the S/N ratio. Find the break frequency if the RC time constant is 75 μs.

5. Determine the peak phase deviation (m) for a PM modulator with k= 4 rad/V and modulating signal $e_m(t) = 4 \cos (4000\ t)$.

6. If a Super heterodyne radio receiver with an intermediate frequency of 455 kHz is tuned to a station operating at 1200 kHz, find the associated image frequency.

7. Is the multiplier and the mixer are same? Explain what happens when a frequency of 6 kHz and a deviation of 2.5 kHz are sent to 2^3 multiplier section. What will be the output when the same frequency and deviation are sent to a mixer with a local oscillator frequency of 12 kHz?

8. What is the noise voltage produced across a 75Ω input resistance at a temperature of 25°C with a bandwidth of 1.5MHz?

9. The noise factor of an IF amplifier is 17dB. The amplifier is preceded by a pre-amplifier with a gain of 15dB and a noise factor of 9dB. Determine the overall noise factor.

10. Define capture effect in FM.

PART - B

Answer any FOUR questions **4 x 15 = 60 Marks**

11. (a) A multi-tone modulating signal $e_{m1}(t) = E_{m1} \text{ Cos } \omega_{m1}t + E_{m2} \text{ Cos}\omega_{m2}t$ amplitude modulates a carrier $e_c(t) = E_C \text{ Cos}\omega_c t$. Develop the mathematical expression for AM and find the bandwidth. If the signal is to be retrieved without difficulty using a detector how should the modulation index be selected? (10)

(b) A Complex modulating signal consisting of a sine wave of amplitude 3V and frequency 1000 Hz plus a cosine wave of amplitude 5V and frequency 3000 Hz amplitude modulates a sine wave carrier of 500 kHz, 50 V peak. Sketch the spectrum of the modulated wave and determine the average power when the wave is fed to a 50 ohms load. (5)

12. (a) With a neat block diagram and phasor representation explain how a wideband FM signal can be generated using a PM

modulator. The output of the PM modulator has a carrier frequency f_{c1} = 200 kHz and a frequency deviation of 29.297Hz. Recommend a suitable chain of frequency multipliers and mixer to get the final carrier frequency of 96 MHz and frequency deviation of 60 kHz. The second local oscillator frequency is 9.8 MHz (10)

(b) Compare AM and FM. (5)

13. (a) A modulating signal 6 Cos (75.36×10^3 t) angle modulates a carrier A Cos (ωc t).

(i) Find the modulation index and bandwidth for a) FM System b) PM system

(ii) Determine the change in bandwidth and Modulation index for both FM and PM if modulating frequency is increased to 20 kHz. Assume kp = kf = 12 kHz/V. (10)

(b) Explain how PLL can be used as an FM detector. (5)

14. With a neat block diagram explain the working of each block in the Communication receiver.

15. Discuss in detail with a neat block diagram how an SSB signal (with a frequency range varying from15.1001 MHz to 15.103 MHz) can be transmitted from the transmitter. The modulating signal has a frequency ranging from 100Hz to 3 kHz and the carrier has a frequency of 100 kHz. The first local oscillator and second local oscillator have a frequency of 3 MHz and 12 MHz respectively.

16. (a) Discuss thermal noise and shot noise. (6)

(b) The first stage of a two-stage amplifier has an output resistance of 20 kΩ, voltage gain of 10, input resistance of 400Ω and equivalent resistance of 2500 Ω. The second stage has output resistance of 200 kΩ, voltage gain of 25, input resistance of 110 kΩ and equivalent resistance of 7 kΩ.The amplifier is driven by a generator of output resistance 50 Ω.Evaluate for this two stage amplifier the equivalent input noise resistance. (9)