# VIT

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

**SCHOOL OF ELECTRONICS ENGINEERING**

**Winter Semester: 2023-24**

**CAT- II**

**Programme Name & Branch:** B.Tech. – Electronics and Communication Engineering

**Course Name & Code:** Analog Communication Systems & BECE304L

**Class Numbers:** VL2023240501318, 1314,1304,1309,1312,1320,1306

**Slot:** G2 + TG2

**Faculty Name (s):** Dr. Vijendra Babu D, Dr.Rajesh N, Dr.Karthikeyan, M, Dr. Sangeetha A, Dr.Aarthi G, ,Dr. Indrasen singh,Dr.Shankar T

**Exam Duration:** 90 Min. **Maximum Marks:** 50

**General instruction(s):** Scientific calculators and Bessel's table are permitted.

| Q.No. | Question | Max. Marks |
|---|---|---|
| 1. | An FM transmitter delivers to a 75 ohm antenna a signal voltage of $V(t) = 1000 \sin ( 10^9 t + 4 \sin 10^4 t )$, Determine:<br>(i)Carrier frequency<br>(ii)Intelligence frequency<br>(iii)Modulation index<br>(iv)Total power in FM signal<br>(v)Carrier power<br>(vi)Power in each side band (Using Bessel table) | 10 |
| 2. | The Indirect FM Generation using Armstrong method generates a WBFM signal of carrier frequency 102. 4 MHz and frequency deviation 20.48 kHz. A NBFM generator with carrier frequency 206.25 kHz and frequency deviation 10 Hz is provided. The storeroom has also an oscillator with adjustable frequency in the range of 8 to 16 MHz. There is a bandpass filter with any center frequency and only frequency doublers are available. Determine the multiplier values, $n_1$, $n_2$ and the local oscillator frequency. Also, draw the block schematic specifying the carrier frequencies and frequency deviations at the output of every block. | 10 |

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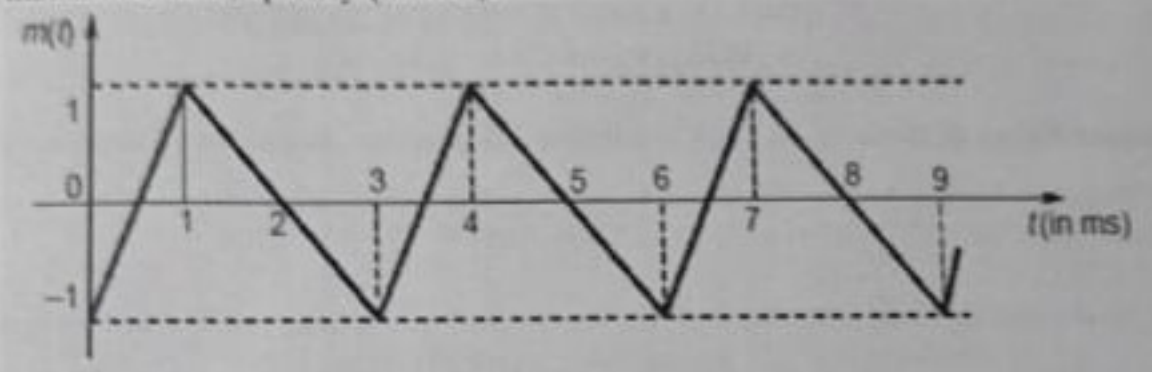
|---|---|---|
| 3. | The baseband signal m(t) shown in the Figure 1 is phase- modulated to generate the PM signal $\emptyset(t = \cos(2\pi f_c t + km(t))$. The time t on the x- axis in the figure is in milliseconds. If the carrier frequency is 50 kHz and k= $10\pi$, then find the ratio of the minimum instantaneous frequency (in kHz) to the maximum instantaneous frequency (in kHz).<br>  <br><br>Figure 1 | 10 |
| 4. | A receiver with 5 dB noise figure, 10 dB gain and 50 kHz noise bandwidth is connected to an antenna that has a noise temperature of 1050 K.<br>(i) What is the overall noise figure?<br><br>(ii) Find the input signal power needed to obtain an output SNR of 6 dB.<br><br>(iii) IF a pre-amplifier of gain 7 dB and noise figure 3 dB is inserted between the antenna and the receiver, what is the minimum detectable signal $v_{min}$ for obtaining an output SNR or 10 dB?<br>Assume that the source resistance is due to a 50Ω coaxial cable with negligible loss and a that reference temp is about 20°C. | 10 |
| 5. | a) A radio receiver with 10 kHz bandwidth has a noise figure of 30 dB. Determine the signal power required at the input of receiver to achieve input SNR of 30 dB. [4]<br><br>b) The first stage of a two-stage amplifier has a voltage gain of 10, a 600 Ω input resistor, a 1600 Ω equivalent noise resistance and a 27 kΩ output resistor. For the second stage, these values are 25, 81 kΩ, 10 kΩ, and 1MΩ, respectively. Calculate equivalent input noise resistance of this two-stage amplifier and also calculate the noise figure of the amplifier if it is driven by a generator whose output impedance is 50 Ω. [6] | 10 |