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**PRESIDENCY UNIVERSITY  
BENGALURU**

**SCHOOL OF ENGINEERING  
MID TERM EXAMINATION - APR 2023**

**Semester :** Semester IV - 2021

**Course Code :** ECE3005

**Course Name :** Sem IV - ECE3005 - Analog Communication

**Program :** ECE

**Date :** 12-APR-2023

**Time :** 2PM - 3.30PM

**Max Marks :** 50

**Weightage :** 25%

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**Instructions:**

- (i) Read all questions carefully and answer accordingly.
  - (ii) Question paper consists of 3 parts.
  - (iii) Scientific and non-programmable calculator are permitted.
  - (iv) Do not write any information on the question paper other than Roll Number.
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**PART A**

**ANSWER ALL THE QUESTIONS**

**(5 X 2 = 10M)**

1. For the AM wave to be properly detected using an envelope detector, the modulation index should be less than 100%. Based on this concept, a carrier wave with an amplitude 12 V and frequency  $f_c=10\text{Mhz}$  is amplitude modulated to 50% level using a modulating signal with frequency  $f_m=1\text{ Khz}$ . Write down the equation of the AM wave.

(CO1) [Knowledge]
2. There are two factors in the communication system which has significant importance in communication system i.e. power and bandwidth requirement to transmit the modulated signal. What is the power transmitted (in W) by a DSB-SC signal when the carrier wave power is 80W and modulation index is 0.4?

(CO1) [Knowledge]
3. The difference between the upper and lower sideband defines the transmission bandwidth. Find the transmission bandwidth of Amplitude Modulation signal, if the bandwidth of the message signal is W.

(CO1) [Knowledge]
4. The parameter modulation index, provides information on the depth of modulation the baseband signal incurs on the carrier signal. Knowledge of the value of the modulation index plays a vital role, particularly in the case of amplitude modulation. In a laboratory, while performing an experiment of AM, a student measures the following values from the DSO:  $V_{\text{max}}=5\text{V}$ ,  $V_{\text{min}}=3.5\text{V}$ . What can be the value of the modulation index in percentage measure?

(CO1) [Knowledge]

5. The envelope detector is a simple RC circuit in combination with Low Pass Filter that is used to demodulate conventional AM waves. A message signal  $m(t) = \cos(1000\pi t) + \cos(3000\pi t)$  modulates the carrier signal  $c(t) = \cos(2\pi f_c t)$  (where  $f_c = 2$  MHz) to generate the AM signal. To demodulate the AM signal using the envelope detector, estimate the RC time constant of the circuit.

(CO1) [Knowledge]

### PART B

#### ANSWER ALL THE QUESTIONS

(4 X 5 = 20M)

6. Ajay was talking on his mobile to his friend for a long time. After his conversation was over, his sister Anita advised him that if his conversation was of such a long duration, it would be better to talk through a landline.
- Why is it considered harmful to use a mobile phone for a long duration?
  - Which values are reflected in the advice of his sister Anita?
  - Draw the basic block diagram of communication system.

Define modulation and list different types of modulation.

(CO1) [Comprehension]

7. In amplitude modulation baseband or modulating signal is a random signal which contains a large number of frequency components. The carrier signal is modulated by a large number of frequency components. Hence discuss amplitude modulation(AM) in which the modulating or baseband signal consists of only one (single) frequency in the time domain and frequency domain with its frequency spectrum.

(CO1) [Comprehension]

8. Let us say in Doddaballapur AM station the speaker voice frequency is represented as  $5 \sin 2\pi(1000)t$  and the station is using a carrier of  $100 \sin 2\pi(10^6)t$ . Consider the modulation index as 0.4. then Find
- Side band Frequency
  - Amplitude of Upper and Lower side band
  - Bandwidth requirement
  - Total power delivered(5M)

(CO1) [Comprehension]

9. Diode can be used as a switch for generating double sideband full carrier (amplitude-modulated) waves. Generate AM using this device with the necessary equations. Illustrate with necessary waveforms and spectrum before and after the filtering process

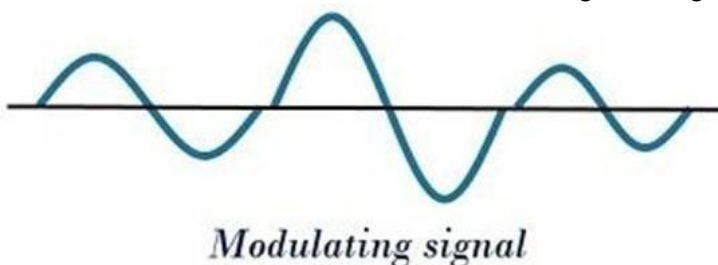
(CO1) [Comprehension]

### PART C

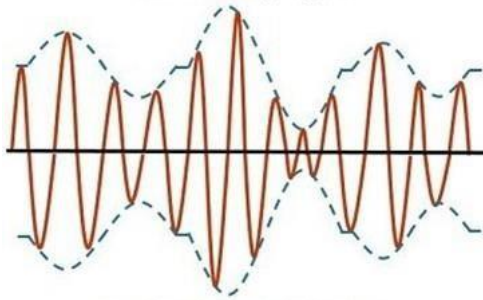
#### ANSWER ALL THE QUESTIONS

(2 X 10 = 20M)

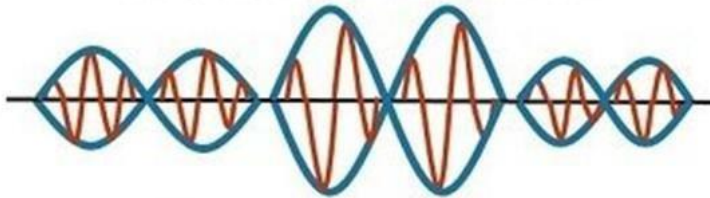
10. Attempt the following questions
- The upper and lower sideband frequencies for 5KHz amplitude modulation with a 30KHz carrier frequency will be?
  - If the waveform of modulating/message signal appears as shown below:



Then which waveform represents the DSB-SC for the above-shown modulating signal?



1.



2.

c. What is the disadvantage of DSB-SC signal in comparison to SSB signal?

d. Which filter is used in the modulation of DSB-SC signal?

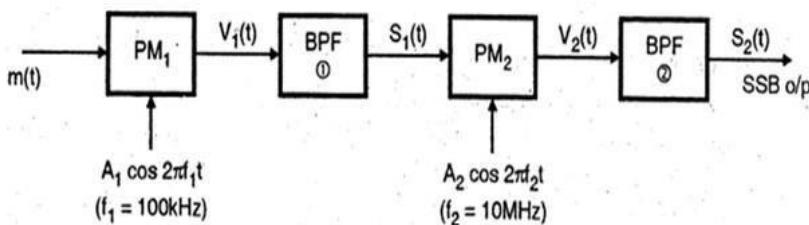
i. Low pass filter (LPF)

ii. Bandpass filter (BPF)

e. What is the advantage of DSB-SC signal in comparison to DSB-FC signal? Draw the block diagram for generating DSB-SC signal.

(CO1) [Application]

11. Consider a 2 stage SSB modulator as shown in figure. The input signal consists of a voice signal in a frequency range of 0.3 to 3.4KHz. The two oscillator frequencies have values  $f_1=100\text{KHz}$  and  $f_2=10\text{MHz}$ . Specify the following



i. Sidebands of DSB-SC modulated waves appearing at the outputs of the product modulator (PM).

ii. Sidebands of SSB modulated waves appearing at two BPF outputs.

iii. The pass bands and guard bands of the two BPFs.

(CO1) [Application]