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**PRESIDENCY UNIVERSITY
BENGALURU**

**SCHOOL OF ENGINEERING
END TERM EXAMINATION - JAN 2023**

Semester : Semester V - 2020

Course Code : ECE3005

Course Name : Sem V - ECE3005 - Analog Communication

Program : B.Tech. Electronics and Communication Engineering

Date : 6-JAN-2023

Time : 9.30AM - 12.30PM

Max Marks : 100

Weightage : 50%

Instructions:

- (i) Read all questions carefully and answer accordingly.*
 - (ii) Question paper consists of 3 parts.*
 - (iii) Scientific and non-programmable calculator are permitted.*
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PART A

ANSWER ALL THE FIVE QUESTIONS

5 X 4 = 20M

1. Define modulation. Classify different types of modulation.

(CO1) [Knowledge]

2. Differentiate between TDM & FDM.

(CO2) [Knowledge]

3. The specified voice spectrum is 300Hz-3.4kHz. The sampling frequency used is 8kHz. In practice the frequency spectrum of human voice extends much beyond the highest frequency necessary for communication. Let the input analog information signal contains 5kHz frequency component also. What would happen at the output of the sampler? How can this problem be prevented?

(CO4) [Knowledge]

4. List four comparison between AM and FM.

(CO2) [Knowledge]

5. What are the advantages and disadvantages of PPM?

(CO3) [Knowledge]

PART B

ANSWER ALL THE FOUR QUESTIONS

4 X 15 = 60M

6. Modulation is the process of changing the characteristics of a carrier signal with respect to the amplitude of the message signal. Based on the characteristics varying for a carrier, there exists different types of modulation. For the transmission of standard AM signal high power and large bandwidth is required. The high transmission power requirement is compensated by DSB-SC modulation but still the bandwidth required is more. SSB-SC modulation is a type of Amplitude Modulation which can reduce transmission power as well as the Bandwidth requirement. Later VSB modulation was developed to transmit wideband signals.

- What are the characteristics of a sinusoidal carrier?
- List any 3 different types of modulation?
- What is the relationship between a carrier frequency f_c and message signal frequency f_m ?
- Compare the different types of Amplitude modulated signals. [Hint: Consider power, BW, carrier suppression, sideband transmission, transmission efficiency, receiver complexity and applications]

(CO1) [Comprehension]

7. In an analog communication laboratory, student is provided with a signal generator set to produce an analog signal of 1kHz. He fed it as input to a modulator of carrier frequency 3kHz. The following observations are made by the student:

- The frequency is swinging between 2.5kHz and 3.5kHz.
- At every instant the frequency is different

- Identify the type of modulation
- Calculate the depth of modulation
- Derive the FM signal equation for a single frequency message signal

(CO2) [Comprehension]

8. As part of the assignment, while performing experiments John observed that in spectrum analyser, the standard AM signal spectrum and NBFM signal spectrum are similar except for polarity of LSB.

- Is the observation true?
- Help him to prove his observation theoretically by deriving the NBFM signal in time as well in frequency domain and comparing it with standard AM signal. Also comment on the Bandwidth.

(CO2) [Comprehension]

9. Pulse modulation is a type of modulation in which the signal is transmitted in the form of pulses. It can be used to transmit analog information. In pulse modulation, continuous signals are sampled at regular intervals. Students have the liberty to take analog message signal of their choice.

- Classify the different types of Pulse modulation techniques
- Identify the form of signal modulation where the message information is encoded in the amplitude of a series of signal pulses.
- Explain the above modulation with the help neat diagrams.
- Can the message information is present in width and positioning of the pulses instead of amplitude? Explain with the help of neat diagrams
- List any 2 advantages and disadvantages of the above mentioned pulse modulations.

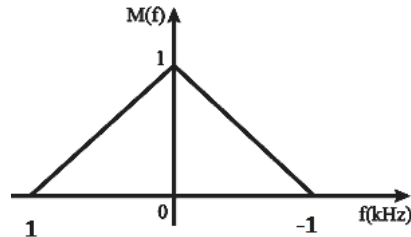
(CO3) [Comprehension]

PART C

ANSWER ALL THE TWO QUESTIONS

2 X 10 = 20M

10. A message signal $m(t)$ with spectrum shown in the below figure is applied to a product modulator with a carrier wave $\text{Accos}(2\pi f_c t)$ producing the DSB-SC modulated wave $S(t)$. This modulated wave is then applied to a coherent detector. Assuming a perfect coherence between the transmitter and receiver, determine the spectrum of the detector output when



- $f_c = 1.25 \text{ kHz}$.
- $f_c = 0.75 \text{ kHz}$ and sketch the same
- The lowest f_c so the $m(t)$ is uniquely determined from $s(t)$.

(CO1) [Application]

11. A RED FM station in Bangalore uses 93.2MHz carrier; which is frequency modulated by an audio signal of 5kHz sine wave. The resultant FM signal has frequency deviation of 40kHz.
- Find the carrier swing of the FM signal.
 - What are the highest and lowest frequencies attained by the frequency modulated signal?
 - Calculate the modulation index for the wave.
 - Calculate Bandwidth.

(CO2) [Application]
