Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – December 2025

Date: 12-12-2025 **Time:** 01:00pm– 04:00pm

School: SOE	**Program**: B.TECH	
Course Code: ECE3165	**Course Name:** Analog Communication	
Semester: V	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5	CO6
Marks	18	17	12	15	12	26

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	In a radio communication system, if the message signal has a bandwidth of 5 kHz, how much transmission bandwidth will be required for DSB-SC and SSB-SC modulation schemes respectively?	**2 Marks**	**L1**	**CO1**
2.	If a carrier of frequency f_c is modulated by a message of frequency f_m using Standard AM scheme, sketch the sideband frequencies?	**2 Marks**	**L3**	**CO2**
3.	A technique of varying phase of carrier signal in accordance to instantaneous value of modulating signal is called as Phase modulation. Write mathematical expression of PM wave.	**2 Marks**	**L1**	**CO1**
4.	Detector are used to recover modulating signal from Modulated signal. Name two types of AM detectors.	**2 Marks**	**L1**	**CO1**
5.	What is the aperture effect in sampling, and why does it cause distortion in the reconstructed signal?	**2 Marks**	**L1**	**CO1**
6.	Pulse Amplitude Modulation is the most simple and cost effective method of pulse modulation. What are the major limitations of Pulse Amplitude Modulation.	**2 Marks**	**L1**	**CO6**

7.	Motor speed control and LED light dimming uses a type of Pulse modulation. Which type of pulse modulation is used?	**2 Marks**	**L1**	**CO3**
8.	What is a guard band, and why is it necessary in FDM systems?	**2 Marks**	**L1**	**CO5**
9.	Define the term Noise figure.	**2 Marks**	**L1**	**CO6**
10.	Why is AM more susceptible to noise compared to FM?	**2 Marks**	**L1**	**CO6**

Part B

Answer the Questions. **Total Marks 80M**

11.	**a.**	Communication refers to the transmission of information between two or more locations through a reliable connection. Explain the major components of an Analog Communication System, illustrating your answer with a clear and well-labeled block diagram. Additionally, state the importance of modulation in communication systems.	**10 Marks**	**L2**	**CO1, CO4**
	b.	Explain with necessary expressions the derivation of power distribution (carrier power, sideband power, and total power) in an SSBSC signal. Further, derive the expression for the bandwidth requirement of SSBSC transmission by drawing the spectrum.	**10 Marks**	**L2**	**CO2, CO3**
		Or			
12.	**a.**	A sinusoidal carrier of amplitude A_c and frequency f_c is amplitude modulated by a sinusoidal message signal m(t)= A_m cos $(2\pi f_m t)$ using AM modulation. a) Derive the expression for the transmitted power in terms of A_c and A_m. Calculate the bandwidth requirement for the AM signal.	**10 Marks**	**L3**	**CO2, CO3**
	b.	With the help of appropriate block representations, explain how DSB-SC modulation is achieved using a balanced modulator and how coherent detection is employed for demodulation. Additionally, present a comparison between DSB-SC and standard AM techniques, focusing on their power requirements and bandwidth advantages.	**10 Marks**	**L2**	**CO1, CO4**

13.	**a.**	Explain the role of pre-emphasis and de-emphasis networks in enhancing the signal-to-noise ratio of FM radio transmission. Illustrate your explanation with suitable frequency response curves.	**10 Marks**	**L2**	**CO1, CO2**

	b.	A 107.6 MHz carrier signal is frequency modulated by a 7KHz sine wave. The resultant FM signal has a frequency deviation of 50 KHz. Determine the following: i) Carrier Swing of FM signal ii) Highest and lowest frequencies attained by the modulated signal. iii) The modulation index of FM wave. Iv) what is the power this FM wave will dissipate in 100Ohm resistor.	**10 Marks**	**L3**	**CO2, CO3**
		Or			
14.	**a.**	Obtain the mathematical expression for a frequency-modulated (FM) signal and interpret the significance of each parameter involved. Using Bessel functions, demonstrate that the FM signal contains the carrier component along with an infinite number of sidebands	**10 Marks**	**L2**	**CO1, CO2**
	b.	Explain with necessary block diagram and equations the working principal of simple slope detector of FM signal. Highlight the advantages of Phase Locked Loop method.	**10 Marks**	**L2**	**CO2, CO3**

15.	**a.**	Explain, with the help of the frequency-domain analysis of a narrowband FM (NBFM) signal, why its required transmission bandwidth can be approximated as 2 fm, where fm is the highest modulating frequency. In addition, describe the principle of varactor-diode-based FM generation, and present a clear block diagram. Discuss the role of each block in producing the frequency-modulated output signal.	**10 Marks**	**L3**	**CO4**
	c.	What is meant by multiplexing in communication system. What are the different types of multiplexing schemes. Discuss the limitations of FDM in analog communication systems with respect to bandwidth, noise, and intermodulation distortion. Suggest methods to minimize these limitations in practical systems.	**10 Marks**	**L3**	**CO5**
		Or			
16.	**a.**	Explain the operating principles of Pulse Width Modulation (PWM) and Pulse Position Modulation (PPM) demodulation systems. Support your explanation with clearly labeled waveform diagrams and block diagrams showing the detection of each modulation technique.	**10 Marks**	**L3**	**CO4**

		Additionally, present a comparative analysis between PWM and PPM, highlighting their advantages, disadvantages, and real-world applications.			
	b.	Explain the working principle of a Frequency Division Multiplexing (FDM) transmitter and receiver using a clear block diagram. In a certain communication setup, ten analog voice signals must be multiplexed. Each voice channel has a bandwidth of 4 kHz, and to prevent interference, a guard band of 1 kHz is placed between every pair of adjacent channels. (a) Sketch the frequency spectrum showing all five channels along with the guard bands. (b) Determine the total bandwidth occupied by this FDM scheme.	**10 Marks**	**L3**	**CO5**

17.	**a.**	Discuss the various types of noise encountered in communication systems. Differentiate between internal noise and external noise, providing appropriate examples of each. Also, explain how these noise sources degrade the performance of communication signals. If a communication channel carries a signal with 100 mW of power and experiences 10 mW of noise, determine the Signal-to-Noise Ratio (SNR) in decibels (dB).	**10 Marks**	**L3**	**CO6**
	b.	What is meant by Noise Figure in communication systems? Discuss its significance in judging receiver performance. For an amplifier with 10 dB gain, the input noise level is 2 μW, and the noise measured at the output is 50 μW. Find the noise figure of this amplifier.	**10 Marks**	**L3**	**CO6**
		Or			
18.	**a.**	Explain shot noise and transit-time noise in semiconductor devices. How do they influence the behavior of electronic communication circuits? Calculate the thermal noise power in a system with a bandwidth of 1MHz at a temperature of 300K. Boltzmann constant $K=1.38\times10^{-23}$ J/K.	**10 Marks**	**L3**	**CO6**
	b.	Explain the concept of Signal-to-Noise Ratio (SNR). How does improving SNR enhance the quality of a communication system? Provide an example.	**10 Marks**	**L2**	**CO6**