Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – MAY 2025

Date: 23-05-2025 **Time:** 01:00 pm –04:00 pm

School: SOE	**Program:** B. Tech-ECE (VLSI Design and Technology)	
Course Code: ECE3160	**Course Name:** Communication Systems	
Semester: IV	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Marks	**24**	**24**	**26**	**26**	**NA**

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**

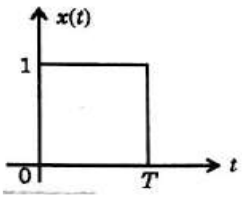
1.	Mathematically define the modulation index of a DSB-WC modulated signal.	**2 Marks**	**L1**	**CO1**
2.	Explain the problems that often happen with transmission routes in wireless communication.	**2 Marks**	**L1**	**CO1**
3.	An AM broadcast radio transmitter radiates 30 kW of power, for modulation index of 30 %. Calculate how much of this is the carrier power.	**2 Marks**	**L2**	**CO2**
4.	Calculate the Fourier Transform of the Dirac delta function, δ(t).	**2 Marks**	**L2**	**CO2**
5.	Give a brief explanation of the different kinds of frequency modulation techniques using modulation index.	**2 Marks**	**L2**	**CO3**
6.	Articulate Carson's rule regarding the bandwidth requirements for angle modulation.	**2 Marks**	**L2**	**CO3**
7.	For low pass signals, state the Nyquist sampling theorem.	**2 Marks**	**L2**	**CO3**

8.	A signal $x(t)$ is band limited to 6 kHz. Find the sampling rate for the time shifted signal $x(t - t_x)$.	**2 Marks**	**L3**	**CO4**
9.	A certain digital-to-analog converter has a step size of 0.5 V and a full-scale output of 16 V. Determine the number of input binary bits.	**2 Marks**	**L3**	**CO4**
10.	Sketch the waveform of OOK modulation for the binary bit stream 10011101.	**2 Marks**	**L3**	**CO4**

Part B

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

11.	**a.**	Utilizing a circuit schematic, elucidate the operation of an asynchronous envelope detector for general AM demodulation.	**10 Marks**	**L1**	**CO1**
	b.	The equation of an amplitude modulated wave is given by: $20[1+0.4\cos(2\pi\times 10^3 t)]\cos(4\pi\times 10^5 t)$. Determine, (i) the carrier power (ii) the side band power (iii) bandwidth of the AM wave.	**10 Marks**	**L1**	**CO1**
		Or			
12.	**a.**	Explain the concept of frequency division multiplexing (FDM) in analog transmission using a simple block diagram.	**10 Marks**	**L1**	**CO1**
	b.	The total antenna current of an AM transmitter is 10 A, if only the carrier is transmitted. It increases to 12A if the carrier is tone modulated. Determine the depth of modulation.	**10 Marks**	**L1**	**CO1**

13.	**a.**	Describe the operation of a non-linear square-law modulator in the context of generating double sideband with carrier (DSB-WC) modulation, including appropriate plots and diagrams.	**10 Marks**	**L2**	**CO2**
	b.	Examine the block models related to the generation and detection of Double Sideband Suppressed Carrier (DSB-SC) waveforms utilizing a product modulator and demodulator.	**10 Marks**	**L2**	**CO2**
		Or			
14.	**a.**	Compute the Fourier Transform of the depicted rectangular pulse. $x(t) = \begin{cases} 1, & 0 < t < T \\ 0, & \text{otherwise} \end{cases}$ 	**10 Marks**	**L2**	**CO2**
	b.	Calculate the Fourier Transform of a single sided exponential function $e^{-kt}.u(t)$. Illustrate both the magnitude and phase spectrum of the transformed domain.		**L2**	**CO2**

15.	**a.**	Depict with basic block diagrams the generation of frequency modulation from phase modulation and the generation of phase modulation from frequency modulation.	**10 Marks**	**L3**	**CO3**
	b.	A single-tone FM is represented by the voltage equation: $v(t) = 15\cos(4 \times 10^8 t + 4\sin 1500t)$. Determine (i) carrier frequency (ii) modulating frequency (iii) modulation index (iv) maximum frequency deviation.	**10 Marks**	**L3**	**CO3**
		Or			
16.	**a.**	Describe how narrow-band FM (NBFM) is generated and detected using appropriate block diagrams.	**10 Marks**	**L3**	**CO3**
	b.	Derive approximate expressions for the bandwidth of Narrowband Frequency Modulation (NBFM) and Wideband Frequency Modulation (WBFM) based on Carson's rule. Determine the bandwidth of a commercial FM transmission if frequency deviates by $\Delta f = 100$ kHz and the modulating frequency $f_m = 25$ kHz.	**10 Marks**	**L3**	**CO3**

17.	**a.**	Find the Nyquist rate and Nyquist interval for the signal $\boldsymbol{x(t) = \frac{1}{2\pi}\mathbf{Cos}(10000\pi t).\mathbf{Cos}(1000\pi t)}$	**10 Marks**	**L3**	**CO4**
	b.	Describe the components of a digital communication system using a clear diagram. Discuss the source encoder and decoder blocks in brief.	**10 Marks**	**L3**	**CO4**
		Or			
18.	**a.**	Find the Nyquist rate and Nyquist interval for the signal $x(t) = \frac{1}{2\pi}\mathrm{Sin}(2500\pi t).\mathrm{Sin}(3500\pi t)$	**10 Marks**	**L3**	**CO4**
	b.	Give a brief explanation of how the BASK transmitter and receiver operate using block diagrams.	**10 Marks**	**L3**	**CO4**