Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – December 2025

Date: 11 – 12- 2025 **Time:** 09:30am – 12:30pm

School: SOE	**Program:** ECE	
Course Code : ECE2517	**Course Name:** Communication Systems	
Semester: III	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5	CO6
Marks	16	14	14	16	20	20

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.	List the components present in a Double Sideband Full Carrier AM wave.	**2 Marks**	**L1**	**CO1**
2.	State one key advantage of Single Sideband (SSB) modulation compared to Double Sideband (DSB) modulation	**2 Marks**	**L1**	**CO1**
3.	Define under-modulation, over-modulation, and perfect modulation in amplitude modulation	**2 Marks**	**L2**	**CO1**
4.	The peak carrier voltage is 25 V in an AM transmitter, modulated at 50%. Calculate the maximum and minimum amplitudes of the modulated wave.	**2 Marks**	**L3**	**CO2**
5.	Find the transmitted power if the carrier power is 20KW and modulation index is 0.5	**2 Marks**	**L3**	**CO2**
6.	Why is narrow band FM used for voice communication?	**2 Marks**	**L2**	**CO3**
7.	Define modulation index in Frequency Modulation (FM)	**2 Marks**	**L2**	**CO3**
8.	Define Phase Shift Keying (PSK)?	**2 Marks**	**L2**	**CO4**
9.	Explain aperture effect in sampling?	**2 Marks**	**L2**	**CO4**
10.	Explain slope overload distortion in delta modulation	**2 Marks**	**L2**	**CO4**

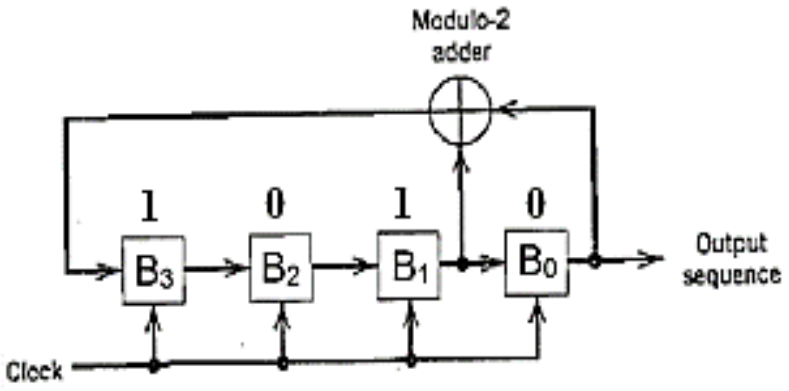
Part B

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

11.	**a.**	Describe the working of a square law modulator with a neat block diagram.	**10 Marks**	**L2**	**CO1**
	b.	An audio frequency signal $20\sin(2\pi\times300t)$ volts modulates a carrier signal $40\sin(2\pi\times120000t)$ volts. Calculate: **(a)** Modulation Index. **(b)** Sideband frequencies. **(c)** Amplitude of each sideband frequency. **(d)** Bandwidth required. **(e)** Total power delivered to the load of 600 ohms. **(f)** Efficiency of the modulation.	**10 Marks**	**L3**	**CO2**
		Or			
12.	**a.**	Illustrate a block diagram of a communication system and describe the role of each block	**10 Marks**	**L2**	**CO1**
	b.	A carrier wave with power of 320 W is amplitude modulated by a sinusoidal signal. The total power transmitted in the AM wave is 374.4 W. **(a)** Calculate the modulation index. **(b)** Find the power in the sidebands. **(c)** Calculate the efficiency of the modulation. **(d)** If the carrier voltage is 80 V, find the amplitude of the message signal. **(e)** Calculate the bandwidth of the AM signal if the message frequency is 2.5 kHz. **(f)** Determine if the signal is in perfect modulation, under-modulation or over modulation.	**10 Marks**	**L3**	**CO2**

13.	**a.**	Derive the mathematical expression for narrowband frequency modulation (NBFM) in the time domain, describe its frequency spectrum, and explain its generation with a block diagram.	**10 Marks**	**L2**	**CO3**
	b.	Define flat top sampling and illustrate its mathematical expression in the time domain with annotated waveforms, including the corresponding frequency domain spectrum.	**10 Marks**	**L2**	**CO4**
		Or			
14.	**a.**	A sinusoidal modulating signal of peak amplitude 18 V and frequency 16 kHz is applied to an FM generator with a frequency sensitivity of 85 Hz/Volt. Calculate the following parameters: **(a)** Frequency deviation (Δf) **(b)** Bandwidth of the NBFM wave **(c)** Modulation index (β) **(d)** Carrier power (Pc) assuming carrier amplitude Ac=1.1V and load resistance R=1 Ω **(e)** Peak instantaneous frequency of the FM wave if fc=105KHZ	**10 Marks**	**L3**	**CO3**
	b.	For signal $g(t) = 2\cos(400\pi t) + 6\cos(640\pi t)$ **(a)** Calculate Nyquist rate and interval based on highest frequency. **(b)** Analyze sampled signal with fs=500 Hz. **(c)** Determine filter output components for LPF cutoff at 400 Hz. **(d)** Draw sampled signal spectrum for fs=500 Hz.	**10 Marks**	**L3**	**CO4**

15.	**a.**	Calculate the processing gain, bandwidth, processing gain in dB, and jamming margin of a slow frequency hop spread spectrum system with the following parameters: Number of bits per MFSK symbol is 4, number of MFSK symbols per hop is 8, hop rate is 200 hops per second, bit rate is 1600 bits per second, and bandwidth per hop is 30 kHz. Assume the jammer power is 10 dB stronger than the signal power.	**10 Marks**	**L3**	**CO5**
	b.	Illustrate the main components of a slow frequency hop spread spectrum transmitter and receiver with a neat block diagram.	**10 Marks**	**L2**	**CO5**
		Or			
16.	**a.**	Given a Direct Sequence Spread Spectrum (DS-SS) system using a 10-stage linear feedback shift register with a chip rate of 3×10^6 chips/sec, perform the following tasks: **(a)** Calculate the PN sequence length. **(b)** Determine the chip duration. **(c)** Calculate the period of the PN sequence. **(d)** Compute the processing gain in dB. **(e)** Apply your calculations to explain how the PN sequence length affects the processing gain and what this implies for the system's resistance to interference and eavesdropping.	**10 Marks**	**L3**	**CO5**
	b.	Describe the main components of a Direct Sequence Spread Spectrum (DS-SS) transmitter and receiver with the help of a neat block diagram.	**10 Marks**	**L2**	**CO5**

17.	**a.**	Design a pseudo-noise (PN) sequence generator using a 4-stage linear feedback shift register (LFSR) with flip-flops arranged as B3, B2, B1, B0, and feedback taps at positions B1 and B0. The initial state of the LFSR is 1010. Perform the following tasks: **(a)** Generate the PN sequence produced by the LFSR **(b)** Verify if the generated sequence satisfies the balanced property **(c)** Verify if the generated sequence satisfies the run property **(d)** Compute the autocorrelation of the generated sequence for a shift of 1 	**20 Marks**	**L3**	**CO6**
		Or			
18.	**a.**	Design a pseudo-noise (PN) sequence generator using a 4-stage linear feedback shift register (LFSR) with flip-flops arranged as C3, C2, C1, C0, and feedback taps at positions C3 and C0. The initial state of the LFSR is 1111. Perform the following tasks: **(a)** Generate the PN sequence produced by the LFSR **(b)** Verify if the generated sequence satisfies the balanced property	**20 Marks**	**L3**	**CO6**

		(c) Verify if the generated sequence satisfies the run property **(d)** Compute the autocorrelation of the generated sequence for a shift of 1