Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 5 – EXAMINATION – SUMMER 2026

Subject Code: 3151104 **Date: 09/06/2026**

Subject Name: Analog and Digital Communication

Time: 02:30 PM TO 05:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

Q.1	**(a)**	Discuss the advantages and disadvantages of Frequency Modulation over Amplitude Modulation.	**03**
	(b)	Define Following Terms: (Draw diagram and write equations if any) i) Sideband splatter in amplitude modulation ii) Single tone modulation iii) Carrier swing	**04**
	(c)	Draw and explain the block diagram of Analog and Digital communication system.	**07**
Q.2	**(a)**	What do you mean by Frequency Division Multiplexing?	**03**
	(b)	Explain vestigial sideband (VSB).	**04**
	(c)	An AM signal is represented by e (t)= 7.5 (1 + 0.5 sin (5027*t)) cos (10053 * 1000*t). Calculate its i) Carrier frequency ii) Modulation index iii) Amplitude of modulating signal iv) Frequency of LSB and USB v) Amplitude of LSB and USB vi) Transmission efficiency vii) Total power delivered to load of 600Ω.	**07**
		OR	
Q.2	**(c)**	Explain the indirect method of generating FM signal with block diagram. Derive its relevant mathematical expression.	**07**
Q.3	**(a)**	Differentiate between Wideband frequency modulation and Narrowband frequency modulation.	**03**
	(b)	A carrier wave is represented by equation 12sin(2πft). Draw the wave-forms of Amplitude Modulation wave for depth of modulation of i) 1 ii) 0.5 iii) 3/2.	**04**
	(c)	Enlist the methods used to generate Single Side Band modulation signal. Discuss any one method in detail.	**07**
		OR	
Q.3	**(a)**	Compare DSBFC and DSBSC of amplitude modulation.	**03**
	(b)	Discuss the significance of pre-emphasis and de-emphasis in FM transmitter and receiver?	**04**
	(c)	Derive the mathematical expression of normal amplitude modulation and draw its and frequency spectrum. Derive its equation of transmitted power.	**07**
Q.4	**(a)**	State and prove sampling theorem in time domain.	**03**
	(b)	Discuss Modulation with its need for communication.	**04**

	(c)	Draw Eye diagram. Show the significance of it in the pulse detection technique?	**07**

OR

Q.4	**(a)**	What do you mean by modulation index of frequency modulation?	**03**
	(b)	Explain in brief Frequency Shifting Keying (FSK) technique and enlist its applicationsa	**04**
	(c)	Explain the different type of line coding techniques with suitable diagrams.	**07**
Q.5	**(a)**	Define the following terms: i) Scrambling ii) Slope overloading iii)Sample and Hold	**03**
	(b)	Derive the Expression of quantization error.	**04**
	(c)	Draw the block diagram of regenerative repeater and briefly explain the function of each block.	**07**

OR

Q.5	**(a)**	Compare Differential Pulse Code Modulation and Pulse Code Modulation.	**03**
	(b)	Draw the signals for Unipolar NRZ, Unipolar RZ, Polar NRZ and polar RZ for data stream 10110011.	**04**
	(c)	Explain Inter symbol interference in digital communication and how to achieve zero ISI.	**07**

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Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V EXAMINATION – SUMMER 2025

Subject Code:3151104 Date:17-05-2025

Subject Name:Analog and Digital Communication

Time:02:30 PM TO 05:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

Q.1	**(a)**	What do you mean by modulation index/modulation depth? Explain its significance in communication system.	**03**
	(b)	Explain Modulation process with its requirement in communication system.	**04**
	(c)	Define Following Terms: (Draw diagram and write equations if any) i) Multi tone modulation ii) Scrambling iii) Aliasing iv) Frequency Division Multiplexing v) Phase modulation vi) DSBSC vii) Sideband splatter in amplitude modulation	**07**
Q.2	**(a)**	Why pre-emphasis and de-emphasis are used in FM transmitter and receiver?	**03**
	(b)	Draw and explain the basic block diagram of communication system.	**04**
	(c)	A modulating signal 10sin (2π*500t) is used to amplitude modulates a carrier of 50sin (2π*100000t). Find i) modulation index, ii) sideband frequencies, iii) amplitude of both side bands, iv) Total Bandwidth, v) Total power delivered to load of 600Ω, vi) power in carrier signal, vii) power in one sideband.	**07**
		OR	
	(c)	Explain amplitude modulation with its mathematical expression and frequency spectrum. Draw its waveforms for under, perfect and over modulation.	**07**
Q.3	**(a)**	Discuss the advantages and disadvantages of Frequency Modulation over Amplitude Modulation.	**03**
	(b)	Amplitude Modulated wave has maximum and minimum amplitudes are measured as 7.2 V and 1.8 V respectively. Calculate its modulation index and transmission efficiency.	**04**

	(c)	List the methods used to generate SSB modulation signal. Discuss any one method in detail.	**07**

OR

Q.3	**(a)**	Discuss about Carson's rule.	**03**
	(b)	Explain vestigial sideband (VSB).	**04**
	(c)	Explain the indirect method of generating FM signal with block diagram and relevant mathematical expression.	**07**
Q.4	**(a)**	Differentiate between RZ and NRZ line codes.	**03**
	(b)	Derive the Expression of quantization error.	**04**
	(c)	Differentiate Delta modulation and Adaptive delta modulation. Discuss the condition for avoiding slope overload error?	**07**

OR

Q.4	**(a)**	Why pulse shaping is required?	**03**
	(b)	Explain in brief Amplitude Shifting Keying (FSK) technique and list the applications of it.	**04**
	(c)	Draw the block diagram of regenerative repeater and briefly explain the function of each block.	**07**
Q.5	**(a)**	State and prove sampling theorem in time domain.	**03**
	(b)	List the advantages of digital communication over analog communication.	**04**
	(c)	Explain Time Division Multiplexing for PCM in T1 carrier systems.	**07**

OR

Q.5	**(a)**	Compare Polar, Bipolar signaling with respect to desirable properties of line codes.	**03**
	(b)	Explain companding process in PCM and state the different laws for companding.	**04**
	(c)	Explain the different type of line coding techniques with suitable diagrams.	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – SUMMER 2024

Subject Code: 3151104 Date:21-05-2024

Subject Name: Analog and Digital Communication

Time:02:30 PM TO 05:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Explain the need of modulation.	**03**
	(b)	Justify: Noise immunity of digital communication system is better than analog communication system.	**04**
	(c)	What are the advantages of Single Side Band (SSB) modulation over Double Side Band (DSB) modulation? Explain filter method to generate SSB signal.	**07**
Q.2	**(a)**	Explain the working of pre-emphasis network in Frequency Modulation.	**03**
	(b)	Compare: Amplitude Modulation and Frequency Modulation.	**04**
	(c)	Explain the working of Phase Locked Loop (PLL).	**07**
		OR	
	(c)	Explain different types of signal distortions over a communication channel.	**07**
Q.3	**(a)**	A broadcast AM transmitter radiates 50 KW of carrier power. What will be the radiated power at 85 % modulation?	**03**
	(b)	For baseband pulse 110100, draw the waveforms of ASK, FSK and PSK.	**04**
	(c)	Explain how FM signal is generated using Indirect method of Armstrong.	**07**
		OR	
Q.3	**(a)**	An FM wave is given by $e(t) = 20 \cos[6 \times 10^8 t + 7 \sin 1250t]$. Determine (i) The carrier frequency (ii) Modulating frequency (iii) The maximum deviation.	**03**
	(b)	Compare binary ASK, FSK and PSK.	**04**
	(c)	Explain how the envelope detector demodulates AM signals. Also indicate the difference between the rectifier detector and the envelope detector.	**07**
Q.4	**(a)**	Explain the principle of non uniform quantization.	**03**
	(b)	Explain the applications of Eye diagram.	**04**
	(c)	What is aliasing? How aliasing can be eliminated?	**07**
		OR	
Q.4	**(a)**	Find the Nyquist rate and Nyquist interval for the signal $x(t) = 10 \cos 3000\pi t \cos 1000\pi t$	**03**
	(b)	Explain the properties of line codes.	**04**
	(c)	Explain the working of delta modulation with the help of block diagram. Discuss the disadvantages of delta modulation.	**07**

Q.5	**(a)**	Compare: Unipolar, polar and bipolar line codes.	**03**
	(b)	What are the advantages of digital communication over analog communication?	**04**
	(c)	Derive the power spectral density (PSD) of polar NRZ line code.	**07**

OR

Q.5	**(a)**	Explain the working of regenerative repeater in digital communication system.	**03**
	(b)	Explain the operation of sample and hold circuit.	**04**
	(c)	Explain the cause of intersymbol interference (ISI) in digital communication systems? Explain Nyquist criterion for zero ISI.	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER- V EXAMINATION-SUMMER 2023

Subject Code: 3151104 Date: 27/06/2023

Subject Name: Analog and Digital Communication

Time: 02:30 PM TO 05:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Compare Analog and Digital Communication.	**03**
	(b)	Give Comparison between Am and FM.	**04**
	(c)	State and prove sampling theorem. Also explain types of sampling in details.	**07**
Q.2	**(a)**	Explain Vestigial Side Band AM in brief.	**03**
	(b)	State and explain Sampling theorem.	**04**
	(c)	An AM signal is represented by $e(t) = (10+ 4 \cos 1000 \pi t) \cos (2 \pi 106 t)$. Find: Modulation index, total power , sideband power, efficiency and transmission Bandwidth required for this AM signal.	**07**
		OR	
	(c)	A 10 kw carrier wave is amplitude modulated at 80%. Compute sideband power, total power and efficiency.	**07**
Q.3	**(a)**	Compare DSB-FC, DSB-SC, SSB,VSB	**03**
	(b)	What is Carson's rule in FM?	**04**
	(c)	A 107.6 MHz carrier is frequency modulated by a 7 KHz sine wave. The resultant FM signal has a frequency deviation of 50 KHz. i) Find the carrier swing of the FM signal. ii) Determine the highest and lowest frequencies attained by the modulated signal iii) What is the modulation index of the FM wave?	**07**
		OR	
Q.3	**(a)**	With related to Amplitude modulation discuss following parameters: (i) Modulation index (ii) Modulation depth (iii) Bandwidth requirement	**03**
	(b)	Discuss drawbacks of direct method for FM generation.	**04**
	(c)	An FM wave is given by $e(t) = 10\sin (5 \times 108\, t + 4\sin 1250t)$. Determine: (i) The carrier frequency (ii) Modulating frequency (iii) The modulation index (iv) The maximum deviation.	**07**
Q.4	**(a)**	What is aliasing effect?	**03**
	(b)	Describe the effect of slope overloading and hunting in delta modulation.	**04**
	(c)	A compact disc (CD) records audio signals digitally by PCM. Assume audio signal's BW to be 15 KHz. If signals are sampled at a rate 20% above Nyquist rate for practical reasons and the samples are quantized into 65,536 levels, determine bps required to	**07**

encode the signal and minimum BW required to transmit encoded signal.

OR

Q.4	**(a)**	Discuss advantages and disadvantages of delta modulation.	**03**
	(b)	What is companding process in PCM? State laws for the same.	**04**
	(c)	A TV signal having a BW of 4.2 MHz is transmitted using binary PCM system. Given that the number of quantization levels is 512. Determine Code word length, Transmission BW, Final bit rate and Output signal to quantization noise ratio.	**07**
Q.5	**(a)**	For the data stream 10111001 draw the following formats. i) Polar NRZ ii)Bipolar NRZ iii) AMI NRZ	**03**
	(b)	Differentiate BPSK,QPSK and DPSK.	**04**
	(c)	What is scrambling? Explain scrambling and descrambling process with block diagram and suitable example	**07**

OR

Q.5	**(a)**	What is line coding? What are the ideal requirements from line coding?	**03**
	(b)	Draw the waveform of OQPSK generator for bit pattern 01101011001.	**04**
	(c)	Explain eye diagram. How ISI and other signal degradation can be studied using eye-diagram.	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V(NEW) EXAMINATION – SUMMER 2022

Subject Code:3151104 Date:09/06/2022

Subject Name:Analog and Digital Communication

Time:02:30 PM TO 05:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Define Following Terms: (1) Modulation Index (2) Power spectral density (3) Signal Distortion	**03**
	(b)	What is modulation? Why modulation required? Describe in detail.	**04**
	(c)	Draw basic diagram of both analog and digital communication system and explain in brief	**07**
Q.2	**(a)**	Give comparison between AM and FM systems.	**03**
	(b)	An audio signal given as 15 sin (2π(1500t)) amplitude modulates a carrier given as 60 sin (2π(100,000t)). Determine the following 1. Sketch the Audio signal 2. Sketch the carrier signal. 3. Determine the percentage of index 4. Draw the frequency spectrum of modulated signal with all frequency component	**04**
	(c)	List the methods of generation of SSB. Explain any one method in detail. Discuss the advantages and disadvantages of SSB over DSB modulation technique.	**07**
		OR	
	(c)	Explain Armstrong method of FM generation with neat diagram.	**07**
Q.3	**(a)**	Draw the transfer function of ideal phase shifter.	**03**
	(b)	Explain pre-emphasis and de-emphasis in relation to FM.	**04**
	(c)	Explain Phased Look Loop with all necessary details.	**07**
		OR	
Q.3	**(a)**	What is the mathematical expression for instantaneous frequency for frequency modulation and Phase Modulation?	**03**
	(b)	An angle modulated signal with carrier frequency $\omega_c = 2\pi \times 10^5$ is described by the equation $e(t) = 10\cos(\omega_c t + 5\sin 3000t + 10\sin 2000\pi t)$ Find: power of modulated signal, frequency deviation Δf and deviation ratio β	**04**
	(c)	Draw the general block diagram of a super heterodyne receiver and briefly explain the function of each block.	**07**
Q.4	**(a)**	What is line coding? What are the ideal requirements from line coding?	**03**

	(b)	State and prove sampling theorem in time domain. Explain aliasing.	**04**
	(c)	Explain Delta Modulation in detail. Also discuss its advantages and disadvantages	**07**

OR

Q.4	**(a)**	What is Inter Symbol Interference? Explain the Nyquist's first criteria for zero ISI.	**03**
	(b)	Draw the block diagram of Regenerative repeater and briefly explain the function of each block.	**04**
	(c)	Derive the formula for signal to quantization noise ratio for PCM.	**07**
Q.5	**(a)**	Explain the zero forcing equalizer with necessary diagrams and expressions.	**03**
	(b)	Explain in brief Frequency Shifting Keying (FSK) technique and list the applications of it.	**04**
	(c)	Draw the block diagram of GMSK modulation technique and explain it.	**07**

OR

Q.5	**(a)**	Explain Noncoherent detection of Amplitude-Shift keying (ASK) signal with necessary equations and diagrams.	**03**
	(b)	Explain coherent detection of Frequency-Shift keying (FSK) signal with necessary equations.	**04**
	(c)	Discuss the MSK modulation technique and list the merits of it	**07**

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