Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– VI EXAMINATION – SUMMER 2020

Subject Code: 2161001 **Date:26/10/2020**

Subject Name: DIGITAL COMMUNICATION

Time: 10:30 AM TO 01:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			MARKS
Q.1	**(a)**	What are the Nyquist criteria for the sampling of signal in communication? Which kind of effect is observed if Nyquist criteria doesn't follow? Explain with example.	**03**
	(b)	State the difference between PCM, DPCM and Delta modulation.	**04**
	(c)	Explain the T_1 digital carrier System with frame structure, important parameters and synchronization mechanism.	**07**
Q.2	**(a)**	List out the importance characteristic of line codes and compare the On-Off, Polar and Bipolar codes in terms of their Power Spectral Density (PSD).	**03**
	(b)	Discuss the Trade-off between transmission rate and transmission power for M-ary signal.	**04**
	(c)	State the importance of Regenerative repeater in digital communication and discuss briefly about the significance of individual components of Regenerative repeater.	**07**
		OR	
	(c)	What is the pulse shaping? Shed the light on Nyquist first and second criteria for pulse shaping.	**07**
Q.3	**(a)**	Establish the relationship between PDF and CDF and enlist the properties of CDF.	**03**
	(b)	What is marginal probability? Explain with mathematical background	**04**
	(c)	Explain central limit theorem in a brief and draw the Probability distribution function (PDF) and CDF for the Random Variable (R.V.). obtain as a sum of large number of R.V.	**07**
		OR	
Q.3	**(a)**	What is conditional probability? State the equation of conditional probability for two variable case.	**03**
	(b)	A binary source generates digits 1 and 0 randomly with probabilities $P(1) = 0.8$ and $P(0) = 0.2$. (a) What is the probability that two 1's and three 0's will occur in a five-digit sequence? (b) What is the probability that at least three 1's will occur in a five-digit sequence?	**04**
	(c)	How many types of correlation does exists between two sets of R.V. ? Explain with diagram and mathematical background.	**07**
Q.4	**(a)**	Derive the equation for Shannon capacity and describe the tradeoff between signal to noise ratio and bandwidth.	**03**
	(b)	What is entropy of message? In which case, Entropy will be maximum explain with the mathematical background.	**04**

	(c)	A source emits seven messages with probability 1/2, 1/4, 1/8, 1/16, 1/32, 1/64 and 1/64 respectively. Find the entropy of the source. Obtain the compact binary code and find the average length of the code word. Determine the efficiency and redundancy of the code.	**07**

OR

Q.4	**(a)**	State the difference between ASK, FSK and PSK in terms of their important parameters.	**03**
	(b)	Explain the concept of GMSK with their transmitter and receiver block diagram.	**04**
	(c)	What is QAM, ?. Draw Constellation diagram of 16- QAM. Discuss their merits and demerits. Draw and explain the transmitter and receiver structure of QAM.	**07**
Q.5	**(a)**	Construct a (7,4) systematic cyclic code for data vector d= 10101 for the Generator matrix $g(x) = x^3 + x^2 + 1$.	**03**
	(b)	Derive the Hamming bound condition for error correcting codes.	**04**
	(c)	For a (6,3), Linear block code the parity check digits c_4, c_5 and c_6 are as follows: $c_4 = d_1 + d_2 + d_3$, $c_5 = d_1 + d_2$, $c_6 = d_1 + d_3$. (+ sign is consider as X-OR Operation) Draw the line block encoder, Generate the Matrix G and find the code vector for following data vector : 001, 111, 010, 101. Comment on maximum error correcting capacity of the code.	**07**

OR

Q.5	**(a)**	What is the trade-off between code efficiency and reliability? Explain with example.	**03**
	(b)	Explain Burst error detecting and correcting codes.	**04**
	(c)	What is convolution code? How it is differ than linear block code ? Draw the encoder if out put $V_1 = S_1 + S_2 + S_3$ and $V_2 = S_1 + S_3$, where S_1, S_2 and S_3 are the number of shift register, Entering data is fetching S_1 first. What is the output of convolution encoder if applied input is 10110. Draw the state diagram for this encoder. (+ sign is consider as X-OR Operation)	**07**

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