Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER – VI EXAMINATION – WINTER 2015

Subject Code:161001 **Date:15/12/ 2015**

Subject Name: Digital Communication

Time:2:30pm to 5:00pm **Total Marks: 70**

Instructions:

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

Q.1	**(a)**	What is undersampling ? How do we overcome the effects of aliasing ? Use Fourier transform properties to illustrate the undersampling effects in frequency domain. Give an example of practical oversampling rates.	**07**
	(b)	Determine the Nyquist sampling rate and sampling interval for the signal (i) $\sin(100\pi t) + \sin(200\pi t)$ (ii) $\cos^2(2000\pi t)$	**07**
Q.2	**(a)**	Describe a generalized method of deriving power spectral density of line codes.	**07**
	(b)	Write mathematical expressions for BPSK , BFSK and QPSK modulated signals. Draw waveforms for binary data , carrier and transmitted signals for all of the above categories of digital modulation.	**07**
		OR	
	(b)	How does the regenerative repeater work ? What is the use of scrambler ?	**07**
Q.3	**(a)**	In a binary communication channel, the receiver detects binary pulses with an error probability Pe. What is the probability that out of 100 received digits, no more than four digits are in error?	**07**
	(b)	Explain probability density function and cumulative distribution function for random variables with suitable examples. Write an expression for general Gaussian probability density function.	**07**
		OR	
Q.3	**(a)**	What is Chebyshev's inequality ? Estimate the width of a Gaussian PDF.	**07**
	(b)	Describe central limit theorem.	**07**
Q.4	**(a)**	Find the channel capacity of Binary Symmetric Channel.	**07**
	(b)	A source emits three equiprobable messages randomly and independently. Find the source entropy. Find a compact binary code, the average length of the code word, the code efficiency and the redundancy.	**07**
		OR	
Q.4	**(a)**	Define information per message and entropy of a source. What is mutual information ? What is its significance ?	**07**
	(b)	A memoryless source emits messages m1 and m2 with probabilities 0.8 and 0.2 respectively. Find the Huffman binary code for this source and determine its efficiency.	**07**
Q.5	**(a)**	How convolutional encoder is designed? What is code tree ?	**07**
	(b)	Construct a single-error correcting (7,4) linear block code and the corresponding decoding table.	**07**
		OR	
Q.5	**(a)**	Explain any one method of decoding of convolutional codes . Draw all the stages of Viterbi decoding.	**07**
	(b)	Find a generator polynomial g(x) for a (7,4) cyclic code and find code vectors for data vectors : 1010, 1111, 0001 and 1000.	**07**

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