Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E. SEMESTER I (old course)–EXAMINATION (Remedial) – WINTER 2015

Subject code: 714101 **Date: 08/12/2015**

Subject Name: Mathematical Methods in Signal Processing

Time: 10:30 AM to 1:00 PM **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)**	Give examples of discrete time signals. Classify these signals. Explain the sampling and aliasing process with suitable figures.	**07**
	(b)	A linear shift invariant system is characterized by its unit sample response $h(n) = a^n u(n)$. Does this system represent a causal system? Justify your answer.	**07**
Q.2	**(a)**	Explain differentiation in Z domain and obtain Z- Transform of the signal $x(n)= u(-n)$.	**07**
	(b)	Solve the difference equation for $y(n)$ assuming $y(n)=0$ for all n < 0 and $x(n) =\delta(n)$. $$y(n) - ay(n-1)= x(n)$$	**07**
		OR	
	(b)	Compute and plot autocorrelation of the signal $x(n) = a^n u(n), 0< a <1$.	**07**
Q.3	**(a)**	Explain modulation theorem and Parsevalôs theorem.	**07**
	(b)	Compute trace, rank and inverse of the matrix $$A = \begin{bmatrix} 3 & 0 & 0 \\ 1 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$	**07**
		OR	
Q.3	**(a)**	Explain linearity and time shifting property of Fourier Transform.	**07**
	(b)	Define l_1 and l_2 norm and state their usefulness in signal processing.	**07**
Q.4	**(a)**	Explain about Induced norms and Cauchy-Schwartz inequality.	**07**
	(b)	Define Banach space and Hilbert space.	**07**
		OR	
Q.4	**(a)**	Which signals can be described by basis function in digital communications. Illustrate the same using constellation diagram.	**07**
	(b)	Define Toeplitz matrices and its applications.	**07**
Q.5	**(a)**	Explain estimation of phase using any one method.	**07**
	(b)	Explain concept of Markov model and HMM for its use in signal processing and communication.	**07**
		OR	
Q.5	**(a)**	Explain signal detection methods with suitable example.	**07**
	(b)	Explain Bayes Estimation Theory	**07**

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