Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY M. E. - SEMESTER - I • EXAMINATION - WINTER • 2013

Subj Subj	ect (ect]	code: 714101N Date: 23-12-2013 Name: Mathematical Methods in Signal Processing	
Time	e: 10	.30 am – 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.	
Q.1	(a)	Obtain rank and inverse of the matrix A if exists. $A = \begin{bmatrix} 1 & 2 & 5 \\ 2 & 1 & 0 \\ 2 & 4 & 4 \end{bmatrix}$	07
	(b)	Exaplain about z – Transform and Fourier Transform.	07
02	(9)	Explain sampling process Explain aliasing effect and anti-aliasing filter	07
~· =	(\mathbf{u})	Explain about correlation of discrete time signal with suitable sequences for	07
	(0)	extension and cross correlation	07
	(b)	Obtain outs correlation of the signal $y(n) = a^n y(n)$ for	07
	(0)	0 < a < 1	07
03	(a)	Explain about adjoint of a matrix and self adjoint of a matrix by giving	07
Q.3	(a)	suitable exemple	07
	(L)	Suitable example.	07
	(D)	Explain about properties of autocorrelation and cross correlation sequences.	07
		OR	
Q.3	(a)	Explain about windowing and modulation theorem of Fourier Transform.	07
	(b)	Explain about Matrix Norms with emphasis on spectral norm and Euclidean norm.	07
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Q.4	(a) (b)	Which method is used to model time varying random phenomena? Provide details of the method with examples.	07 07
04	(a)	What is linear predictive coding ? State typical properties of LMS algorithm	07
Q.4 Q.4	(a) (b)	Prove that if the eigen values of $m \times n$ matrix A are all distinct, then the eigenvectors of A are all linearly independent.	07 07
0.5	(a)	Explain about binary hypothesis testing with suitable difinitions and	07
<u> </u>	(1)	examples.	
	(h)	For the discrete time signal	07
	(0)	$s = cos(\omega t + A)$ for $t = 1.2$ m	07
		with known frequency and unknown phase θ , determine the maximum likelihood estimate of the θ assuming s is observed in Gaussian noise	
		$y = s + n$ where $n \sim \aleph(0,\sigma^2)$	

(a) What are the applications of ML estimations ? Give suitable examples. Q.5 07 07

(b) Compare the maximum likelihood and loglikelihood function.