Q.P. Code : 27384

1) Question **No.1** is Compulsory
2) Answer **any three** out of the remaining questions.
3) Assume suitable data wherever required.
4) Figures to the **right** indicate **full** marks.

Time 3 Hours	**Total Marks**	**80**

Q. 1		Answer any four	20
	a)	Linear Vector Space	
	b)	Field	
	c)	Dot Product	
	d)	Vandermonde Matrix	
	e)	Row Space of a Matrix	

Q. 2	a)	What are free variables? Identify the free variables in the following system with four unknown variables and solve the system.	10

$$3y - 12z - 7w = -15$$

$$y - 4z = 2$$

$$-2x + 4y + 5w = -1$$

	b)	Determine whether the vectors $u_1 = (1,1,2)$, $u_2 = (2,3,1)$, $u_3 = (1,0,5)$, $u_4 = (1,1,1)$ are linearly independent or not?	10
Q.3	a)	What do you mean by basis vector? Explain how the basis vector for Row space and column space of a matrix can be obtained. Choose a suitable numerical example.	10

b) Identify whether the following statements are true or false. Justify your answer.

    i) If x is an eigen vector of a matrix A, then every vector in the line through x is an eigen vector. **3**

    ii) If 5 is an eigen value of matrix A, then 25 is an eigen value of A^2 **3**

    iii) The matrix $A = \begin{bmatrix} 1 & 2 \\ 1 & 1 \end{bmatrix}$ is diagonalizable. **4**

Q.4 a) Let 'U' be a subspace of R^4 with basis $B = \{(u_1, u_2, u_3)\}$ where **10**

$u_1 = (-1,1,1,0)$, $u_2 = (-1,0,1,0)$, $u_3 = (1,0,0,1)$. Find an orthonormal basis for U.

b) Find A^8 using the concept of diagonalization where **10**

$$A = \begin{bmatrix} 3 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 3 \end{bmatrix}$$

Q.5 a) What do you mean by singular value? Explain the concept of singular value decomposition. **10**

b) If A is an $n \times n$ matrix, explain how the solution can be obtained for linear system Ax = b using least square concept. **10**

Q.6 a) Consider the following basis of R^3 **10**

$E = \{e_1, e_2, e_3\}$

$U = (u_1, u_2, u_3)$

Obtain change of basis matrix 'P' from E to basis U.

Where $e_1 = (1,0,0)$, $e_2 = (0,1,0)$, $e_3 = (0,0,1)$

$u_1 = (1,0,1)$, $u_2 = (2,1,2)$, $u_3 = (1,2,2)$,

b) Obtain change of basis matrix Q from basis U to basis E. Establish the relationship between Q and P. **10**

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ME/ INST/ Sem I/ Choice Based / May 2018
Advanced Signal Processing for
Sensors
Q.P.Code: 27690

Duration 3 Hours   [Total Marks : 80]

Note :   1. Question No. 1 is **compulsory**.

2. Attempt any **three** questions from remaining **five** questions.

3. Assume suitable data if necessary.

Q. 1 Answer the following: 20

a) Explain why dark current is associated with photodiodes.

b) Discuss advantages of Kelvin sensing system used for sensing signals from remotely

driven bridge circuits .

c) Discuss the factors which affect accuracy of capacitive sensors.

d) Explain measurement error sources in RTDs with remedies.

Q. 2 a) Explain working principle of encoders and discuss the ways to increase its resolution.   10

b) Discuss thin and thick film sensors with applications.   10

Q.3 a) Explain circuit used for processing signals from capacitive transducers.   10

b) Draw and explain generic architecture of smart transducer with its features.   10

Q.4 a) Explain advantages and methods of implementation of ratio metric measurement.   10

b) Explain why photodiode used in photoconductive mode can give higher speed and   10

higher dark current as compared to photodiode used in photovoltaic mode

Q.5 a) Explain the need of preamplifiers in processing signals from radioactivity and discuss   10

different types of preamplifiers.

b) Explain signal processing circuit used for processing output of LVDT.   10

Q.6 Write short notes on the following – **(Any Two)**   20

a) Signal processing for sensors with high output impedance.

b) Single channel analyzer.

c) Semiconductor temperature sensors.