COURSE CODE (CREDITS): 18B1WCI740 (3) MAX. MARKS: 25

COURSE NAME: Computational Techniques and Algorithms in Engineering

COURSE INSTRUCTORS: Dr. Rakesh Kanji MAX. TIME: 1 Hour 30 Minutes

Note: (a) Answer any 5 questions

(b)Marks are indicated against each question in square brackets.

(c) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

Q1.(i) Provide any example of bad system of equations. Name any algorithm for handling bad system. [1+1] [CO3,CO4]

(ii) How least square helps to solve bad system of equations? [1] [CO3]

(iii) How least square is related to solving system of equations by Gram Schmidt method?

[2] [CO3,CO4]

Q2. (i) Find out the condition on D and U for which P to be projection matrix.

Consider $P = UD\,U^T$. [2] [CO3]

(ii) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 1 & 1 \end{bmatrix}X=\begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$, Find out X vector via orthogonal projection method. [3] [CO3,CO4]

Q3. Find out the Gram Schmidt orthogonalization transformation for column and row of $\begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 1 & 1 \end{bmatrix}$.

[2.5+2.5] [CO3,CO4]

Q4. (i) Provide the algorithm and complexity for Given Rotation of n cross m matrix with rank k.

[4] [CO3]

(ii) Is R a valid rotational matrix under orthonormal transformation?

$R=\begin{bmatrix} \cos\theta & 1 & -sin\theta \\ 0 & 1 & 0 \\ sin\theta & 0 & \cos\theta \end{bmatrix}$ [1] [CO3]

Q5. What is the difference between Psudoinverse and inverse? Compute the Psudoinverse for $\begin{bmatrix} 1 \\ 2 \end{bmatrix}$. [1+4] [CO4]

Q6. Provide the strategy for finding outlier by Gram Schmidt. How orthonormal part (Q) of Gram Schmidt process could be justified as data visualization? [3+2] [CO3,CO4]

Q7. Please rotate $\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$ vector with 30 degree angle in every possible planes. Why one should prefer Given rotation to Gram Schmidt for solving system of equations. [4+1] [CO3,CO4]