JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -1 EXAMINATION- MARCH-2023

COURSE CODE (CREDITS): L-22M1WCI233 MAX. MARKS: 15

COURSE NAME: Advanced Computational Techniques in Engineering

COURSE INSTRUCTORS: Mr. Nishant Sharma MAX. TIME: 1 Hour

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***Note:*** *All questions are compulsory. Marks are indicated against each question in square brackets.*

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Q1. For three given matrices A,B and C, verify if A*(B+C)= AB + AC. Also, write pseudo-code for matrix multiplication between two matrices.

$$A = \begin{pmatrix} 1 & 3 \\ 5 & -1 \end{pmatrix}, B = \begin{pmatrix} 1 & -1 & 2 \\ 3 & 5 & 2 \end{pmatrix}, C = \begin{pmatrix} 1 & 3 & 2 \\ -4 & 1 & 3 \end{pmatrix}$$

**[3 marks] [CO-1]**

Q2. Explain following terms:

1. Vector space
2. Range of matrix.
3. Null space.
4. Rank of matrix.

Also, prove that matrix $A \in R^{n \times m}$ with $n \geq m$ has full rank if and only if it maps no two distinct vectors to the same vector.

**[4 marks] [CO-3]**

Q3 (A). Calculate cholesky factorization for the given lower triangular matrix.

$$L = \begin{bmatrix} 1 & 0 \\ 1-2i & 2 \end{bmatrix}$$

(B). Find the lower triangular matrix used in Cholesky factorization for the given 2×2 matrix.

$$A = \begin{bmatrix} 9 & 15i \\ -15i & 74 \end{bmatrix}$$

**[2 + 3 marks] [CO-2]**

Q5. Define Symmetric Positive-Definite (SPD) matrices. Write down characteristic properties of SPD matrices. **[3 marks] [CO-2]**