

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION-2022

M.Sc-I Semester (BT/MB)

COURSE CODE (CREDITS): 20MS1MA111 (2)

MAX. MARKS: 25

COURSE NAME: Basics of Mathematics and Statistics

COURSE INSTRUCTOR: Dr.Neel Kanth

MAX. TIME: 1 Hour 30 Min

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

Q1. (a) Simplify $\cos \theta \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix} + \sin \theta \begin{bmatrix} \sin \theta & -\cos \theta \\ \cos \theta & \sin \theta \end{bmatrix}$ [2]

(b) If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$, find the value of $A^2 - 5A + 7I_2$ [3]

Q2. For the matrix $A = \begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$, show that $A^{-1}A = I_3$ [5]

Q3. Find the square root of the complex number $-15 - 8i$ [5]

Q4. (a) Find $(\vec{a} + 3\vec{b}) \cdot (2\vec{a} - \vec{b})$ if $\vec{a} = \hat{i} + \hat{j} + 2\hat{k}$ and $\vec{b} = 3\hat{i} + 2\hat{j} - \hat{k}$ [3]

(b) Find the area of the parallelogram determined by the vectors

$\vec{a} = \hat{i} - 3\hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + \hat{j} + \hat{k}$ [2]

Q5. (a) What do you understand by mathematical modelling of biological systems? [2]

(b) Develop mathematical model for equiangular spiral growth patterns of a nautilus shell [3]