

International Islamic University Chittagong (IIUC)

Department of Electronics and Telecommunication
Engineering (ETE)

Final Examination, Autumn 2022

Course Code: Math 2307/2411 Course Title: Matrices, Linear System of
Equations & Vector Analysis

Full Marks: 50

Total Time: 03 hours

(Figures in the margin indicate full marks and course outcome)

Group-A (20 Marks)

Answer any Two (2) Sets of Questions from Group-A:

1.(a) If $A = \begin{bmatrix} 1 & 0 \\ 1 & -2 \end{bmatrix}$, $B = \begin{bmatrix} 0 & 1 \\ 3 & -1 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$ then show that $A(B + C) = AB + AC$. 5 CO1

(b) Solve the following system of linear equation using matrix 5 CO2

$$\begin{aligned} 2x - 3y + 4z &= 1 \\ 3x + 4y - 5z &= 10 \\ 5x - 7y + 2z &= 3 \end{aligned}$$

2. (a) Find eigenvalue and eigenvector of the matrix $A = \begin{bmatrix} 3 & 0 \\ 8 & -1 \end{bmatrix}$. 5 CO1

(b) Find the matrix P that diagonalizes the matrix A and also determine $P^{-1}AP$. 5 CO1

3. (a) Verify Cayley-Hamilton theorem for this Matrix $A = \begin{bmatrix} 1 & 2 & -3 \\ 3 & 1 & 4 \\ 2 & 2 & -1 \end{bmatrix}$. 5 CO2

(b) Find the inverse of the matrix A using Cayley-Hamilton theorem, 5 CO1

where, $A = \begin{bmatrix} 2 & 0 & -1 \\ 5 & 1 & 0 \\ 0 & 1 & 3 \end{bmatrix}$.

Group-B (30 Marks)

Answer any Three (3) Sets of Questions from Group-B:

4. (a) What is unit vector? Find a unit vector parallel to the resultant vector R of the vectors $r_1 = 2\hat{i} + 4\hat{j} - 5\hat{k}$ and $r_2 = -\hat{i} - 2\hat{j} + 3\hat{k}$. 5 CO2
- (b) Find the projection of the vector $A = 2\hat{i} - 3\hat{j} + 5\hat{k}$ on the vector $B = \hat{i} + 2\hat{j} + 3\hat{k}$. 5 CO1
5. (a) A particle moves along the curve $x = 2\sin 3t$, $y = 2\cos 3t$, $z = 8t$; where, t is the time. Find the velocity and acceleration at $t = 2$. 5 CO2
- (b) Suppose $A = -\hat{i} + \hat{j} + \hat{k}$, $B = \hat{i} - \hat{j} + \hat{k}$ and $C = \hat{i} + \hat{j} - \hat{k}$; Find $A \times (B \times C)$. 5 CO1
6. (a) Find the angle that the vector $A = 4\hat{i} - 8\hat{j} + \hat{k}$ makes with the coordinate axes. 4 CO1
- (b) Let $A = \cos xy \hat{i} + (3xy - 2x^2)\hat{j} - (3x + 2y)\hat{k}$, prove that $\frac{\partial^2 A}{\partial x \partial y} = \frac{\partial^2 A}{\partial y \partial x}$. 6 CO2
7. (a) The acceleration of a particle at any time $t \geq 0$ is given by $a = 25\cos 2t \hat{i} + (16\sin 2t)\hat{j} + (9t)\hat{k}$. Then find the velocity at any time. 6 CO1
- (b) For $\phi = xz^4 - 2x^2y$, Find $\text{curl}(\text{grad}\phi) = ?$ 4 CO1