

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING

Mid Semester Examination
Course No.: Math 4411
Course Title: Linear Algebra And Solid Geometry

Summer Semester: 2021-2022
Full Marks: 75
Time: 1.5 Hours

There are 3 (Three) questions. Answer 3 (Three) questions. Programmable calculators are not allowed. Do not write on this question paper. The figures in the right margin indicate full marks and corresponding CO and PO in the brackets. Symbols convey their usual meanings.

1. (a) Find the symmetric and skew-symmetric parts of the matrix AB , where (5)
 $A = \begin{bmatrix} 1 & 0 \\ 2 & 3 \\ 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 2 & 4 \\ 0 & 4 & 2 \end{bmatrix}$. (CO1)
(PO1)
- (b) Verify that $(AB)^T = B^T A^T$, where (8)
 $A = \begin{bmatrix} 1 & 1 & 0 \\ 2 & 2 & 1 \\ 4 & 3 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 & 1 \\ 2 & 1 & 2 \\ 3 & 1 & 0 \end{bmatrix}$. (CO1)
(PO2)
- (c) Using elementary row transformations, to reduce A to I , find inverse of A , (12)
where (CO1)
(PO2)
 $A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 3 & 4 & 5 \\ 3 & 4 & 5 & 7 \\ 4 & 5 & 5 & 7 \end{bmatrix}$.
2. (a) What do you mean by direction cosines and direction ratio of a straight line? (5)
(CO3)
(PO1)
- (b) The direction cosines of a moving line in two adjacent positions are l, m, n and $l + \delta l, m + \delta m, n + \delta n$. Show that the small angle $\delta\theta$ between the positions is given by $(\delta\theta)^2 = (\delta l)^2 + (\delta m)^2 + (\delta n)^2$. (8)
(CO3)
(PO2)
- (c) Find the equation of the plane passing through the line of intersection of the planes $2x - y = 0$ and $3z - y = 0$ and perpendicular to the plane $4x + 5y - 3z + 7 = 0$. (12)
(CO3)
(PO2)
3. (a) Determine the value of P that the following system equations has no solution (5)
 $x_1 + x_2 - x_3 = 1$ (CO1)
 $2x_1 + 3x_2 + Px_3 = 3$ (PO1)
 $x_1 + Px_2 + 3x_3 = 2$

- (b) Solve the following system of equations using Gaussian elimination method: (8)
(CO1)

$$\begin{aligned}x_1 + 2x_2 + 3x_3 + 3x_4 &= 4 && \text{(PO2)} \\2x_1 + 5x_2 + 5x_3 + x_4 &= 5 \\x_1 + 8x_3 - 2x_4 &= 9 \\2x_1 + x_2 - 5x_3 - 3x_4 &= -3\end{aligned}$$

- (c) Solve the system of equations using LU factorization of the coefficient matrix: (12)
(CO1)

$$\begin{aligned}x + y - z &= 6 && \text{(PO2)} \\3x - 2y + z &= -5 \\x + 3y - 2z &= 14.\end{aligned}$$

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