Mahindra University Hyderabad
École Centrale School of Engineering,
Minor-2 Examination, November 2023
Program: B.Tech Branch: Computation & Mathematics Year: III
Semester: I
Subject: Advanced Linear Algebra (MA3117)

Date: 10/11/2023 Start Time: 02.00 PM
Time Duration: 1.5 Hours Max. Marks: 20

Instructions:

1. All questions are compulsory.

Q 1: 5 marks

Let $Q \in \mathbb{R}^{n\times n}$ be an unitary matrix and $R_1, R_2 \in \mathbb{R}^{n\times n}$ be upper triangular matrices with positive diagonal elements. If $R_1 = QR_2$, then prove that Q is Identity matrix of order n.

Q 2: 5 marks

Consider $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 1 & 1 \end{bmatrix}$ and $b = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$. Then find the projection of b onto the column space of A.

Q 3 : 5 marks

Find a QR decomposition of the following matrix by using Givens rotations.

$$A = \begin{bmatrix} 1 & -1 & 4 \\ 1 & 4 & 2 \\ 1 & 4 & 2 \end{bmatrix}.$$

Q 4: 5 marks

Find the Householder matrix H of order 4 that satisfies the following relation:

$$H \begin{pmatrix} 1 & -1 \\ 1 & 4 \\ 1 & 4 \\ 1 & -1 \end{pmatrix} = \begin{pmatrix} 2 & 3 \\ 0 & 5 \\ 0 & 0 \\ 0 & 0 \end{pmatrix}.$$