

## General Instructions to the students

- 1 Place your Permanent / Temporary Student ID card on the desk during the examination for verification by the Invigilator.
- 2 Reading material such as books (unless open book exam) are not allowed inside the examination hall.
- 3 Borrowing writing material or calculators from other students in the examination hall is prohibited.
- 4 If any student is found indulging in malpractice or copying in the examination hall, the student will be given F grade for the course and may be debarred from writing other examinations.
- 5 No extra pages will be given

Best of Luck

1. (a) Find the eigenvalue, eigenvector, and eigenspace of the matrix  $A = \begin{pmatrix} 4 & 1 & -6 \\ 5 & 0 & 0 \end{pmatrix}$ . Find also

the algebraic and geometric multiplicities of all the eigenvalues. (b) Let  $A$  be an idempotent matrix ( $A=A^2$ ) show that 0 and 1 are the only possible eigenvalues. [CO-2] [8+2=10].

2. (a) Find the QR factorization of the matrix  $A = \begin{pmatrix} 1 & 8 & -1 \\ -2 & 7 & -2 \end{pmatrix}$ . (b) Find out whether the

following matrix is orthogonal or not  $\begin{pmatrix} 1/2 & -1/2 & 1/2 & 1/2 \\ 1/2 & 1/2 & 1/2 & -1/2 \\ -1/2 & 1/2 & 1/2 & 1/2 \\ 1/2 & 1/2 & -1/2 & 1/2 \end{pmatrix}$ . [CO-2] [8+2=10].

3. (a) Find the conjugate transpose of the matrix  $A = \begin{pmatrix} 2-i & 8 & 2i \\ 1 & 7+i & -1-i \\ -2 & -2+i & 1 \end{pmatrix}$ . (b) Let  $u = \begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix}$  and  $v = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$

be two vectors in  $\mathbb{R}^3$ . Is  $\langle u, v \rangle = u^T v - 3u^T v^2$  an inner product? [CO-2] [2+3=5]