UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2021

Course: Generic Elective (Matrices)	**Semester** : I
Program: B.Sc. (H) Physics/Chemistry/Geology	**Duration** : 03 hrs.
Course Code: MATH 1029	**Max. Marks: 100**

Instructions:

SECTION A

(Scan and upload) (5Qx 4M = 20 Marks)

		Marks	COs
Q 1	By mathematical induction, prove that if $A = \begin{bmatrix} 11 & -25 \\ 4 & -9 \end{bmatrix}$, then $A^n = \begin{bmatrix} 1 + 10n & -25n \\ 4n & 1 - 10n \end{bmatrix}$		CO1
Q 2	Determine the values of k for which the system of equations $$(3k - 8)x + 3y + 3z = 0$$ $$3x + (3k - 8)y + 3z = 0$$ $$3x + 3y + (3k - 8)z = 0$$		CO2
Q 3	Discuss, the values of m for which the vectors $u_1 = (m, 4,0), u_1 = (1, -1,8)$ & $u_3 = (0, -1, m)$ are linearly dependent.		CO3
Q 4	Consider the matrix $\begin{bmatrix} -2 & 0 & 1 \\ -5 & 3 & a \\ 4 & -2 & -1 \end{bmatrix}$ for some variable $'a'$ which will prove that A has eigen values $0, 3, -3$.		CO4
Q 5	Check whether the following matrix nilpotent? If so, what is its degree? $$A = \begin{bmatrix} 0 & 3 & 5 & 7 \\ 0 & 0 & 4 & 2 \\ 0 & 0 & 0 & 3 \\ 0 & 0 & 0 & 0 \end{bmatrix}.$$		CO1

SECTION B

(Scan and upload) (4Qx10M = 40 Marks)

Q 1	State and prove Cayley Hamilton theorem.		CO4
Q 2	Reduce the following matrix into its normal form and hence find its rank. $$A = \begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$$		CO2
Q 3	Explain LU decomposition also apply Cholesky Decomposition method to decompose the following matrix $$A = \begin{bmatrix} 4 & 12 & -16 \\ 12 & 37 & -43 \\ -16 & -43 & 98 \end{bmatrix}$$		CO3
Q 4	Evaluate the characteristic and minimal polynomial of the matrix $$A = \begin{bmatrix} 7 & 2 & 0 & 0 & 0 \\ 0 & 7 & 2 & 0 & 0 \\ 0 & 0 & 7 & 1 & 0 \\ 0 & 0 & 0 & 0 & 7 \end{bmatrix}$$		CO5

	SECTION-C		
	(Scan and upload) **(2Qx 20M= 40 Marks)**		
Q 1	Verify Cayley Hamilton theorem also find the matrix P which transforms the matrix $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ to the diagonal form. Hence calculate A^4.		**CO4**
Q 2	Differentiate between Dolittle, Crout's and Cholesky methods of LU decomposition also apply Crout's method to find the solution of following system of equations: $$2x_1 - 4x_2 + 3x_3 = 4$$ $$6x_1 + 2x_2 - x_3 = 10$$ $$-2x_1 + 6x_2 - 2x_3 = -6$$		**CO3**