

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, January 2021

Programme Name: B.Sc. (Hons.) Physics , B.Sc.(Hons.) Chemistry

Semester : I

Course Name : Matrices

Time : 3 Hrs

Course Code : MATH-1029

Max. Marks : 100

Nos. of page(s) : 2

Section-A

1. Each question will carry 5 Marks. 2. Select correct answer in each question. 3. All Questions of this section are compulsory.

S. No.		CO
Q1	If A and B are Hermitian matrices, then $AB - BA$ is A. Hermitian B. Skew Hermitian Matrix C. Unitary Matrix D. None of the above	CO1
Q2	Rank of the matrix $\begin{bmatrix} 3 & 1 & 7 \\ 1 & 2 & 4 \\ 4 & -1 & 7 \\ 2 & 1 & 5 \end{bmatrix}$ is A. 1 B.2 C.3 D.4	CO2
Q3	The value of λ for which the following equations will have a non-trivial solution is: $x + 2y + 3z = \lambda x$ $2x + 3y + z = \lambda x$ $3x + y + 2z = \lambda y$ A. 4 B. Not equal to 4 C. 6 D. Not equal to 6	CO2
Q4	The value of k for which the vectors $(1, -2, k)$, $(2, -1, 5)$ and $(3, -5, 7k)$ are linearly dependent is: A. 5/14 B. 2/13 C. 5/12 D. 0	CO3
Q5	The eigenvalues of the matrix $\begin{bmatrix} 1 & 2 & 2 \\ 0 & 2 & 1 \\ -1 & 2 & 2 \end{bmatrix}$ are: A. 1,2,2 B. 0,2,3 C. 1,1,3 D. 0,0,5	CO4
Q6	The matrix A whose eigenvalues are 2,2,4 and eigenvectors are $(-2,1,0)'$, $(-1,0,1)'$, $(1,0,1)'$ is A. $\begin{bmatrix} 1 & 1 & 1 \\ 2 & 3 & 4 \\ 7 & 2 & 4 \end{bmatrix}$ B. $\begin{bmatrix} 3 & 2 & 1 \\ 2 & 2 & 2 \\ 1 & 2 & 3 \end{bmatrix}$ C. $\begin{bmatrix} 3 & 2 & 3 \\ 1 & 2 & 1 \\ 1 & 2 & 3 \end{bmatrix}$ D. $\begin{bmatrix} 3 & 2 & 1 \\ 0 & 2 & 0 \\ 1 & 2 & 3 \end{bmatrix}$	CO4

Section-B

1. Each question will carry 10 Marks. All Questions of this section are compulsory. In Question 5, there is an internal choice.

S. No.		CO
Q1	Check for consistency and if possible, solve the following system of equations by Gauss elimination method: $4x - 3y - 9z + 6w = 0$ $2x + 3y + 3z + 6w = 6$ $4x - 21y - 39z - 6w = -24$	CO2
Q2	Solve the following system of equations using the Choleski LU decomposition method: $4x - y - z = 3$ $-x + 4y - 3z = -1/2$ $-x - 3y + 5z = 0$	CO3
Q3	Find the algebraic and geometric multiplicity of all eigenvalues of the following matrix: $\begin{bmatrix} -3 & -7 & -5 \\ 2 & 4 & 3 \\ 1 & 2 & 2 \end{bmatrix}$	CO4
Q4	Find the characteristic and minimal polynomials of the following matrix: $A = \begin{bmatrix} 2 & 5 & 0 & 0 & 0 \\ 0 & 2 & 0 & 0 & 0 \\ 0 & 0 & 4 & 2 & 0 \\ 0 & 0 & 3 & 5 & 0 \\ 0 & 0 & 0 & 0 & 7 \end{bmatrix}$	CO5
Q5	Find the eigenvalues and eigenvectors of the matrix $A = \begin{bmatrix} a & h & g \\ 0 & b & 0 \\ 0 & 0 & c \end{bmatrix}$. <p align="center">OR</p> Show that for any square matrix A, the product of all eigenvalues of A is equal to determinant of A.	CO4

Section-C

1. The question will carry 20 Marks. 2. Choose one question from two options.

S. No.		CO
Q1	Find the modal matrix P and show that it diagonalizes the matrix $A = \begin{bmatrix} 3 & 1 & -1 \\ -2 & 1 & 2 \\ 0 & 1 & 2 \end{bmatrix}$ by similarity transformation $P^{-1}AP$. <p align="center">OR</p> Find A^n (n is a positive integer) using Cayley Hamilton's theorem given that $A = \begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -1 \\ 0 & 0 & 3 \end{bmatrix}$.	CO4