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 $A=\begin{bmatrix}a & h & g\\ 0 & b & 0\\ 0 & 0 & c\end{bmatrix}$. **OR** 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 $P^{-1}AP$. **OR** 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**