Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2019

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

S. No.		Marks	CO
Q 1	Prove that the matrix $\frac{1}{\sqrt{3}}\begin{bmatrix} 1 & 1+i \\ 1-i & -1 \end{bmatrix}$ is unitary.	**4**	**CO1**
Q2	Find the rank of matrix $A = \begin{bmatrix} -1 & 2 & -2 \\ 1 & 2 & 1 \\ -1 & -1 & 2 \end{bmatrix}$.	**4**	**CO2**
Q3	Prove that $X_1 = (1,2,3), X_2 = (3,-2,1)$ and $X_3 = (1,-6,-5)$ form a linearly dependent system.	**4**	**CO3**
Q4	Obtain the eigen value of A^3 where $A = \begin{bmatrix} 3 & 2 \\ 1 & 2 \end{bmatrix}$.	**4**	**CO4**
Q5	Find the characteristic equation of the matrix $A = \begin{bmatrix} 4 & 3 & 1 \\ 2 & 1 & -2 \\ 1 & 2 & 1 \end{bmatrix}$.	**4**	**CO4**

SECTION B

Q6	If $A = \begin{bmatrix} 2+i & 3 & -1+3i \\ -5 & i & 4-2i \end{bmatrix}$, verify that A^*A is a Hermitian where A^* is the conjugate transpose of A.	**10**	**CO1**
Q7	Show that the equations $-2x + y + z = a$ $x - 2y + z = b$ $x + y - 2z = c$ have no solution unless $a + b + c = 0$. In which case they have infinitely many solutions? Find these solutions when $a = 1, b = 1$ and $c = -2$.	**10**	**CO2**
Q8	Find the minimal polynomial of the following block matrix: $\begin{bmatrix} A_1 & 0 & 0 \\ 0 & A_2 & 0 \\ 0 & 0 & A_3 \end{bmatrix}$ where $A_1 = \begin{bmatrix} 2 & 5 \\ 0 & 2 \end{bmatrix}$, $A_2 = \begin{bmatrix} 4 & 2 \\ 3 & 5 \end{bmatrix}$ and $A_3 = [7]$	**10**	**CO5**

Q9	Verify that the matrices $X = \begin{bmatrix} 0 & h & g \\ h & 0 & f \\ g & f & 0 \end{bmatrix}$, $Y = \begin{bmatrix} 0 & f & h \\ f & 0 & g \\ h & g & 0 \end{bmatrix}$ and $Z = \begin{bmatrix} 0 & g & f \\ g & 0 & h \\ f & h & 0 \end{bmatrix}$ have the same characteristic equation. **OR** Find the modal matrix P that diagonalizes matrix $A = \begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -1 \\ 0 & 0 & 3 \end{bmatrix}$ through similarity transformation $P^{-1}AP$.	**10**	**CO4**
	SECTION-C		
Q10	Find the characteristic equation of the matrix $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$ and hence compute inverse of the A. Also, find the matrix represented by $A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 + 8A^2 - 2A + I$.	**20**	**CO4**
Q11	Solve the following system of equations by Crout's method: $4x + y + z = 4$ $x + 4y - 2z = 4$ $3x + 2y - 4z = 6$ **OR** Solve the following system of equations using Choleski's method: $4x - y - z = 3$ $-x + 4y - 3z = -0.5$ $-x - 3y + 5z = 0$	**20**	**CO3**