BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: IMSC | **SEMESTER: V**
BRANCH: PHYSICS | **SESSION: MO/2022**

SUBJECT: PH303 ADVANCED MATHEMATICAL PHYSICS

TIME: 2 HOURS | **FULL MARKS: 25**

INSTRUCTIONS:
1. The total marks of the questions are 25.
2. Candidates attempt for all 25 marks.
3. Before attempting the question paper, be sure that you have got the correct question paper.
4. The missing data, if any, may be assumed suitably.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

				CO	BL
Q1	(a)	Explain the properties of a vector space by taking an example into account.	[2]	1	1
Q1	(b)	How the dimensions of a Vector Space is defined. When the vectors are called linearly independent?	[3]	1	1
Q2	(a)	Define a group of order 4 and explain the basic properties of their elements.	[2]	1	1
Q2	(b)	Explain homomorphic and isomorphic groups with suitable examples.	[3]	1	2
Q3	(a)	Solve the transpose relation $(AB)' = B'A'$ for the following two matrices $\begin{bmatrix} 1 & -2 \\ 1 & -1 \end{bmatrix}$ and $\begin{bmatrix} 2 \\ 1 \end{bmatrix}$.	[2]	2	3
Q3	(b)	Analyze whether the given matrix is unitary. $A = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 2 & 5 \\ 3 & -1 & 2 \end{pmatrix}$	[3]	2	4
Q4	(a)	Conclude that the diagonal elements of a Hermitian matrix are real.	[2]	2	3
Q4	(b)	Develop an LU decomposition of the following matrix. $\boldsymbol{A} = \begin{pmatrix} \mathbf{2} & \mathbf{3} & \mathbf{1} \\ \mathbf{1} & \mathbf{2} & \mathbf{3} \\ \mathbf{3} & \mathbf{1} & \mathbf{2} \end{pmatrix}$	[3]	2	6
Q5	(a)	Define the characteristic equation of a matrix equation.	[2]	2	1
Q5	(b)	Evaluate the eigenvalues and eigenvectors of the given matrix. $A = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix}$.	[3]	2	5

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