**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI**
**(END SEMESTER EXAMINATION)**

**CLASS: B.Tech.** **SEMESTER: V**
**BRANCH: ALL** **SESSION: Mo/2023**

**SUBJECT: PH303 ADVANCED MATHEMATICAL PHYSICS**

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

**INSTRUCTIONS:**
**1. The question paper contains 5 questions each of 5 marks and total 25 marks.**
**2. Attempt all questions.**
**3. The missing data, if any, may be assumed suitably.**
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

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|---|---|---|---|---|---|
| Q1 | (a) | Discuss the properties of a vector space by taking cartesian coordinates into account. | [2] | 1 | 2 |
| Q1 | (b) | Say about the solution space of homogeneous differential equations of 2nd order. | [5] | 1 | 1 |
| Q2 | (a) | When are the vectors called linearly independent? | [2] | 1 | 2 |
| Q2 | (b) | Write an example of representing a set of linear transformations | [3] | 1 | 4 |
| Q3 | (a) | Examine whether the following matrix is Hermitian. | [2] | 2 | 4 |

$$A = \begin{pmatrix} 0 & 1+i & 2 \\ 0 & 1 & 0 \\ 1 & i & 2-i \end{pmatrix}$$

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|---|---|---|---|---|---|
| Q3 | (b) | Illustrate the nature of the diagonal elements of a Hermitian matrix with a suitable example. | [3] | 2 | 3 |
| Q4 | (a) | State the definitions of lower and upper triangular matrices. | [2] | 2 | 1 |
| Q4 | (b) | Develop an LU decomposition of the following matrix. | [3] | 2 | 5 |

$$\boldsymbol{A} = \begin{pmatrix} \mathbf{3} & \mathbf{1} & \mathbf{6} \\ \mathbf{-6} & \mathbf{0} & \mathbf{-16} \\ \mathbf{0} & \mathbf{8} & \mathbf{-17} \end{pmatrix}$$

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|---|---|---|---|---|---|
| Q5 | (a) | Define the eigen value equation. | [2] | 2 | 1 |
| Q5 | (b) | Evaluate the eigenvalues and eigenvectors of the given matrix. | [3] | 2 | 3 |

$$\boldsymbol{A} = \begin{pmatrix} 3 & 1 \\ 1 & 3 \end{pmatrix}$$

**:::::29/09/2023 M:::::**