M 18436

Reg. No. : BOPSPH1610

Name : Kiran

First Semester M.Sc. Degree Examination, November 2010
PHYSICS
PH-101 : Mathematical Physics – I

Time : 3 Hours Max. Marks : 50

Instructions : *Section A : Answer **any two** questions. **Each** question carries **10** marks.*
*Section **B** : Answer **any five** questions. **Each** question carries **3** marks.*
*Section **C** : Answer **any three** questions. **Each** question carries **5** marks.*

SECTION – A

Answer **any two** questions. **Each** question carries **ten** marks :

1. Diagonalise the matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$.

2. What are contravariant, co-variant and mixed tensors ? Show that velocity and acceleration are contravariant and the gradient of a field is a covariant tensor.

3. State and prove Cauchy's integral formula.

4. Obtain the Rodrigues formula for legendre polynomials. **(2×10=20)**

SECTION – B

Answer **any five** questions. **Each** question carries **three** marks :

5. Obtain the line element in cylindrical co-ordinate system.

6. Define Hermitian and unitary matrices.

7. Construct a scalar from the tensor A^{ij}_{kl}.

$\frac{\partial x_i'}{\partial x_m} \frac{\partial x_j'}{\partial x_n} \frac{\partial x_k}{\partial x_i'} \frac{\partial x_l}{\partial x_j'}$

P.T.O.

8. Using the Cauchy-Riemann conditions test the analyticity of the function $f(z) = z^2$.

9. Explain Frobenius method to obtain series solution around a regular singular point.

10. Explain different classes of partial differential equation.

11. Obtain the relation between Beta and Gamma functions.

12. Show that $H_{n+1}(x) = 2xH_n(x) - 2nH_{n-1}(x)$. **(5×3=15)**

SECTION – C

Answer **any three** questions. **Each** question carries **5** marks :

13. Express the Laplacian in spherical polar co-ordinates.

14. Prove that the transpose of an orthogonal matrix in orthogonal.

15. If $ds^2 = g_{ij}dx^i dx^j$ is invariant, show that g_{ij} is a symmetric covariant tensor of rank 2.

16. Find the residue of $z^4/(z-1)^2(z-2)(z-3)$ at $z = 1$.

17. Show that, if n is an integer $j_{-n}(x) = (-1)^n J_n(x)$. **(3×5=15)**