



M 26585

Reg. No. : .....

Name : .....

I Semester M.A./M.Sc./M.Com. Degree (Reg./Supple./Improve.)

Examination, November 2014

PHYSICS

(2014 Admn. Under CBSS)

PHY 1C 01 : Mathematical Physics – 1

Time : 3 Hours

Max. Marks : 60

SECTION – A

Answer **both** questions, **either** (a) or (b).

1. a) With suitable example explain in detail Unitary and Orthogonal Matrices. If a square matrix  $A$  of order  $n$  has  $n$  linearly independent Eigen vectors, then a matrix  $P$  can be found such that  $P^{-1}AP$  is a diagonal matrix.

OR

- b) Obtain an expression for Grad, Divergence and Curl in terms of Circular Cylindrical Coordinates.

2. a) Prove that Hermitian matrix remain Hermitian under unitary similarity transformation. If  $A$  and  $B$  are two square matrices and  $A$  is non-zero singular prove that  $A^{-1}B$  and  $BA^{-1}$  have the same Eigen value.

OR

- b) Discuss the general solution of Bessel differential equation. Explain briefly the orthogonal property of Bessel function. (2×12=24)

P.T.O.



## SECTION - B

Answer any four :

3. a) Give the advantages of curvilinear coordinate system.
  - b) Obtain an expression for curl in spherical coordinate system.
  - c) Briefly explain unit vectors in spherical coordinates.
4. a) Explain what is rank of a tensor.
  - b) Show that every tensor of second rank can be resolved into symmetric and anti-symmetric Parts.
  - c) With suitable example explain contraction. State and prove quotient law.

5. a) Explain order and degree of a differential equation.

b) Solve the equation  $\frac{d^2y}{dx^2} + \cot x \left( \frac{dy}{dx} \right) + 4 (\operatorname{cosec}^2 x) y = 0$ .

- c) Discuss in detail the series integration method of the solution of Linear Differential Equations (Fresenius method).
6. a) Discuss Cauchy Integral formula.
  - b) State and explain Laurent's theorem.
  - c) Evaluate the following integral using residue theorem :

$$\int_c \frac{4 - 3z}{z(z-1)(z-2)} dz \text{ Where } c \text{ is the circle } |z| = \frac{3}{2}.$$

7. a) Define Beta function.
- b) Define Gamma function. Derive the recurrence relation  $\tau(n) = \frac{1}{n} \tau(n+1)$ .
- c) Write down Bessel's differential equation and discuss in detail its solution.

8. a) What is Legendre Polynomial ?

b) Show that  $P_n(1) = 1$ .

- c) Prove that  $P_n(\cos \theta)$  can be expressed as a series consisting of cosines of even or odd integer multiples of  $\theta$ .

(4×9=36)