K15P 0304

Reg. No. : .....

Name : .....

I Semester M.Sc. Degree (Reg./Sup./Imp.) Examination, November 2015
(2014 Admn. Onwards)
PHYSICS
PHY 1C01 : Mathematical Physics – I

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **both** questions, either (**a**) or (**b**). **Each** question carries **12** marks.

1. a) Define Hermitian matrix. Prove that Hermitian matrix remains. Hermitian under unitary similarity transformation.

   OR

   b) Derive Laplacian operator in any orthogonal curvilinear co-ordinates system.

2. a) i) Explain inner multiplication and contraction of tensors.

      ii) Apply a suitable contractions to the curvature tensor and arrive at Ricci tensor.

   OR

   b) Obtain Rodrigues's formula for Legendre polynomials. Deduce first three Legendre polynomials. **(2×12=24)**

SECTION – B

Answer **any four** (**1** mark for part '**a**', **3** marks for part '**b**', **5** marks for part '**c**') :

3. a) What is scale factors in cylindrical polar coordinates ?

   b) What are orthogonal curve linear co-ordinates ?

   c) Obtain an expression for curl in spherical polar co-ordinates.

P.T.O.

4. a) What is the importance of diagonal elements in a diagonalized matrix ?
   b) With suitable example explain what are diagonal matrices ?
   c) Explain how a matrix can be diagonalized ?
5. a) What is second order linear ODE's ?
   b) Explain Frobeniu's method.
   c) Apply Frobeniu's method to linear oscillator problem.
6. a) Give a short account of graphical representation of complex numbers.
   b) Prove that the modulus of the sum of two complex numbers does never exceed the sum of their moduli.
   c) Discuss the necessary and sufficient conditions for f(z) to be analytic.
7. a) What is the role of Euler's definite integral in the definitions of Gamma function ?
   b) Derive the recursion relation for gamma function :
   $\Gamma(n+1) = n\Gamma(n)$.
   c) Find the value of $\Gamma\left(\frac{1}{2}\right)$.
8. a) Write down Bessel differential equation.
   b) Obtain a power series solution.
   c) Show that $e^{\frac{x}{2}\left(t-\frac{1}{t}\right)} = \sum_{n=-\infty}^{+\infty} J_n(x)\, t^n$ where $J_n(x)$ is given by the series obtained in (a). **(4×9=36)**
