

I Semester M.Sc. Degree Examination  
 I internal September 2015  
 PHY1C01: MATHEMATICAL PHYSICS- (60 Marks)  
 Section A  
 (Answer both questions- Each carries 12 marks)

1. Explain diagonalisation of a matrix with examples
2. What is eigen value problem. Explain Hermitian matrix diagonalisation

Section B  
 (Answer any four)  
 (1 mark for part a; 3 marks for part b; 5 marks for part c)

1. a) What are the different types of curvilinear coordinate systems?  
 b) Write the limits of the variables used in the above questions.  
 c) Working entirely in circular Cylindrical co-ordinates, show that  $\nabla \cdot \vec{r} = 3$  and  $\nabla \times \vec{r} = 0$ .
2. a) What do you mean by tensors?  
 b) Distinguish between Covariant and Contra variant tensors.  
 c) Explain the term direct product of tensors. Illustrate the formation of a mixed tensor of rank 2 from a covariant vector  $a_i$  (rank 1) and a contra variant vector  $b^j$  (rank 1) by direct product.
3. a) Give advantages of curvilinear coordinate systems  
 b) Obtain an expression for curl in curvilinear coordinate system  
 c) Briefly explain unit vectors in spherical coordinates
4. a) Explain what is rank of a tensor  
 b) Show that a second rank tensor can be resolved into symmetric and antisymmetric parts  
 c) State and prove quotient laws
5. a) What are Hermitian matrices  
 b) Give an example of Hermitian matrix  
 c) Show that eigenvalues of Hermitian matrices are real
6. a) What are orthogonal matrices  
 b) Give some properties of orthogonal matrices  
 c) Show that rotation matrix is orthogonal