

K21P 0539

Reg. No. :

Name :

**First Semester M.Sc. Degree (C.B.S.S. – Reg./Suppl. (Including Mercy
Chance)/Imp.) Examination, October 2020
(2014 Admission Onwards)
PHYSICS
PHY1C01 : 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) Using Gauss Jordan method, find the inverse of the matrix $A = \begin{bmatrix} 3 & 2 & 1 \\ 2 & 3 & 1 \\ 1 & 1 & 4 \end{bmatrix}$.

OR

- b) What do you mean by a normal matrix ? Prove that eigen vectors corresponding to different eigen values of a normal matrix are orthonormal. What about the converse of this result ?
2. a) State and prove Cauchy's integral formula. Also obtain an expression for the derivative of a complex function $f(z)$ from the above formula of $f(z)$.

OR

- b) What do you mean by associated Laguerre polynomials ? Obtain the generating function for the associated Laguerre polynomials. Also obtain a Rodrigues representation of the associated Laguerre polynomial. **(2×12=24)**

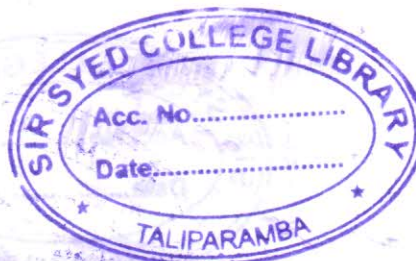
SECTION – B

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

3. a) Define curl of a vector field.
- b) If $\vec{u}$ and $\vec{v}$ are irrotational vectors, prove that $\vec{u} \times \vec{v}$ is solenoidal.
- c) Explain the physical interpretation of divergence.

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4. a) Define a tensor of rank two.
b) Obtain the Christoffel symbol of the first kind $[i, j, k] = g_{mk} \Gamma_{ij}^m$ as derivative of the metric tensor.
c) Find the eigen values and eigen vector corresponding to the largest eigen value of $\begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 2 \end{bmatrix}$.
5. a) What do you mean by an exact differential equation ?
b) Compare linear and non-linear differential equations with examples.
c) Obtain the indicial equation of $y'' + w^2y = 0$.
6. a) Check whether $f(z) = z^2$ is analytic or not.
b) What are the different types of singularities of a complex functions ? Give examples in each case.
c) Derive Cauchy-Riemann conditions in polar form for an analytic function.
7. a) Define Gamma function.
b) Explain double factorial notation.
c) Evaluate $\int_0^1 (1-x^n)^{-\frac{1}{2}} dx$ in terms of gamma function.
8. a) Write the Rodrigues' formula for Legendre polynomials.
b) Prove that $H_{2n}(0) = (-1)^n \frac{(2n)!}{n!}$.
c) Write down the Laguerre ordinary differential equation. Derive Rodrigues' formula for Laguerre polynomials. (4×9=36)