K19P 1498

Reg. No. : .....

Name : .....

I Semester M.Sc. Degree (CBSS-Reg./Suppl./Imp.)
Examination, October - 2019
(2014 Admission 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. **(2×12=24)**

1. a) Explain Gauss elimination method to solve a system of linear equations. Using Gauss elimination method, solve the system of equations $2y+z=8, x-2y-3z=0, -x+y+2z=3.$

(OR)

b) Obtain the series solution to the Bessel's equation $x^2y''+xy'+(x^2-n^2)y=0.$

2. a) What do you mean by an analytic function? State and prove the necessary and sufficient condition for a complex function to be analytic.

(OR)

b) Derive Rodrigues' formula for Legendre polynomials. Deduce first two Legendre polynomials.

SECTION-B

Answer any Four (1 mark for part 'a', 3 marks for part 'b', 5 marks for part 'c') **(4×9=36)**

3. a) Define gradient of a scalar field.

b) Express the spherical polar unit vectors in terms of Cartesian unit vectors.

c) Prove that $\nabla.(r^n\vec{r})=(n+2)r^{n-1}$ where $\vec{r}$ is the general vector and $r=|\vec{r}|.$

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4. a) What do you mean by a symmetric tensor?
   b) Explain divergence of tensors.
   c) Prove that every square matrix A can be expressed as sum of two matrices of the form A=B + *i* c where B and *i* c are Hermitian matrices.

5. a) Give an example for a linear first order ordinary differential equation.
   b) Discuss the singular points of the Bessel's equation: $x^2y'' + xy' + (x^2 - n^2)y = 0$.
   c) Explain Forbenius method to find the series solution of a linear second order homogeneous ordinary differential equation.

6. a) Check whether $f(z) = \bar{z}$ is analytic or not.
   b) Discuss the derivative of the logarithmic function $f(z) = \ln z$.
   c) Find the Laurent series expansion of $f(z) = \frac{ze^z}{z-1}$ about $z = 1$. Also specify the region of convergence.

7. a) Define beta function.
   b) Express the coefficient of n^{th} term of the expansion of $(1+x)^{-\frac{1}{2}}$ in power of *x* in terms of the double factorial notation.
   c) Prove that $\beta(p,q) = \frac{\Gamma(p)\Gamma(q)}{\Gamma(p+q)}$.

8. a) Write the first three Hermite polynomials.
   b) Define spherical Bessel function. Obtain the expression for $j_1(x)$.
   c) Discuss the orthogonality property of Legendre polynomials.
