32731 (Pages : 2) Name.....

Reg. No.....

FIRST SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, NOVEMBER 2022

(CBCSS)

Physics

PHY 1C 02—MATHEMATICAL PHYSICS—I

(2019 Admission onwards)

Time : Three Hours Maximum : 30 Weightage

Section A

8 Short questions answerable within 7.5 minutes)

Answer **all** *questions, each question carries weightage* 1.

1. If V represents a vector derive the divergence of V in orthogonal curvilinear co-ordinates.
2. Is the given matrix Hermitian ?
3. Explain quotient law for tensors.
4. Explain the general form of a second order differential equation and classify them based on being elliptic, parabolic or hyperbolic.
5. Explain the significance of the Dirac-Delta function.
6. Explain Gram-Schmidt orthogonalization.
7. Evaluate the Fourier co-efficients a_0, a_n and b_n for a piecewise continuous function where L is half of the period of the function.
8. Explain the convolution property of Fourier transform with an example.

(8 × 1 = 8 weightage)

Section B

4 essay questions answerable within 30 minutes

Answer any **two** *questions, each question carries weightage* 5

9. Explain the Frobenius' method of finding solution to homogenous differential equation of second order.
10. Using appropriate differential equation obtain the general form for Hermite polynomials of degree *n*.

Turn over

11. Define a Fourier transform. Explain any *five* properties of Fourier transforms.

12. Explain the algebraic operations of Tensors.

(2 × 5 = 10 we

Section C

7 problems answerable within 15 minutes

Answer any **four** *questions, each question carries weightage 3.*

13. A string of length π is stretched until the wave speed is 40 m/sec. It is given an initial $4 \sin(x)$ from its initial position. What is maximum displacement ?

14. Evaluate $\Gamma\left(-\frac{3}{2}\right)$.

15. If A_{ij} is antisymmetric tensor, find the component A_{11}.

16. Find Laplace transform of the function $F(t) = \frac{e^{at} - 1}{a}$.

17. For the Legendre polynomial prove that $P_n(x) = 1$.

18. Find the Fourier series of the function e^x in the interval $-\pi < x < \pi$.

19. Prove that the given matrix is unitary :

$$\begin{bmatrix} \frac{1}{\sqrt{2}} & \frac{i}{\sqrt{2}} \\ -\frac{i}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \end{bmatrix}.$$

(4 × 3 = 12 weig