**A-0585**

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# MSCPH–501

## M.Sc. PHYSICS (MSCPH)

### (Mathematical Physics)

1st Semester Examination, Session December 2024

Time : 2:00 Hrs. Max. Marks : 70

***Note* :–** This paper is of Seventy (70) marks divided into Two (02) Sections 'A' and 'B'. Attempt the questions contained in these Sections according to the detailed instructions given therein. ***Candidates should limit their answers to the questions on the given answer sheet. No additional (B) answer sheet will be issued.***

### Section–A

**Long Answer Type Questions** 2×19=38

***Note* :–** Section 'A' contains Five (05) Long-answer type questions of Nineteen (19) marks each. Learners are required to answer any *two* (02) questions only.

1. Explain Christofel's 3-index symbols. Establish Relations between Christofel's symbols of first and second kind.

2. Find the Solution of equation :

$$\frac{d^2y}{dx^2} + 7y = 0$$

3. Find the Fourier transform of :

$$f(x) = \begin{cases} 2 & \text{for} \quad |x| < a \\ 0 & \text{for} \quad |x| > a \end{cases}$$

4. Find series solution of Hermite function.

5. Show that :

$$\lim_{z \to 0} \frac{d^3}{dz^3}\left[(1-z)^{-1} \exp\left(-\frac{x}{1-z}\right)\right] = (6 - 18x + 9x^2 - x^3)e^{-x}$$

## Section–B

**Short Answer Type Questions** 4×8=32

***Note :–*** Section 'B' contains Eight (08) Short-answer type questions of Eight (08) marks each. Learners are required to answer any *four* (04) questions only.

1. Prove that :

$$\int_0^\infty \frac{dx}{1+x^2} = \frac{\pi}{2}$$

2. Find :

$$\text{L}(\cos at) = \frac{s}{s^2+a^2}$$

3. Show that :

$$(n+1)\text{P}_{n+1}(x) = (2n+1)x\text{P}_n(x) - n\text{P}_{n-1}(x)$$

4. Expand cos $z$ in a Taylor series about $z = \pi/4$.

5. Explain Metric tensor in Riemannian space.

6. Prove that :

$$\text{H}_n''(x) = 4n(n-1)\text{H}_{n-2}$$

7. Solution of the second order differential equation :

$$\frac{d^2y}{dt^2} - 5\frac{dy}{dt} + ky = 0$$

is $y = e^{2t}$, the value of $k$ is.

8. Prove that $\hat{n}.d\text{S} = 0$ and $\int\int_S (\nabla \times \vec{\text{F}}).d\vec{\text{S}} = 0$ .

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