

A-0428

Total Pages : 3

Roll No.

MSCPH-501

Master of Science (MSC)

Mathematical Physics

Examination, June 2025

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. Solve the differential equation :

$$x \frac{dy}{dx} = x^2 + 3y$$

2. Show that :

$$\lim_{z \rightarrow 0} \frac{d^2}{dz^2} \left[(1-z)^{-1} \exp\left(-\frac{x}{1-z}\right) \right] = (x^2 - 4x + 2)e^{-x}$$

3. Find the Fourier transform of e^{-ax^2} , where $a > 0$.

4. Find series solution of Bessel function.

5. Show that :

$$\int_{-1}^1 P_m(x)P_n(x)dx = \begin{cases} 0 & \text{if } n \neq m \\ \frac{2}{2n+1} & \text{if } n = m \end{cases}$$

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. Expand the function $\left(\frac{\sin z}{z - \pi} \right)$ about $z = \pi$.
2. Show that the sum or difference of two tensors of the same rank and same type is also a tensor of the same rank and same type ?
3. Find :

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

4. Show that :

$$H'_n(x) = 2nH_{n-1}(x); n \geq 1$$

5. Show that :

$$F\{e^{iax} f(x)\} = F(s + a)$$

6. Consider the differential equation :

$$\frac{d^2x}{dt^2} - 3\frac{dx}{dt} + 2x = 0$$

if $x = 0$ at $t = 0$, and $x = 1$ at $t = 1$, determine the value of x at $t = 2$.

7. If the line integral of a vector $\vec{A}$ around a closed curve is equal to the surface integral of the vector $\vec{B}$ taken over the surface bounded by the given closed curve then show that $\vec{B} = \text{curl } \vec{A}$.

8. Find the eigen values of the matrix :

$$A = \begin{bmatrix} 4 & 2 & -2 \\ -5 & 3 & 2 \\ -2 & 4 & 1 \end{bmatrix}$$
