

C118

Total Pages : 3

Roll No.

PHY-501

Mathematical Physics and Classical Mechanics

M.Sc. Physics (MSCPHY)

Ist Year Examination, 2022 (June)

Time : 2 Hours]

Max. Marks : 80

Note : This paper is of Eighty (80) marks divided into two (02) Sections A and B. Attempt the questions contained in these sections according to the detailed instructions given therein.

SECTION-A

(Long Answer Type Questions)

Note : Section 'A' contains Five (05) long answer type questions of Twenty (20) marks each. Learners are required to answer any Two (02) questions only.

(2×20=40)

1. Derive Lagrange's equations of motion from Hamilton's principle.

2. Find series solution of Bessel differential equation :

$$x^2y'' + xy' + (x^2 - v^2)y = 0.$$

3. Show that

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

4. State and prove Fourier integral theorem.
5. What do you understand by variation method. Deduce Hamilton's equation of motion from it.

SECTION-B

(Short Answer Type Questions)

Note : Section 'B' contains Eight (08) short answer type questions of Ten (10) marks each. Learners are required to answer any Four (04) questions only. (4×10=40)

1. Explain Poisson Bracket in detail.
2. What do you understand by virtual forces? State and explain D' Alembert's principle.
3. Discuss conservation of linear momentum, angular momentum and energy.

4. Find Laplace transform of following :
 - (a) $\sin at$.
 - (b) $\cosh at$.
 5. What do you understand by Contraction of tensors? Discuss it with an example.
 6. Show that $(n + 1) P_{n+1}(x) = (2n + 1)xP_n(x) - n P_{n-1}(x)$.
 7. Obtain the equation of motion of a simple pendulum by using Lagrange's equation of motion and hence deduce the formula for its time period for small amplitude oscillations.
 8. Explain Christoffel's 3-index symbols ?
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