

Roll No. :

Total No. of Questions : 11]

[Total No. of Printed Pages : 3

APF-2170

M.A./M.Sc. (Final) Examination, 2022

MATHEMATICS

Paper - Opt.-III

(Mechanics)

Time : 3 Hours]

[Maximum Marks : 100

Section-A

(Marks : $2 \times 10 = 20$)

Note :- Answer all *ten* questions (Answer limit 50 words). Each question carries 2 marks.

Section-B

(Marks : $4 \times 5 = 20$)

Note :- Answer all *five* questions. Each question has internal choice (Answer limit 200 words). Each question carries 4 marks.

Section-C

(Marks : $20 \times 3 = 60$)

Note :- Answer any *three* questions out of five (Answer limit 500 words). Each question carries 20 marks.

Section-A

2 each

1. (i) Write the statement of D'Alembert's principle.
- (ii) Define the centre of percussion.
- (iii) Define the impulsive force.

BR-626

(1)

APF-2170 P.T.O.

- (iv) Define the linear momentum for under finite forces.
- (v) Define Hamilton's variables.
- (vi) Write the statement of Jacobi-Poisson theorem.
- (vii) Define Transport Equation.
- (viii) Define non-linear PDE of first order.
- (ix) Define Heat equation.
- (x) Define mean value formula.

Section–B

2. Find the product of Inertia (P.I.) of a half loop of the lemniscate $r^2 = a^2 \cos 2\theta$ about its axis and a line through the pole in its plane perpendicular to its axis.

Or

An ellipse of axes a, b and a circle of radius b are cut from the same sheet of thin uniform metal and are superposed and fixed together with their centres coincident. The figure is free to move in its own vertical plane about one end of the major axis, show that the length of the equivalent simple pendulum is :

$$\frac{5a^2 - ab + 2b^2}{4a}$$

3. The ends of a heavy beam are attached by cords of equal length to two fixed points in a horizontal line, the cords making an angle of 30° with the beam. If one of the cords be cut, show that the initial tension of the other is two-sevenths of the weight of the beam.

Or

Describe Holonomic and non-Holonomic system.

4. Describe Hamilton Jacobi equations.

Or

Describe Poisson's bracket.

5. Solve :

$$p^2 - q^2 = 1$$

Or

Solve :

$$\frac{\partial^2 z}{\partial x \partial y} + \frac{\partial z}{\partial x} - \frac{\partial z}{\partial y} = z + xy$$

6. Describe Laplace equation of PDE.

Or

Describe non-Homogeneous wave equation.

Section-C

7. Derive the general equations of motion of rigid body from D'Alembert's principle.

8. Discuss the principle of conservation of energy.

9. Derive the Lagrange's equations of second kind.

10. (i) Solve :

$$Z^2(p^2 - q^2) = x^2 + y^2$$

(ii) Solve :

$$2xz - px^2 - 2qxy + pq = 0$$

11. Describe fundamental solution of Heat equation of PDE.