

Roll No. 223112320007
Havi

Exam Code : M-23

Subject Code—59302

B. Sc. EXAMINATION

(Main & Reappear) (Batch 2018 Onwards)

(Second Semester)

PHYSICS

CPL-202

(Core Course—III)

Mechanics—II

Time : 3 Hours

Maximum Marks : 80

Note : The question paper consists of nine questions. Attempt *Five* questions in all. Q. No. 1 is compulsory. Attempt *four* more questions, selecting *one* question from each Unit. All questions carry equal marks.

1. (a) What is meant with degree of freedom ?

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P.T.O.

- (b) What is Relativistic Doppler effect ?
- (c) What is a compound pendulum ?
- (d) What is inertial frame of reference ?
- (e) What is the basic difference in the formulation of Galilean and Lorentz transformation ?
- (f) What is meant by "Potential energy" ?
- (g) What is meant with "Generalized coordinates" ?
- (h) What are "Massless particles" ? $8 \times 2 = 16$

Unit I

2. Define Lagrangian function. State and explain Hamilton's principle. Derive Lagrange's equation of motion from Hamilton's principle.

16

3. (a) Explain the physical meaning of generalized displacement, velocity, acceleration, momentum using their mathematical formulation.

12

- (b) Describe the motion of single particle under Lagrangian formulation using Cartesian coordinates. 4

Unit II

4. What are Forced Oscillations ? Set up an equation of motion for Forced Oscillations and work out its solutions. Also, explain the physical significance based on solutions. 16
5. What is Simple Harmonic Oscillator ? Set up a differential equation of Simple Harmonic Oscillator and find its solution. Obtain the mathematical expressions for its maximum kinetic and potential energy. 16

Unit III

6. Describe Michelson-Morley experiment in detail along its outcomes. 16
7. What are Lorentz Transformation (LT) equations ? Derive LT equations. 16

Unit IV

8. What is mass-energy equivalence ? Derive its mathematical expression. Also, derive a mathematical formula of relativistic Doppler frequency. 16

9. Derive mathematical formula of relativistic addition of velocities and explain its physical meaning. Also, derive a mathematical relation providing an account on variation of mass with velocity.

From galilean transformation we have 16

$$x = x' + ut \quad \text{--- (i)}$$

$$x' = x - ut \quad \text{--- (ii)}$$

Multiply both eqn by k

$$x = k(x' + ut) \quad \text{--- (iii)}$$

$$x' = k(x - ut) \quad \text{--- (iv)}$$

Now multiply both eqn by each other

$$xx' = k^2 (x' + ut)(x - ut) \quad \text{---}$$

Now put $x = ct$ in all equation

$$ctct' = \dots$$

Now put $t' = t$

After this find k

$$k = \frac{1}{\sqrt{1 - \frac{c^2}{v^2}}}$$

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1,500

Put this k in eq iii and iv
we get LT.