

A Charutar Vidya Mandal's Institution
V.P. & R.P.T.P. SCIENCE COLLEGE (AUTONOMOUS)
(Grant-in-Aid)

Affiliated to Sardar Patel University
VALLABH VIDYANAGAR-388120
Bachelor of Science (Semester-5)
Internal Examination - 2025



Course Code:US05MAPHY01 Course Title:Classical Mechanics

Date: 22/10/2025, Monday

Total Marks: 30

Time: 10:45 a.m. to 12:15 p.m.

Q-1 Multiple Choice Questions (Attempt All)

[06]

- (1) The number of independent variables for a free particle in space are _____
(a) zero (b) one
(c) two (d) three
- (2) _____ constraints are time dependent
(a) Holonomic (b) Non-Holonomic
(c) Scleronomous (d) Rheonomous
- (3) If $I_1 = I_2$ and $I_3 = 0$, then the body is called _____
(a) spherical top (b) symmetrical top
(c) asymmetrical top (d) rotator
- (4) The shortest distance between two points in a plane is _____
(a) circular (b) hyperbolic
(c) parabolic (d) straight line
- (5) The path of a particle is _____ when it is moving under constant conservative force field
(a) cycloid (b) hyperbolic
(c) parabolic (d) straight line
- (6) The Lagrangian and Hamiltonian are related by the relation _____
(a) $H = \sum p_i \dot{q}_i + L$ (b) $H = \sum p_i \dot{q}_i - L$
(c) $H = L + \sum p_i \dot{q}_i$ (d) $H = L - \sum p_i \dot{q}_i$



Q-3 Derive the Lagrange's equation of motion for a conservative system from D'Alembert's principle [06]

OR

Q-3 Construct the Lagrangian of Atwood machine and derive it's the equation of motion [06]

Q-4 Explain the motion of the earth with necessary diagrams [06]

OR

Q-4 Derive the expressions of velocity and acceleration of the particle for rotating coordinate system [06]

Q-5 Discuss the technique of calculus of variation and derive the general Euler's equation [06]

OR

Q-5 Derive the Lagrange's equation of motion for non-holonomic system [06]

Q-6 Derive the Hamilton's equation of motion [06]

OR

Q-6 Construct the Lagrangian for simple pendulum with moving support and deduce the expression of Hamiltonian in terms of momenta [04]



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BSC (Semester-5) Quiz - 2025

COURSE CODE: US05MAPHY01

COURSE TITLE: Classical Mechanics



Date: 22/09/2025

Time: Maximum 20 minutes

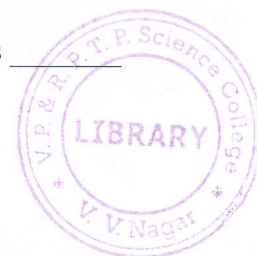
Day: Monday

Total marks :15

Q-1 Fill in the blanks with appropriate answer given in the bracket.

[08]

- (i) The Lagrangian equations of motion are _____ order differential equations (second/third)
- (ii) The degree of freedom for N particles in space is _____ (N/3N)
- (iii) A frame of reference is accelerated relative to a fixed frame is called _____ frame (inertial/non-inertial)
- (iv) In a cyclone the wind whirls in the _____ sense in the southern hemisphere (clockwise/anti-clockwise)
- (v) The 3n-dimensional space is called _____ space (configuration/phase)
- (vi) In variational principle the line integral of some function between two end points is _____ (zero/extremum)
- (vii) For conservative system, the potential energy is a function of (position/velocity)
- (viii) The condition for transformation is an exact (integral/differential)



Q-2 Whether the following statement is true or false. Write your answer in the box

[07]

- (i) Rheonomous constraints are independent of time []
- (ii) The generalized coordinates for motion of a particle moving on the surface of a sphere of radius 'a' are θ and ϕ []
- (iii) The term $\vec{\omega} \times (\vec{\omega} \times \vec{r})$ is called angular acceleration []
- (iv) A rigid body have six degrees of freedom []
- (v) The equation of constraints for a simple pendulum is $r d\theta - l = 0$ []
- (vi) The Poisson brackets are commutative []
- (vii) The space depends on position coordinate and momenta is called phase space []