

Register Number :

Name of the Candidate :

6 0 9 6

M.Sc. DEGREE EXAMINATION, 2012

(MATHEMATICS)

(FIRST YEAR)

(PAPER - IV)

**140. ANALYTICAL MECHANICS AND
TENSOR ANALYSIS**

May]

[Time : 3 Hours

Maximum : 100 Marks

SECTION – A (8 × 5 = 40)

Answer any EIGHT of the following.

ALL questions carry equal marks.

1. Derive Euler's equation of motions for a rigid body with a fixed point.
2. Describe Conical pendulum.
3. Explain the motion of a rigid body with a fixed point under no force.

Turn Over

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4. Explain the Gyroscopic couple.
5. Consider a spherical pendulum consisting of a particle of mass m which moves under gravity on a smooth sphere of radius a . Find the kinetic energy, potential energy and Lagrangian.
6. Prove that the action has a stationary value for natural motion when compared with adjacent motion having the same and events.
7. Prove that the set of all admissible transformations forms a group.
8. Show that a tensor of order 2 can always be written as the sum of a symmetric tensor and a skew symmetric tensor.
9. Define derivatives of the fundamental tensors.
10. Define Christoffel symbols.
11. (a) State and prove the principle of conservation of energy.

*Answer any THREE of the following.
ALL questions carry equal marks.*

SECTION – B ($3 \times 20 = 60$)

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- (b) Find the equation of motion of the simple pendulum in terms of elliptic functions.
12. Discuss the general motion of a top.
13. (a) Derive Lagrange's equations for a non – holonomic system.
- (b) Derive Hamilton's Canonical equations.
14. (a) Prove that g_{ij}^1 is a mixed tensor of rank two.
- (b) Explain outer product of two tensors.
15. (a) Find the metric tensor and its expression for the five element in spherical coordinates.
- (b) Show that Covariant differentiation commutes with contraction.