

4530/MP2

MAY 2010

**CLASSICAL MECHANICS AND STATISTICAL
MECHANICS**

(For those who joined in July 2003 and after)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

All questions carry equal marks.

1. (a) (i) State and derive D'Alembert's principle. (8)
(ii) Obtain Lagrange's equation of motion for a holonomic conservative system using D'Alembert's principle. (12)

Or

- (b) (i) State and prove conservation of linear momentum. (10)
(ii) Define generalized coordinate and obtain the expression for generalized momentum. (10)

2. (a) (i) State and prove Bertrand's theorem. (12)
(ii) Derive the motion in time in the Kepler problem. (8)
- Or
- (b) Deduce equations of motion and first integrals. (20)
3. (a) (i) Derive the Euler's equation of motion for a rigid body. (8)
(ii) Explain normal coordinates. (12)
- Or
- (b) (i) State and prove the principle of least action. (12)
(ii) Derive the Hamilton's equations from a variational principle. (8)
4. (a) (i) Describe the harmonic oscillator problem as an example of canonical transformation. (15)
(ii) Deduce equation of motion in terms of Poisson's bracket. (5)
- Or
- (b) Solve Kepler problem applying action angle variable. (20)