18. (a) Explain the use of calculus of variations.

Or

(b) Derive Hamiltons' principle from Lagrange's equation.

19. (a) Obtain the differential equation for the central orbit.

Or

(b) Discuss the inverse square law.

20. (a) State and prove Betran's theorem.

Or

(b) State and prove kepler's third law.

Reg. No. : ....

Code No. : 6053 **Sub. Code : C 24 M**

M.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2011.

Second Semester

Mathematics

Paper IV — CLASSICAL MECHANICS

(For those who joined in July 2008 and afterwards)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 1 = 10$ marks)

Answer ALL the questions.

1. Define the moment of a force.

2. State the strong law of action and reaction.

3. Define the Holonomic constraints.

4. Define Rayleigh's dissipation function.

5. State "integral principle".

6. Define the term canonical momentum.

7. State virtual thorem.

8. Characterize the virial theorem.

9. State the inverse square law.

10. Define the mean anomaly.

PART B — (5 × 5 = 25 marks)

Answer ALL the questions, choosing either (a) or (b).

11. (a) Write a note on Galiean System.

Or

(b) Classify the Constraints.

12. (a) Discuss the motion of one particle using Cartesian Coordinates.

Or

(b) Show that for a single particle with constant mass the equation of motion implies the following differential equation for the Kinetic Energy $\frac{dT}{dt}=\overline{F}.V$.

13. (a) Explain the Hamilton's principle.

Or

(b) Prove that the shortest distance between two points in space is a straight line.

14. (a) Show that the central force motion of two bodies about their center for mass can always be reduced to an equivalent one-body problem.

Or

(b) Obtain the Laplace-Runge-Lenz vector.

15. (a) With usual notation prove that $\tan\frac{\theta}{2}=\sqrt{\frac{1+e}{1-e}}\tan\frac{\omega}{2}$.

Or

(b) Explain a condition for a stable orbit.

PART C — (5 × 8 = 40 marks)

Answer ALL the questions, choosing either (a) or (b).

16. (a) State and prove energy conservation theorem for a particle.

Or

(b) Show that the total angular momentum about a point O is the angular momentum of the system concentrated at the centre of mass, plus the angular momentum of motion about the centre of mass.

17. (a) Derive Lagrange's equations for a Holonomic system.

Or

(b) Obtain the Lagrange equations of motion for a spherical pendulum.