UG–318 **BMS–06**

B.Sc. DEGREE EXAMINATION – JUNE 2008.

(AY 2005–06, CY 2006 batches only)

Second Year

Mathematics

MECHANICS

Time : 3 hours Maximum marks : 75

PART A — (5 × 5 = 25 marks)

Answer any FIVE questions.

Each question carries 5 marks.

1. When two forces of equal magnitudes are inclined at the angle 2α, their resultant is twice as great as when they are inclined at the angle 2β. Prove that $\cos\alpha = 2\cos\beta$.

2. Two weights P and Q are suspended from a fixed point 0 by strings OA and OB and kept apart by a light rod AB. If the strings OA and OB make angles α and β with the rod, show that the angle θ which the rod makes with the vertical is given by $\tan\theta = \dfrac{P+Q}{Q\cot\beta - P\tan\alpha}$.

3. State laws of friction.

4. Obtain the range on the inclined plane.

5. Two perfectly elastic spheres of equal masses impinge directly. Prove that they interchange their velocities after impact.

6. Define simple harmonic motion. Derive $x = a\cos\sqrt{\mu}\ t$.

7. Find the components of velocity and acceleration of a particle in the tangential and normal direction.

8. A particle describes the orbit $r^n = a^n \cos n\ \theta$ under a central force, the pole being the centre. Find the law of force.

PART B — (5 × 10 = 50 marks)

Answer any FIVE questions.

Each question carries 10 marks.

9. State and prove parallelogram law of forces.

10. State and prove Varignon's theorem on moments.

11. Obtain the resultant of two like parallel forces.

12. A ladder which stands on a horizontal ground leaning against a vertical wall is so loaded that its centre of gravity is at the distances a and b from the lower and upper ends respectively. Show that if the ladder is in limiting equilibrium its inclination θ to the horizontal is given by $\tan\theta = \frac{a - b\mu\mu'}{(a+b)\mu}$, where μ, μ' are the coefficients of friction between the ladder and the ground and the wall respectively.

13. A particle is thrown over a triangle from one end of a horizontal base and grazing the vertex falls on the other end of the base. If α and β are base angles and θ the angle of projection, prove that $\tan\theta = \tan\alpha + \tan\beta$.

14. Two smooth spheres impinges obliquely. Find their velocities after impact.

15. Show that the composition of two simple harmonic motions of the same period along two perpendicular lines is an ellipse.

16. Find the differential equation of central orbit in polar coordinates.

———————