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Register Number:
Name of the Candidate:

B.Sc. DEGREE EXAMINATION, May 2015

(MATHEMATICS)

(THIRD YEAR)

(PART – III)

750. MECHANICS

Time: Three hours | Maximum: 100 marks

Answer any FIVE questions **(5 × 20 = 100)**

1. a) Two forces P and Q acting at a point have got a resultant R. If Q is doubled, R is doubled. Again if Q is reversed in direction then also R is doubled. Prove that P:Q:R= $\sqrt{2} : \sqrt{3} : \sqrt{2}$

   b) State and prove the Lami's theorem.

2. a) Prove that two couples acting in the same plane whose moments are equal and opposite balance one another.

   b) Three forces acting along the sides of a triangle in order are equivalent to a couple. Prove that they are proportional to the sides of triangle.

3. a) A solid cone of height h and semiveritical angle α is placed with its base against a smooth vertical wall and is supported by a string attached to its vertex and to a point in the wall. Prove that the greatest possible length of the string is $h\sqrt{1+\frac{16}{9}\tan^2 x}$

   b) Prove that a system of coplanar forces acting on a rigid body can be reduced to a single force acting at an arbitrary point in their plane together with a couple.

4. a) State the laws of friction and explain about the angle of friction.

   b) A hemispherical shell rests on a rough inclined plane whose angle of friction is λ. Show that the inclination of the plane base of the rim to the horizon cannot be greater than Sin-1 (2 Sin λ)

5. a) Find the centre of gravity of a tetrahedron.

   b) A Uniform cubical box of edge a is placed on the top of a fixed sphere, the centre of the face of the cube being in contact with the height point of the sphere. Prove that the least radius of the sphere for which the equilibrium will be stable is $\frac{a}{2}$

6. a) A point moves with uniform acceleration and v_1, v_2, v_3 denote average velocities in three successive intervals of time t_1, t_2, t_3 prove that $(v_1-v_2):(v_2-v_3)=(t_1+t_2):(t_2+t_3)$

   b) A Particle starts from rest from the top of a smooth inclined plane of a given base. Show that the time of descent is least when the inclination of the plane to the horizontal is 45°

7. a) A particle of mass m is projected under gravity in a medium in which the resistance is equal to mk (velocity)^2 Discuss the motion of the particle.

   b) Discuss the motion of a simple pendulum.

8. a) Derive the formula for the length of perpendicular from the pole on the tangent.

   b) Discuss the motion of the conical pendulum.

9. a) State and prove the parallel axes theorem.

   b) Derive the moment of Inertia of a uniform rectangular lamina of sides 2a and 2b

10. Show that the moment of inertia of a triangular lamina of mass M about a side is $\frac{mh^2}{b}$, where h is the altitude from the opposite vertex.
