**DE–4059** **23**

DISTANCE EDUCATION

B.Sc. DEGREE EXAMINATION, DECEMBER 2008.

Mathematics

MECHANICS

Time : Three hours Maximum : 100 marks

Answer any FIVE questions.

(5 × 20 = 100)

1. (a) Prove that if three jokes acting at a point are in equilibrium then any triangle drawn so as to have its sides parallel to the directions of the jokes shall represent them in magnitude also.

(b) A, B, C are three points on the circumference of a circle and jokes P and Q act along AB and BC respectively. If their resultant is a joke R along the tangent at B, show that $\frac{P}{BC}=\frac{Q}{AB}=\frac{R}{AC}$.

2. (a) Derive the equation to the line of action of the resultant.

(b) Forces 3, 2, 4, 5 kg. wt. act respectively along the sides AB, BC, CD and DA of a square. Find the magnitude of their resultant and the point where its line of action meets AB and AD.

3. (a) Write the condition of equilibrium of three coplanar parallel forces.

(b) Three line parallel jokes acting at the vertices of a triangle, have magnitudes proportional to the opposite sides. Show their resultant passes through the incentre of the triangle.

4. (a) Explain the terms statical, law of dynamical friction, cone of friction.

(b) A weight can be supported on a rough inclined plane by a force P acting along the plane or by a force Q acting horizontally. Show that the weight is $\frac{PQ}{\sqrt{Q^2 \sec^2 \lambda - P^2}}$ where $\lambda$ is the angle of friction.

5. (a) Show that the path of a projectile (in Vacuo) is a parabola.

(b) If the greatest height attained by the particle is a quarter of its range on the horizontal plane through the point of projection, find the angle of projection.

6. (a) A gun of mass $M$ fires a shell of mass $m$ horizontally and the energy of the explosion is such as would be sufficient to project the shell vertically to a height $h$. Show that the velocity of the horizontal recoil $V$ of the gun is given by $V^2 = 2m^2gh/M(M+m)$.

(b) Three equal spheres are in a straight line on a table and one of them moves towards the other two which are at rest and not in contact. If $e = 1/2$. Show that there will be three impacts.

7. (a) Explain the Geometrical representation of a simple harmonic motion.

(b) A horizontal shelf moves vertically with S.H.M. whose complete period is one second. Find the greatest amplitude in centimetres, it can have, so that an object restring on the shelf may always remain in contact.

8. (a) Derive the pedal equation of circle pole at any point.

(b) Find the law of force towards the pole under which the curve $r^n = a^n \cos n\theta$ can be described.

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