(b) Find the centre of gravity of a quadrilateral lamina.

6. (a) State and prove the prinicple of virtual work.

(b) State and prove Newton's laws of motion.

7. (a) Find the resultant of two simple harmonic motions of the same period and in the same straight line.

(b) In a S.H.M., if f be acceleration and V be the velocity at any time and T is the periodic time , prove that

$$f^2 T^2 + 4 \pi^2 v^2$$

is constant.

8. (a) Show that the path of a projectile is a parabola.

(b) If a particle is projected from a point O on a plane of inclination β with a velocity u making an angle α with the horizontal then find the range on the plane.

Register Number :

Name of the Candidate :

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B.Sc. DEGREE EXAMINATION, 2008

(MATHEMATICS)

(THIRD YEAR)

(PART - III)

(PAPER - VIII)

750. MECHANICS

December] [Time : 3 Hours

Maximum : 100 Marks

Answer any FIVE questions.
All questions carry equal marks.

1. (a) State and prove Zami's theorem.

(b) ABC is a given triangle. Forces $\bar{P}$, $\bar{Q}$, $\bar{R}$ acting along the lines OA, OB, OC are in eqilibrium.

Turn over

Prove that

(i) $P : Q : R = a^2(b^2 + c^2 - a^2)$
$= b^2(c^2 + a^2 - b^2) = c^2(a^2 + b^2 - c^2)$

if O is the ortho center of the triangle.

(ii) $P : Q : R = \cos\frac{A}{2} : \text{Cos}\ \frac{B}{2} : \text{Cos}\ \frac{C}{2}$

if O is the incenter of the triangle.

2. (a) OA, OB, OC are the lines of action of two forces P and Q and their reslutant R respectively. Any transversal meets the line in L,M,N respectively: prove that

$$\frac{P}{OL} + \frac{Q}{OM} = \frac{R}{ON}.$$

(b) Forces of 2, $\sqrt{3}$, 5 $\sqrt{3}$ 2 kgs wt. respectively act at one of the angular points of a regular hexagon towards the five others in order. Find the direction and magnitude of the resultant.

3. (a) Two unlike parallel forces $\overline{P}$ and $\overline{Q}$ acting on a rigid body at A and B respectively by interchanged in position. Show that the point of application of the resultant

AB will be displaced along AB through a distance

$$\frac{P + Q}{P - Q} \cdot AB.$$

(b) State and prove Varigon's theorem of moments.

4. (a) Prove the resultant of any number of couples in the same plane on a rigid body is a single couple whose moment is equal to the algebraic sum of the moments of the several couples.

(b) Derive the equation to the line of action of the resultant for a number of forces acting on a rigid body.

5. (a) A ladder AB rests with A resting on the ground and B against a vertical wall, the co-efficients of friction of the ground and the wall being μ and μ' respectively. The centre of gravity G of the ladder divides AB in the ratio *1 : n*. If the ladder is on the point of slipping at both ends, show that its inclination to the ground by

$$\tan\theta = \frac{1 - n\ \mu\mu 1}{(n + 1)'\ \mu}$$

Turn over

9. A mass m after falling freely through a distance a begins to raise a mass M greater than itself and connected with it by means of an inextensible string passing over a fixed pully. Show that M will have returned to its original position at the end of time

$$\frac{2\,m}{M - m}\sqrt{2a / g}\ .$$

10. (a) Find the law of force towards the pole underwhich the curve

$$r^2 = a^2 \cos 2\theta$$

can be described.

(b) Show that the moment of inertia of triangular lamina of mass m about a side is $\frac{Mh^2}{6}$ where h is the altitude from the opposite vertex.

5

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