(i) **Printed Pages: 3**

(ii) **Questions   : 8**

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B.A./B.Sc. (General) 3rd Semester
(2122)
MATHEMATICS
Paper–III (Statics)

Time Allowed : Three Hours]   **[Maximum Marks : 30**

Note :—Attempt **five** questions in all, selecting at least **two** questions from each Unit.

UNIT–I

1. (a) Find the magnitude and direction of the resultant of two forces acting at a point at an angle α.   3

    (b) If P and Q are two components of a force F and its line of action divides the angle between them in the ratio 1 : 2. Prove that $Q(F + Q) = P^2$.   3

2. (a) The resultant of forces P and Q acting at a point is R. If Q be doubled, R is doubled and if Q is reversed R is again doubled. Prove that $P : Q : R :: \sqrt{2} : \sqrt{3} : \sqrt{2}$.

          3

    (b) State and prove λ–μ theorem.   3

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3. (a) The resultant of two like parallel forces P, Q passes through the point C. When P is increased by R and Q by S, the resultant still passes through C, and also when Q, R replaces P, Q respectively show that

$$S = R - \frac{(Q - R)^2}{P - Q}.$$

3

(b) If a number of forces acting at a point be represented in magnitude and direction by the sides, taken in order of a Closed Polygon. Prove that they are in equilibrium.

3

4. A weight W is supported on a smooth plane of inclination α to the horizontal by a force whose line of action makes an angle 2α with the horizontal. If the pressure on the plane be arithmetic mean of the weight and the force. Show that

$$\alpha = \frac{1}{2} \sin^{-1}\left(\frac{3}{4}\right).$$

6

UNIT–II

5. (a) Explain the moment of a force about a point and give its Geometrical representation.

3

(b) Forces P, Q, R act along the sides BC, CA, AB respectively of triangle ABC. If the resultant passes through the centroid. Show that $\frac{P}{a} + \frac{Q}{b} + \frac{R}{c} = 0$.

3

2

6. (a) Prove that a single force and a Coplanar Couple acting on a rigid body cannot balance and are equivalent to a single force equal and parallel to the given force. 3

(b) A uniform rod AB of weight W, movable about a hinge at A, rests with the other end against a smooth vertical wall. If α be the inclination of the rod to the vertical, prove that the magnitude of the reaction at hinge A is

$$\frac{1}{2} W \sqrt{4 + \tan^2 \alpha} .$$
3

7. (a) P, Q are two like parallel forces. If two equal and opposite forces S along any two parallel lines at a distance b apart in the plane of P, Q are combined with them. Show that the resultant is displaced through a

distance $\dfrac{bS}{P + Q}$. 3

(b) Explain Angle of friction and Co-efficient of friction.
3

8. (a) How high can a particle rest inside a rough hollow sphere of radius a if the coefficient of friction is μ ?
3

(b) A uniform ladder rests with one end against a smooth vertical wall and the other on the rough ground, the

coefficient of friction is $\dfrac{3}{4}$. If the inclination of the

ladder to the ground is 45°. Show that a man whose weight is equal to that of the ladder can just ascend to the top of the ladder without slipping. 3