

Roll.No.

20UMACT4008

SHRIMATHI DEVKUNVAR NANALAL BHATT VAISHNAV COLLEGE FOR WOMEN
(AUTONOMOUS)

(Affiliated to the University of Madras and Re-accredited with 'A+' Grade by NAAC)

Chromepet, Chennai - 600 044.

B.Sc Mathematics- END SEMESTER EXAMINATIONS - NOVEMBER 2025

SEMESTER -IV

20UMACT4008 - Statics

Total Duration : 2 Hrs.30 Mins.

Total Marks : 60

Section B

Answer any **SIX** questions ($6 \times 5 = 30$ Marks)

- (a) Define Force.
(b) The magnitude of the resultant of two given forces P, Q is R. If Q is doubled, then R is doubled. If Q is reversed, then also R is doubled. Show that $P:Q:R = \sqrt{2} : \sqrt{3} : \sqrt{2}$.
- (a) Define Equilibrium of a particle.
(b) State and prove Triangle of forces.
- Prove that there is a limiting equilibrium at P when a particle of weight W lying on a rough plane inclined at an angle α to the horizontal is subjected to a force P along the plane in the upward direction.
- (a) Define a Moment of a force.
(b) Forces of magnitudes 3P, 4P, 5P act along the sides BC, CA, AB of an equilateral triangle of side a. Find the moment of the resultant about A.
- Derive the resultant of two like parallel forces acting on a rigid body.
- Three forces P, Q and R act along the sides BC, CA, AB of a triangle ABC. If their resultant passes through the in centre and centroid, then show that
$$\frac{P}{a(b-c)} = \frac{Q}{b(c-a)} = \frac{R}{c(a-b)}$$
- Show that the forces $\overline{AB}, \overline{CD}, \overline{EF}$ acting respectively at A, C, E of a regular hexagon ABCDEF, are equivalent to a couple of moment equal to the area of the hexagon.
- Show that the vertical angle of a cone which is such that the centre of gravity of its whole surface area including the base coincides with the centre of gravity of its volume, is $2 \sin^{-1}\left(\frac{1}{3}\right)$.

contd....

Section C

Answer any **THREE** questions ($3 \times 10 = 30$ Marks)

9. a) Forces of magnitudes F_1, F_2, F_3 act on a particle. If their directions are parallel to $\overline{BC}, \overline{CA}, \overline{AB}$ ABC is a triangle, show that the magnitude of their resultant is

$$\sqrt{F_1^2 + F_2^2 + F_3^2 - 2F_1F_3 \cos A - 2F_3F_1 \cos B - 2F_1F_2 \cos C}$$

- (b) E is the midpoint of the side CD of a square ABCD. Forces $16, 20, 4\sqrt{5}, 12\sqrt{2}$ act along $\overline{AB}, \overline{AD}, \overline{EA}, \overline{CA}$. Show that they are in equilibrium.

10. (a) State and prove Lami's theorem.
(b) State the laws of friction.
11. State and prove Varignon's theorem.
12. (a) Define Couple and Moment of a couple.
(b) Three coplanar forces represented by and acting along the sides of a triangle, taken in order, reduce to a couple, then prove that the magnitude of whose moment is equal to twice the area of the triangle.
13. (a) Define Centre of gravity.
(b) Establish mass centre of a system consists of three uniform rods forming a triangle without using integration.
