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 - APRIL 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)

1. 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 $P{:}Q{:}R = \sqrt{2}{:}\sqrt{3}{:}\sqrt{2}$.
2. A weight is supported on a smooth plane of inclination α by a string inclined to the horizon at an angle γ. If the slope of the plane be increased to β and the slope of the sting be unaltered, the tension of the string is doubled.
   Prove that cot α-2cot $\beta = \tan \gamma$.
3. If two like parallel forces of magnitude $P, Q(P > Q)$, acting on a rigid body at A,B, are interchanged in position, show that the line of action of the resultant is displaced through a distance $\dfrac{AB(P-Q)}{P+Q}$.
4. $ABCDEF$ is a regular hexagon. Forces P,$2P$,$3P$,$4P$,$5P$,$6P$ act along AB,BC,CD,DE,EF,AF. Prove that the six forces are equivalent to a couple and find the moment of the couple.
5. Find the centre of gravity of a uniform quadrant of an elliptic lamina.
6. If 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.
7. Three forces of magnitudes P,Q,R acting at a point being parallel to the sides of a triangle, are in equilibrium. If another set of forces of magnitudes P', Q', R' acting at a point being parallel to the sides of the same triangle, are also in equilibrium. Show that $\dfrac{P}{P'} = \dfrac{Q}{Q'} = \dfrac{R}{R'}$.
8. Find the resultant of two parallel forces acting on a rigid body.

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Section C

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

9. Two forces of magnitudes F_1 and F_2 act at a point. They are inclined at an angle α. If the forces are interchanged, prove that their resultant is turned through the angle $2\tan^{-1}\left(\frac{F_1 - F_2}{F_1 + F_2}\tan\frac{\alpha}{2}\right)$.
10. State and prove Lami's theorem.
11. State and prove Varignon's theorem.
12. Five equal forces act along the sides AB, BC, CD, DE, EF of a regular hexagon. Prove that the sum of the moments of these forces about any point Q on FA is a constant.
13. Find the centre of gravity of a solid hemisphere.

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