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.(Maths) END SEMESTER EXAMINATIONS NOVEMBER -2023
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. Forces of magnitudes F_1, F_2, F_3 act on a particle. If their directions are parallel to $\overline{BC}$, $\overline{CA}$, $\overline{AB}$, where ABC is a triangle, show that the magnitude of their resultant is $\sqrt{F_1^2 + F_2^2 + F_3^2 - 2F_2F_3cosA - 2F_3F_1cosB - 2F_1F_2cosC}$.

2. Prove that the necessary and sufficient conditions for a system of coplanar forces to keep a particle in equilibrium, is that the sums of the components of the forces in two mutually perpendicular directions in the plane are zero.

3. If two like parallel forces of magnitudes P,Q act on a rigid body. If Q is changed to $\frac{P^2}{Q}$, with line of action being the same, show that the line of action of the resultant will be the same as it would be, if the forces were simply interchanged.
4. Find the resultant of a couple and a force.

5. Find the mass centre of a lamina in the form of a quadrant of an ellipse of axes 2a and 2b.

6. State the laws of friction.

7. State and prove Lami's theorem.

8. A B C D E F is a regular hexogon. Forces P, 2P, 3P, 2P, 5P, 6P act along AB, BC, DC, ED, EF, AF.Show that the six forces are equivalent to a couple and find the moment of the couple.

Section C

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

9. Compute the magnitude and direction of the resultant of two forces $\overline{F_1}$ and $\overline{F_2}$.

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10. S is the circumference of a triangle ABC. If forces of magnitudes P,Q,R acting along SA,SB,SC are in equilibrium, show that P,Q,R are in the ratio
    (i) $\frac{P}{sin2A} = \frac{Q}{sin2B} = \frac{R}{sin2c}$
    (ii) $\frac{P}{a^2(b^2+c^2-a^2)} = \frac{Q}{b^2(c^2+a^2-b^2)} = \frac{R}{c^2(a^2+b^2-c^2)}$
    (iii) $\frac{P}{\Delta BSC} = \frac{Q}{\Delta CSA} = \frac{R}{\Delta ASB}$
11. If six forces, of relative magnitudes 1,2,3,4,5 and 6 act along the sides of a regular hexagon, taken in order, show that the single equivalent force is of relative magnitude 6 and that is acts along a line parallel to the force 5 at a distance from the centre of the hexagon $3\frac{1}{2}$ times the distance of the centre from a side.
12. State and prove Varignon's theorem.
13. Find the mass centre of Cardioidal Lamina.

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