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 - NOV'2024
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. How will you resolve a force $\vec{F}$ in two given directions?
2. E is the mid point of the side CD of a square $ABCD$ forces 16,20,$4\sqrt{5}$,$12\sqrt{2}$ act along $\overrightarrow{AB}$, $\overrightarrow{AD}$, $\overrightarrow{EA}$, $\overrightarrow{CA}$. Show that they are in equilibrium.
3. State and prove Lami's theorem.
4. Two fixed smooth bars B, AC in a vertical plane are each inclined at 30° to the vertical. The ends of a light string are tied to two rings each of weight 'w' which slide on the bars. From the mid point of the string is hung a weight 'W'. Find the angle made by half of the string with the vertical in the position of equilibrium.
5. One end of a rope of 20 m is to be fixed to a telegraph post and the other end is to be pulled by a man on the ground with a constant force F. To cause the maximum effect to overturn the post, at what height the rope is to be fixed ?
6. State and prove Varignon' theorem.
7. ABCDEF is a regular hexagon. 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.
8. OA and OB are two uniform rods of lengths 2a, 2b. If angle AOB $= \alpha$, find the distance of the mass centre of the rods from O.

Section C

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

9. Two forces of magnitude F_1 and F_2 act at a point. They are inclined at an angle α. If the forces are interchanged, show that their resultant is turned throughthe angle $2\ tan{-}1\ \left[\frac{F_1 - F_2}{F_1 + F_2} tan\left(\frac{\alpha}{2}\right)\right]$.

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10. Suppose a particle of mass m is placed on a rough inclined plane, inclined at an angle α to the horizontal and a force of magnitude S acts on it in a direction making an angle θ with the plane. If the equilibrium is limiting, find S.

11. Find the resultant of two parallel forces acting on a rigid body.

12. P, Q, R are forces acting along the sides BC, CA, AB if a triangle ABC taken in order. Show that if their resultant

    i) Passes through the in centre, then $P + Q + R = 0$.

    ii) Passes through the centroid, then $\frac{P}{sinA} = \frac{Q}{sinB} = \frac{R}{sinC}$.

    iii) Passes through the circumcentre, then $P\ cos\ A + Q\ cos\ B + R\ cos\ C = 0$.

    iv) Passes through the orthocentre then $\frac{P}{cosA} + \frac{Q}{cosB} + \frac{R}{cosC} = 0$.

13. Find the centre of mass of the following

    i. Lamina in the form of a sector of a circle.

    ii. Solid hemisphere of radius 'a'.

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