

(FOR THE CANDIDATES ADMITTED  
DURING THE ACADEMIC YEAR 2024 ONLY)

24UMS305

REG.NO. :

N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI

END-OF-SEMESTER EXAMINATIONS : NOVEMBER-2025

B.Sc.-MATHEMATICS

MAXIMUM MARKS: 75

SEMESTER: III

TIME : 3 HOURS

**PART - III**

**STATICS**

**SECTION – A**

**(10 X 1 = 10 MARKS)**

**ANSWER THE FOLLOWING QUESTIONS.**

**MULTIPLE CHOICE QUESTIONS.**

**(K1)**

1. The resultant of two forces P and Q is at right angles to P. then the angle between the forces is \_\_\_\_\_.  
a)  $\cos^{-1}(-P/Q)$     b)  $\sin^{-1}(-P/Q)$     c)  $\cos^{-1}(P/Q)$     d)  $\sin^{-1}(P/Q)$
2. The position of the resultant of two like parallel forces P and Q is unaltered, when the position of P and Q are interchanged. then P and Q are of \_\_\_\_\_ magnitude.  
a) equal    b) different    c) less than    d) greater than
3. Forces of 3,4,5,6 and  $2\sqrt{2}$  act respectively along the sides AB,BC,CD,DA and along the diagonal AC of the square ABCD. Then the resultant is \_\_\_\_\_.  
a)  $2\sqrt{2} - 1$     b)  $2\sqrt{2} - 2$     c)  $2\sqrt{2}$     d)  $\sqrt{2} - 2$
4. When  $R=0$  but  $G \neq 0$ , the system reduces to \_\_\_\_\_.  
a) equilibrium    b) single force R at O    c) couple    d) none of these
5. When motion ensues by one body sliding over another, the friction exerted is called \_\_\_\_\_ friction.  
a) Statical    b) Dynamical    c) Limiting    d) None of these

**ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES.**

**(K2)**

6. State the polygon of force.
7. Write the magnitude of the resultant of two like parallel forces and two unlike parallel forces on a rigid body.
8. Define moment of a couple.
9. Write the Two trigonometrical results useful in solving problems.
10. What is meant by cone of friction?

**SECTION – B**

**(5 X 5 = 25 MARKS)**

**ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. (K3)**

- 11.a) Two forces act on a particle. If the sum and difference of the forces are at right angles to each other, show that the forces are of equal magnitude.

**(OR)**

- b) OA, OB, OC are the lines of action of two forces P and Q and their resultant R respectively.

Any transversal meets the lines in L, M and N respectively, Prove that,  $\frac{P}{OL} + \frac{Q}{OM} = \frac{R}{ON}$ .

**(CONTD .... 2)**

- 12.a) Two men one stronger than the other, have to remove a block of stone weighting 300 kgs. With a light pole whose length is 6 metre. The weaker man can carry more than 100 kgs. Where must the stone be fastened to the pole, so as just to allow him his full share of weight?

(OR)

- b) Two men carry a load of 224 kg wt which hangs from a light pole of length 8m each end of which rests on a shoulder of one of the men. The point from which the load is hung is 2m nearer to one man than the other. What is the pressure on each shoulder.
- 13.a) ABC is an equilateral triangle of side a . D,E,F divide the sides BC,CA,AB respectively in the ratio 2:1. Three forces each equal to P act at D,E,F perpendicularly to the sides and outward from the triangle. Prove that they are equivalent to a couple of moment  $\frac{1}{2} Pa$ .

(OR)

- b) If any number of forces acting on a rigid body be represented in magnitude, direction and line of action by the sides of a polygon taken in order, then prove that they are equivalent to a couple whose moment is twice the area of the polygon.
- 14.a) If three coplanar forces acting on a rigid body keep it in a equilibrium, then prove that they must either be concurrent or be all parallel.
- (OR)
- b) If forces  $P_1, P_2, P_3$  act along the sides BC,CA,AB of a triangle ABC, and if they reduce to a couple , show that  $\frac{P_1}{BC} = \frac{P_2}{CA} = \frac{P_3}{AB}$ .

- 15.a) State the Laws of friction.

(OR)

- b) A particle of weight 30 kgs. Resting on a rough horizontal plane is just on the point of motion when acted on by horizontal forces of 6 kg wt. and 8 kg wt. at right angles to each other. Find the coefficient of friction between the particle and the plane and the direction in which the friction acts.

**SECTION – C****(5 X 8 = 40 MARKS)****ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.****(K4 (Or) K5)**

16. a) ABCDEF is a regular hexagon and at A, act forces represented by  $\overline{AB}, 2\overline{AC}, 3\overline{AD}, 4\overline{AE}$  and  $5\overline{AF}$ . Show that the magnitude of the resultant is  $AB \sqrt{351}$  and it makes an angle  $\tan^{-1}\left(\frac{7}{\sqrt{3}}\right)$  with AB .

(OR)

- b) If forces  $\lambda\overline{OA}$  and  $\mu\overline{OB}$  act at a point O along the lines OA and OB. Prove that their resultant will be the force  $(\lambda + \mu)\overline{OC}$  where C is the point on AB such that  $\lambda AC = \mu CB$ .
- 17.a) State and Prove Varignon's theorem of moments

(OR)

- b) A uniform plank of length 2a and weight W is supported horizontally on two vertical props at a distance b apart. The greatest weight that can be placed at the two ends in succession without upsetting the plank are  $W_1$  and  $W_2$  respectively Show that  $\frac{W_1}{W + W_1} + \frac{W_2}{W + W_2} = \frac{b}{a}$

18. a) Five equal forces act along the sides AB, BC, CD, DE, EF of a regular hexagon. Find the sum of the moments of these forces about a point Q on AF at a distance  $x$  from A. Interpret the result and explain why it is so.

(OR)

- b) Prove that if two couples, whose moments are equal and opposite, act in the same plane upon a rigid body, they balance one another.
- 19.a) A uniform rod of length  $a$ , hangs against a smooth vertical wall being supported by means of a string, of length  $l$ , tied to one end of the rod, the other end of the string being attached to a point in the wall. Show that the rod can rest inclined to the wall at an angle  $\theta$  given by

$\cos^2 \theta = \frac{l^2 - a^2}{3a^2}$ . What are the limits of the ratio of  $a:l$  in order that equilibrium may be possible?

(OR)

- b) Forces  $P, 4P, 2P, 6P$  act along the sides AB, BC, CD, DA of a square of side  $a$ ,
- Reduce the system to a force at A and a couple
  - Show that the equation to the line of action of the resultant is  $2x - y + 6a = 0$  with AB and AD as axes of coordinates
  - Find the points where the resultant meets AB and AD.
- 20.a) A particle is placed on a rough plane whose inclination to the horizon is  $\alpha$  and is acted upon by force  $P$  acting parallel to the plane and in a direction making an angle  $\beta$  with the line of greatest slope in the plane. If the coefficient of friction be  $\mu$  and the equilibrium be limiting, find the direction in which the body will begin to move.

(OR)

- b) In a solid hemisphere of radius  $a$ , the density varies inversely as the distance from the centre. Find the position of the centre of mass.

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