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**SUBJECT CODE NO:- B-2048**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.Sc. S.Y. (Sem-III) Examination Oct/Nov 2019**  
**Mathematics MAT - 303**  
**Mechanics-I**

[Time: 1:30 Hours]

[Max. Marks: 50]

Please check whether you have got the right question paper.

N.B

- 1) Attempt all questions.
- 2) Figures to the right indicate full marks.
- 3) Draw well-labelled diagrams whenever necessary.

- Q.1 A) Attempt any one 08
- a) Find the resultant of two unlike parallel forces acting upon a rigid body.
  - b) Prove that if the three forces acting on a particle be represented in magnitude and direction by the three sides of a triangle, taken in order, then the forces are in equilibrium.
- B) Attempt any one 07
- c) If the resultant R divides the angle between the two forces P and Q in the ratio 1:2. Prove that  $R = \frac{P^2 - Q^2}{Q}$
  - d) A body of weight 52 kg is suspended by two strings of length 5m and 12m attached to the points in the same horizontal line whose distance apart is 13m. Find the tensions of the strings.
- Q.2 A) Attempt any one 08
- a) Prove that the sum of the vector moments of two like parallel forces acting on a rigid body about any point equals to the vector moment of their resultant about the same point.
  - b) Determine the magnitude and direction of the resultant  $\vec{R}$  of two forces  $\vec{P}$  and  $\vec{Q}$  acting at an angle  $\theta$
- B) Attempt any one 07
- c) Prove that the vector moment of the resultant couple of two couples acting upon a rigid body is the sum of the vector moments of the given couples.
  - d) A small heavy ring of weight W is free to slide on a smooth vertical circular wire of radius a. one extremity of a light inextensible string of length l is attached to the ring while the other to the highest point of the wire. Find the tension of the string and the reaction of the wire.

- Q.3 A) Attempt any one 05
- Prove that the sum of the vector moments of a system of forces acting on a particle about any point equals to the vector moment of their resultant about the same point.
  - Prove that the centre of gravity of a uniform triangular lamina is the same as that of three equal particles placed at the vertices of the triangle.
- B) Attempt any one 05
- Three forces  $\vec{P}, \vec{Q}, \vec{R}$  act along the sides BC, CA, AB of a  $\Delta ABC$ , taken in order. Prove that if the resultant passes through the orthocenter of the triangle ABC, then  $P \cdot \sec A + Q \cdot \sec B + R \cdot \sec C = 0$
  - Three rods of unequal lengths are jointed to form a  $\Delta ABC$ . If the masses of the sides a, b, c be proportional to  $(b + c - a)$ ,  $(c + a - b)$  and  $(a + b - c)$ , prove that the centre of gravity is the incentre.

Q.4 Choose the correct alternative and rewrite the sentence. 10

- If X and Y are the resolved parts of force  $\vec{R}$  along OX and OY respectively where  $OX \perp OY$  then  $R^2 = \text{-----}$ 
  - $X^2 - Y^2$
  - $X^2 + Y^2$
  - $\frac{X^2}{Y^2}$
  - $X^2 \cdot Y^2$
- If a, b, c are the lengths of sides opposite to the angles A, B, C respectively of  $\Delta ABC$  then  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$  is known as -----
  - Sine rule
  - Cosine rule
  - Lami's theorem
  - Triangle law
- Centre of gravity of rigid body is -----
  - Unique
  - Non unique
  - A line
  - None of the above
- Two equal, unlike, parallel forces acting at the different points of the rigid body are said to form -----
  - A triangle
  - A parallelogram
  - A couple
  - A square
- If  $\Delta$  and S denotes area of triangle and half of perimeter of the triangle respectively then  $\frac{\Delta}{s} = \text{-----}$ 
  - Radius of incircle of triangle
  - Radius of circum circle of triangle
  - Perimeter of triangle
  - Area of incircle of triangle