# Jharsuguda Engineering School (JES), Jharsuguda

## Department of Mechanical Engineering

## **Subject/Semester:** Engineering Mechanics/1st-2nd

Q1 State and explain the triangle law of forces and parallelogram law of forces.

Q2 Two forces are acting at an angle of 120°. If the bigger force is 40 N and the resultant is perpendicular to the smaller one, calculate the smaller force.

Q3 State and explain the Varignon's theorem and Lami's Theorem with neat sketches.

Q4 State and explain the principles of transmissibility and superposition of forces.

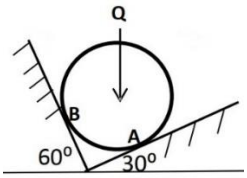
Q5 Define and explain angle of repose and angle of friction with neat sketches.

Q6 The following forces act at a point: i) 20 N inclined at 30° towards North of East, ii) 25 N towards North, iii) 30 N towards North West, and iv) 35 N inclined at 40° towards South of West. Find the magnitude and direction of the resultant force.

Q7 A particle is acted on by three forces 2, $2\sqrt{2}$, and 1 kN. The first force is horizontal and towards the right, the second force acts at $45^0$ to the horizontal and inclined right upward, and the third force is vertical. Determine the resultant of the given forces.

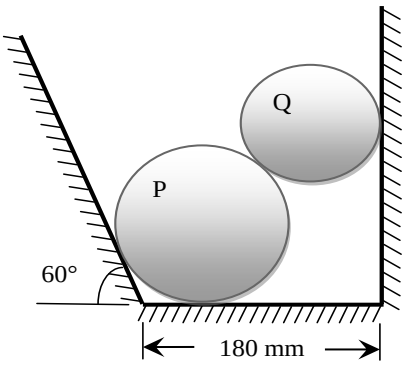
Q8 The following forces act at a point: i) 20 N inclined at 30° towards North of East, ii) 25 N towards North, iii) 30 N towards North West, and iv) 35 N inclined at 40° towards South of West. Find the magnitude and direction of the resultant force.

Q9 Determine the values of normal reaction force at contact points for Figure 1. Assume all contact surfaces are smooth and weight of the sphere is 500 N.

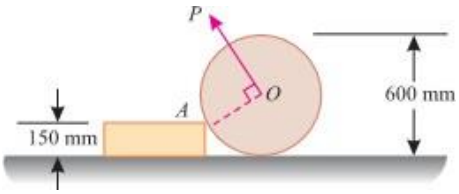



Q10 An arbitrary shaped body is under the action of three forces, all three passing through a common point. The magnitudes of forces F1 and F2 are 5 N and 2 N respectively with an angle of θ=120° between them. What is the magnitude of the force F3 if the body is in equilibrium?

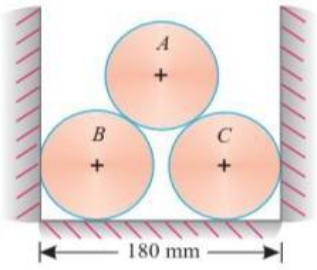
Q11 Two cylinders P and Q rest in a channel as shown in Figure. The cylinder P has diameter of 100 mm and weighs 200 N, whereas the cylinder Q has diameter of 180 mm and weighs 500 N. If the bottom width of the box is 180 mm, with one side vertical and the other inclined at 60°, determine the reactions at all the four points of contact.



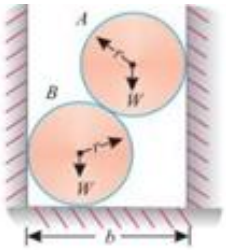

Q12 A uniform wheel of 600 mm diameter, weighing 5 kN rests against a rigid rectangular block of 150 mm height as shown in FigURE. Find the least pull,through the centre of the wheel, required just to turn the wheel over the corner A of the block. Also find the reaction on the block. Take all the surfaces to be smooth.



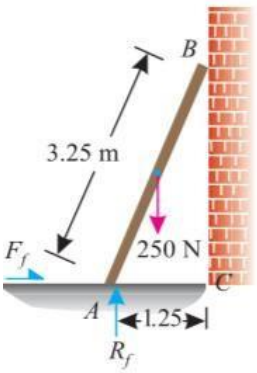

Q13 Three cylinders weighting 100 N each and of 80 mm diameter are placed ina channel of 180 mm width as shown in Figure. Determine the pressure exerted by (i) the cylinder A on B at the point of contact (ii) the cylinder Bon the base and (iii) the cylinder B on the wall.



Q14 Two smooth spheres of weight W and radius r each are in equilibrium in a horizontal channel as shown in the figure. Find the reaction forces given by the walls to the sphere and force exerted by each sphere on the other. Calculate these values, if r = 250 mm, b = 900 mm and W = 100 N.

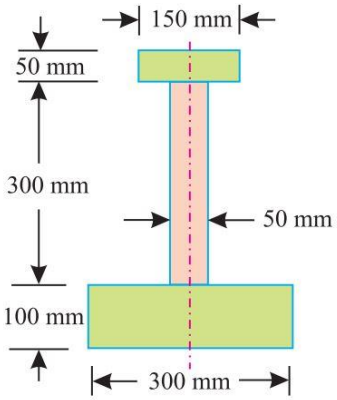



Q15 A uniform ladder of length 3.25 m and weighing 250 N is placed against a smooth vertical wall with its lower end 1.25 m from the wall. The coefficient of friction between the ladder and floor is 0.3. What is the frictional force acting on the ladder at the point of contact between the ladder and the floor? Show that the ladder will remain in equilibrium inthis position.

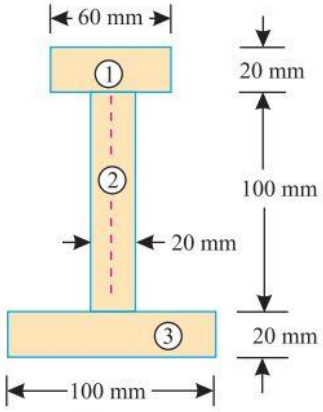



Q16 Find the moment of inertia of a T-section with top flange as 150 mm × 50 mm and web as 50 mm × 150 mm about X-X and Y-Y axes through the centre of gravity of the section.

Q17 An I-section has the following dimensions in mm units: Bottom flange = 300 × 100, Top flange = 150 × 50, Web = 300 × 50. Determine mathematically the position of center of gravity of the section. Assume the bottom of the bottom flange be the axis of reference.



Q18 An I-section is made up of three rectangles as shown in the figure. Find the moment of inertia of the section about the horizontal axis passing through the center of gravity of the section. Assume the bottom face of the bottom flange be the axis of reference.




Q19 Define perpendicular axis and parallel axis theorem.

Q20 Explain impulse and Momentum.

Q21 State and explain D'Alembert principle. Give an example.

Q22 What is collision of elastic bodies? Define the coefficient of restitution.

Q23 Explain work energy principle with an example.

Q24 Define coefficient of restitution.

Q25 State Impulse Momentum theorem.