

Code No: 152AH

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year II Semester Examinations, September/October - 2021

ENGINEERING MECHANICS

(Common to CE, ME, MCT, MMT, AE, MIE)

Time: 3 Hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks

- 1.a) Explain the reactive force between two smooth surfaces in contact with each other.
b) A rope is tied horizontally between two buildings 30 m apart. A weight of 200 N is attached to it at its midpoint. Determine the angle the rope would make with the horizontal, if the tension developed in the rope is three times the weight of the body. Assume the string to be inextensible and neglect its weight. Also determine by how much the weight would sag. [7+8]
- 2.a) A system of four forces acting on a body is shown in figure 1. Determine the resultant force and its direction.

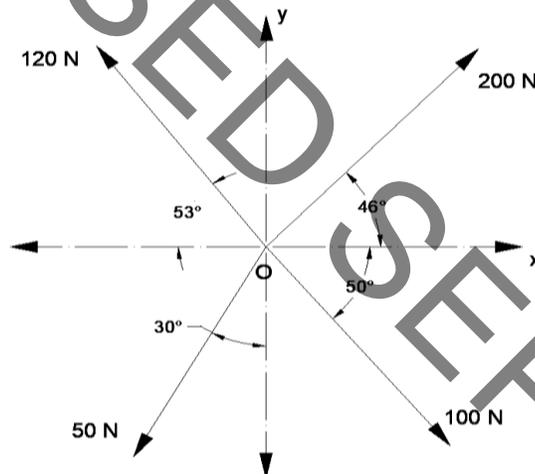


Figure: 1

- b) Explain the steps to be followed while drawing free body diagram. [8+7]
- 3.a) Find the coordinates of the centroid of the shaded area K shown in figure 2. The curve OAB is a quarter circle with radius 200 mm, and OCB is a semicircle of radius 100 mm.

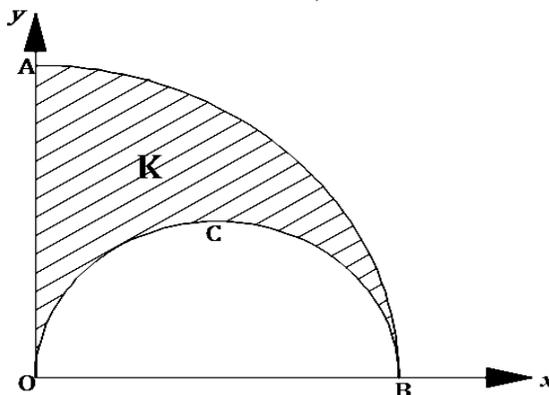


Figure: 2

- b) Explain, with a sketch, the principle of working of a differential screw jack. [8+7]

- 4.a) A 10 N force is pushing a 40 N block down an inclined plane of inclination 40° . The coefficient of static friction between the block and the plane is 0.75, and the coefficient of kinetic friction is 0.65. Will the block slide on the plane? If it does, will it slide up or down the plane? What is the friction force between the block and the plane? [7+8]
- b) What is a wedge, what are its applications? [7+8]
5. A right circular cone made of steel (density 7850 kg/m^3) has a height of 30 cm and base diameter of 20 cm. A 5 cm deep hole and of 8 cm diameter is drilled from the center of base of the cone and filled with a material of density $11,375 \text{ kg/m}^3$. Determine the mass moment of inertia of the resulting solid with respect to the geometric axis. [15]
- 6.a) Explain why the moment of inertia is always positive while the product of inertia can be positive or negative.
- b) Calculate the moment of inertia of the composite area shown in figure 3 about the centroidal axis. All dimensions are in mm. [7+8]

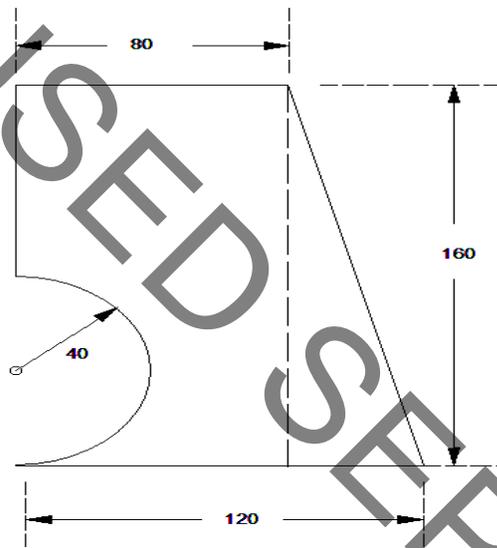


Figure: 3

- 7.a) Derive the $x - t$, $v - t$ and $a - t$ relationships for uniformly accelerated motion.
- b) A projectile is fired with an initial velocity of 250m/s at a target located at a horizontal distance of 4 km and vertical distance of 700 m above the gun. Determine the value of firing angle to hit the target. Neglect air resistance. [7+8]
- 8.a) State the work-energy principle and conservation of mechanical energy for a rigid body motion.
- b) Determine the angular velocity of earth assuming it to be a perfect sphere revolving about the north and south poles. If the radius of earth is 6370 km and its mass is $6 \times 10^{24} \text{ kg}$, determine its angular momentum and rotational kinetic energy. [7+8]