

**I B. Tech II Semester Regular/Supplementary Examinations, July/August-2023**  
**ENGINEERING MECHANICS**

(Common to ME, PE, Agri. E, Food E)

Time: 3 hours

Max. Marks: 70

*Answer any five Questions one Question from Each Unit*  
*All Questions Carry Equal Marks*

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**UNIT - I**

- 1 Two cylinders P and Q rest in a channel as shown in the figure 1. The cylinder P has a diameter of 100 mm and weighs 200 N where as the cylinder Q has diameter of 180 mm diameter and weighs 500 N . If the bottom width of the box is 180mm, with one side vertical and the other inclined at  $60^\circ$ , determine the reactions at all the four points of contact. [14M]

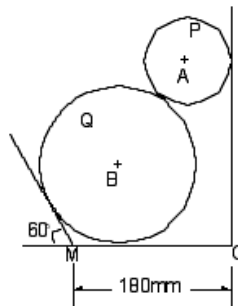


Figure 1  
**(OR)**

- 2 The cutter of a broaching machine is pulled by square threaded screw of 55 mm external diameter and 10 mm pitch. The operating nut takes the axial load of 400 N on a flat surface of 60 mm internal diameter and 90 mm external diameter. If the coefficient of friction is 0.15 for all contact surfaces on the nut, determine the power required to rotate the operating nut, when the cutting speed is 6 m/min. [14M]

**UNIT-II**

- 3 A mast AB supported by a spherical socket at A and guy wires BC and BD carries a vertical load P at B as shown. Point B is 0.3 m vertically below the xy plane. Find the axial force induced in each of the three members of this system. {As shown in the figure2} [14M]

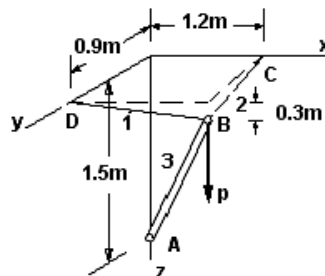
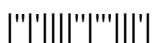


Figure 2



(OR)

- 4 a) Calculate the magnitude of the force supported by the pin at B for the bell crank loaded and supported as shown in the figure 3. [7M]

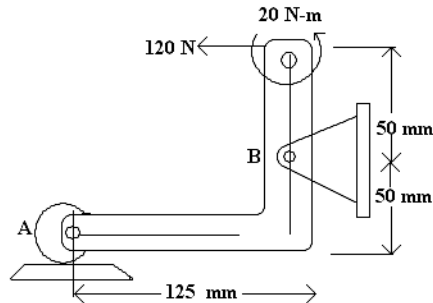


Figure 3

- b) Determine the reactions of the beam shown in figure 4 [7M]

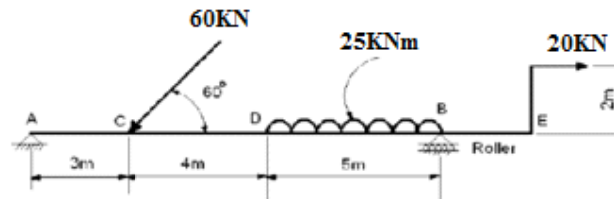


Figure 4

## UNIT-III

- 5 a) State and prove parallel axis theorem. [7M]  
 b) Find the moment of inertia about the horizontal centroidal axis of shaded portion. [7M]  
 {As shown in the figure 5}.

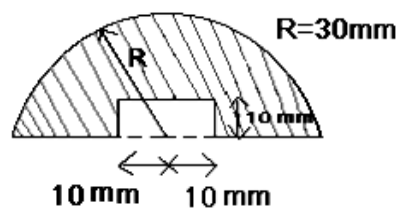
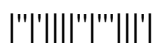


Figure 5

(OR)

- 6 A cylinder of diameter 400mm and height 1000mm rests vertically. Over this, a cone of base diameter 400mm and height 500mm is placed such that the axis of the cone coincides with the axis of the cylinder. Find out the mass moment of inertia of this composite solid about a line which passes through the vertex of the cone and which is parallel to the base of the cylinder if the mass density is  $4000\text{kg/m}^3$ . [14M]



**UNIT-IV**

- 7 For the system of connected bodies shown in figure 6 determine the acceleration of each block and the tension in the rope. Coefficient of friction between block A and horizontal surface is 0.3. Block A and B weigh 100 N and 200 N respectively. Hence find the velocity of each block after 5 sec. [14M]

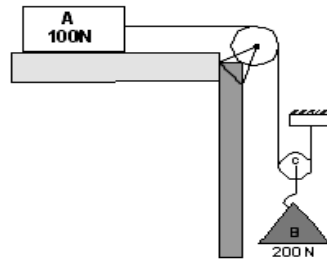


Figure 6  
(OR)

- 8 A motorist is traveling on a curved portion of highway of radius 50 m at a speed of 72 km/hr. The brakes are suddenly applied causing the speed to decrease at a constant rate of  $1.25 \text{ m/sec}^2$ . Determine the magnitude of the total acceleration of the motor. [14M]
- Immediately after the brakes have been applied
  - 4 sec later.

**UNIT-V**

- 9 a) A flywheel rotates on a fixed axle in a steam engine. The flywheel is rotating at a rate of 600 rpm before a brake begins decelerating the flywheel at a constant rate of  $30 \text{ rad/s}^2$ . What is the time required to bring the flywheel to a complete stop? How many rotations does the flywheel go through while decelerating? [7M]
- b) Derive Work energy method. [7M]
- (OR)
- 10 a) What is the angular speed in radians per second of i) the Earth in its orbit about the Sun and ii) the Moon in its orbit about the Earth? [7M]
- b) Derive impulse momentum method. [7M]

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