Indian Institute of Engineering Science and Technology, Shibpur

B.Tech (AE, CE, ME, MT, MN, CST, ETC, IT, EE) 1st Semester Mid Sem Examination, February, 2022

Mechanics (AM 1101)

Full marks: 30 Time: 45 Minutes

All notations have their usual meanings

(i) Take g = 9.81 m/s^2. (ii) Assume any other data not given in the question.

(iii) Answer any **Three (03)** questions

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1. A weightlifter is holding a 50N weight with his forearm as shown in Fig. 1. His forearm is positioned at β=60^0 with respect to his upper arm. The forearm is supported by a contraction of the biceps muscle, which causes a torque around the elbow. Assuming that the tension in the biceps acts along the vertical direction given by gravity, what tension must the muscle exert to hold the forearm at the position shown? What is the force on the elbow joint? Assume that the forearm's weight is negligible. [10]

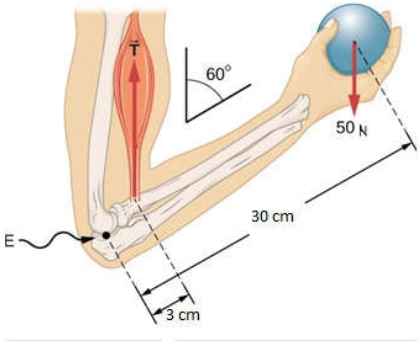

Fig 1

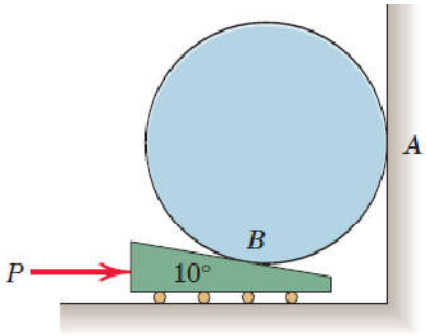

Fig 2

2. Calculate the horizontal force P on the light 10^0 wedge necessary to initiate movement of the 41-kg cylinder (as shown in Fig. 2). The coefficient of static friction for both pairs of contacting surfaces is 0.30. Also determine the friction force F_B at point B. [10]
3. Solve for force in the members, DE, EF and CG of the truss as shown in Fig. 3. [10]

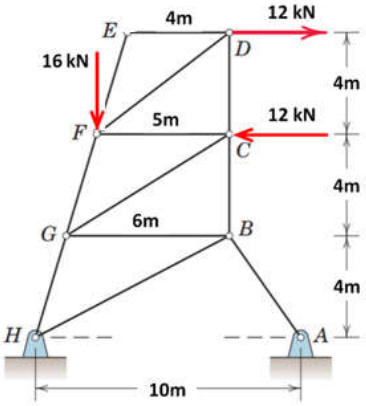

Fig 3

4. A lifting device for transportation 155-kg steel drums is as shown in Fig. 4. Calculate the magnitude of the force exerted on the drum at E and F. [10]

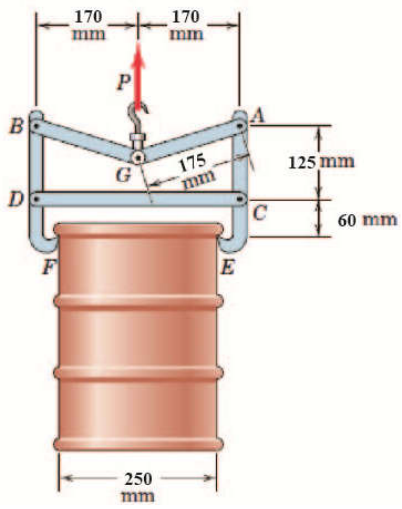

Fig 4

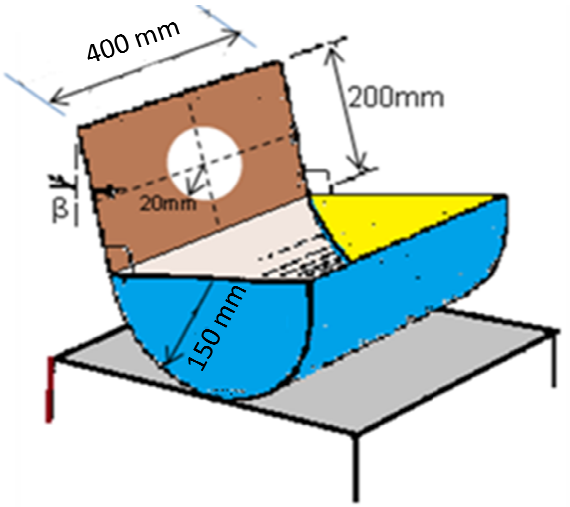

Fig 5

5. A cylindrical container with an extended rectangular back having a circular hole of 20mm at centre of back and semicircular ends is all fabricated from the same sheet-metal stock as shown in Fig. 5. Calculate the angle β made by the back with the vertical when the container rests in an equilibrium position on a horizontal surface. [10]