B.Sc. IPE-1st Semester

**Date:** 3 October, 2023
**Time:** 2:30 pm – 4:00 pm

# ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
## ORGANISATION OF ISLAMIC COOPERATION (OIC)
## DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING

**Mid Semester Examination**
**Course Number:** ME 4151
**Course Title:** Statics & Dynamics

**Winter Semester:** 2022 - 2023
**Full Marks:** 75
**Time:** 1 Hour 30 Minutes

There are **three** questions. Answer **all the** questions. The symbols have their usual meanings. Marks of each question and the corresponding CO and PO are written on the right side. Assume a reasonable value of missing data.

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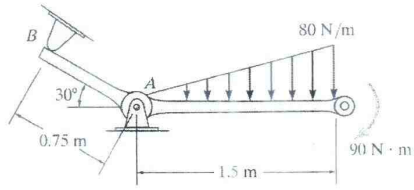
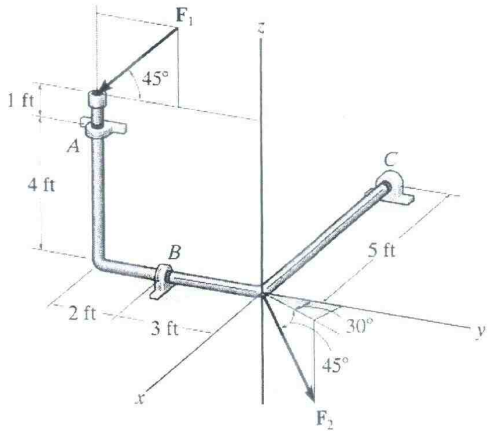
**1. a.** Describe all the necessary conditions for a rigid body to be in equilibrium. Draw the Free-Body Diagram of the object under force shown in **Figure (A)** — **5** **CO1** **PO1** **PO2**



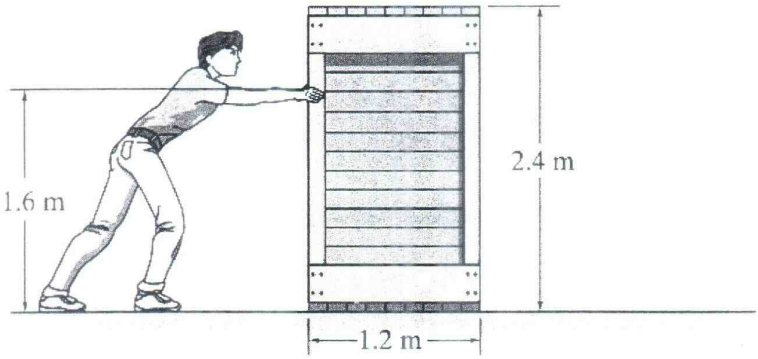

(A)

**b.** The bent rod in Figure (B) is supported at A, B, and C by smooth journal bearings. Compute the x, y, and z components of the reaction at the bearings if the rod is subjected to force $F_1 = 300\ lb$ and $F_2 = 250\ lb$. $F_1$ lies in the y–z plane. The bearings are in proper alignment and exert only force reactions on the rod. — **20** **CO1** **PO1** **PO2**



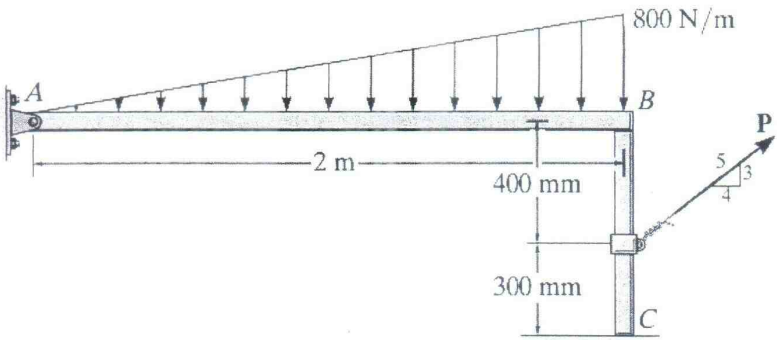

(B)

2 **a.** The uniform crate in **Figure (A)** has a mass of 150 kg. If the coefficient of static friction between the crate and the floor is $\mu_s = 0.2$, determine whether the 85-kg man can move the crate. The coefficient of static friction between his shoes and the floor is $\mu'_s = 0.40$. Assume the man exerts only a horizontal force on the crate. **10** **CO2** **PO2** **PO3**



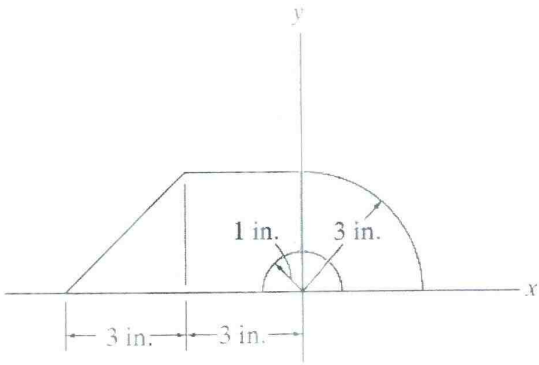

**(A)**

**b.** The beam in **Figure (B)** AB has a negligible mass and thickness and is subjected to a triangular distributed loading. It is supported at one end by a pin and at the other end by a post having a mass of 50 kg and negligible thickness. Determine the two coefficients of static friction at B and at C so that when the magnitude of the applied force is increased to P = 150N, the post slips at both B and C simultaneously. **15** **CO2** **PO2** **PO3**




(B)

3. **a.** Locate the centroid (x, y) of the shaded area. 10 CO1 PO1 PO2




**b.** Determine the moment of inertia of the beam's cross-sectional area about the y-axis. 15 CO1 PO1 PO2