NATIONAL INSTITUTE OF TECHNOLOGY, HAMIRPUR
Mid-Semester Examination
B.Tech I[st] Year (Section: A,B,C,D&E) I- Semester: 2022–2023
CE-101 Applied Mechanics

Course No: CE 101
Duration: 11/2 Hours (4.00 P.m - 5.30 P.m)
Hall No: S1, S2, F1, F2, G1

Date of Exam: 12.01.2023 (Thursday)
Mark.max:30marks

Instructions: Attempt any SIX questions only.

(Q.1). The coplanar force system in Fig.1 consists of three forces and one couple. **Determine the equivalent force-couple system** with the force acting at point O. -(5 Mark

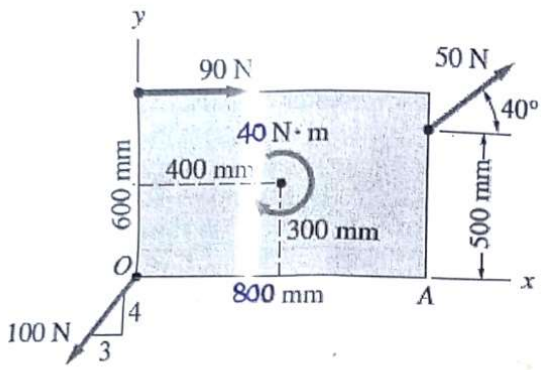


Fig.1

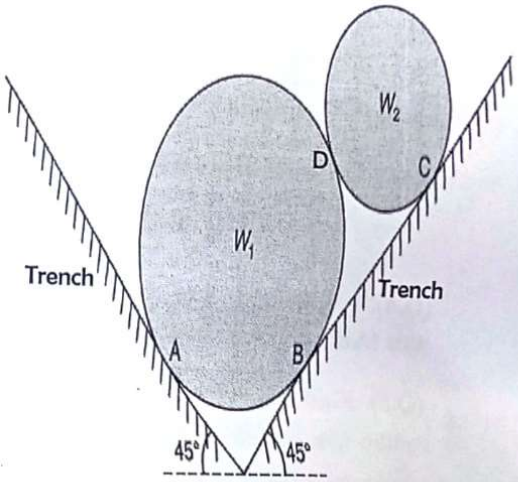


Fig.2

(Q.2). Two spheres are resting in a trench as shown in Fig.2. The weights and radii of the spheres are W_1 =75 N, W_2 =10 N, r_1 = 425 mm and r_2 = 125 mm, respectively. **Determine the reactions acting on the spheres at points A, B, C, and D, assuming the surfaces to be smooth.** (5Mar

(Q.3). Locate the Center of Gravity and Compute the Moment of Inertia about Central axis and Polar Moment of Inertia about zz axis for the following Composite shape cross section of structures as shown in Fig.3. (5Mar

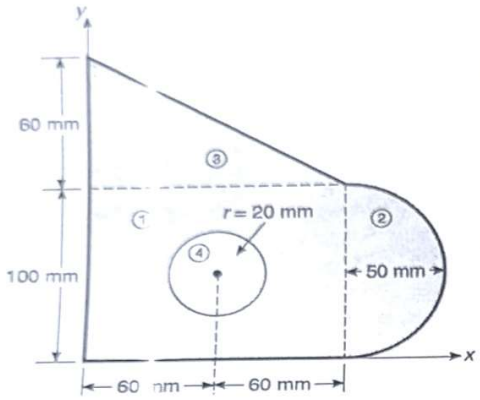


Fig.3

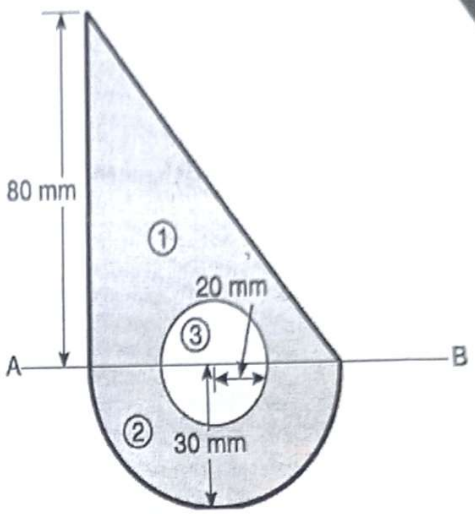


Fig.4

(Q.4). Locate the Center of Gravity and Compute the **Moment of Inertia about Reference line axis (AB)** *for the following* **built-up shape cross section of structures** as shown in Fig.4. (5Ma

(Q.5). Find the angle of **inclination of the bar** (θ) to maintain the system shown in Fig.5 in equilibrium position Neglect the weight of the bars (5Ma

$\delta = 0.002m$

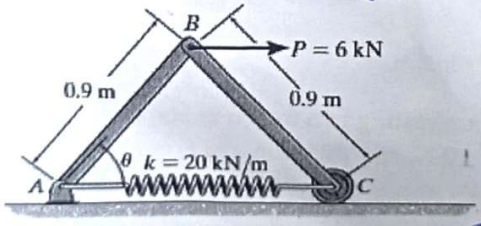


Fig.5

(Q.6). Calculate the minimum co-efficient of static friction (μ_s) between the ladder and the floor as shown in Fig.6 which is necessary for the person to be able to climb to the top of the ladder without slipping? (5Mar

$\mu_s = 0.3$

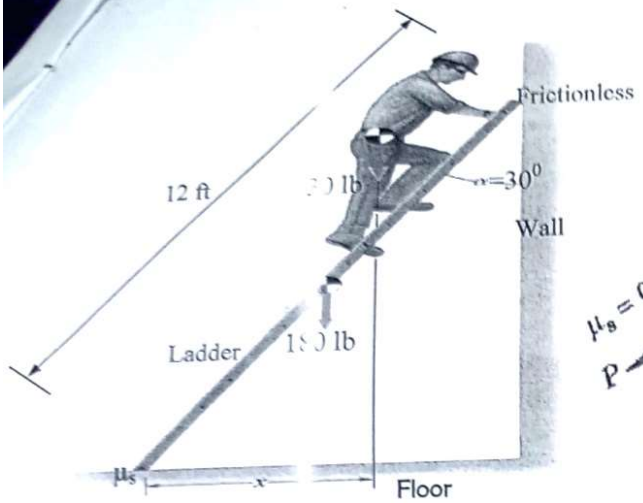


Fig.6

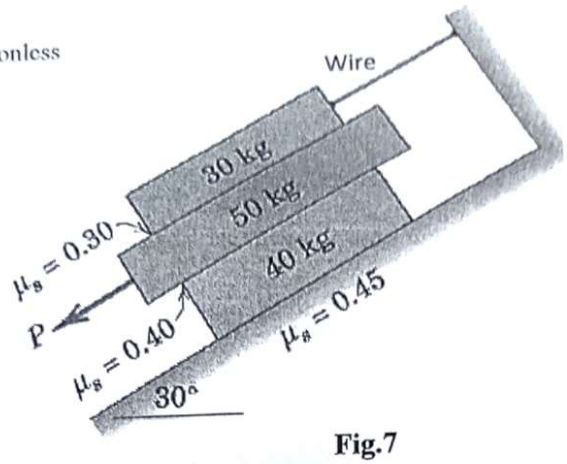


Fig.7

(Q.7). Determine the largest Force P for which blocks shown in Fig.7 remains in Equilibrium. (5Marks)

(Q.8). Determine the maximum incline (α) that the car as shown in Fig.8 can drive up at (5Mark constant speed if the car has **(a) A rear –wheel drive (b) A front –wheel drive.**

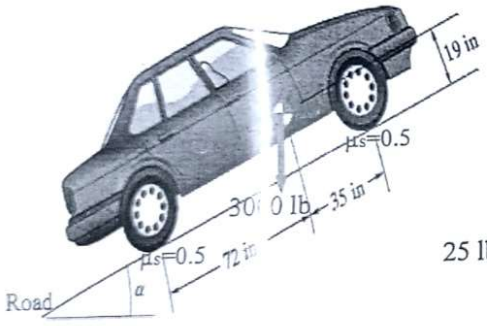


Fig.

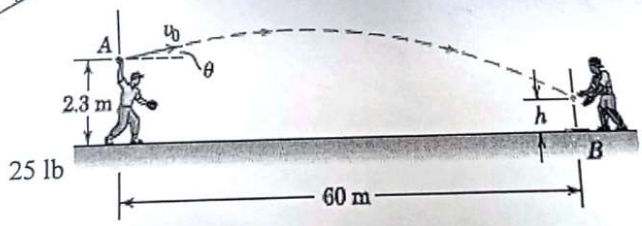


Fig.9

(Q.9). A outfielder experiments with two different trajectories for throwing baseball to home (5M plate from the position shown in Fig.9: (a) $v_o = 42$m/sec with $(\theta) = 8^0$ and (b) $v_o = 36$m/sec with $(\theta) = 12^0$. For each set of initial conditions, **determine the time (*t*) required for the baseball to reach the top of home plate and the height (*h*) as the baseball crosses the plate.**

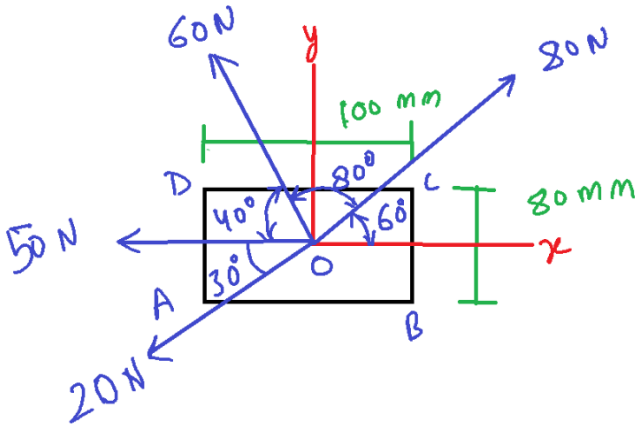
Mid Semester Examination, January 2021

Subject: Applied Mechanics **Subject Code: CE-101**

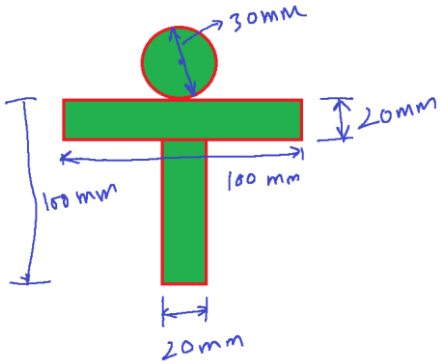
Maximum Marks: 30 **Time Duration 90 Minutes**

Q1. A rectangular body is acted upon four forces as shown in figure. Calculate the magnitude of the resultant force acting on the body and its direction with x-axis. Also calculate the equivalent force couple system at the corner B of the rectangle. Also draw the sketch.

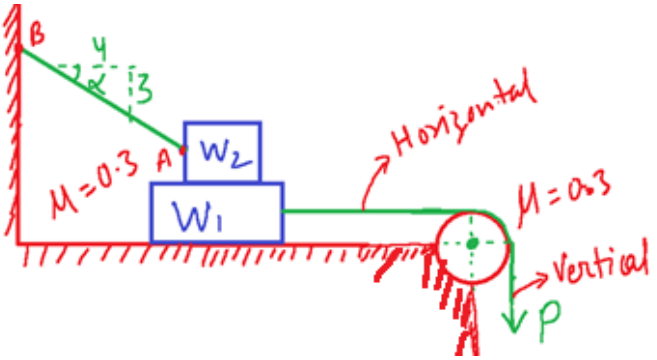
(6+2 = 8 Marks)



Q2. Calculate moment of inertia for the following symmetrical cross-section about the x and y axis passing through the centroid of the area.
(8 Marks)



Q3. A block of weight W1=200 N rests on a horizontal surface and supports on top of it another block of weight W2= 50 N. The block W2 attached with vertical wall by a string AB. Find the amount of vertical force P applied to the lower block necessary for impending slipping. The coefficient of friction for all contiguous surface is 0.3. **(10 Marks)**



Q4. Define the following terms:

(a) Angle of repose
(b) Parallel axis theorem
(c) Varignon theorem
(d) Mass and weight

(1 mark X 4 = 4 Marks)

Applied Mechanics (101) NIT Hamirpur

3rd Feb., 2022 Time 1:30 Hr

Marks (30)

Attempt any five

1. A man is centering the load hanging over a crane truck as shown in Fig.1. If the angle of the rope is 20^o then find a) tension in rope CB, b) and tension in cable AC.

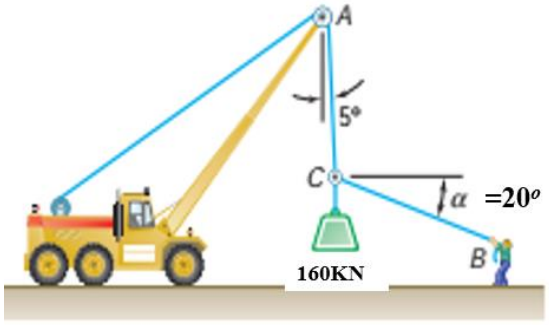


Fig.1 (6)

2. Determine the equivalent force couple system at A for the forces acting as shown in fig.2.

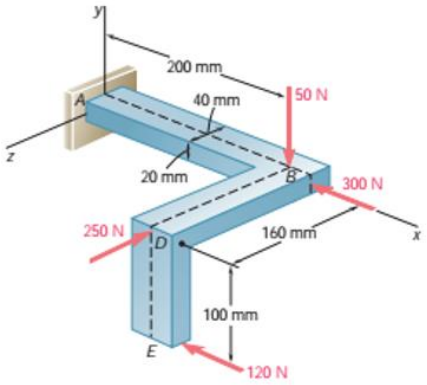


Fig.2 (6)

3. A 5^0 wedge is used to lift a machine of 1400 kN at *A (ref Fig.3)*. Knowing that the coefficient of static friction at all surfaces is 0.20, (*a*) determine the force **P** required to move the wedge, (*b*) indicate whether the machine base will move.

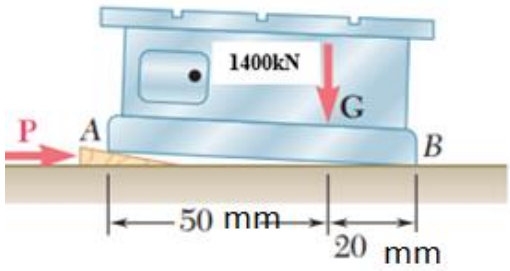


Fig.3 (6)

4. Determine the center of gravity of the L-section and moment of Inertia about centroid axes as shown in fig.4.

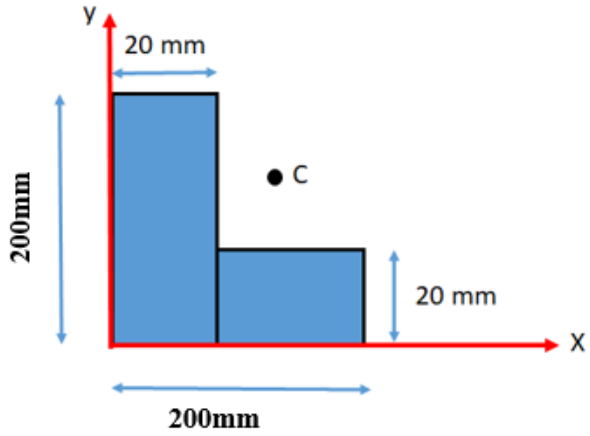


Fig.4 (6)

5. Using the method of virtual work, determine the reaction at supports A and B of the transversely loaded beam shown in fig.5.

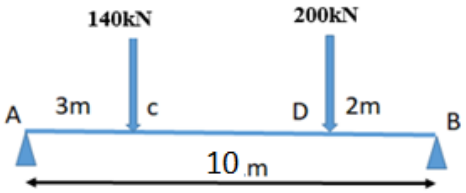


Fig.5 (6)

6. Locate the centroid of plate shown in Fig.6 and also find moment of inertia about axis passing through the centroid.

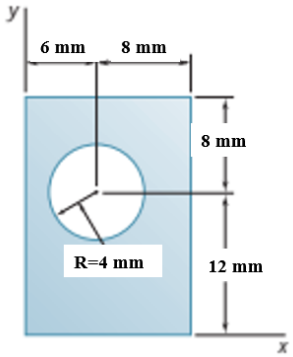


Fig.6 (6)