80

2009 MIDTERM 1 FOR ME 85/CE 30 SECTION (Zohdi)

(NO CALCULATORS/100 POINTS)

(BE NEAT and turn in this test sheet in with your work!)

NAME:

PROBLEM 1 (20 points)

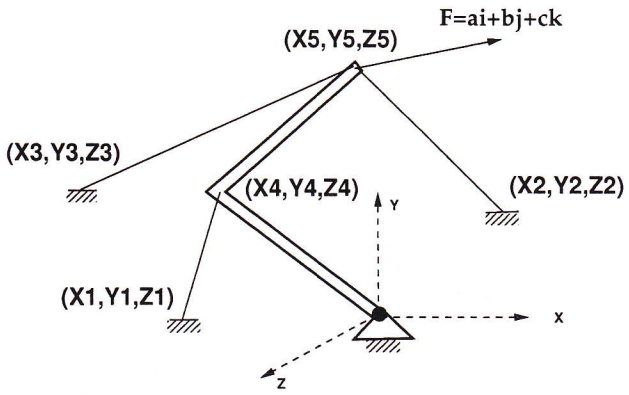

Figure 1: Problem 1.

Consider the cable and rod system in Figure 1.

(a) Neatly draw a freebody diagram for each cable and the rod. $\mathbf{F}$ is a vector.

(b) Sum the forces and moments for the rod, resulting in a system of 6 equations and 6 unknowns. In these equations, there should only be these 6 unknowns. (*Do not solve the equations.*) Identify the 6 unknowns.

Hint: Use vector form; do not find any angles.

PROBLEM 2 (30 points)

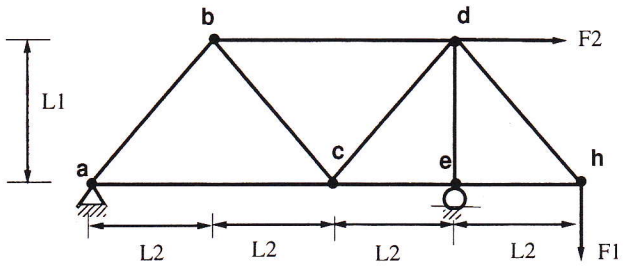

Figure 2: Problem 2

Consider the truss system in Figure 2.

(a) Neatly draw a freebody diagram for the entire system (do not break it up, yet).

(b) Determine the reaction forces at the supports.

(c) Draw the freebody diagram for each joint. Please use the labels given on the test for the joints, for example a_x and a_y are the reactions at point a.

(d) For each joint, sum (express the equations) in the x and y directions. In each equation, clearly identify the unknowns. (*Do not solve the equations.*)

PROBLEM 3 (30 points)

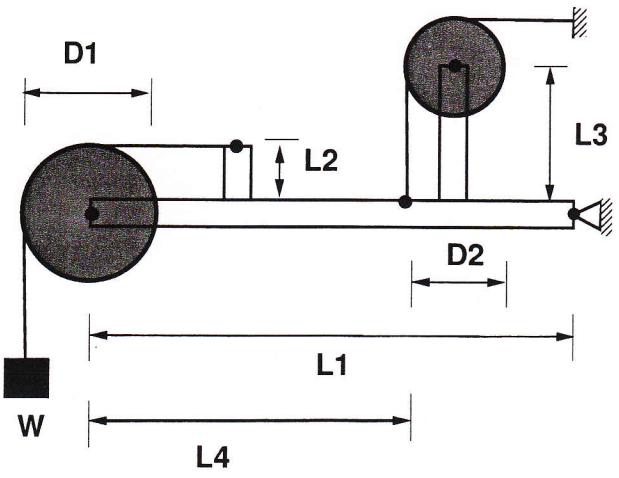

Figure 3: Problem 3

Consider the "frame/machine" system in Figure 3.

(a) Neatly draw a freebody diagram for the entire system (do not break it up, yet). Everything is assumed massless except for the hanging weight.

(b) Determine the reaction forces at the supports.

(c) Draw the freebody diagram for each component (3 diagrams; one for each disk and one for the whole support structure).

(d) For each component, sum the forces in the x and y directions, and the moments (a single equation for the moment about the z-axis pointing out of the plane of the page). In each equation, clearly identify all of the unknowns (including the external reactions). (*Do not solve the equations.*)

PROBLEM 4 (20 points)

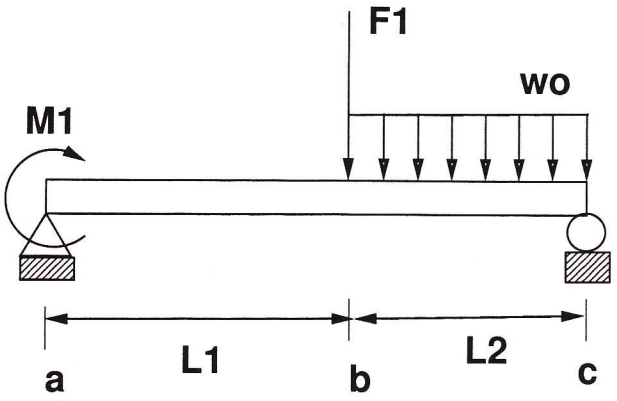

Figure 4: Problem 4

Consider the beam system in Figure 4.

(a) Neatly draw a freebody diagram for the entire system (do not break it up, yet).

(b) Determine the reaction forces at the supports.

(c) Determine the shear ($V(x)$) and moment ($M(x)$) as a function of x, in section ab and in section bc. Make sure to draw the freebody diagram for each section.