King Fahd University of Petroleum & Minerals
CIVIL ENGINEERING DEPARTMENT

CE 203 STRUCTURAL MECHANICS I

Second Semester 1433 / 2012 (**112**)

HOMEWORK NO. 4

- **Textbook Sections Covered: 4.1- 4.5**
- **Subject Material Covered:** Axially Loaded members – Statically Determ. & Indeterm.
- **DUE DATE: Monday 5-4-1433 (27-2-2012)**

---

1) Solve problem 4-7 (p. 132) in the textbook, but let the 4-kN load be 20 kN. [Secs. 4.1-4.3)] (20 pts.)

2) Determine the magnitude of the largest force Q that can be applied to the axially loaded composite step-shaft shown in Fig. P2. The maximum permissible displacement of the right end is 0.025 mm, and the maximum permissible normal stress in either material is 2.5 MPa. (E_{ST} = 210 GPa and E_{AL} = 70 GPa) [Secs. 4.1-4.3)] (20 pts.)

3) A 12-mm-diameter steel rod, shown in Fig. P3, is welded to a rigid plate that is supported by a brass pipe whose outside diameter is 30 mm and whose inside diameter is 20 mm. If E_{ST} = 210 GPa and E_{BR} = 105 GPa, determine
   a) the displacement of point *A;*
   b) the stress in the steel and in the brass. [Secs. 4.1-4.3)] (20 pts.)

4) A large steel pipe (E == 210 GPa, outer D = 4.5 m, inner D = 4.026 m) filled with concrete (E = 21 GPa) is loaded as shown in Fig. P4. Determine the normal stress in the steel and in the concrete when the 10-kN force acts along the geometric axis of the pipe. Neglect the weights of the concrete and the steel. [Secs. 4.4 & 4.5)] (20 pts.)

5) Determine the stresses in the steel and aluminum rods shown in Fig. P5. For steel, A = 200 mm^2, E = 210 GPa, and for aluminum, A = 400 mm^2, E = 70 GPa. [Secs. 4.4 & 4.5)] (20 pts.)

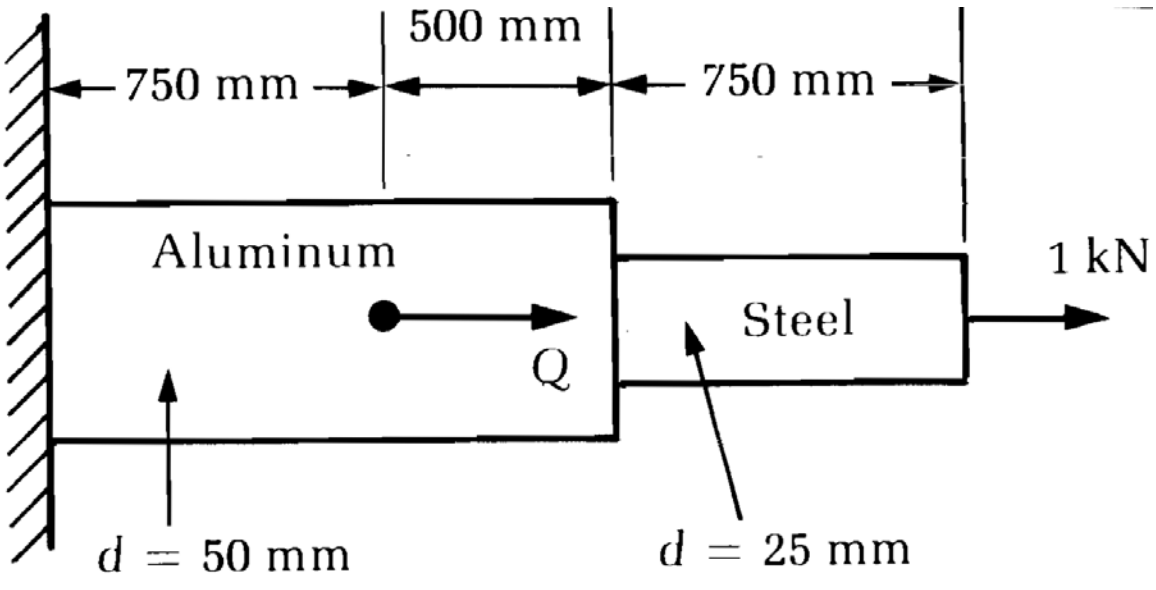

Fig. P2

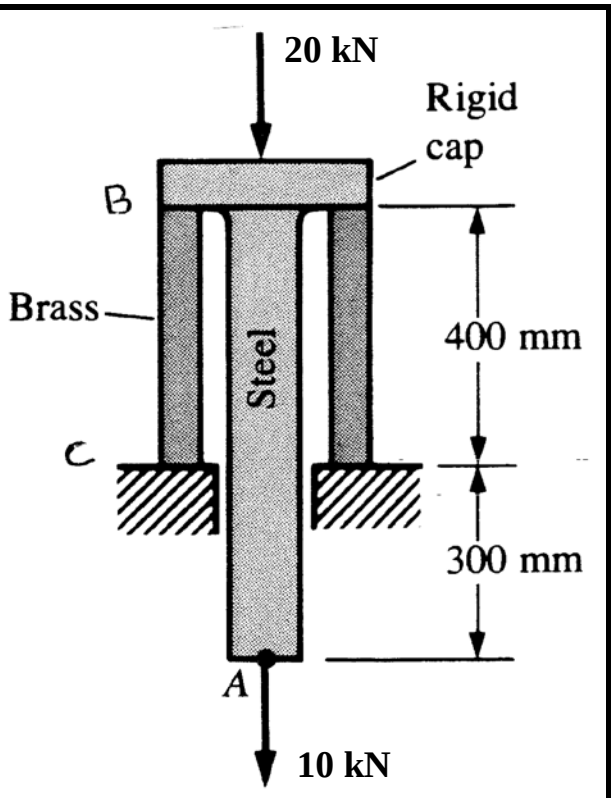

Fig. P3

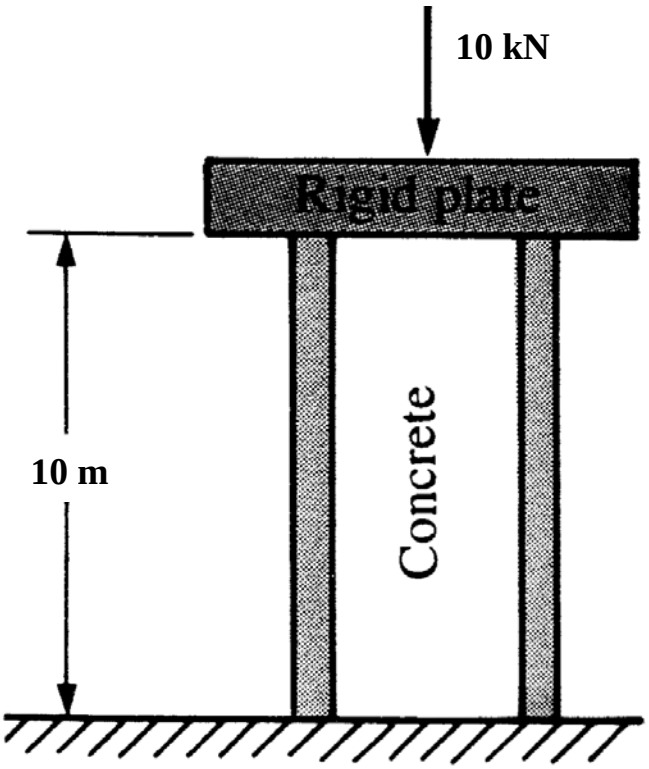

Fig. P4

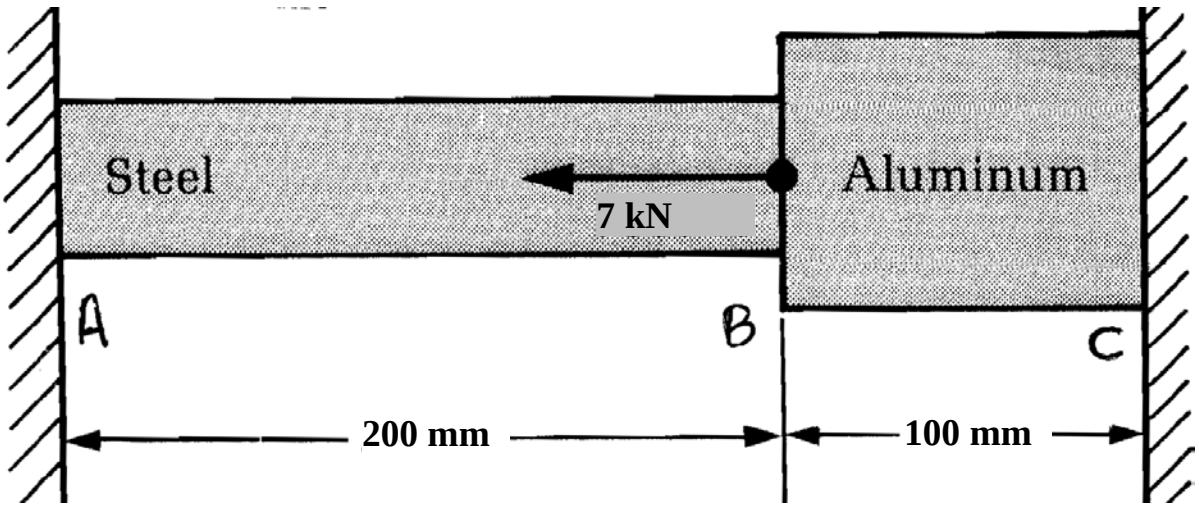

Fig. P5