King Fahd University of Petroleum & Minerals

CIVIL ENGINEERING DEPARTMENT

CE 203 STRUCTURAL MECHANICS I

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

HOMEWORK NO. 8

- **Textbook Sections Covered:** 5.5–5.7, Torsion : Statically Indeterminate Shafts & Non-circular Cross Sections
- **DUE DATE**: **Monday 2-April-2012**

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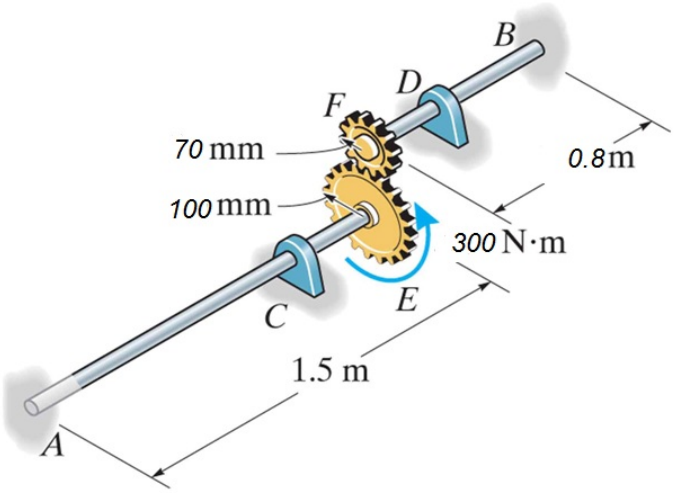
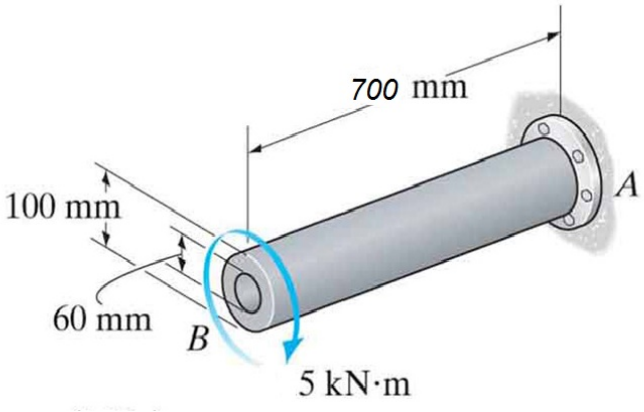
1 – The 2 shafts (*r = 30 mm*) are connected using the shown gears and are fixed at A and B. Determine the magnitude and location of the maximum shear stress in the whole shaft. Also, determine the angle of twist of point F. ***(G = 100 GPa)***

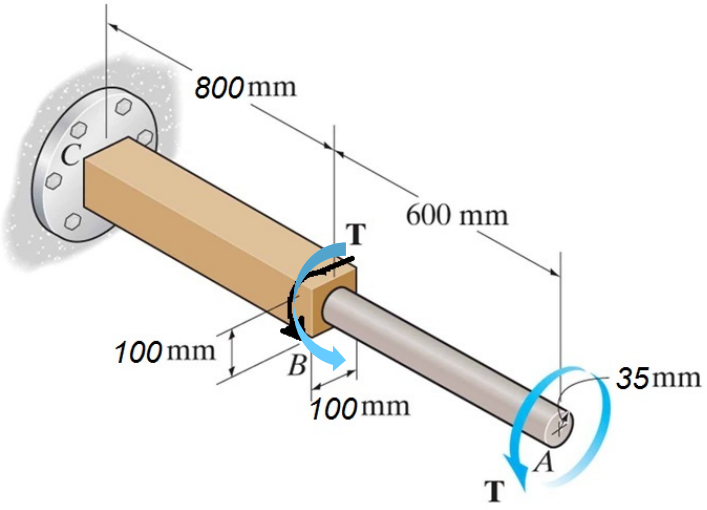


2- Use the figure and data for problem **5-79** in the textbook. Determine the support reactions. Also, determine the angle of twist of D with respect to C , and the angle of twist of D with respect to B.

3- The assembly (shown below) consists of a solid steel rod *(d=60mm)* bonded to the inside of a brass tube. The assembly is fixed at A. Determine the maximum and minimum shear stress in the brass shaft, and then for the steel shaft. Plot the distribution of the shear stress along radial distance **ρ**. (For steel *G = 80 GPa, for brass G = 40 GPa*)



4 – The given shaft has a solid circular segment connected to a solid square segment. The shaft is subjected to 2 equal torques T at A and B. Determine the value of the maximum allowable torque **T** that can be applied, knowing that : Allowable shear stress = 120 MPa, Max. angle of twist of A = 1 degree , Max. angle of twist of B = 0.5 degree. (***G = 100 GPa***)



5 - Solve problem **5- 96** in the textbook. Use the distance "***a***" as 30 mm (*instead of 25*).

6 – The given shaft cross section is subjected to a torque T=300 kN.m. Determine the magnitude and location of the maximum shear stress in the whole cross section. Also, calculate the angle of twist per unit length for the shaft . (***G = 100 GPa***). *Note : the distances 0.35 and 0.7 m are mean distances, i.e. to the middle of the wall thickness.*