Alexandria University	**جامعة الاسكندرية**
Faculty of Engineering	**كلية الهندسة**
Electrical Engineering Department - Communication	**قسم الهندسة الكهربية- اتصالات**
May 2016	**مايو 2016**
Mechanical Engineering	**الهندسة الميكانيكية**
Second Year	**السنة الثانية**
Time Allowed: 3 Hours	**الزمن: 3 ساعات**

Answer the following questions:

QUESTION ONE (15 points):

A piping system transports a fluid and supports a vertical load of 9 kN and a horizontal load of 13 kN (acting in the +x direction) at flange A. The pipe has an outside diameter of D = 200 mm and an inside diameter of d = 176 mm. Determine the principal stresses, the maximum shear Stress at points H and K.

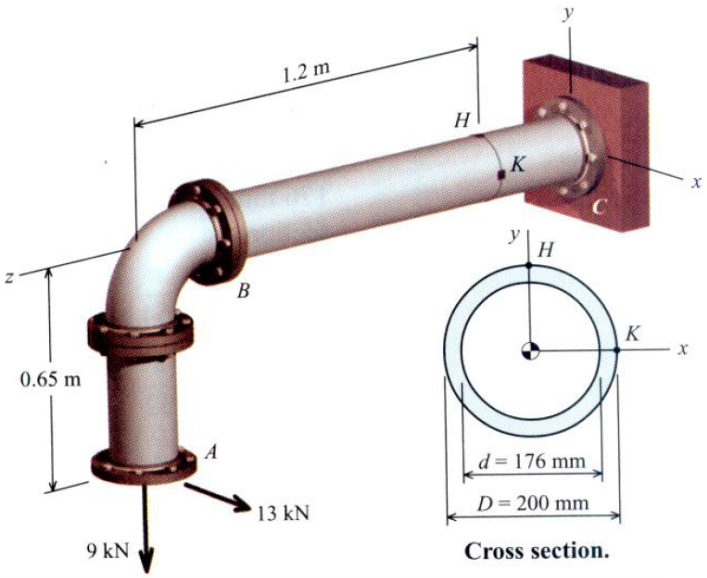


Figure 1.

QUESTION TWO (15 points):

Determine the required weld size for Figure 2 using a yield stress of 345 MPa and a safety factor of 2.5. All dimensions are in mm.

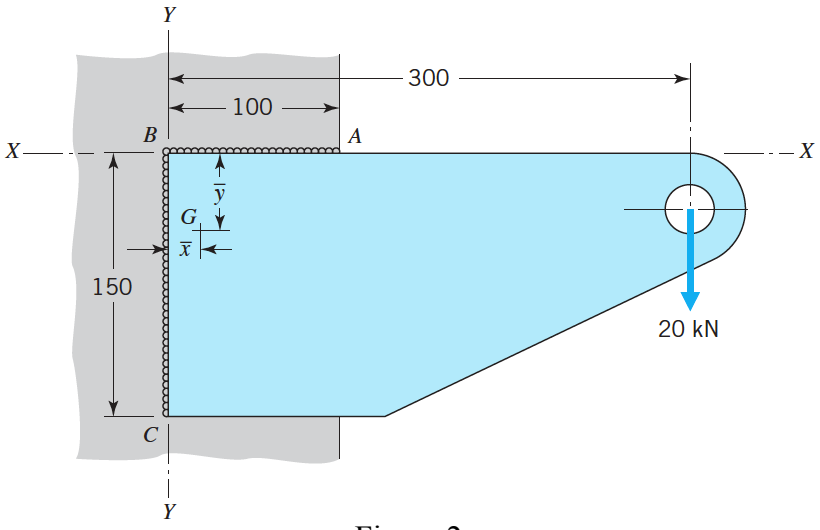
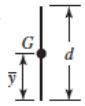
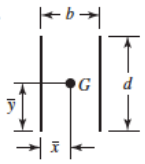
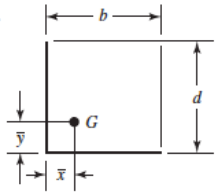
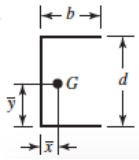


Figure 2.

Design Equations:

$$d_o = \left\{ \frac{16}{\pi \tau_{all} (1-k^4)} \sqrt{\left(K_m M + \frac{\alpha F_a d_o (1+k^2)}{8} \right)^2 + (K_T T)^2} \right\}^{1/3}$$

Weld	Throat Area	Location of G	Unit Second Polar Moment of Area
1. 	$A = 0.707hd$	$\bar{x} = 0$ $\bar{y} = d/2$	$J_u = d^3/12$
2. 	$A = 1.414hd$	$\bar{x} = b/2$ $\bar{y} = d/2$	$J_u = \frac{d(3b^2 + d^2)}{6}$
3. 	$A = 0.707h(b + d)$	$\bar{x} = \frac{b^2}{2(b + d)}$ $\bar{y} = \frac{d^2}{2(b + d)}$	$J_u = \frac{(b + d)^4 - 6b^2d^2}{12(b + d)}$
4. 	$A = 0.707h(2b + d)$	$\bar{x} = \frac{b^2}{2b + d}$ $\bar{y} = d/2$	$J_u = \frac{8b^3 + 6bd^2 + d^3}{12} - \frac{b^4}{2b + d}$

$$\sigma_{max,min} = \frac{\sigma_x + \sigma_y}{2} \pm \sqrt{\left(\frac{\sigma_x - \sigma_y}{2} \right)^2 + \tau_{xy}^2}$$

$$\tau_{max} = \sqrt{\left(\frac{\sigma_x - \sigma_y}{2} \right)^2 + \tau_{xy}^2}$$

$$I = \frac{\pi}{64} (D_{out}^4 - D_{in}^4)$$

$$J = \frac{\pi}{32} (D_{out}^4 - D_{in}^4)$$

End of the Design Part Questions. Check the following Pages for the Fluid and Thermodynamics questions.