QUESTION 1

1.1 1.1.1 ✓

$$\sigma_{LOP} = \frac{F_{LOP}}{A_i} = \frac{72000}{3{,}1416 \times 10^{-4}} = 229{,}183MPa$$ ✓

1.1.2 σ_{LOP} L_i ✓ ^{6} 0,085 ✓

$$E = \frac{E = \sigma_{LOP} \times X_{LOP}}{LOP} = \frac{229{,}183 \times 10^{6} \times 0{,}085}{110 \times 10^{-6}}$$

$=177{,}096GPa$

1.1.3 F_Y 90000 ✓ ✓

$$\sigma_Y = \frac{}{A_i} = \frac{}{3{,}1416 \times 10^{-4}} = 286{,}478MPa$$

1.1.4 F_{Max} 145000 ✓ ✓

$$\sigma_{Max} = \frac{F_{Max}}{A_i} = \frac{145000}{3{,}1416 \times 10^{-4}} = 461{,}548MPa$$

1.1.5 F_F 80000 ✓ ✓

$$\sigma_F = \frac{F_F}{A_F} = \frac{80000}{5{,}8088 \times 10^{-5}} = 1377{,}221MPa$$

1.1.6 X_F 21 ✓ ✓

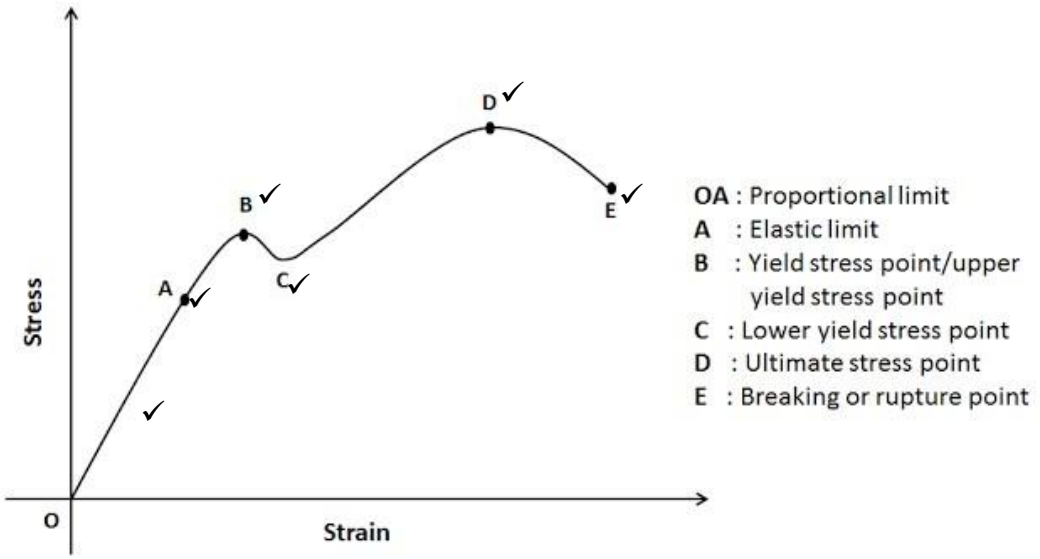
$$\%X = \frac{}{L_i} = \frac{21}{85}.100 = 24{,}71\%$$

1.1.7 $A_i - A_F$ $3{,}1416 \times 10^{-4} - 5.8088 \times 10^{-5}$ ✓ ✓

$$\%\Delta = \frac{A}{A_i} = \frac{3{,}1416 \times 10^{-4} - 5.8088 \times 10^{-5}}{3{,}1416 \times 10^{-4}}.100 = 81{,}51\%$$

(7 × 2) (14)

1.2



[Image source: *http://www.mechanicalbooster.com/2016/09/stress-strain-curve-relationship-diagram-explanation.html*] (6)

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QUESTION 2

2.1 2.1.1 $F_{causing} = P\ D\ L_i\ .\ _i\ .$

$= 1{,}2\ 10\ .(1{,}2).(2{,}\times\ ^{6}5)$ ✓

$= 3\ 600\ kN$ ✓

2.1.2 $F_{resisting} = \sigma_T .2.\ .t\ L$

$= 72\ 10\times\ ^{6}.(2).(0{,}010).(2{,}5)$ ✓

$= 3\ 600\ kN$ ✓

2.1.3 $F_{causing} = P_i .\ \frac{\pi}{4}.D_i^{\ 2}$

$= 1{,}2\ 10\ .(\times\ ^{6}\frac{\pi}{4}).(1{,}2\ )^2$ ✓

$= 1357{,}168\ kN$ ✓

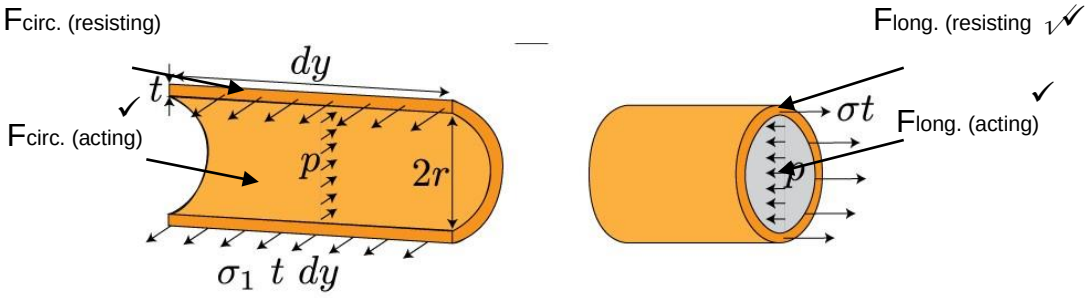
2.1.4 $F_{resistnig} = \sigma\pi_L .\ .D\ t_i\ .$

$= 36\ 10\ .(\ ).(1{,}2).(0{,}010)\times\ ^{6}\pi$ ✓

$= 1357{,}168\ kN$ ✓

(4 × 2) (8)

2.2 ✓



[Image source: http://www.bu.edu/moss/mechanics-of-materials-combined-loading/] (4)

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QUESTION 3

3.1

$$J_1 = \frac{\pi}{32}.D^4 = \frac{\pi}{32}.(0{,}048)^4 = 5{,}2115\ 10\times^{-7}\ m^4 \checkmark$$

$$\frac{T L1.1}{J G1.1} = \frac{T L2.2}{J G2.2} \checkmark$$

$$\frac{\frac{1}{3}TL_1.{}_1 \checkmark}{5{,}2115\ 10.(2{,}2.\times G_2)} \quad \checkmark \quad \frac{{}_2{}_1}{J G_2.{}_2} \quad -7 = T L.$$

$$\therefore = J_2 \quad 3{,}4396\ 10\times^{-6} m^4 \checkmark$$

$$J_2 = 3{,}4396\ 10\times^{-6} = .[D^4 - (0{,}048)]^4 \checkmark \qquad \frac{\pi}{32}$$

$$\therefore = D\ 79{,}697\ mm \checkmark \quad (7)$$

3.2

$$T_T = +T_1\ T_2 \checkmark$$

$$= \frac{\pi}{16}.\tau_1 D + .\tau_2.\left[\frac{\pi\ 3\ \pi\ (D^4 - d^4)}{D}\right]$$

$$\frac{\pi}{16}{}_{6\,3}{}^{\checkmark}\ \pi_{\,6}(0{,}0797^4 - 0{,}048)^4 \checkmark = \frac{\pi}{16}.(84\ 10).(0{,}048)\times + \frac{\pi}{16}.(46\ 10).[\times \frac{}{0{,}0797}]$$

$$= 1824{,}034 + 3970{,}474$$

$$= 5794{,}508\ N\ m.{}^{\checkmark} \quad (4)$$

3.3

$$P = 2\ .\pi\ \frac{N}{60}.T$$

$$= 2\ .\pi\ \frac{388}{60}.(5794{,}5087)^{\checkmark}$$

$$= 235{,}438\ kW \checkmark \quad (2)$$

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