ENGR 240
HW # 13

1) Table 8.1 $\sigma_y = 495$ MPa $K_{Ic} = 24$ MPa $\sqrt{m}$

a) Brittle failure at $\sigma = \frac{\sigma_y}{2} = 248$ MPa

$$248 \text{ MPa} = \frac{24 \text{ MPa}\sqrt{m}}{(1)\sqrt{\pi a}}$$

$$\boxed{a = 2.98 \text{ mm}}$$

b) yielding when $\sigma_y < \sigma_c$

$\sigma_c = \sigma_y = 495$ at what a?

$$495 \text{ MPa} = \frac{24}{(1)\sqrt{\pi a}} \rightarrow \boxed{a = 0.75 \text{ mm}}$$

↖ Lower than that for yielding

2) For no fatigue failure (ever)
must be Below fatigue limit of 320 MPa stress amplitude

2x Factor of safety =

What d gives $S = \frac{320}{2} = 160$ MPa?

$$\left(160 \times 10^6 \frac{N}{m^2}\right) = \frac{22,000 N}{\frac{\pi}{4}(d^2)}$$

$$\boxed{d = 0.013 \text{ m} = 13 \text{ mm}}$$