

c) Ans =

$$D = 10 \text{ mm} = 0.010 \text{ m}$$

$$h = 1.1 \text{ mm} = 0.0011 \text{ m}$$

$$r = 0.5 \text{ mm} = 0.0005 \text{ m}$$

$$M = 55 \text{ N}$$

$$h/r = \frac{0.0011}{0.0005} = 2.2$$

$$h/\rho = \frac{0.0015}{0.010} = 0.15$$

$$\sqrt{h/r} = \sqrt{2.2} = 1.48$$

$$\begin{aligned} i) C_1 &= 0.455 + 3.354 \sqrt{h/r} - 0.769 h/\rho \\ &= 0.455 + (3.354 \times 1.48) - (0.769 \times 2.2) \\ &= 3.73 \end{aligned}$$

$$\begin{aligned} C_2 &= 0.891 - (12.721 \times 1.48) + (4.593 \times 2.2) \\ &= -7.83 \end{aligned}$$

$$\begin{aligned} C_3 &= 0.286 + (15.481 \times 1.48) - (6.392 \times 2.2) \\ &= 9.14 \end{aligned}$$

$$\begin{aligned} C_4 &= -0.632 - (6.115 \times 1.48) + (2.568 \times 2.2) \\ &= -4.032 \end{aligned}$$

$$K_t = 3.73 + (-7.83 \times 0.15) + (9.14 \times 0.15^2) + (-4.032 \times 0.15^3)$$

$$K_t = \underline{4.21}$$

$$\begin{aligned} ii) \sigma_{\max} &= K_t \frac{32 M}{\pi (D - 2h)^3} = 4.21 \times \frac{32 \times 55}{3.14 (0.010 - 2 \times 0.0011)^3} = \underline{1.44 \text{ GPa}} \\ &\text{or} \\ &\underline{1.44 \times 10^9 \text{ Pa}} \end{aligned}$$