2 a) $C = 76/12.5 = 6.08$

$k = Gd/8n_a C^3 = 79e3 \times 12.5 / 8 \times 5 \times 6.08^3$

$\frac{N}{mm^2}\ mm$ — from (2)

$= \underline{110}\ N/mm$

b) $L_s = n_t d = (n_a + 2)d = (5+2)12.5 = 87.5\ mm$ — from Table 1.

$\therefore \delta_s = L_0 - L_s = 140 - 87.5 = 52.5\ mm$

& $F_s = k\delta_s = 110 \times 52.5 = 5775\ N$

$\tau_s = K_s . 8F_s C / \pi d^2$ from (1)

$= 8 \times 5775 (6.08 + 1/2) / \pi \times 12.5^2 = \underline{619}\ MPa$

c). $\hat{F} = 3000\ N$ $\check{F} = 2000\ N$

$\therefore F_m = 2500\ N$ & $F_a = 500\ N$.

From (5b).

$$F_e = \frac{2F_m C K_s}{S_{us}/S_{ut}} + \frac{2F_a C K_h}{S_{es}/S_{ut}}$$

$$= \frac{2 \times 2500 (6.08 + \frac{1}{2})}{0.63} + \frac{2 \times 500 \times 6.08 \frac{6.08+0.6}{6.08-0.67}}{0.13}$$

— — using Table 1

$= 110\ kN.$

whereas $F_{ut} = 142\ kN$ from table

$\therefore n = 142/110 = \underline{1.29}$. say $\underline{1.3}$

5

Since zero-to-max endurance limit is known, use (4d). $\check{F} = 250$ $\hat{F} = 500$ $\therefore \bar{F} = 375$ $\tilde{F} = 125\ N$.

$\tau_m = CK_s . 8\bar{F}/\pi d^2$ set $A = \frac{\pi}{4}d^2$ as the unknown (mm^2)

$= CK_s 2\bar{F}/A = (7 + 0.5) 2 \times 375/A = 5625/A$ MPa

$\tau_a = CK_h 2\tilde{F}/A = 7\frac{7.6}{6.33} \times 2 \times 125/A = 2101/A$ MPa

(4d) $5625/A \times 1000 + (2101/A)(2/550 - 1/1000) = 1/n$ *

Selecting $n = 1.2$ say $\Rightarrow A = 13.4\ mm^2$ $d = 4.1\ mm$

Use $d = \underline{4\ mm}$ with $n = 1.13$ from *

Check static yield at $\hat{F} = 500\ N$.

$\tau_{hi} = CK_s F_{hi} 8/\pi d^2 = 7.5 \times 500 \times 8/\pi \times 4^2 = 597\ MPa$

which is $< S_{ys} = 680\ MPa$ — so OK.

No information given on stiffness or deflexions so can't examine buckling etc.