Remarks: See §5.5, example 1, pages 368 till 374

Answer:

a. 33,3 mm right from the web

b. $I_{zz} = 400\times 10^6\ \text{mm}^4$

For the bottom flange: $S_z^a = 600\times 10^3\ \text{mm}^3$

For the lower half of the cross-section: $S_z^a = 1200\times 10^3\ \text{mm}^3$

c. $\tau_{\text{max;flange}} = 2\ \text{N/mm}^2$

$\tau_{\text{max;}web} = 2\ \text{N/mm}^2$

d. $R_{\text{flange}} = 3\ \text{kN}$

$R_{web} = 24\ \text{kN}$

e. 60 mm left from the web.

f. Along the symmetric axis $(y = 0)$, 60 mm left from the web.

Explanation:

c. The shear stress varies linearly in the top and bottom flanges:

$$\tau_{\text{max}} = \frac{(20\times 10^3\ \text{N})(600\times 10^3\ \text{mm}^3)}{(15\ \text{mm})(400\times 10^6\ \text{mm}^4)} = 2\ \text{N/mm}^2$$

The shear stress distribution is parabolic in the web:

$$\tau_{\text{max}} = \frac{(20\times 10^3\ \text{N})(1200\times 10^3\ \text{mm}^3)}{(30\ \text{mm})(400\times 10^6\ \text{mm}^4)} = 2\ \text{N/mm}^2$$

$$\tau_{\text{corner}} = \frac{(20\times 10^3\ \text{N})(600\times 10^3\ \text{mm}^3)}{(30\ \text{mm})(400\times 10^6\ \text{mm}^4)} = 1\ \text{N/mm}^2$$

d. $R_{\text{flange}} = \frac{1}{2}(200\ \text{mm})(2\ \text{N/mm}^2)(15\ \text{mm}) = 3\ \text{kN}$

$R_{web} = (400\ \text{mm})(30\ \text{mm})\left\{\frac{2}{3}(1\ \text{N/mm}^2) + (1\ \text{N/mm}^2)\right\} = 20\ \text{kN}$

e. The shear forces in the flanges result in a couple:

$R_{\text{flange}} \times h = 1,2\times 10^6\ \text{Nmm}$

The line of action of the shear force is located at a distance of e left from the web:

$$e = \frac{1,2\times 10^6\ \text{Nmm}}{20\times 10^3\ \text{N}} = 60\ \text{mm}$$