Problems related to Valve design

1) The conical valve of an I C engine is 60 mm in diameter and is subjected to a maximum gas pressure of 4 N/mm^2. The safe stress in bending for the valve material is 46 MPa. The valve is made of steel for which K = 0.42. The angle at which the valve disc seat is tapered is 30°. Determine (i) Thickness of the valve head (ii) Stem diameter and (iii) Maximum lift of valve

Given data:

$d_p = 60$ mm

$p = 4$ N/mm^2

$\sigma_b = 46$ MPa $= 46$ N/mm^2

$K = 0.42$

$\alpha = 30°$

To find:

(i) t.

(ii) d_s

(iii) h

Solution:

Thickness of Valve head

$$t = k \cdot d_p \sqrt{\frac{P}{\sigma_b}}$$

$$= 0.42 \times 60 \sqrt{\frac{4}{46}}$$

$$t = 7.43 \simeq 7.5$$

$$\boxed{t = 7.5 \text{ mm}}$$

Stem diameter

$$d_s = \frac{d_p}{8} + 6.35$$

$$= \frac{60}{8} + 6.35$$

$$\boxed{d_s = 13.85 \text{ mm}} \simeq 14$$

$$\boxed{d_s = 14 \text{ mm}}$$

Maximum lift of the Valve

$$h = \frac{d_p}{4 \cos\alpha} = \frac{60}{4 \cos 30^\circ}$$

$$= 17.32 \simeq 17.4$$

$$\boxed{h = 17.4 \text{ mm}}$$

Result:

(i) $t = 7.5\ mm$

(ii) $d_s = 14\ mm$

(iii) $b = 17.4\ mm$