FAQ's

1. Write the shear equation and explain the terms?

$$q = \frac{FA\bar{y}}{Ib}$$

Where,

q= Shear stress

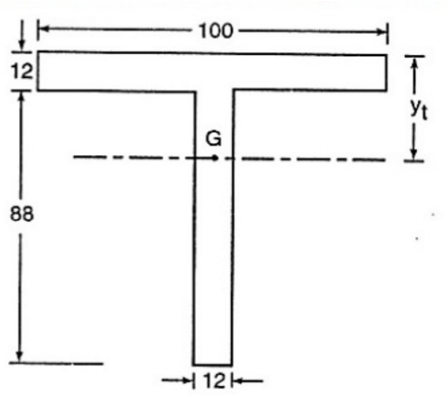
A = Area of the beam above the layer considered

Y = Distance between neutral axis and the centre of gravity of area A

I = Moment of inertia

B = Width of section

2. Draw the shear stress distribution diagram of the given beam subjected to a shear force of 20kN?



Let y be the distance of C.G. from top fibre. Then taking moment of area about top fibre and dividing it by total area we get

y_t= (100x12x6+12x88(44+12))/(100x12+88x12)

= 29.404mm

Moment of inertia about neutral axis,

I= ($100x12^3/12$) + ($100x12(29.404-6)^2$+ ($12x88^3/12$)

+ ($12x88(56-29.404)^2$)

= $2100127.3mm^4$

Shear stress at bottom of the flange

Area above this level=$100x12=1200mm^2$

c.g of this area from neutral axis= y_t-6=23.404mm

width at this level=100mm

$q_b=20x10^3x(1200x23.404)/(100x2100127.3)$

$= 2.675\ N/mm^2$

At web,

$q_w = 20x10^3x(1200x23.404)/(12x2100127.3)$

$= 22.299\ N/mm^2$

At neutral axis,

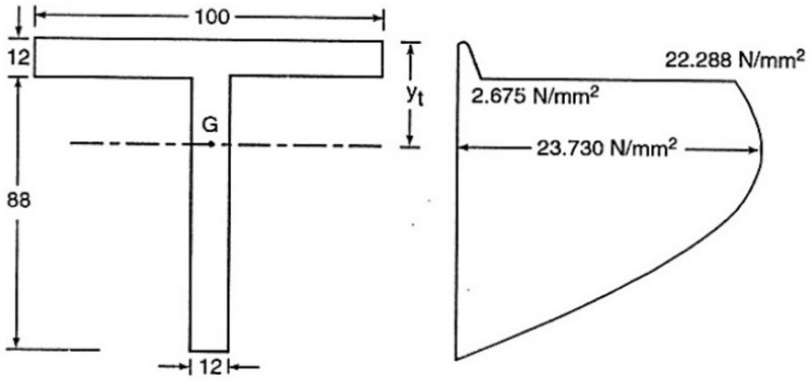
$I=(12x100x(29.404-6))+12x(29.404-12)((29.404-12)/2)$

$= 29902.195\ mm^3$

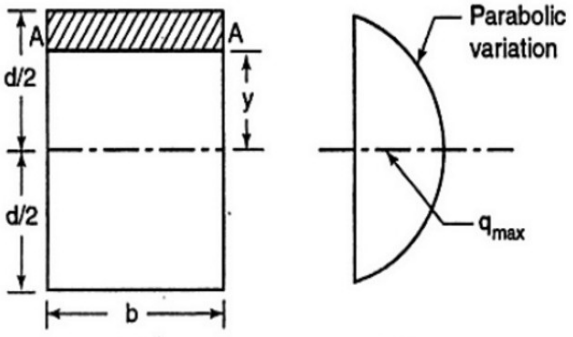
$q_n=20x10^3x29902.195/12x2100127.3$

$= 23.730\ N/mm^2$

The shear stress distribution is given below



3. Draw the shear stress distribution of the rectangular section and state the difference between average shear stress and maximum shear stress?



Shear stress,

$q= FAy/I$

$= (Fxb((d/2)-y)x0.5((d/2)+y))/(bxbd^3/12)$

$= 6F((d^2/4)-y^2)/(bd^3)$

i.e, shear stress varies parabolically

When y=d/2, q=0

When y=0, q= maximum

$q_{max}=6Fd^2/4bd^3=1.5F/bd=1.5q_{avg}$

Therefore the maximum shear stress is 1.5 times greater than the average shear stress for a rectangular section.