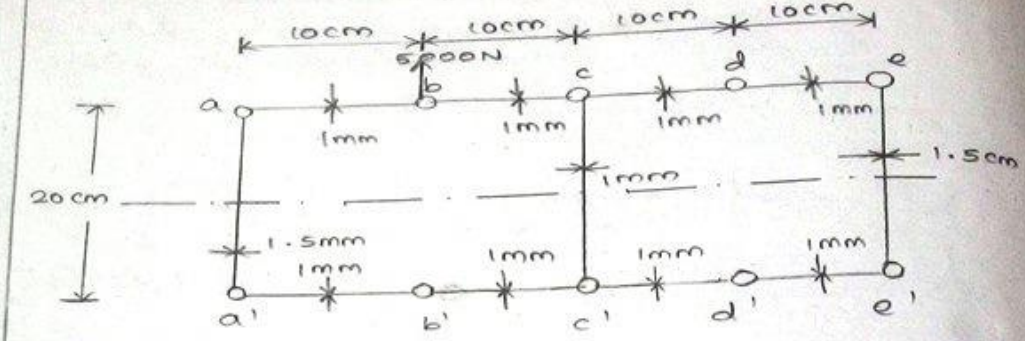
Subject Code & Name**: 23AST205 AEROSPACE STRUCTURES**

UNIT: **3. SHEAR FLOW IN CLOSED SECTIONS**

TOPIC: **6. Shear flow in single & multicell structures under torsion**

21-08-24 Shearflow In Multicell Under Bending.



$a = a' = 4\,cm^2$

$b = b' = d_2d' = 1\,cm^2$

$c = c' = e = e' = 2\,cm^2$

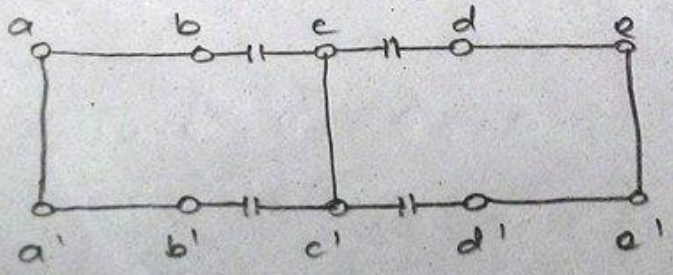
$$I_{xx} = \Sigma I_{oo}x + \Sigma Ay^2 - \Sigma A\bar{y}^2$$

$$= 4\times10^2 + 1\times10^2 + 2\times10^2 + 1\times10^2 + 2\times10^2$$

$$+ 4\times(-10)^2 + 1\times(-10)^2 + 2\times(-10)^2 + (1\times(-10)^2 + 2\times(-10$$

$$I_{xx} = 2000\,cm^4$$

Make a cut between Stringes 'b' and 'c', 'c' an b' & c', c' & e' making three open Section.



$$q = -\frac{S_y}{I_{xx}}\Sigma A_i y_i = -\frac{V}{I}\Sigma A_i y_i$$

$$= -\frac{5000}{2000}\Sigma A_i y_i$$

$$= -2.5\Sigma A_i y_i$$

$q_{ba} = -2.5(1)(10) = -25$ N/cm

$q_{aa'} = -2.5(4)(10) + q_{ba} = -2.5(4)(10) + (-25)$

$q_{aa'} = -125$ N/cm

$q_{ab'} = -2.5(4)(10) + q_{aa'} = -25$ N/cm

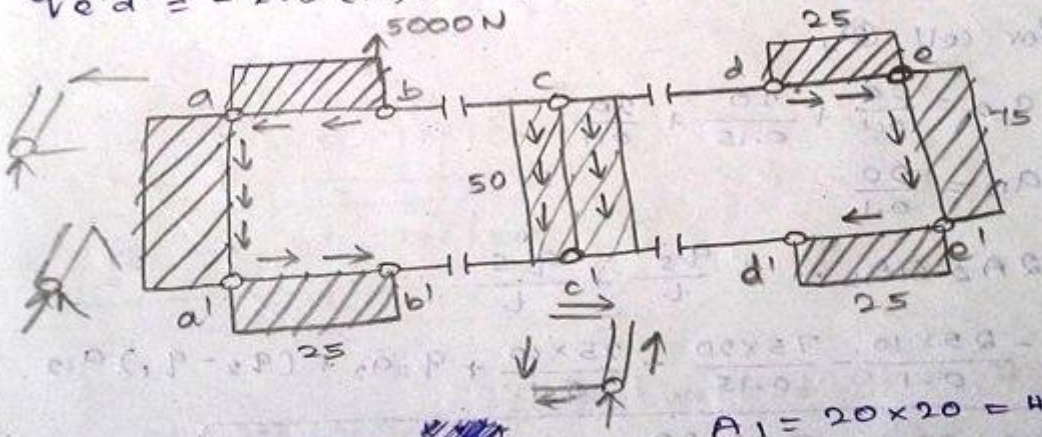
$q_{cc'} = -2.5(2)(10)$

$q_{cc'} = -50$ N/cm

$q_{de} = -2.5 \times 1 \times 10 = -25$

$q_{ee'} = -2.5(2)(10) + q_{de} = -75$ N/cm

$q_{e'd'} = -2.5(2)(-10) + q_{ee'} = -25$ N/cm



$A_1 = 20 \times 20 = 400$

$A_2 = 20 \times 20 = 400$

Moment about 'b'

$-125 \times 20 \times 10 - 25 \times 10 \times 20 + 50 \times 20 \times 10 + 75 \times 20$

$+ 25 \times 10 \times 20 + 2A_1q_1 + 2A_2q_2 = 0$

$2(A_1q_1 + A_2q_2) = -30000$

$A_1q_1 + A_2q_2 = \frac{-30000}{2}$

$A_1q_1 + A_2q_2 = -15000$

$400q_1 + 400q_2 = -15000 = 400(q_1 + q_2) =$

$q_1 + q_2 = \frac{-15000}{400}$

$q_1 + q_2 = -37.5$

for cell ①,

$$2A_1G\theta_1 = \Sigma\frac{q_s}{t} + \frac{q's}{t}$$

$$q_1 = \frac{s_1}{t_1} = \frac{20}{0.1} + \frac{20}{0.15} + \frac{20}{0.1} = 533.3$$

$$q_{12} = \frac{s_{12}}{t_{12}} = \frac{20}{0.1} = 200$$

$$2A_1G\theta_1 = \frac{-25\times10}{0.1} - \frac{125\times20}{0.15} - \frac{25\times10}{0.1} + q_1q_1 + (q_1 - q_2)q_{12}$$

$$2A_1G\theta_1 = 733.33q_1 - 200q_2 - 21666.6 \quad \text{——} (2)$$

for cell ②,

$$q_2 = \frac{20}{0.1} + \frac{20}{0.15} + \frac{20}{0.1}$$

$$q_{12} = \frac{20}{0.1}$$

$$2A_2G\theta_2 = \Sigma\frac{q_s}{t} + \frac{q's}{t}$$

$$= -\frac{25\times10}{0.1} - \frac{75\times20}{0.15} - \frac{25\times10}{0.1} + q_2q_2 + (q_2 - q_1)q_{12}$$

$$2A_2G\theta_2 = 733.3q_2 - 200q_1 - 125000 \quad \text{——} (3)$$

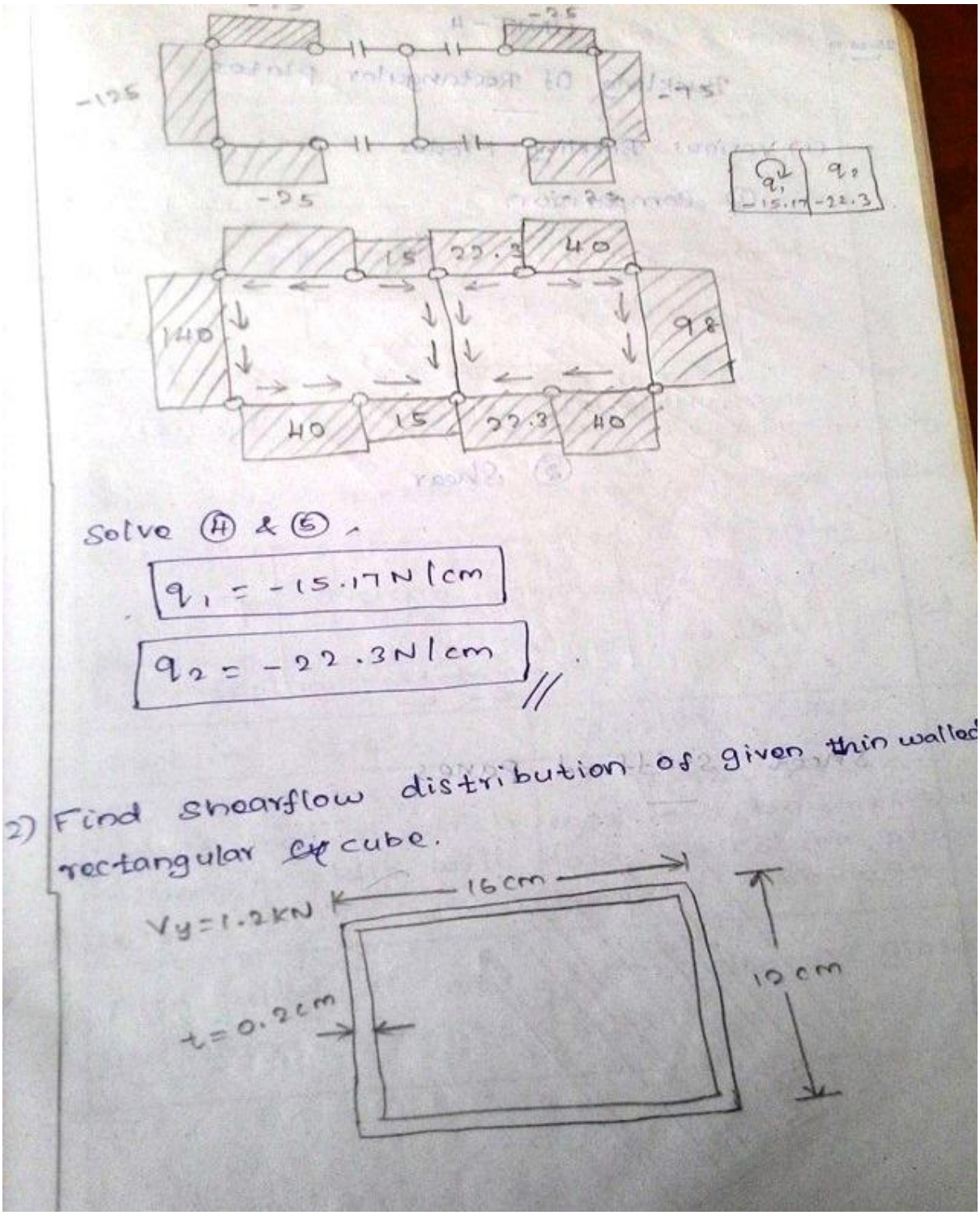
Assume $\theta_1 = \theta_2 = \theta$

$\therefore$ (2) = (3)

$$\Rightarrow 933.3q_1 - 933.3q_2 = 6666.7$$

$$q_1 - q_2 = 7.14 \quad \text{——} (4)$$

$$q_1 + q_2 = -37.5 \quad \text{——} (1)$$



Solve (4) & (5).

$$q_1 = -15.17\ N/cm$$

$$q_2 = -22.3\ N/cm$$ //

2) Find shearflow distribution of given thin walled rectangular ~~cy~~ cube.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CLASS!