CMR INSTITUTE OF TECHNOLOGY

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Internal Assesment Test – 2

Sub: Analysis of Determinate structures				Code: 15CV42
Date: 08/05/2017	Duration: 90 mins	Max Marks: 50	Sem: 4th	Branch (sections): civil (A,B,)

Answer any Two question from PartA And one question from Part B

	Marks	OBE CO	OBE RBT

Part A

a) Calculate the reactions at the support of a Three hinged parabolic arch shown in Fig.1(a). [4] CO2 L3

b) Calculate the reactions at the support of a Three hinged parabolic arch shown in Fig.1(b).Also find the Maximum bending moment at the section where it occurs. [16] CO2 L3

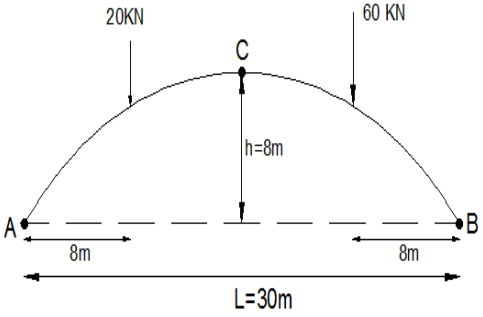


Fig.1(a)

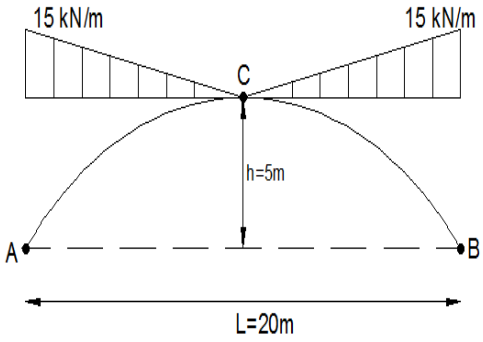


Fig.1(b)

a) Calculate the reactions at the support of a Three hinged parabolic arch shown in Fig.2(a). [4] CO2 L3

b) Calculate the reactions at the support of a Three hinged parabolic arch shown in Fig.2(b).Also find the Maximum bending moment at the section where it occurs. [16] CO2 L3

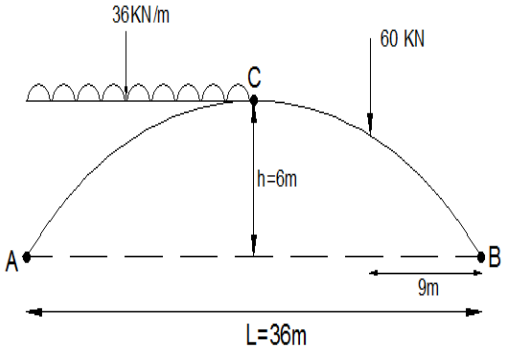


Fig.2(a)

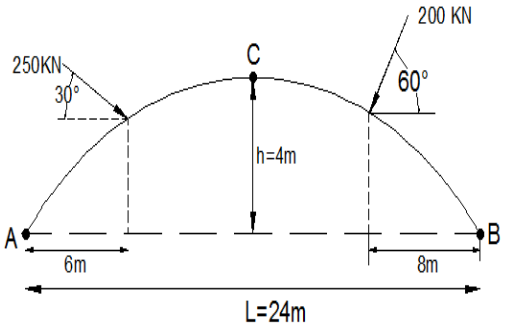


Fig.2(b)

	a) A three hinged parabolic arch of 20m symmetrical span and 5m rise, carries a UDL of 40 kN/m on the entire span and a point load of 200 kN at 5m from right end. Determine the reactions .Also determine Bending Moment , Normal thrust and Radial shear at 5m from left end.	[16]	CO3	L3
	b) A three hinged parabolic arch of 25 m symmetrical span and rise 5m , carries a UDL of 25 kN/m on the entire span. Find the reaction at supports.	[4]		

Part B

4	A suspension cable having supports at same level has a span of 40m and maximum dip of 4m. The cable is loaded with UDL of 10kN/m through its length. Calculate maximum and minimum tension in the cable.Also find length of the cable	[10]	CO3	L3
5	A Cable of span 20m and dip 5m carries a UDL of 20 kN/m over the whole span. Find Maximum tension in the cable , Minimum tension in the cable and Length of the cable	[10]	CO3	L3

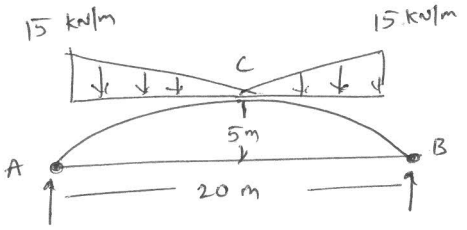
CI CCI HOD

Analysis determinate structures.

IAT – 2. [Solution

1)

b)



→ $V_a = V_b = \frac{1}{2} \times 10 \times 15 = 75$ KN

→ Taking moment about c, of the forces on the left forces of C

$$H \times 5 + 75 \times \frac{2}{3} \times 10 = 75 \times 10$$

$$\therefore H = 50 \text{ KN} \quad (4)$$

→ The eqn to the parabola with the crown C as origin

$$y = \frac{4h}{l^2} x^2 = \frac{4 \times 5}{20 \times 20} x^2$$

$$y = \frac{x^2}{20} \quad (4)$$

→ consider the equilibrium of the part c,

$$M_x = 50 \cdot \frac{x^2}{20} - \frac{1}{2} \times \frac{3x}{2} \cdot \frac{x}{3}$$

$$M_x = \frac{5}{2} x^2 - \frac{x^3}{4} \quad (4)$$

→ For B.M to be Max, $\frac{dM_x}{dx} = 0$

$$= 5x - \frac{3}{4} x^2 = 0$$

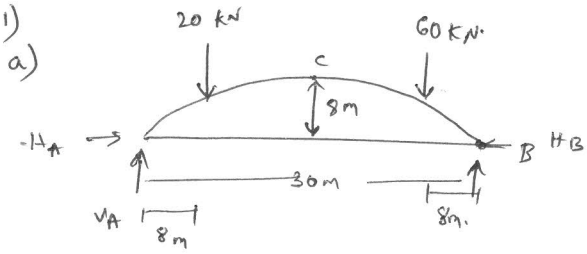
$$\therefore x = \frac{20}{3} \text{ m}$$

$$M_{max} = \frac{5}{2}\left(\frac{20}{3}\right)^2 - \frac{1}{4}\left(\frac{20}{3}\right)^3 \quad (4)$$

$$= 37.03 \text{ kN/m.}$$

1)

a)



$$V_A + V_B = 20 + 60$$

$$\Sigma M_A = 0, \quad V_B \times 30 = (60 \times 22) + 20(2)$$

$$V_B = 1360/30 = \underline{45.33 \text{ KN}} \qquad (2)$$

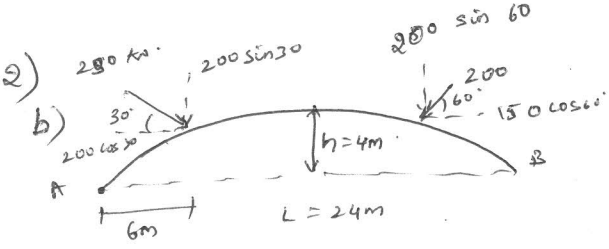
$$\Sigma M_c = 0,$$

$$+ V_B \times 15 + H_B \times 8 = 60 \times 7 = 420 \qquad (2)$$

$$\underline{H_B \times 8 = 46.8 \text{ kN}}$$

2)

b)



$$y = \frac{4hx}{L^2}(l - x)$$

$$= \frac{4 \times 4 \times 6}{(24)^2}(24 - 6)$$

@ D = 3m

@ E = 3.55 m

$$\Sigma M_A = 0$$

$$V_B \times 24 + 200 \cos 60 \times 3.55 - 200 \sin 60 \times 16 - 250 \sin 30 \times 6 - 150 \cos 30 \times 3 = 0$$

$$V_B = \frac{355}{24} - 2771.2 - 750 - 649$$

$$\boxed{V_B = 158.9 \text{ KN}} \qquad (4)$$

$$\boxed{V_A = 139.2 \text{ KN}} \qquad (4)$$

$\Sigma H = 0$

$= V_B(12) - H \times 4 - 200 \sin 60 (4) - 200 \cos 60 (0.44)$

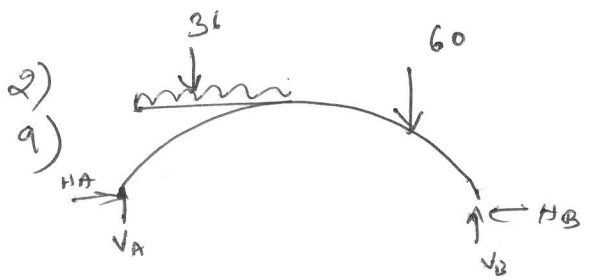
$\boxed{H = 292.54 \text{ KN}}$ (4)

B.M $M_D = -176.15 \times 3 + 139.2 \times 6$

$= 307.05 \text{ KN-m}$

$M_E = -292.6 \times 3.56 + 158.95 \times 8$ (4)

$= 229.766 \text{ KN-m}$



$V_A + V_B = 60 + (36 \times 18)$

$= 708$

$\Sigma M_B = 0$

$V_A \times 36 - 60 \times 9 - 36 \times 18 \times 27 = 0$

$V_A = 501 \text{ KN}$ (2)

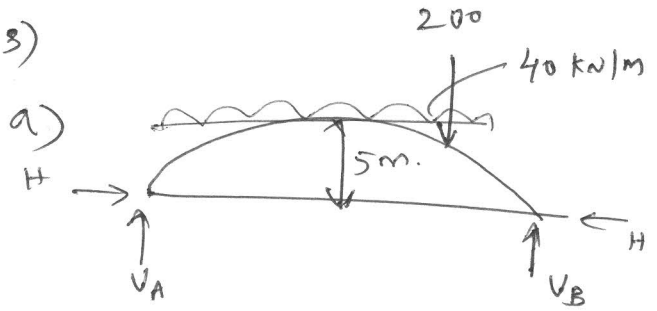
$V_B = 207 \text{ KN}$

Taking moment about C

$\boxed{H = 531 \text{ KN}}$ (2)

3)

a)



→ $\Sigma M_A = 0$

$20 V_B = (40 \times 20 \times 10) + (200 \times 15)$

$= 550$ kN

(4)

→ $\Sigma V = 0$

$V_A + V_B = 200 + (40 \times 20)$

$= 450$ kN

→ $\Sigma M_C = 0$ (7)

$5H = 5500 - 1000 - 2000$

$\therefore H = 500$ kN

→ $\tan\theta = 0.5$

$\therefore \theta = 26.56$ (4)

→ B.M @ D

$\Sigma M_D = -V_A \times 5 + H(3.75) + 40 \times 5 \times 5/2$

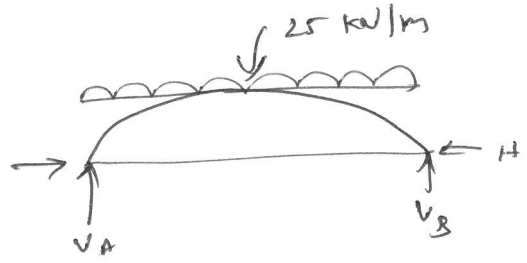
$= 125$ kN/m

$N = 178.5$ kN

$F = 469.5$ kN (4)

(3)

3b)



$\rightarrow \quad \Sigma M_A = 0 = -V_B(25) + 25 \times \frac{25^2}{2}$

$\therefore V_B = \frac{25 \times 25}{2} = 312.5\ kN$

$\rightarrow \quad \Sigma V = 0$

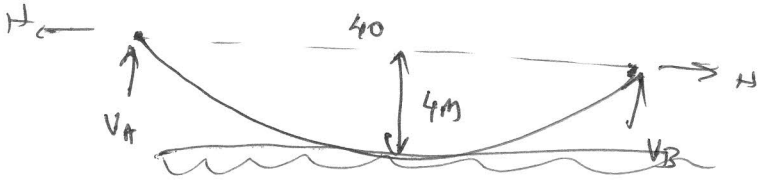
$V_A + V_B = 25 \times 25$ (2)

$= 312.5\ kN$

$\rightarrow \quad \Sigma M_C = V_B(12.5) - H(5) - 25 \times \frac{25}{2} \times \frac{25}{4}$

$\therefore H = 390.6\ kN.$ (2)

4)



$\Sigma M_A = 0,$

$V_B \times 40 - 10 \times 40 \times \frac{40}{2} = 0$

$\therefore V_B = 200kN$

$\therefore V_A = 200kN.$ $\quad \therefore V_A = V_B = \frac{WL}{2}$ (4)

$\Sigma M_C = 0,$

$V_B \times 20 - H_B \times 4 - 10 \times 20 \times \frac{20}{2} = 0$

$\therefore H = \frac{WL^2}{8h} = 500kN$ (2)

→ Max tension, $T_{max} = \sqrt{V^2 + H^2} = \sqrt{200^2 + 500^2}$ (2)

$= 538.1$ kN.

→ Length of cable, $L_c = L + \frac{8h^2}{3l} = \underline{41.06 \text{ m}}$ (2)

5A)

$\Sigma M_A = 0$,

$V_B \times 20 - 20 \times 20 \times \frac{20}{2} = 0$

$\underline{V_B = 200 \text{ kN}}$ (2)

$V_A + V_B = 20 \times 20$

$\therefore \underline{V_A = V_B = 200 \text{ kN}}$ (2)

(b) horizontal reaction.

$\Sigma M_C = 0$.

$V_B \times 10 - H_B \times 4 - 20 \times 10 \times \frac{10}{2} = 0$

$H = \frac{WL^2}{8h} = \underline{250 \text{ kN}}$ (2)

(c) $T_{max} = \sqrt{V^2 + H^2} = \sqrt{200^2 + 250^2} = 320.15$ kN.

$T_{min} = \sqrt{H^2} = \underline{250 \text{ kN}}$. (2)

$L_c = \frac{L + 8h^2}{3l} = \underline{22.13 \text{ m}}$ (2)