University of Technology
Building and Construction Eng. Dept.
FINAL Exam –2014/2015

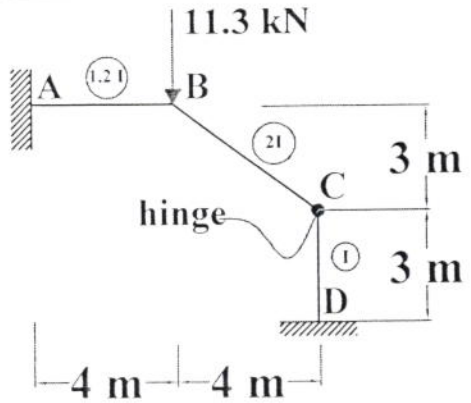
Subject :Theory of Structures — Class: 3rd year
Branch : Highway & Bridges Eng. — Time : 3.0 Hours
Examiner : Dr. Qays Abdul-Majeed — Date : 31/05/2015

ANSWER 4 QUESTIONS ONLY | **ALL QUESTIONS EI=10^4 kN.m^2 : AE=10^4 kN**

Q 1 :- For the structure shown in the figure :

a) Check the stability and determinacy.

b) By using Moment Distribution Method find all Reactions .



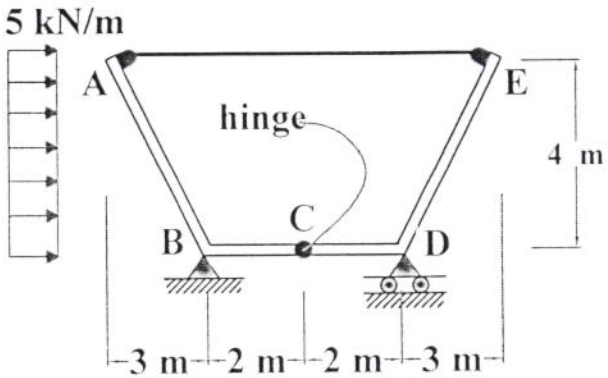
25 °

Q 2A :-For the Composed Structure shown in the figure :

a) Check the stability and determinacy.

b) Find force in member $\overline{AE}$.

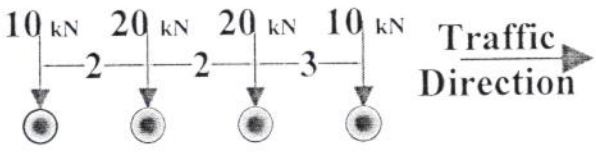
c) Draw axial , shear and bending moment for member $\overline{AB}$.

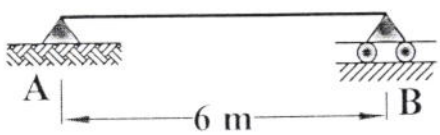


15 °

Q 2B :-For the simply supported beam shown in the figure :

a) Find absolute maximum moment due to moving load shown.





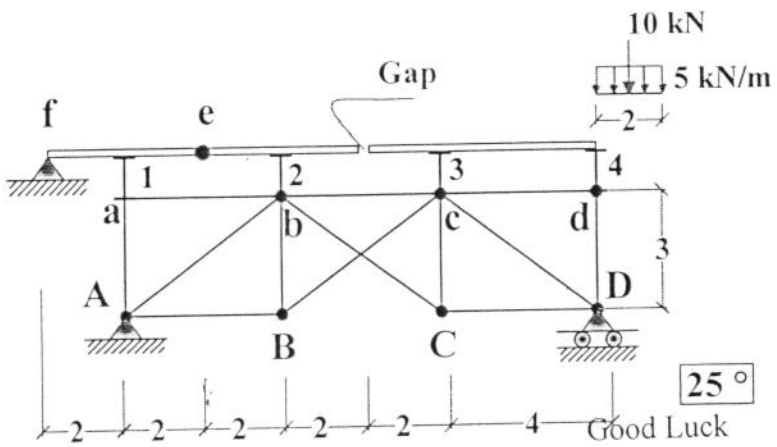
10 °

Q 3 :- For the Truss shown in the figure :

a) Write the type of truss.

b) Find maximum Reaction @ 1 due to moving load shown uniform load of 5 kN/m of 2m long and a concentrated load of 10 kN .

c) Draw influence line for reaction @ "A" and member $\overline{bc}$.



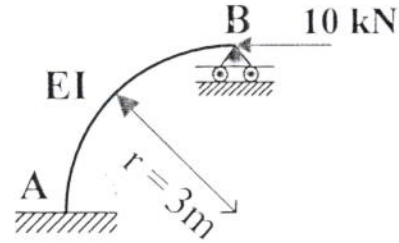
25 °

Good Luck

Q 4A :-

By using the Consistent deformation Method Find the vertical reaction @ B due to the applied load For the structure shown .

knowing that : $EI=10^4$ kN.m^2

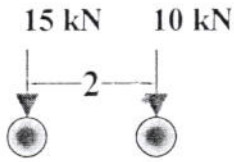


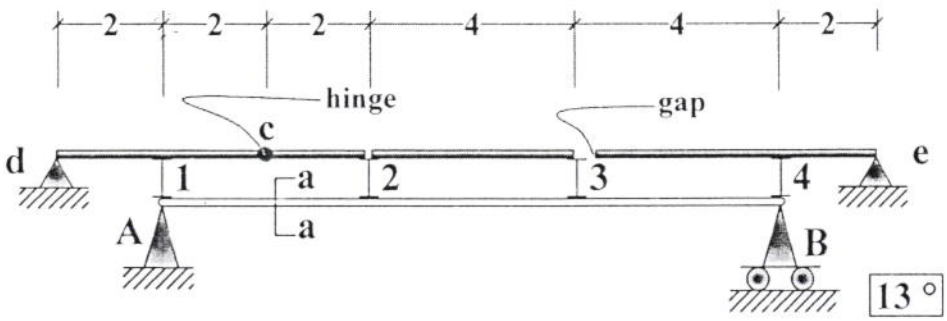
12 °

Q 4B :-For the structure shown :

a) Find maximum Reaction @ 1 due to moving load shown.

b) Draw influence line for Moment @ "section a-a" .





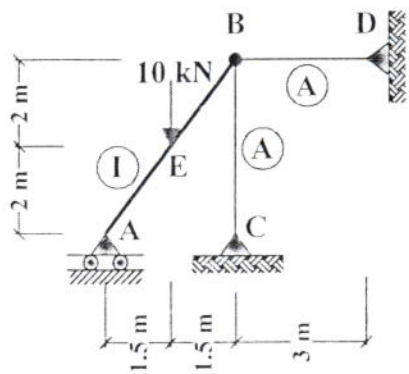
13 °

Q 5A :-For the structure shown :

a) Find the vertical deflection at point "E" due to load shown .

knowing that :

$EI=10^4$ kN.m^2 $AE=10^4$ kN.



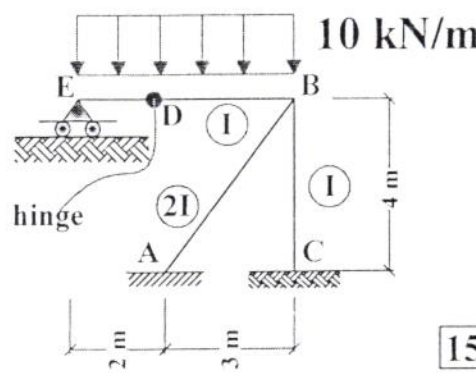
10 °

Q 5B :-For the structure shown in the figure :

a) State the stability and determinacy.

b) By using Slope Deflection Method find Moment @ "A".

c) Find vertical reaction @ "C".



15 °

$\sin^2 O = (1-\cos 2O)/2$: $\cos^2 O = (1+\cos 2O)/2$

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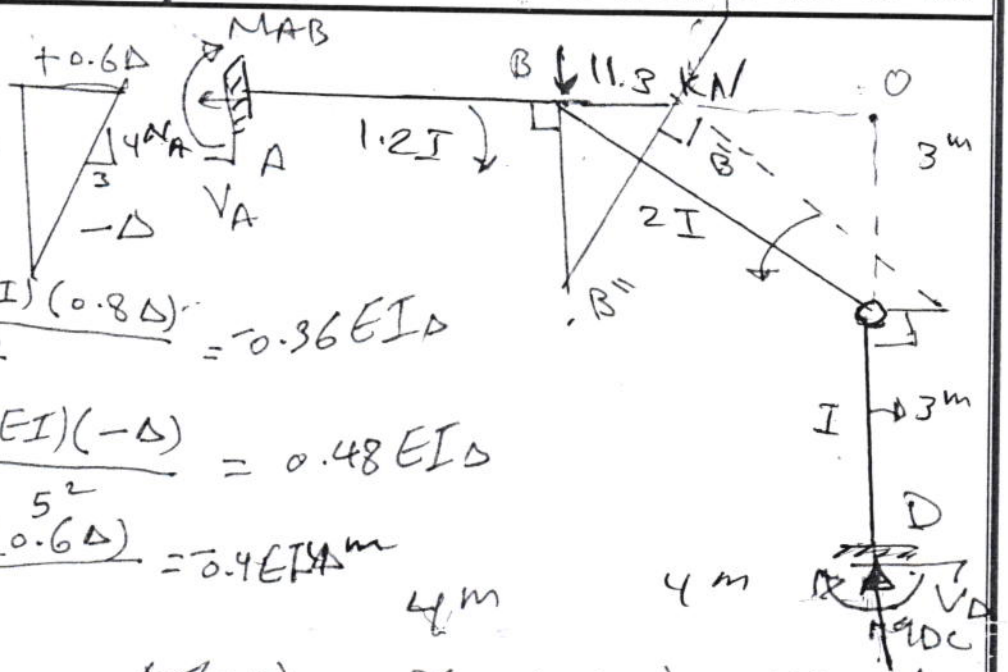
Q-1

$\Delta AB = 0.8\Delta$
$\Delta BC = -\Delta$
$\Delta CD = 0.6\Delta$



$M_{AB})_F = \frac{-6(1.2EI)(0.8\Delta)}{4^2} = -0.36EI\Delta$

$M_{BC})_F = \frac{-6(2EI)(-\Delta)}{5^2} = 0.48EI\Delta$

$M_{CD})_F = \frac{-6(EI)(0.6\Delta)}{3^2} = -0.4EI\Delta$ kN.m

Let $EI\Delta = 100$ $\quad M_{AB})_F = -36$, $M_{BC})_F = 48$, $M_{CD})_F = -40$

JB

			D.F
BA	$\frac{4(1.2EI)}{4}$	$= 1.2EI$	0.5
BC	$\frac{3(2EI)}{5}$	$= 1.2EI$	0.5
		$2.4EI$	

shear eq.

$\Sigma M_D = 0$ (+)

$11.3(4) + V_A(8) + V_D(6) - M_{AB} - M_{DC} = 0$

$V_A = \frac{M_{AB}+M_{BA}}{4}$, $V_D = \frac{M_{DC}}{3}$

$V_A = \frac{-63k}{4}$, $V_D = \frac{-20k}{3}$

نعوض في معادلة الاتزان

$45.2 - 126k - 40k + 33k + 20k = 0$

$k = 0.4$

$\therefore V_A = \frac{-63(0.4)}{4} = -6.3$, $V_D = \frac{-20(0.4)}{3} = -8/3$

final answer

$N_A = V_D = -8/3$ kN

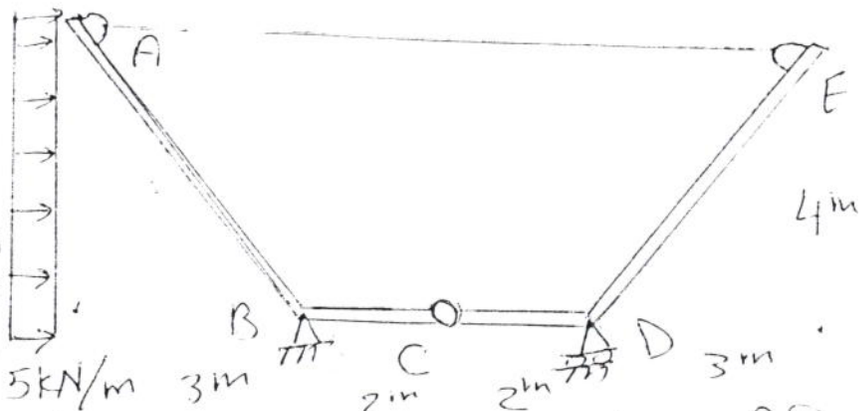
$N_D = V_A + 11.3 = -6.3 + 11.3 = 5$ kN

Joint	A	B		C ℓ	C R	D
mem.	AB	BA	BC	CB	CD	DC
D.F	0	0.5	0.5	1	1	0
F.EM	-36	-36	48	48	-40	-40
D.M	0	-6	-6	-48	40	0
C.O.M	-3	0	-24			20
D.M	0	12	12			0
C.O.M	6	—				
D.M	0					
ΣM	-33	-30	36	0	0	-20
Final M	-33k -13.2	-30k -12	36k 12			-20k 8

Good Luck

Q2 A

15 For the structure shown:



(1) discuss the stability for composed structure

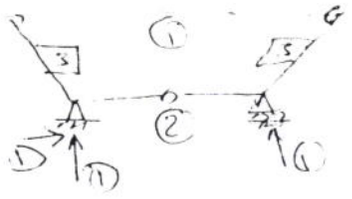
(2) find force in mem. AE

(3) Draw axial, shear & bending moment for member AB.

(1) $U = 1+1+1+1+2 = 6$

$S = 3+3 = 6$ $\quad U = E$

stable & det.



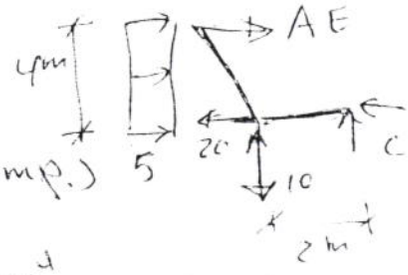
(2) $\Sigma M_B = 0 \quad 5(4)(2) - R_D(4) = 0$

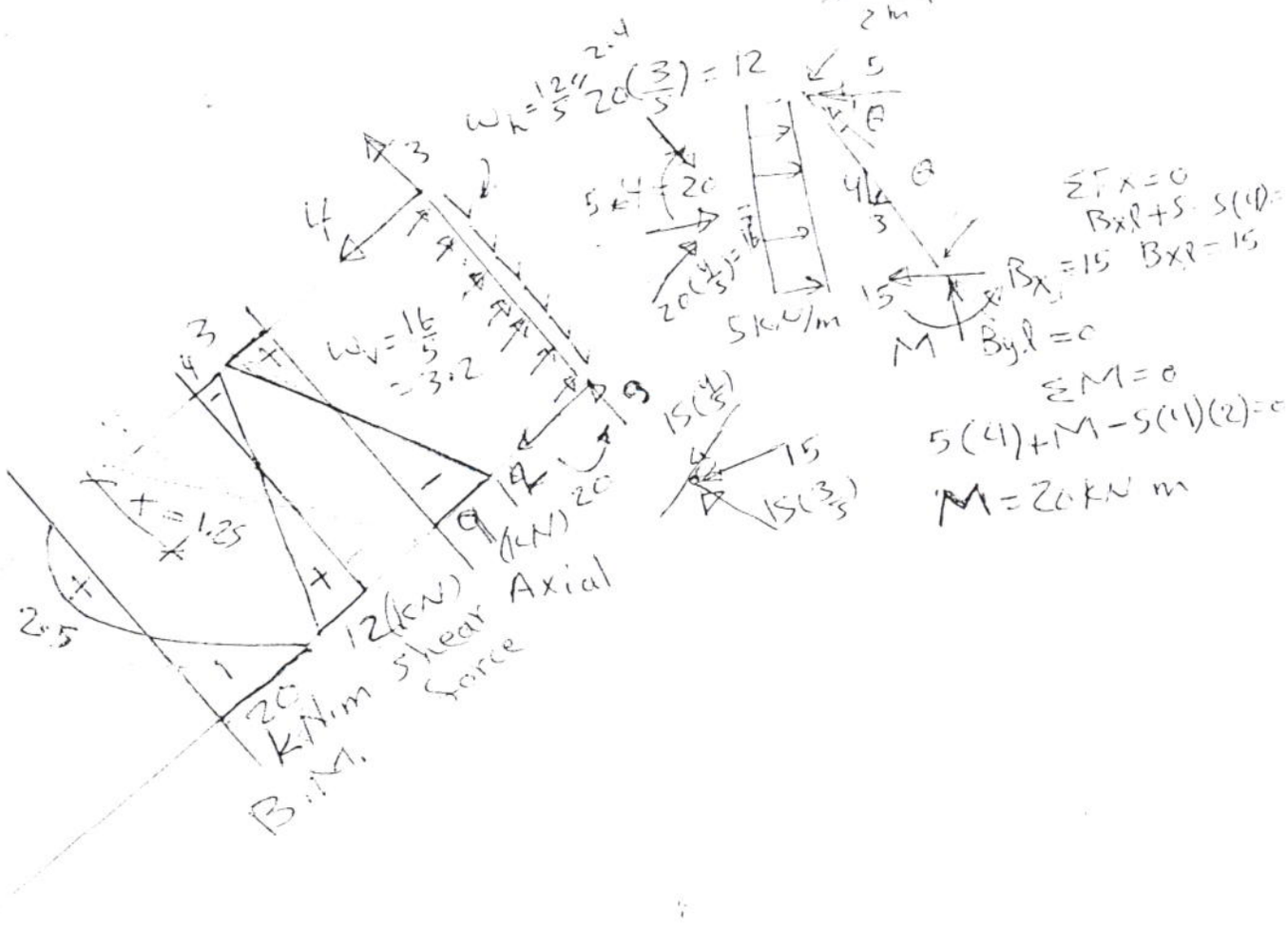
$R_D = 10 \quad \therefore B_y = 10 \downarrow \quad \Sigma F_y = 0$

$\Sigma M_C = 0$

$AE(4) + 5(4)(2) - 10(2) = 0$

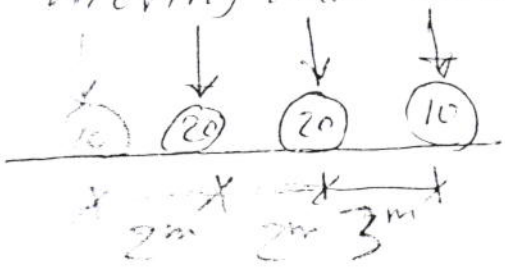
$AE = -5 = 5\,kN$ (comp.)

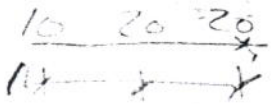




Q2B / find absolute maximum moment, due to moving load shown for the beam 6m length

(10°)



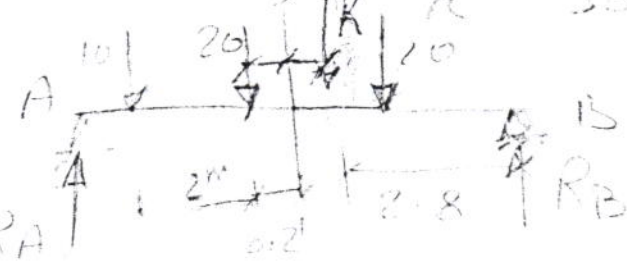


$R = 50\,kN$

$M_A = 10(4) + 20(2) = 80$

$\bar{x} = \frac{M_A}{R} = \frac{80}{50} = 1.6^m$

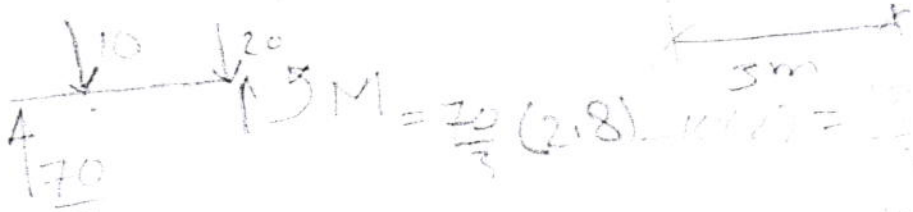
$\therefore x = 0.4^m$



$\sum M_B = 0$

$50(2.8) - R_A(6) = 0$

$R_A = \frac{70}{3}\,kN$ $R_B = R_A$



$\sum M = \frac{70}{3}(2.8)$