University of Technology
Building and Construction Eng. Dept.
FINAL Exam –2015/2016

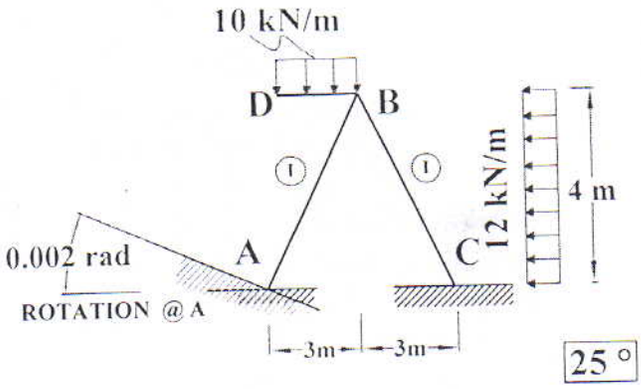
Subject :Theory of Structures
Branch : Highway & Bridges Eng.
Examiner : Dr. Qays Abdul-Majeed

Class: 3rd year
Time : 3.0 Hours
Date : 29 /05/2016

ANSWER 4 QUESTIONS ONLY

Q 1 :-For the Frame shown :

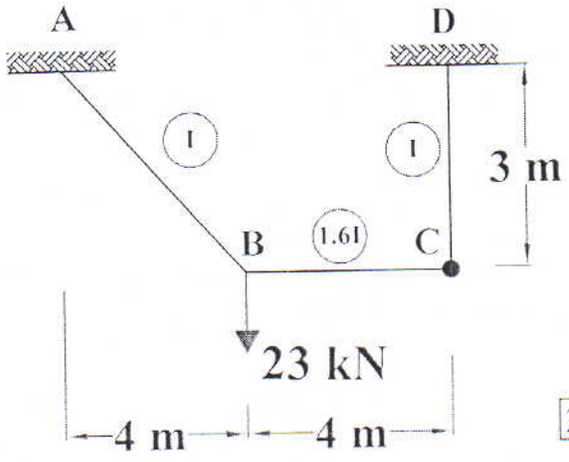
a) Discuss the stability and determinacy.
b) Use Slope-Deflection Method to find end moments.
c) Draw the bending moment diagrame for member AB .
known that EI = 10^4 kN.m²



25 °

Q 2 :-For the structure shown :

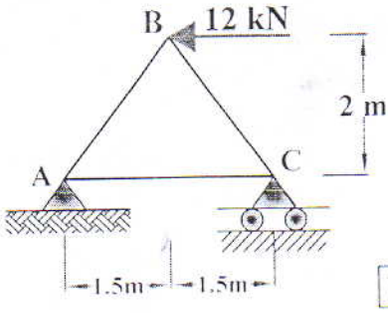
a) Check the stability and determinacy.
b) By using Moment Distribution Method find end moments.
c) find Axial force in member $\overline{CD}$.
known that EI = 10^4 kN.m²



25 °

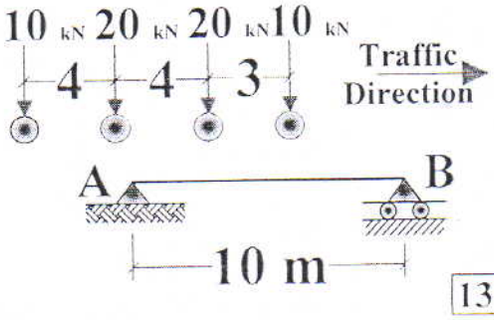
Q3 :

a. Find the horizontal deflection at B "ΔBh" due to a horizontal force "12 kN" shown in the figure.
known that AE = 10^4 kN.



12 °

b. Find absolute maximum moment for a simply supported beam of length of "10 m" due to moving load shown .



13 °

Q 4 :- For the structure shown :

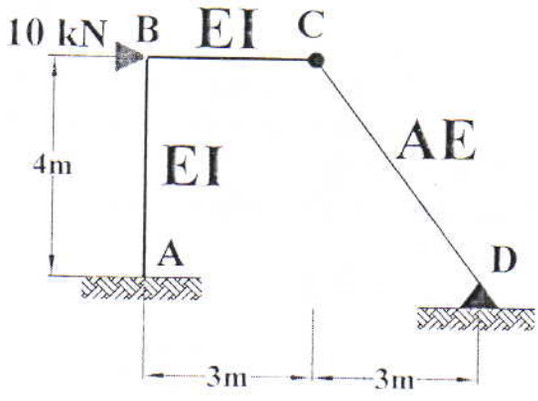
a) Check the stability and determinacy.

b) By using Consistant Deformation Method find the force in link $\overline{CD}$.

c) Draw the Axial & Shear force Diagram for member $\overline{BC}$.

known that EI = 10^4 kN.m² for AB & BC

AE=10^4 kN. for CD.

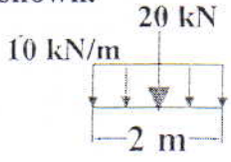


25 °

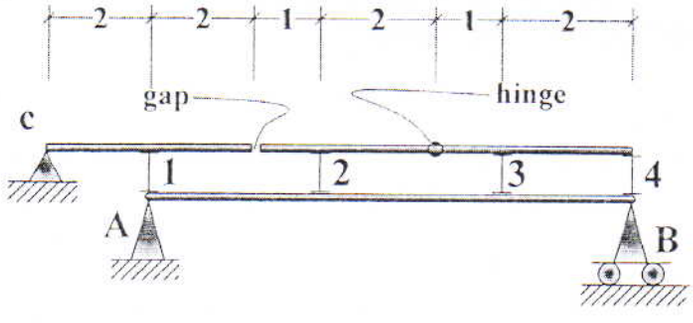
Q 5 :-

a) For the structure shown :

1- Find maximum Reaction @ 3 due to moving load shown.

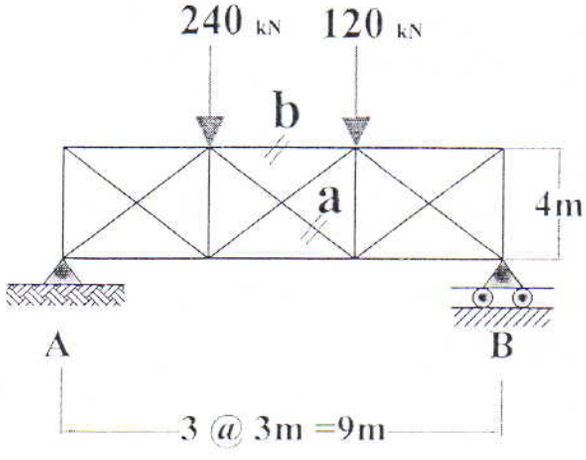


2- Draw influence line for Shear between 2&3 .



15 °

b) By using the Approximate Analysis find the forces in members (a & b).



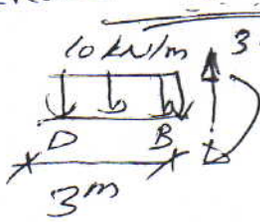
10 °

Q1 الحل معادلة الانشاءات

a) Stable & Indet. to 3rd deg.

b) $\Sigma M_B = 0$

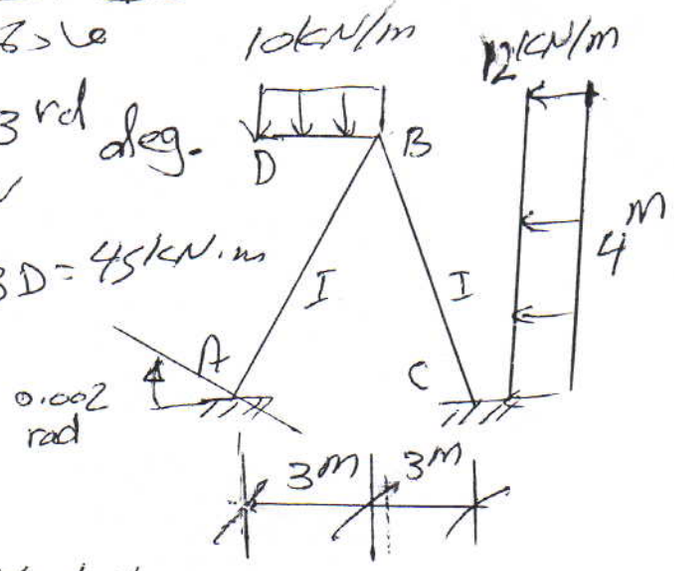
$M_{BD} = 10(3)(1.5) = 45$ kN.m



$M_{BD} = 45$ kN.m

$\Sigma F_y = 0$

$V_B = 10(3) = 30$ kN



$M_{AB})_F = \frac{4(10^4)(0.002)}{5} = 16$ kN.m

$M_{BA})_F = \frac{2(10^4)(0.002)}{5} = 8$ kN.m

$M_{BC})_F = -\frac{12(4)^2}{12} = -16$ kN.m

$M_{CB})_F = \frac{12(4)^2}{12} = 16$ kN.m

(انثنه البعد الهوائي فقط العمودي للعنلم لأن الاحمال افقية)

Krel	AB	BC
$\frac{I}{L}$	$\frac{1}{5}$	$\frac{1}{5}$
K_{rel}	1	1

معادلة التوازن حول العقدة B

$M_{AB} = 16 + 1(0 + \theta_B) = 16 + \theta_B$

$M_{BA} = 8 + 1(2\theta_B + 0) = 8 + 2\theta_B$

$M_{BC} = -16 + (2\theta_B + 0) = -16 + 2\theta_B$

$M_{CB} = 16 + (0 + \theta_B) = 16 + \theta_B$

$\Sigma M_{JointB} = M_{ext} = 0$

$M_{BA} + M_{BC} + M_{BD} = 0 \Rightarrow 8 + 2\theta_B - 16 + 2\theta_B + 45 = 0$

$\therefore 4\theta_B = -37 \Rightarrow \theta_B = -9.25$ (relative rotation)

$\therefore M_{AB} = 6.75$ kN.m, $M_{BA} = -10.5$ kN.m

$M_{BC} = -34.5$, $M_{CB} = 6.75$ kN.m

(2-8.

① $V_A = V_B$ لعدم وجود ABJ الحمل

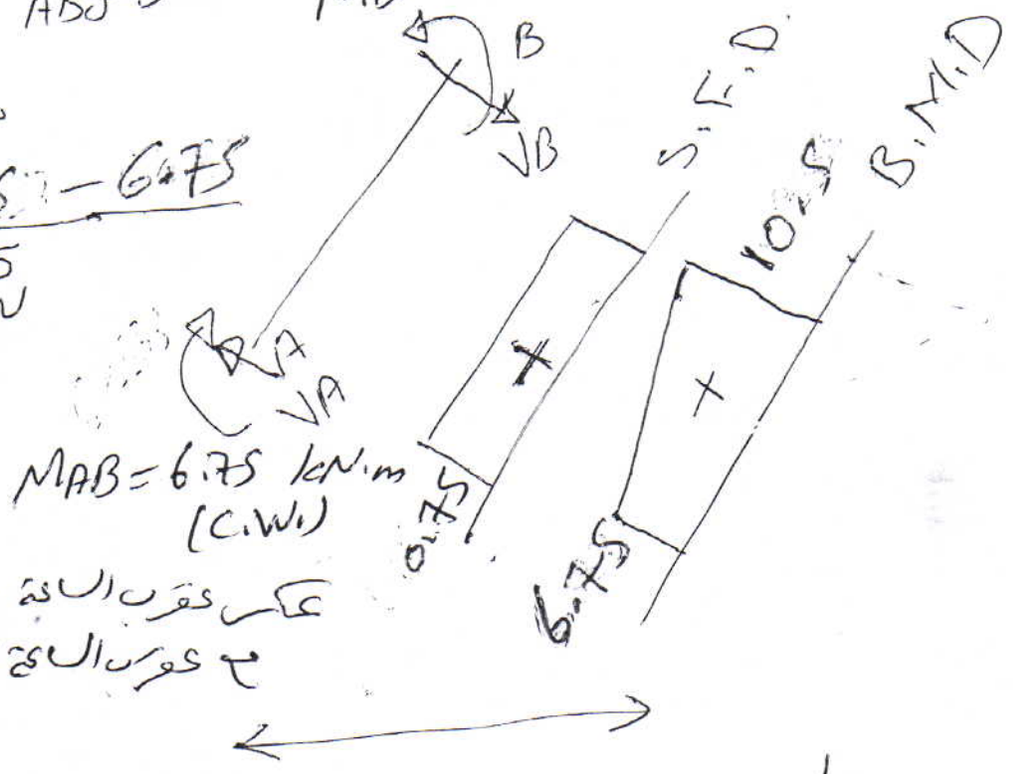
② $\Sigma M_B = 0$

$V_A = \frac{10.5 - 6.75}{5}$

$= 0.75 kN$

$M_{BA} = 10.5 kN.m$ C.C.W

$M_{AB} = 6.75 kN.m$ (C.W.)

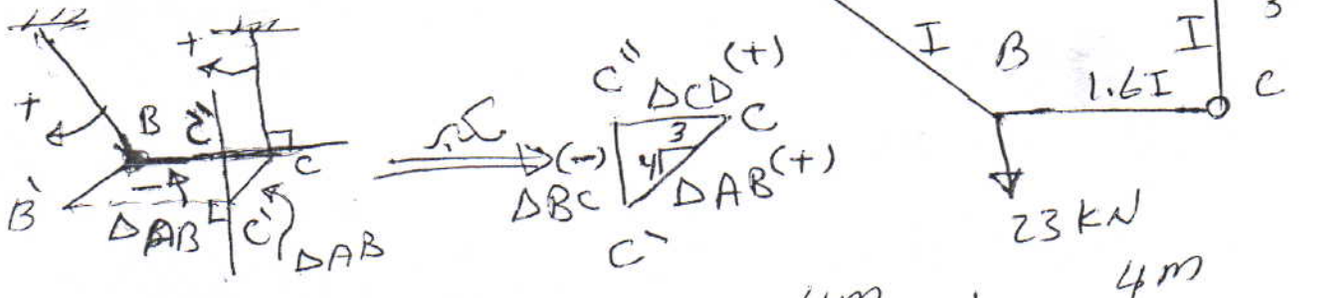


* C.C.W عكس عقرب الساعة
* C.W مع عقرب الساعة

Q1 على

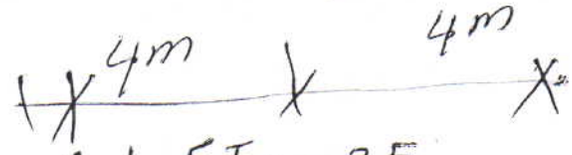
Q2 a) stable & Indet. to 2nd deg.

b) The structure has no external moment of loading cause moment. so $M_1 = 0$
but for sway case M_2 must be calculated



let $\Delta AB = +\Delta$ ∴ $\Delta BC = -0.8\Delta$

$\Delta CD = +0.6\Delta$



let $EI\Delta = 25$

$M_{AB})_F = M_{BA})_F = \frac{-6EI\Delta}{5^2} = \frac{-6}{25} EI\Delta = -6$

$M_{BC})_F = M_{CB})_F = \frac{-6(1.6EI)(-0.8\Delta)}{4^2} = 0.48 EI\Delta = 12$

$M_{CD})_F = M_{DC})_F = \frac{-6(EI)(0.6\Delta)}{3^2} = -0.4EI\Delta = -10$

حلول اسئلة الواجبات المرحلة الثالثة مركة المرونة والجواز

(3-8)

تكملة Q_2

في الصفحة السابقة تم حساب العزوم عند ازالة الاسناد B وتم فرضها $EI\Delta = 2$ (أراد تم ام) وكانت نتائج العزوم كما موضحة في الصفحة السابقة الان نحسب معامل التوزيع للعقد B

	BA	BC	Σk
k	$\frac{4(EI)}{5} = 0.8EI$	$\frac{3(1.6EI)}{4} = 1.2EI$	$2EI$
$D.F = \frac{k}{\Sigma k}$	$\frac{0.8EI}{2EI} = 0.4$	$\frac{1.2EI}{2EI} = 0.6$	

معامل التوزيع

Joint	A	B		C_L	C_R	D
Member	AB	BA	BC	CB	CD	DC
D.F.	0	0.4	0.6	1	1	0
F.E.M	-6	-6	12	12	-10	-10
D.M	0	-2.4	-3.6	-12	10	0
C.O.M	-1.2	0	-6		0	5
D.M	0	+2.4	+3.6			0
C.O.M	1.2	0	0			—
D.M	0	0	0			—
ΣM_2	-6	-6	6	0	0	-5
	-6k	-6k	6k			-5k

Mutal

(3-8)