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POLITEKNIK
Jabatan Pengajian Politeknik

EXAMINATION AND EVALUATION DIVISION

DEPARTMENT OF POLYTECHNIC EDUCATION

(MINISTRY OF HIGHER EDUCATION)

CIVIL ENGINEERING DEPARTMENT

FINAL EXAMINATION

JUNE 2012 SESSION

CC505: STRUCTURAL ANALYSIS 1

DATE : 18 NOVEMBER 2012(SUNDAY)

DURATION : 2 HOURS (11.15 AM - 1.15 PM)

This paper consists of EIGHT (8) pages including the front page.

Section B: Structured (2 questions – answer all)

Section C: Essay (4 questions – answer 2 questions)

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DO NOT OPEN THIS QUESTION PAPER UNTIL INSTRUCTED BY THE CHIEF INVIGILATOR

(The CLO stated is for reference only)

SECTION A (50 marks)

Instruction: This section consists of **TWO (2)** structured questions. Answer **ALL** the questions.

QUESTION 1

For the portal frame in **Figure 1** below, use the **Slope Deflection Method** to;

[CLO1,C3]

i.	calculate the fixed end moment	(6 marks)
ii.	write down the Slope Deflection Equation	(6 marks)
iii.	determine the end moment at all the supports	(10 marks)
iv.	sketch the bending moment diagram	(3 marks)

Given that EI value is constant.

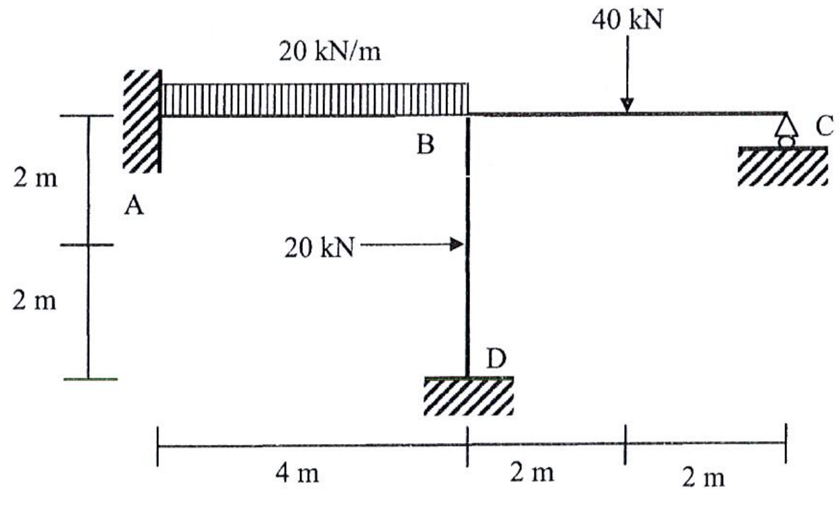


Figure 1

QUESTION 2

Figure 2 shows 20 kN and 15kN of point load acting at span AB and 10kN/m uniform distributed load acting along span BC. Assuming EI is constant and by using **Moment Distribution Method** ; [CLO1,C3]

a) determine the stiffness values and distribution factors (4 marks)

b) calculate the fixed end moment for each member (4 marks)

c) calculate the end moment at all the supports (8 marks)

d) determine reaction forces at the supports (4 marks)

e) draw shear force and bending moment diagram (5 marks)

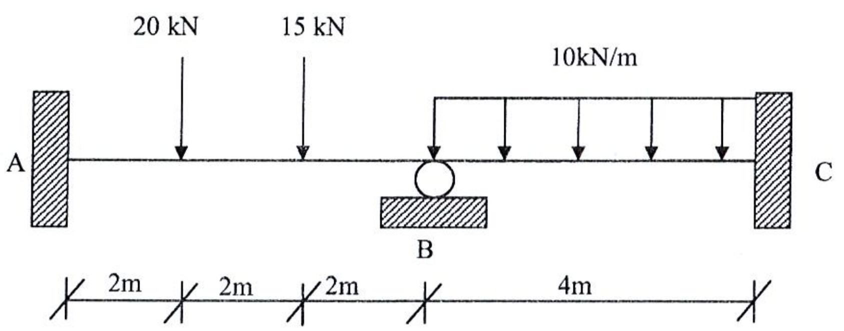


Figure 2

SECTION B (50 marks)

Instruction: This section consists of **FOUR (4)** structured questions. Answer **TWO (2)** questions.

QUESTION 1

(a) Prove that the beam in **Figure 3** is a statically indeterminate beam and state its degree of indeterminancy. [CLO1,C2]
(2 marks)

(b) **Superposition method** is a method that has been modified from the method of Macaulay Method to solve the case of the statically indeterminate beams. By using this method ; [CLO1,C3]

i. write down the compatibility equation (4 marks)
ii. determine the reaction at the supports (12 marks)
i. calculate the moment at B (2 marks)
ii. draw the shear force diagram (2 marks)
iii. draw the bending moment diagram (3 marks)

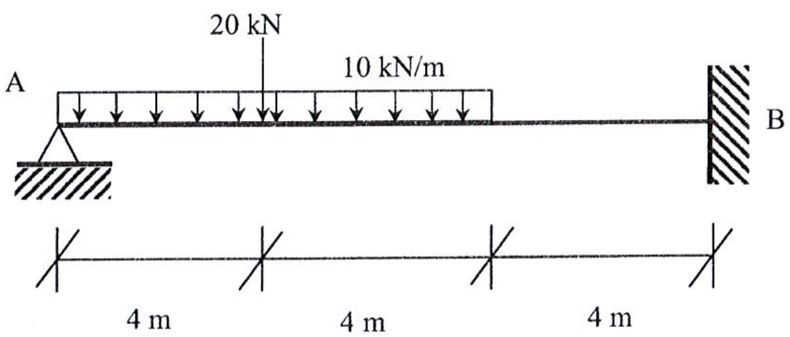


Figure 3

QUESTION 2

Analyze the beam in **Figure 4** and by using **Slope Deflection Method**; [CLO1,C3]

i.	calculate the fixed end moment	(7 marks)
ii.	write down the slope deflection equation and find θ value	(8 marks)
iii.	calculate the end moment at all the supports	(2 marks)
iv.	calculate the reaction forces at the supports	(2 marks)
v.	draw shear force and bending moment diagram	(6 marks)

Given that EI value is constant.

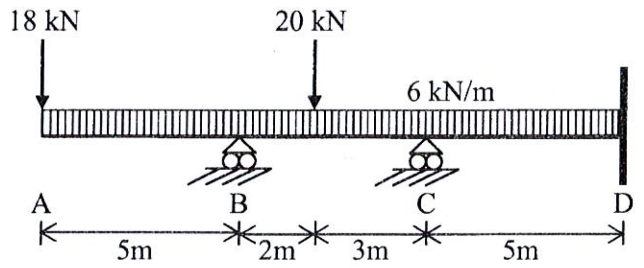


Figure 4

QUESTION 3

Figure 5 shows a portal frame with the second moment of area, I for the span AB = 2I, BC = 2I and CD = 1.5I. By using the **Moment Distribution Method**, determine:-

[CLO1,C3]

a) value of each Fixed End Moment of span. (5 marks)

b) the value of stiffness factor and distribution factor. (6 marks)

c) the internal moments at point A, B and D (do the calculations only up to 4 times of the balancing). (14 marks)

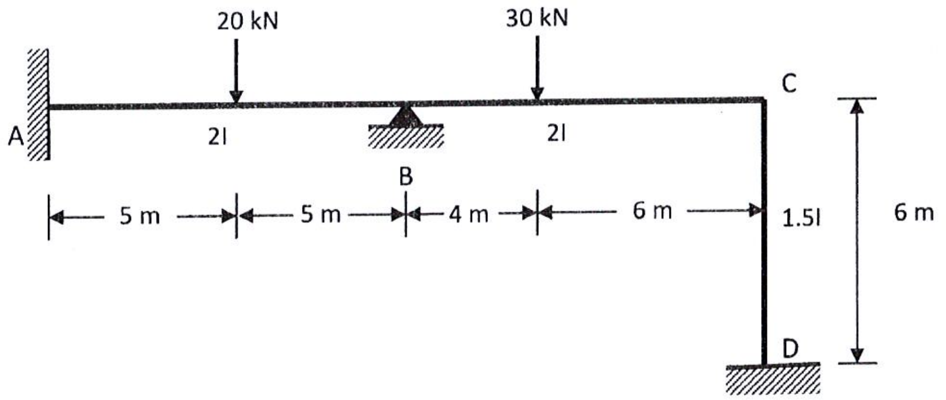


Figure 5

QUESTION 4

Figure 6 shown the sway portal frame ABCD. The moment distribution with sidesway is shown in Table 1 . Use **Moment Distribution Method** determine :

[CLO1,C3]

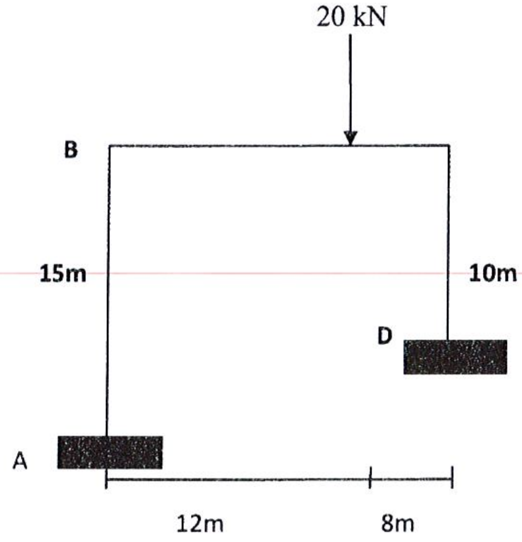


Figure 6

(a) The end moments for non-sidesway case (8 marks)

(b) The preventing force, P (6 marks)

(c) The sway force, S (6 marks)

(d) The correction factor, and (1 mark)

(e) End moment for all members (4 marks)

Table 1 : End moments with sidesway

JOINT	A		B		C	D
MEMBER	AB	BA	BC	CB	CD	DC
DF	0	4/7	3/7	1/3	2/3	0
END MOMENT	+14.11	+28.21	-28.21	+45.55	-45.55	-22.63

1. Slope Deflection Method

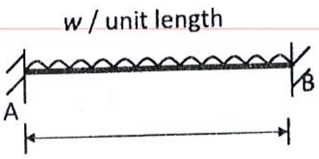
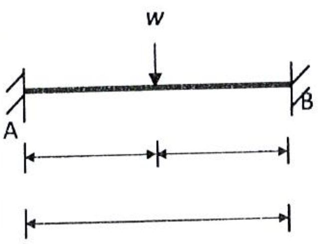
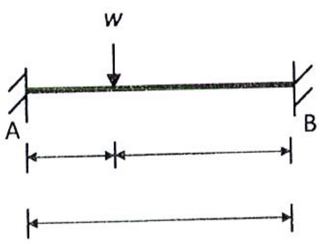
$$M_{AB} = 2EI/L\,(2\theta_A + \theta_B - 3\delta/L) + FEM_{AB}$$

$$M_{BA} = 2EI/L\,(2\theta_B + \theta_A - 3\delta/L) + FEM_{BA}$$

2. Moment Distribution Method

$$SettlementMoment = \frac{6EI\Delta}{L^2} \quad @ \quad \frac{3EI\Delta}{L^2}$$

Table 1 : Fixed End Moment (FEM)

$FEM_{AB} = \frac{-wL^2}{12}$		$FEM_{BA} = \frac{+wL^2}{12}$
$FEM_{AB} = \frac{-wL}{8}$		$FEM_{BA} = \frac{+wL}{8}$
$FEM_{AB} = \frac{-Wab^2}{L^2}$		$FEM_{BA} = \frac{+Wa^2b}{L^2}$