College of Engineering

Final Examination
Department of Civil Engineering
Second Semester 1441 (2019/2020)
CE 360 Structural Analysis-1
Section #: 66359, 47362 & 34897

Date of Exam: 10.9.1441 H (03.05.2020 G)
Time: 9:00 – 11:45 AM
Open-Book
Attempt all Questions
Time Allowed: 2 Hours, and 45 Minutes
Instructor(s): Dr. Yousef, Dr. Shehab & Dr. Yassir

Student Name	
Student ID#	
Final Exam Mark (20)	
Course Work Mark (80)	
Total (100)	
Grade	

Course Learning Outcomes (CLO)	
CLO1	Determine magnitude of different types of loads using the relevant Codes.
CLO2	Identify the determinacy, stability of structures and different types of floor systems.
CLO3	Determine the internal forces in determinate beams and frames using classical and computer-based methods.
CLO4	Calculate displacements of determinate structures by energy methods.
CLO5	Analyze the determinate structures for moving loads by using influence lines.
CLO6	Determine the internal forces in indeterminate structures using classical and computer-based methods.

Question #	**Full Mark Out of 100**	**Students Mark**
1	**40**	
2	**40**	
3	**20**	
Mark	**100**	
Mark out of 20 =		

Student name		Marks obtained for Q. #1	
Student number			

Question 1: (40%) CLO6: 100%

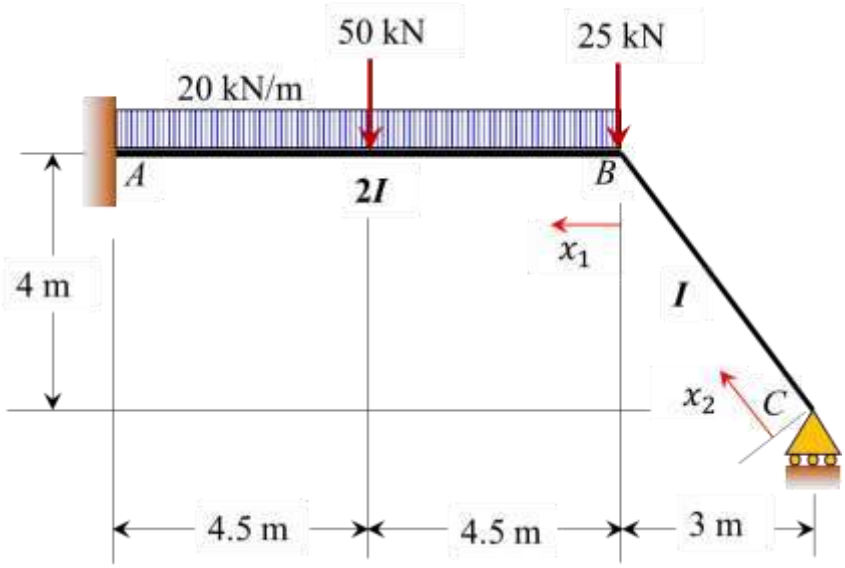
The shown loaded rigid-jointed frame with variable moment of inertia is supported by a fixed support at ***A***, and roller support at ***C***. Use the **Force Method** to:

a. Determine the vertical reaction at the roller support ***C***.

b. Determine the reactions at the fixed support ***A***.

c. Draw the *normal force*, *shear force*, and *bending moment diagrams* for the entire frame.

Notes. i) Use the given **coordinate systems**, ii) Show your calculations and all **critical values** in diagrams including the **maximum positive moment** in span ***AB***.



Solution:

Student name		**Marks obtained for Q. #1**	
Student number			

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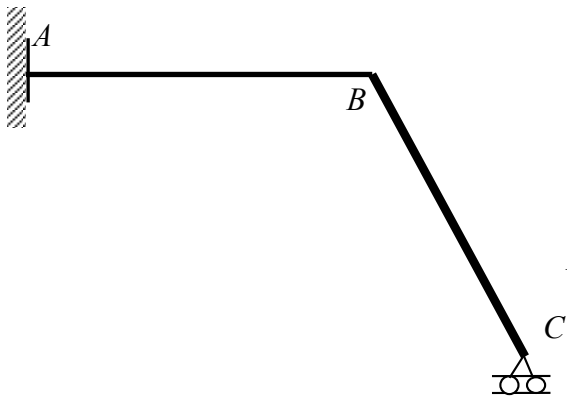
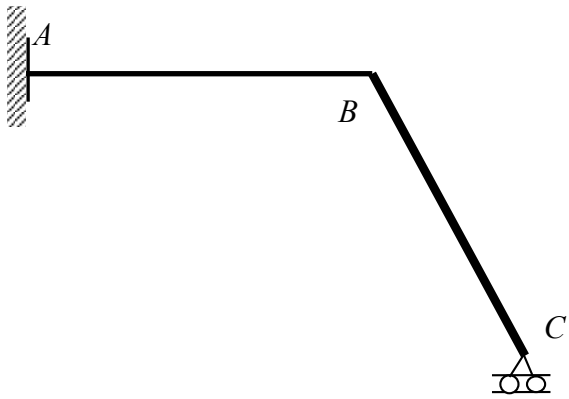
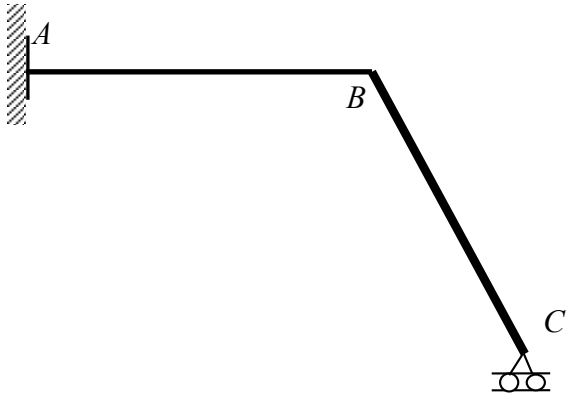
Student number			



N.F.D



S.F.D



B.M.D

Student name		Marks obtained for Q. #2	
Student number			

Question 2: (40%) CLO6: 100%

The shown loaded rigid-jointed frame with variable moment of inertia has fixed support at ***A*** and ***D***, and pin support at ***E***. The downward settlements at support ***A***, and support ***D*** are **40 mm** and **35 mm** respectively.

Take: ***E*** **= 20 GPa ,** and **I = 0.003 m^4**

Use the moment distribution (up-to four analysis cycles) to:

a. Determine the fixed-end moments (**FEM**) for members ***BD***, and ***CE*** **due to loads only.**

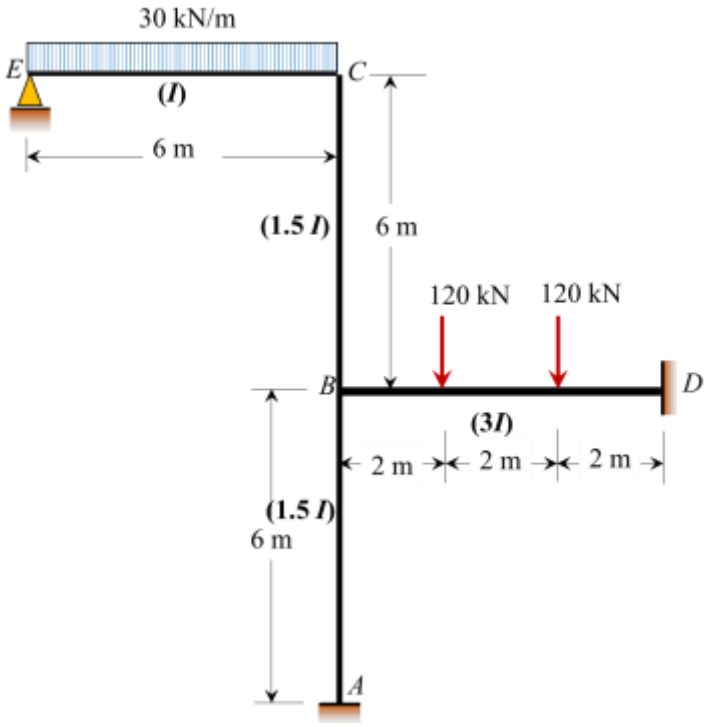
b. Draw a **neat deflected shape** due to **supports settlement only**.

c. Determine the **FEM** for members ***BD***, and ***CE*** **due to support settlements only.**

d. Determine the **total FEM** for members ***BD***, and ***CE*** **due to the applied loads and support settlements.**

e. Use the given Moment Distribution table to obtain the member end moments in the frame due to **the applied loads and support settlements.**

f. Draw the **shear force and bending moment diagrams** for the entire frame due to the **applied loads and support settlements.**

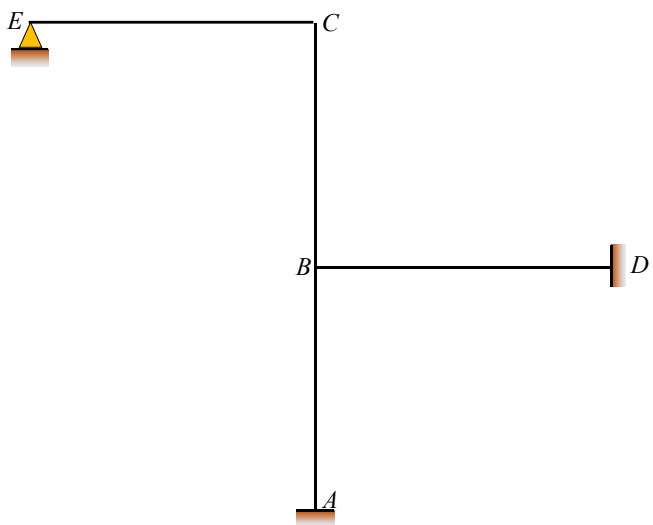


Solution:

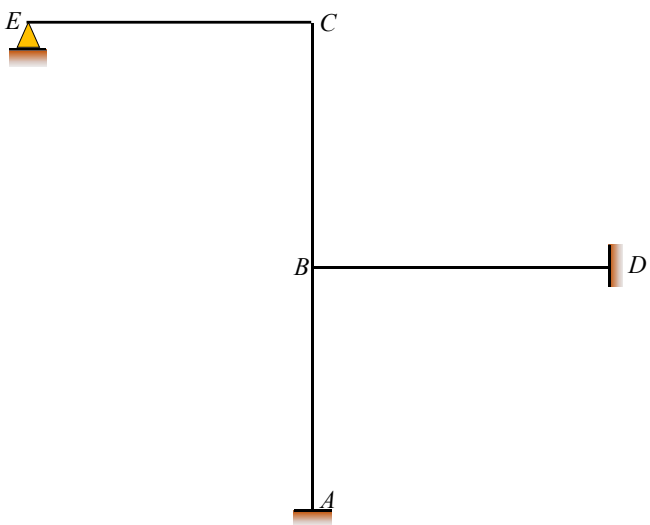
Student name		**Marks obtained for Q. #2**	
Student number			

Student name		**Marks obtained for Q. #2**	
Student number			

	Joint	**A**	**B**			**C**		**D**	**E**
	Member	**AB**	**BA**	**BD**	**BC**	**CB**	**CE**	**DB**	**EC**
	D.F								
Cycle 1	F.E.M								
	Dist								
Cycle 2	CO								
	Dist								
Cycle 3	CO								
	Dist								
Cycle 4	CO								
	Dist								
	Σ M								



SFD (kN)



BMD (kN)

Student name		**Marks obtained for Q. #1**	
Student number			

Question 3: (20%) CLO5: 100%

The compound beam shown in the figure is supported by the fixed ***A***, and rollers ***B***, and ***C***. The three parts of the beam are jointed by the hinges ***D***, and ***E***. Draw the following influence lines (ILs):

a. IL for the vertical reactions at ***A***, ***B*** and ***C*** (i.e. Y_A, Y_B, and Y_C).

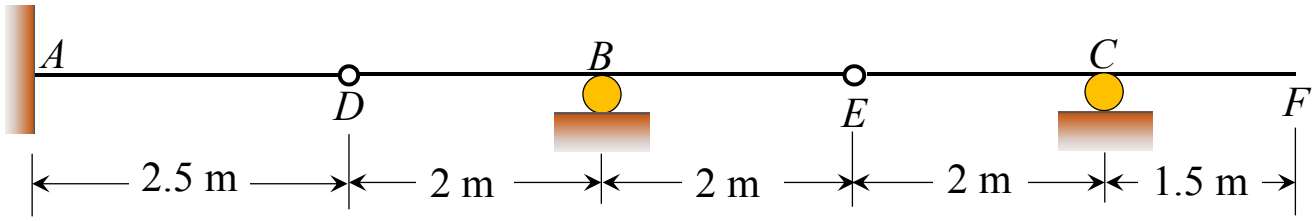
b. IL for the shear at ***B*** "left" (i.e. V_{B-left}),

c. IL for the moment at *A* (*i.e.* M_A).

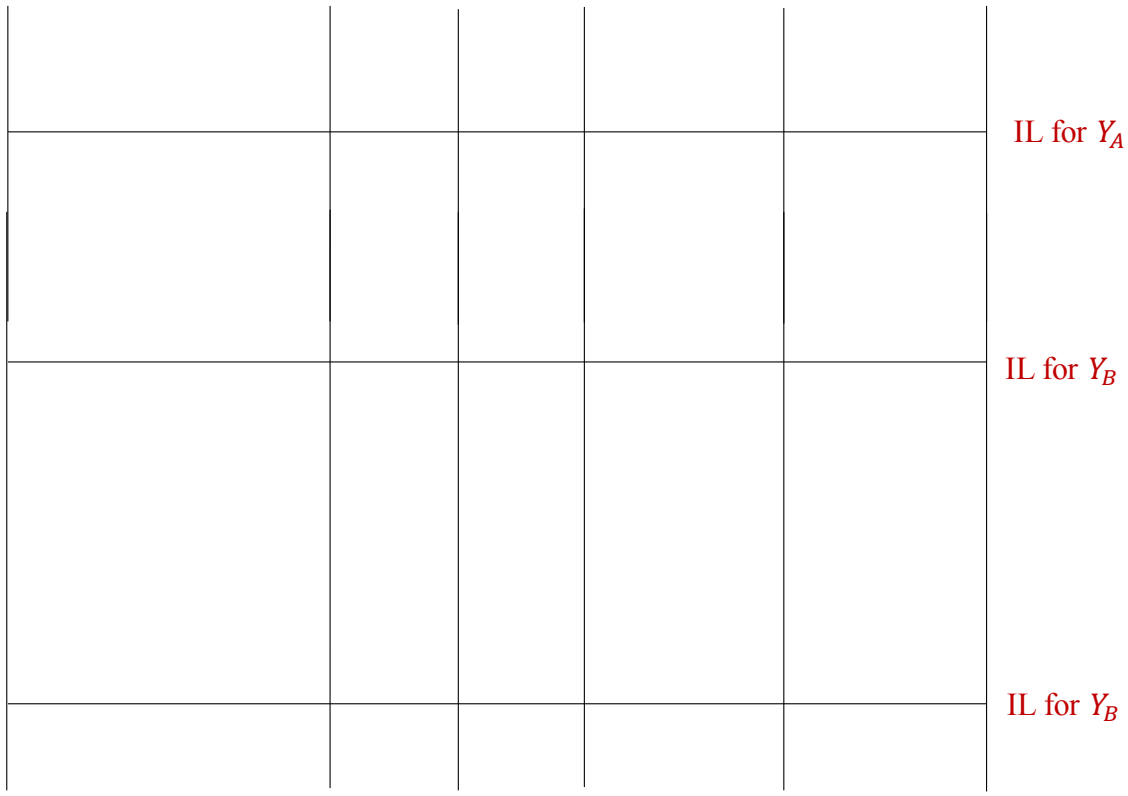
If the beam is subjected to: i) moving concentrated live load of **150 kN**, ii) uniform live load of **15 kN/m**, and iii) uniform dead load of **10 kN/m**, determine:

d. The maximum negative shear at *B* "left"

e. The maximum positive moment at *A*.



Solution:



Student name		**Marks obtained for Q. #1**	
Student number