PROGRAM	:	BACHELOR OF ENGINEERING TECHNOLOGY *ENGINEERING : CIVIL*
SUBJECT	:	**STRUCTURAL ANALYSIS 3A**
CODE	:	**STRCIA3**
DATE	:	WINTER SSA EXAMINATION 19 JULY 2019
DURATION	:	(SESSION 1) 08:00 - 11:00
WEIGHT	:	40 : 60
TOTAL MARKS	:	100

ASSESSOR	:	MR F THAIMO
MODERATOR	:	DR J MAHACHI
NUMBER OF PAGES	:	4 PAGES

INSTRUCTIONS	:	NON-PROGRAMABLE POCKET CALCULATOR MAY BE USED.
REQUIREMENTS	:	2 SHEETS OF A4 GRAPH PAPER PER CANDIDATE.

INSTRUCTIONS TO STUDENTS

PLEASE ANSWER ALL QUESTIONS

QUESTION 1

Figure below shows a propped cantilever beam subjected to a point load as shown on the figure.

a) Calculate the magnitude of the collapse load (W) if the fully plastic moment (M_P) of the beam section is 150kNm.
(**Please take note: use the STATIC METHOD, i.e. reactant and free bending moment, in your analysis**)

b) Calculate the reactions at the supports on the verge of collapse.

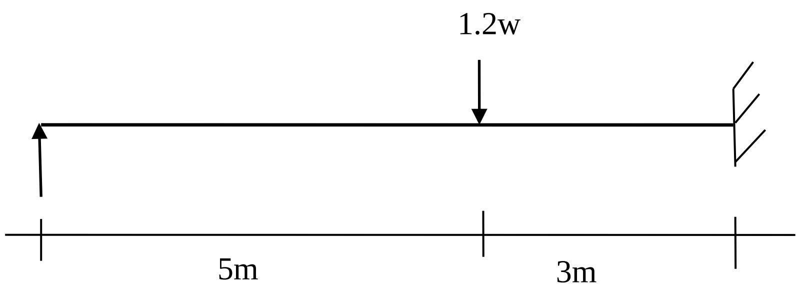

Figure 1

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QUESTION 2

The frame shown below is fixed at both supports A and D. The fully plastic bending moment (M_P) is 200kNm.

a) Under the loading shown, determine the collapse mode and the collapse load (w) on the verge of collapse.
(**Please note: use the VIRTUAL WORK (displacement) method in your analysis**).

b) Calculate the vertical and horizontal components of the reactions at the supports.

(Please note: no Bending Moment, Shear Force or Axial Force Diagrams are required).

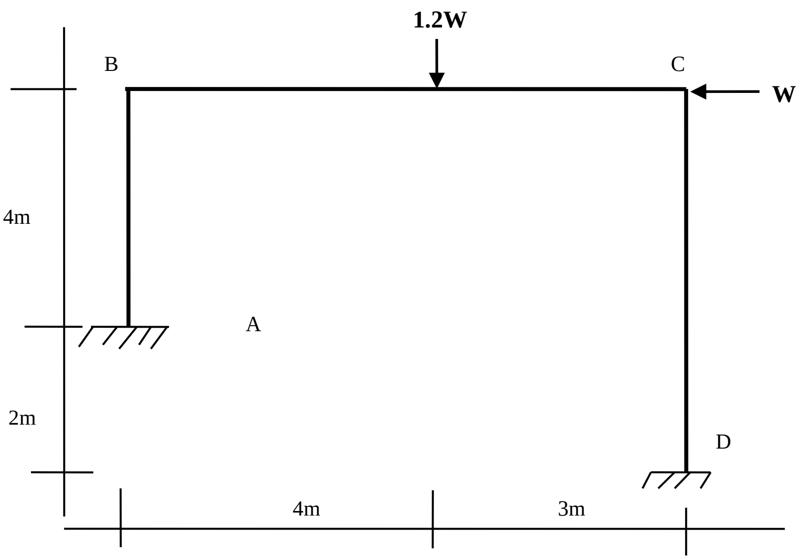

Figure 2

[20]

QUESTION 3

The continuous beam shown below is of a cross-section with constant flexural rigidity (EI).

a) Using MOMENT DISTRIBUTION method determine the reactant (end) moments at the supports/joints.

b) Calculate the support reactions.

c) Draw the Shear Force and Bending Moment Diagrams for the beam on the graph paper provided.

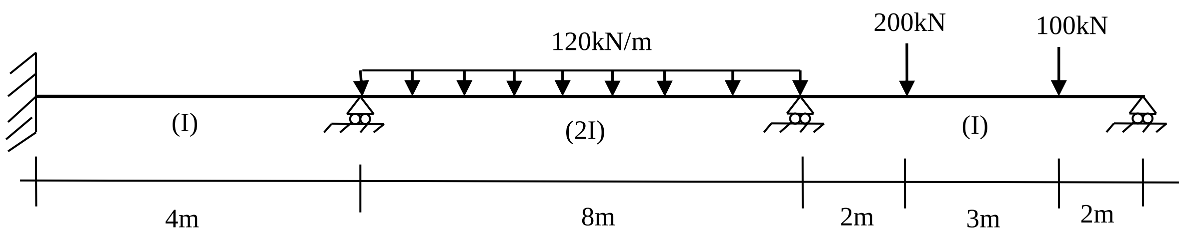

Figure 3

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QUESTION 3

The pin-jointed plane truss shown below is supported by rollers at **A** and by pin (hinged) at **B**, and is subjected to loading as shown. The truss members are all made from steel with Young's modulus of 200 GP_a and cross-sectional area of 500 mm^2.
Using **Strain Energy** method (Castigliano's Theorem), calculate the vertical and horizontal deflections (displacements) of point E on the truss.

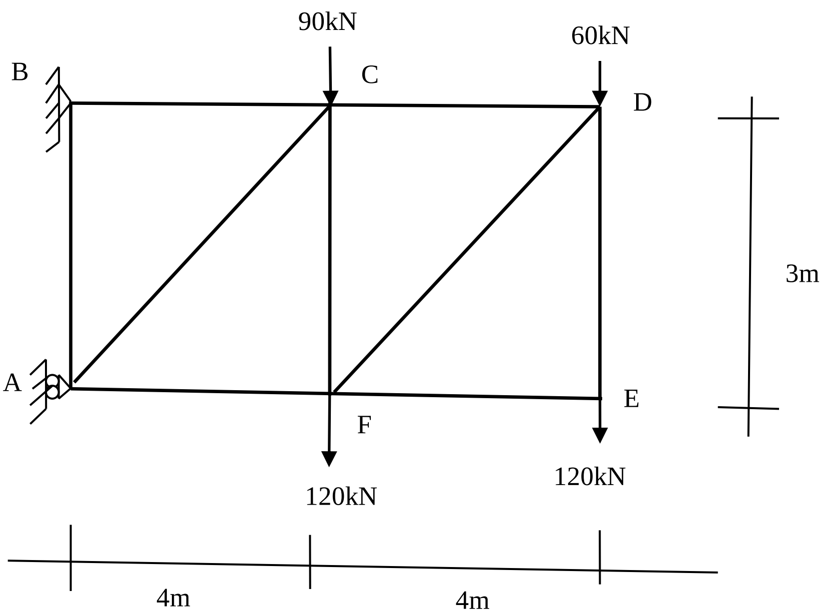

Figure 4

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TOTAL = 100