PROGRAM	:	NATIONAL DIPLOMA *ENGINEERING : CIVIL*
SUBJECT	:	**STRUCTURAL ANALYSIS III**
CODE	:	**AIS3211**
DATE	:	SUMMER EXAMINATION 09 NOVEMBER 2019
DURATION	:	(SESSION 1) 08:00 - 11:00
WEIGHT	:	40 : 60
TOTAL MARKS	:	100

ASSESSOR	:	MR F THAIMO
MODERATOR	:	MR S JOUBERT
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.

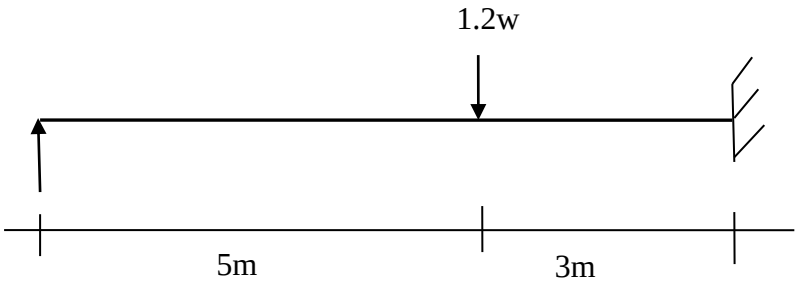

Figure 1

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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).

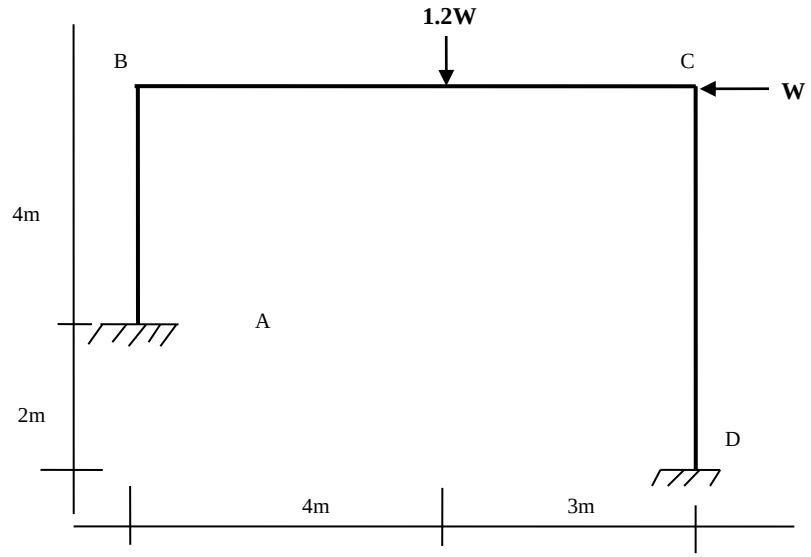

Figure 2

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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.

b) Calculate the support reactions.

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

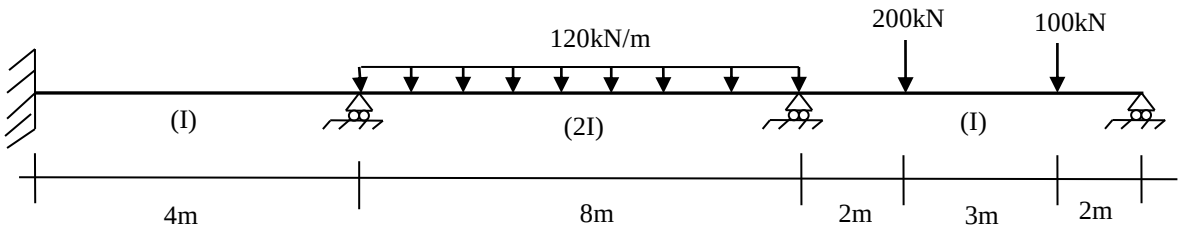

Figure 3

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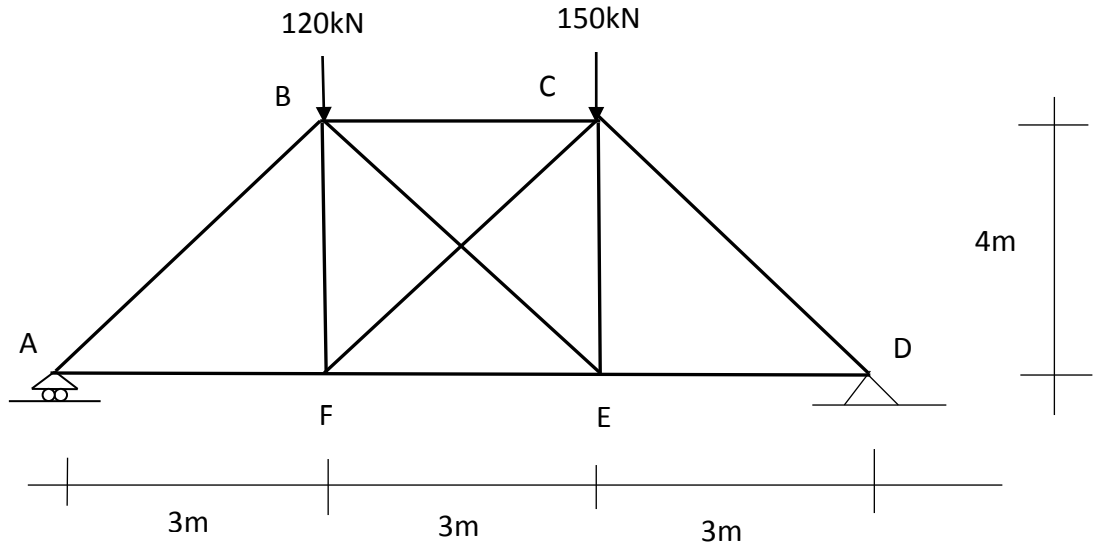
QUESTION 1

The members of the truss shown below are made of material with modulus of elasticity (E) of 200GPa and cross-sectional area of 500 mm^2.
The truss is subjected to loading as shown on the figure. **Member B-E is the redundant member in the truss and was fabricated 6 mm too short.**

Using Strain Energy method (Castigliano's Theorems), calculate the force in all the members of the truss.

Castigliano's equation is as follows:

$$W = \frac{\lambda - \sum \frac{Ffl}{AE}}{\sum \frac{f^2 l}{AE}}$$



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TOTAL = 100