PROGRAM	:	NATIONAL DIPLOMA *ENGINEERING : CIVIL*
SUBJECT	:	**STRUCTURAL ANALYSIS III**
CODE	:	**AIS3211**
DATE	:	SUMMER SSA EXAMINATION 10 JANUARY 2020
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 beam, which is fixed at both ends A and B, 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 250kNm.
(**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.

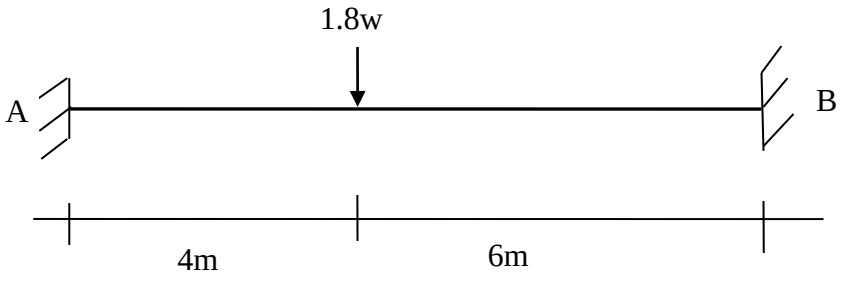

Figure 1

[15]

QUESTION 2

The support conditions of the frame shown as Figure 2 below are such that the frame is pinned at A and fixed at D.

The frame is subjected to a vertical and horizontal point loads of magnitude (w) as shown on Figure 2 below.

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 reactions at the supports.

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

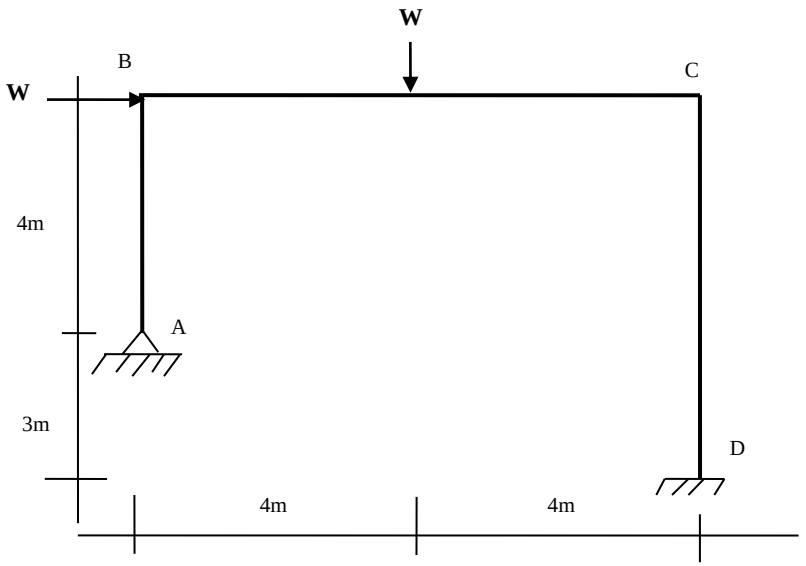

Figure 2

[20]

QUESTION 3

The frame shown below is fixed at A, rests on rollers at B and C and pinned at E. The flexural rigidity (EI) is constant.

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

b) Calculate the support reactions and draw the Shear Force and Bending Moment Diagrams for the frame on the graph paper provided.

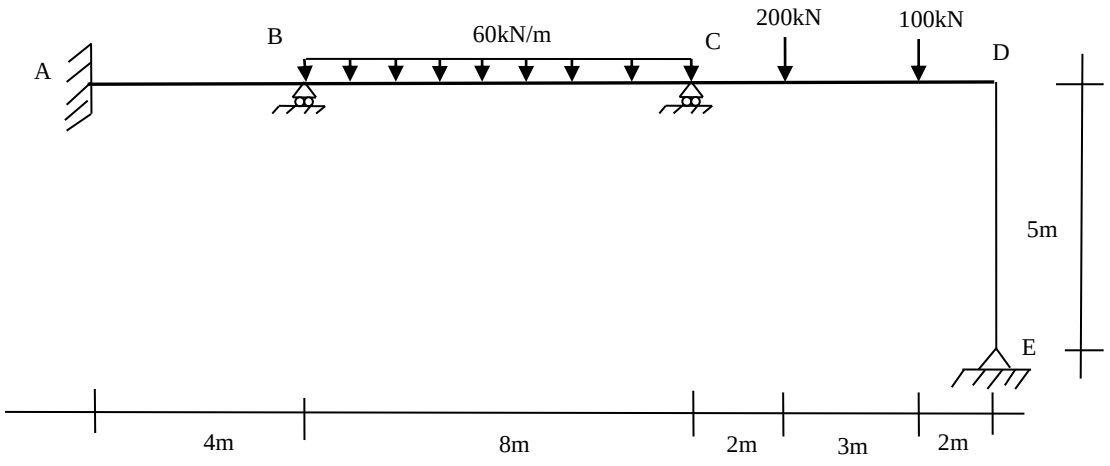

Figure 3

[35]

QUESTION 3

QUESTION 1

The girder shown in Figure 1 is made up of steel members with modulus of elasticity (E) equal to 200GPa and cross-sectional area of 600 mm^2. The truss is subjected to loading as shown on the Figure.

Using Strain Energy method (Castigliano's equations), calculate the vertical deflection of point F and the horizontal deflection of point E.

$$\Delta = \sum \frac{FfL}{AE}$$

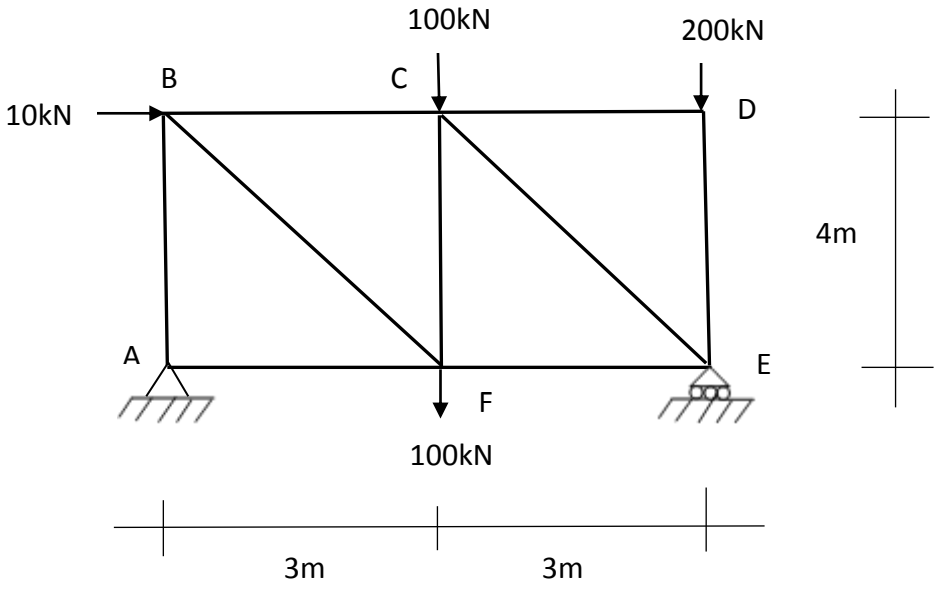

Figure 1

[30]

TOTAL = 100