UNIVERSITY OF JOHANNESBURG

PROGRAM	:	NATIONAL DIPLOMA *CIVIL ENGINEERING*
SUBJECT	:	**STRUCTURAL ANALYSIS II**
CODE	:	**AIS2111**
DATE	:	WINTER EXAMINATION 2014 11 JUNE 2014
DURATION	:	(X-PAPER) 12:30 - 15:30
WEIGHT	:	40 : 60
TOTAL MARKS	:	100

EXAMINER	:	MR F THAIMO
MODERATOR	:	MR C BRUWER
NUMBER OF PAGES	:	3 PAGES

File Number: 2250

INSTRUCTIONS	:	HAND HELD CALCULATOR MAY BE USED
REQUIREMENTS	:	2 SHEETS OF A4 GRAPH PAPER PER CANDIDATE.

INSTRUCTIONS TO CANDIDATES:

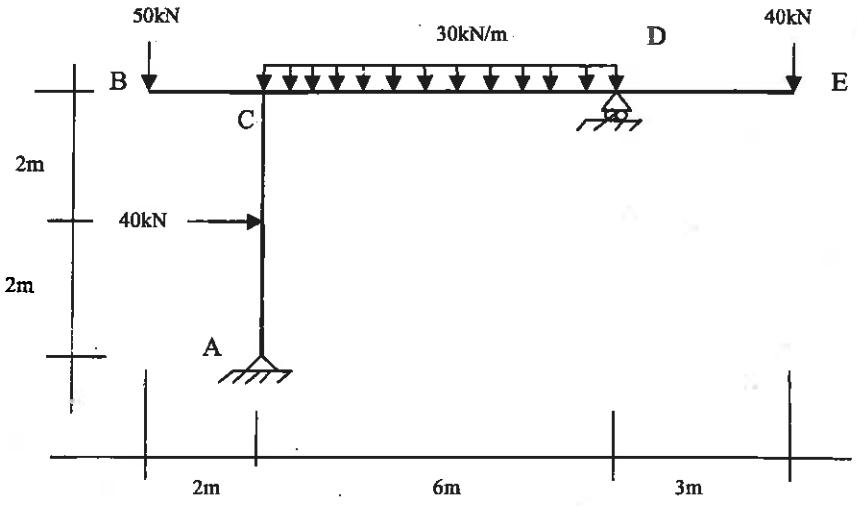
PLEASE ANSWER ALL THE QUESTIONS.

QUESTION 1

The support conditions of the frame **ABCDE** shown below are such that the frame is pinned at A and on rollers at D. The frame is subjected to a horizontal point load of 40 kN at mid-height of column A-C, two (2) vertical point loads, one 50kN acting at the free end B and the other 40kN acting at the free end E and a Uniformly Distributed Load (UDL) of 30kN/m extending from C to D as shown on the figure.

1.1 Determine the reactions at the supports A and D and sketch the free body diagram of the frame showing the loading and support reactions.

1.2 Draw the Shear Force, Bending Moment and Axial Force Diagrams for the frame on the graph paper provided. **(Please note that the bending moments are to be drawn on the side of the member where they cause tension).**



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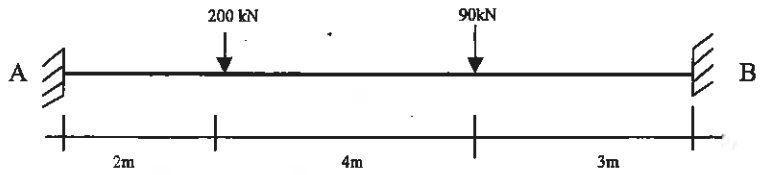
QUESTION 2

The fixed ended beam A-B, Figure below, is subjected to two vertical point loads one of 200kN acting at 2m from support A and the other of 90kN acting at 3m from support B as shown on the figure. The flexural rigidity EI value for the beam section is constant and is equal to $80x10^3$ kNm^2.

Using **MOMENT-AREA** Theorems, determine the magnitude of the fixed end (reactant) bending moments at A and B. **Show all steps to arrive at your answers.**



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QUESTION 3

The frame **ABCD** figure below is pinned at A, fixed at D and on rollers at support C.
The frame is subjected to loading as shown on the Figure.
All the members of the frame have the same EI value.

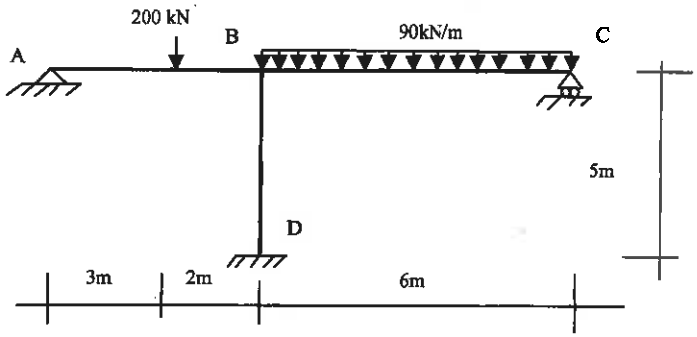
Using **SLOPE DEFLECTION** method:

a) Calculate the reactant bending moments at the joints and or supports.
b) Calculate the support reactions at supports A, C and D. **(Please note: no SFD, BMD or AFD is required to be drawn).**

The Slope-Deflection equations are as follows:

$\mathbf{M_{AB} = 2EI/L[2\theta_A + \theta_B - 3/L(\delta_B - \delta_A)]}$

$\mathbf{M_{BA} = 2EI/L[\theta_A + 2\theta_B - 3/L(\delta_B - \delta_A)]}$



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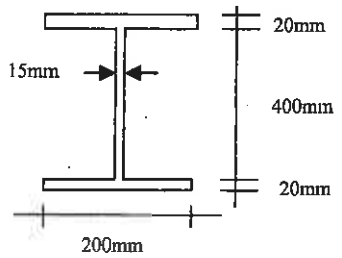
QUESTION 4

A structural steel member 5m long is used as a compression member (strut) which is fixed at both ends for bending about y-y axis and pinned at one end and fixed at the other for bending about x-x axis.
The cross-section of the member have dimensions as shown on figure below and is made of material with Modulus of elasticity and yield stress of 200GPa and 300MPa respectively.



a) Calculate the slenderness ratio for bending about both axis (x-x and y-y axis) and state about which axis the member will buckle.

b) Calculate the buckling stress using the following:
- Euler equation
- Rankine-Gordon equation

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Total: 100