

National Exams December 2011

04-For-B1, Structural Analysis & Design

3 hours duration

NOTES:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
2. This is an OPEN BOOK EXAM.
Any non-communicating calculator is permitted.
3. FIVE (5) questions constitute a complete exam paper.
The first five questions as they appear in the answer book will be marked.
4. Each question is of equal value.
5. The designs must be to the following Standards:
Steel: CAN/CSA-S16 (latest edition)
Wood: CAN/CSA- O86 (latest edition)

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1. Determine the forces in the members AB, AF, FI and AI of the truss shown in Fig. 1.
2. Determine the reactions and draw shear-force diagram and bending moment diagram for the frame shown in Fig. 2. Show magnitude and location of maximum moment in the beam CD.
3. For the three-hinged arch shown in Fig.3, determine (a) the support reactions and (b) axial force, shear force and bending moment at D.
4. Determine (a) the vertical deflection and slope at C and (b) vertical deflection and slope at B of the cantilever beam shown in Fig. 4. $E = 200\,000\text{ MPa}$ and $I = 50 \times 10^6\text{ mm}^4$.
5. Using plastic method of analysis, design the steel beam shown in Fig. 5 to resist the specified live load of 10 kN.
6. Design the compression member AB of Fig. 1 using
 - (a) a steel wide-flange shape
 - (b) a Douglas Fir-Larch glulam member.
7. For the beam ABC shown in Fig. 4, assuming the load shown is the specified live load, choose
 - (a) a steel wide-flange shape
 - (b) a Hem-Fir Select Structural grade sawn timber
8. Using Douglas Fir-Larch Select Structural Grade, design an oblique purlin given the following:

Purlin spacing = 2.0 m

Purlin span = 6.0 m

Pitch of roof = 20 degrees

Specified dead load (including allowance for purlin weight) = 1.0 kPa

Specified live load (includes snow load) = 2.0 kPa

Fire-retardant treatment.

Wet service condition.

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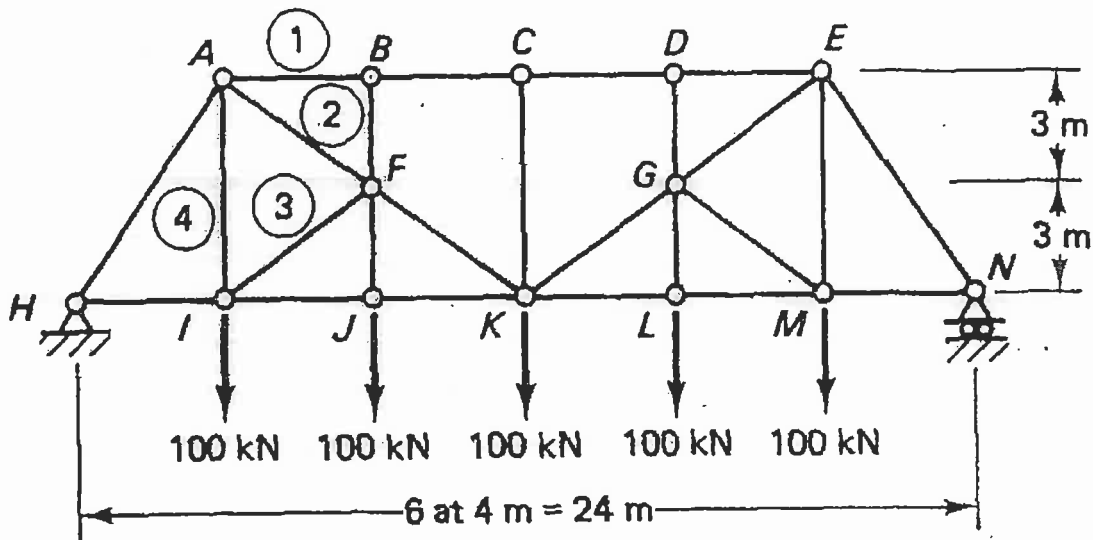


Fig. 1

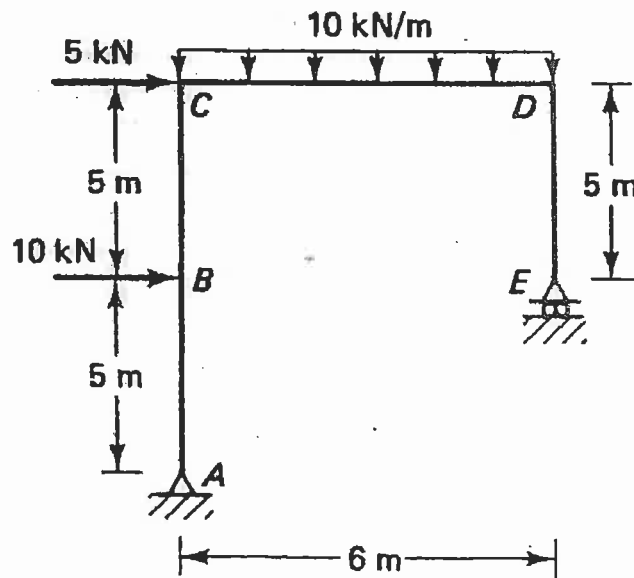


Fig. 2

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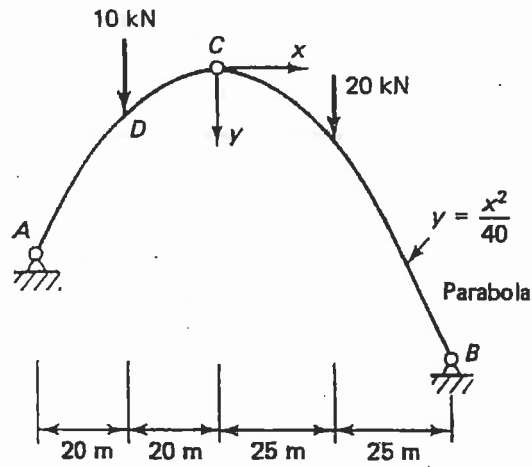


Fig. 3

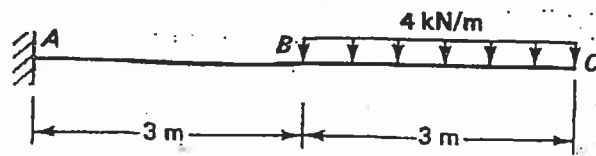


Fig. 4

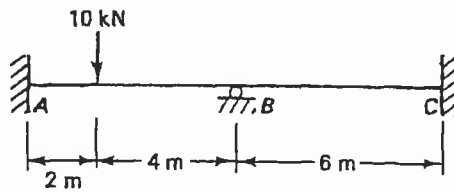


Fig. 5

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Marking Scheme

1. 20 marks total
2. 20 marks total
3. 20 marks total
4. 20 marks total
5. 20 marks total
6. 20 marks total (10 marks each)
7. 20 marks total (10 marks each)
8. 20 marks total.