National Examinations – May 2016

98-Civ-A2, Elementary Structural Design

3 Hour 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 a **"CLOSED BOOK"** examination. Handbooks and textbooks are permitted. **No notes or sheets are allowed.** Candidates may use one of two calculators, the Casio or Sharp approved models. You must indicate the type of calculator being used, i.e. write the name and model designation of your calculator on the first inside left-hand sheet of the exam work book.

3. Solutions must be to the following standards:

Steel:	CSA-S16 (latest edition)
Concrete:	CSA-A23.3 (latest edition)
Timber:	CSA-O86 (latest edition)

4. A total of **five** solutions is required. Only the first five as they appear in your answer book will be marked.

   Do **two** questions from Part A.
   Do **two** questions from Part B.
   Do the **one** question in Part C.

5. All questions are of equal value.

6. **All loads shown are unfactored**.

Marking Scheme:

A1. (8 + 12)
A2. (8 + 12)
A3. (8 + 12)
B1. (12 + 8)
B2. (10 + 6 + 4)
B3. (8 + 12)
C1. (8 + 6 + 6)

Part A (Do two of three questions)

A1. An 8-m steel hollow post of G40.21, 350W class H, 219.1 mm OD and thickness of 7.95 mm, supports two rows of power cables, Figure A1. The post is free standing at the top and fixed at the base. Calculate the maximum factored load, P_F, that the post can carry.

A2. A loaded steel stub-beam AB, Figure A2, of W360 x 79 section (G40.21M) is welded to a heavy column, W460 x 106 (G40.21M). Design the welded connection at BC. Check whether the stub-beam AB can adequately carry the load shown.

A3. The determinate steel frame ABCD, Figure A3, is constructed with a hinge (bolted) at B. For the loads shown, design the steel beam ABC.

Part B (Do two of three questions)

B1. Figure B1 shows the cross-section of a reinforced concrete girder. Calculate the section moments of resistance about the centroidal axes, a-a and b-b.

B2. The determinate frame ABCD shown in Figure A3, is to be constructed in reinforced concrete. Design the column CD, and sketch the reinforcement details.

B3. Design the reinforced concrete girder with the two overhangs, Figure B3. Take into account the self-weight of the girder. Sketch the reinforcement details.

[Use $f_c' = 35$ MPa and $f_y = 400$ MPa.]

Part C (Do question C1)

C1. A glulam column is to be designed under the following conditions:

Axial load = 12 kN dead load, 36 kN snow load, and wind load = 8 kN.

The column is 6 m long, hinged at top and bottom, restrained at its mid-height, where it is subjected to a lateral load of 12 kN.

[Assume any other data that may be required.]

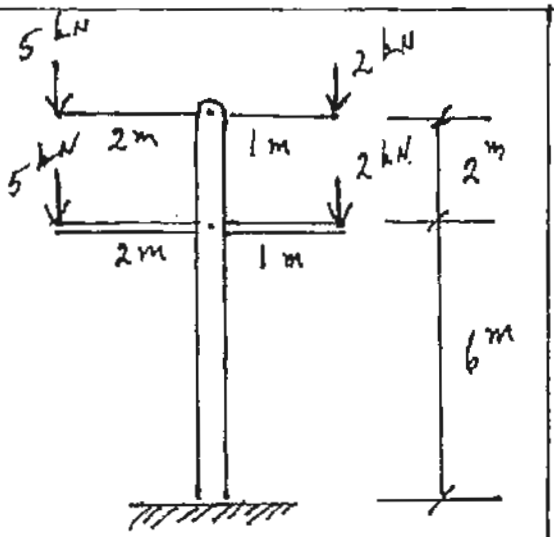

FIGURE A1

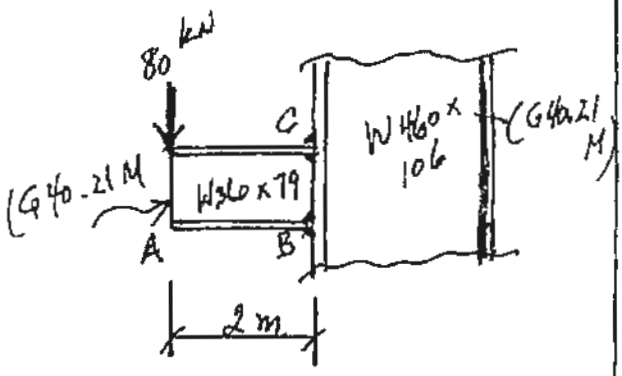

FIGURE A2

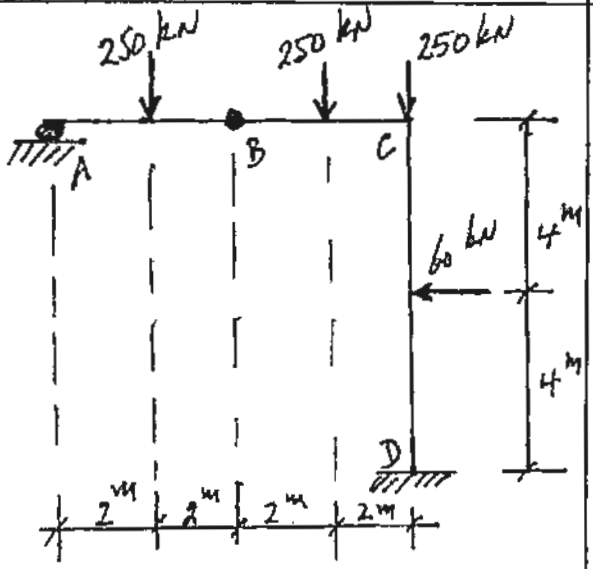

FIGURE A3

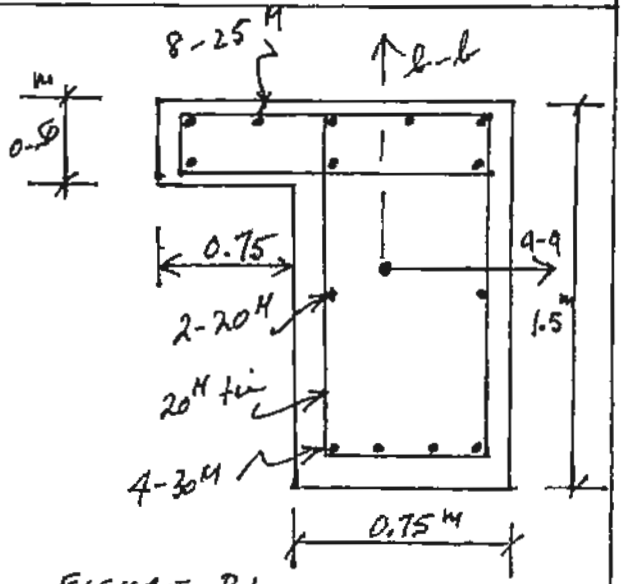

FIGURE B1

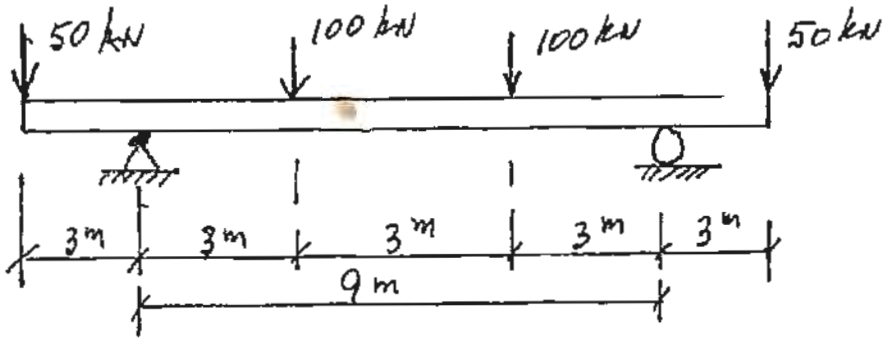

FIGURE B3