National Examinations – May 2015

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. Any textbooks are permitted as well as Design handbooks. **No notes or sheets are allowed.** Candidates may use one of two calculators, the Casio or Sharp approved models.

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. (10 + 10)
A2. (8 + 12)
A3. (12 + 8)
B1. (10 + 10)
B2. (12 + 8)
B3. (12 + 8)
C1. (10 + 5 + 5)

Part A (Do two of three questions)

A1. Figure A1 shows a determinate steel frame constructed of two parts, column AB and beam BC, bolted at B. Design the bolted connection. [Ignore self-weight].

A2. The steel column AB is Figure A1 is loaded as shown. Check the design of the steel column, AB.

A3. The cross-section of a steel member is shown in Figure A2. The section is made from G40.21 350W steel plates, 20 mm thick. Determine the section moments of resistance about the two axes, a-a and b-b.

Part B (Do two of three questions)

B1. The cross-section of an r.c. culvert is shown in Figure B1. Determine the moment and shear resistances of the section. Use $f_c' = 35$ MPa and $f_y = 400$ MPa.

B2. The reinforced concrete determinate frame in Figure B2 is loaded as shown. Design a cross-section and the reinforcing steel for beam-column AB. Ignore self-weight. Use $f_c' = 35$ MPa and $f_y = 400$ MPa.

B3. Design a reinforced concrete rectangular section for beam BC in Figure B2. Determine the quantities of reinforcing steel for moment and shear. Show the arrangement of the steel. Use $f_c' = 35$ MPa and $f_y = 400$ MPa.

Part C (Do question C1)

C1. Single span oblique sawn timber purlins are required for a roof. Using untreated D. Fir-L select structural grade, in dry service conditions, design the purlins to satisfy the following conditions: Purlin spacing = 2.5 m; Purlin span = 5.5 m, Roof pitch = 20.0°

Specified dead load (including weight of purlin) = 1.0 kPa;
Specified live load = 2.0 kPa.

[Assume any other data that may be required.]

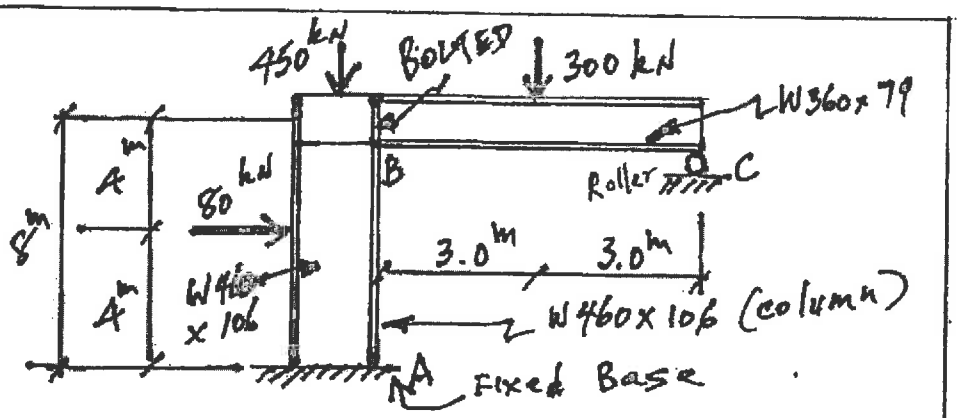

FIGURE A1

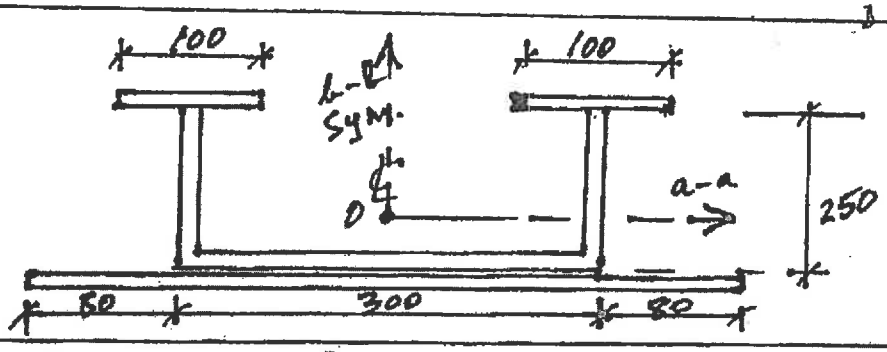

FIGURE A2

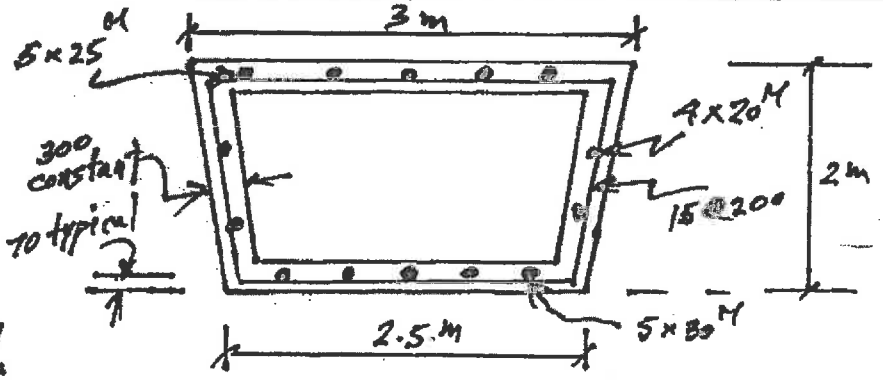

FIGURE B1

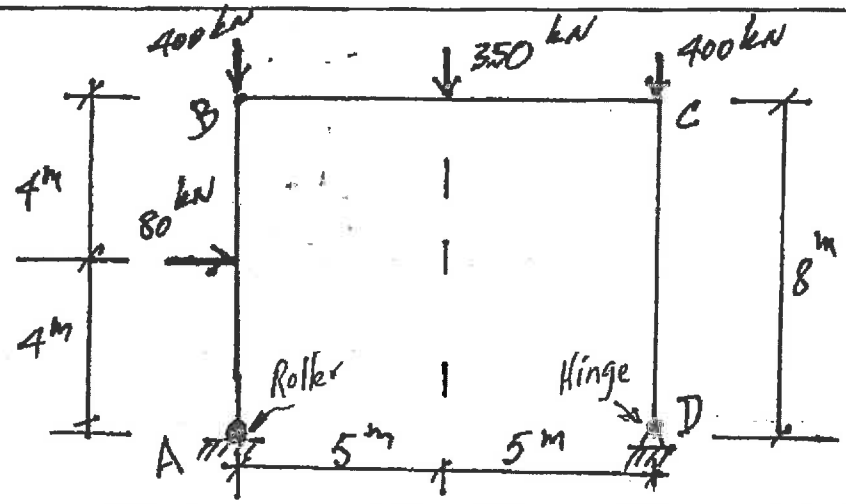

FIGURE B2