National Examinations – December 2008

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:	CAN/CSA-S16 (latest edition)
Concrete:	CAN/CSA-A23.3 (latest edition)
Timber:	CAN/CSA-086 (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.

Part A (Do <u>two</u> of three questions)

A1. The cross-section of a scaled-model of a fuselage is shown in Figure A1. The model is fabricated from steel round hollow section of G40.21 350W class H, 273.1 mm OD and thickness of 11.13 mm and two G40.21 350W steel struts, each 16 mm thick and 176 mm wide. Determine the section moments of resistance about the centroidal axes x-x and y-y.

A2. Figure A2 shows the profile of a determinate steel frame ABCDEF of G40.21 350W. Design the column ABC for the specified loads shown. (Ignore self-weight of members.)

A3. For the determinate steel frame in Figure A2, design an appropriate steel section for the crane bracket at B as well as a welded connection to the column AC at B.

Part B (Do <u>two</u> of three questions)

B1. Figure B1 shows a reinforced concrete beam ABC, hinged at B, and loaded with the specified live loads shown. Determine the dimensions of its rectangular cross-section and steel requirements for moment and shear. Take into account the self-weight of the beam. Use f_c' = 35 MPa and f_y = 400 MPa.

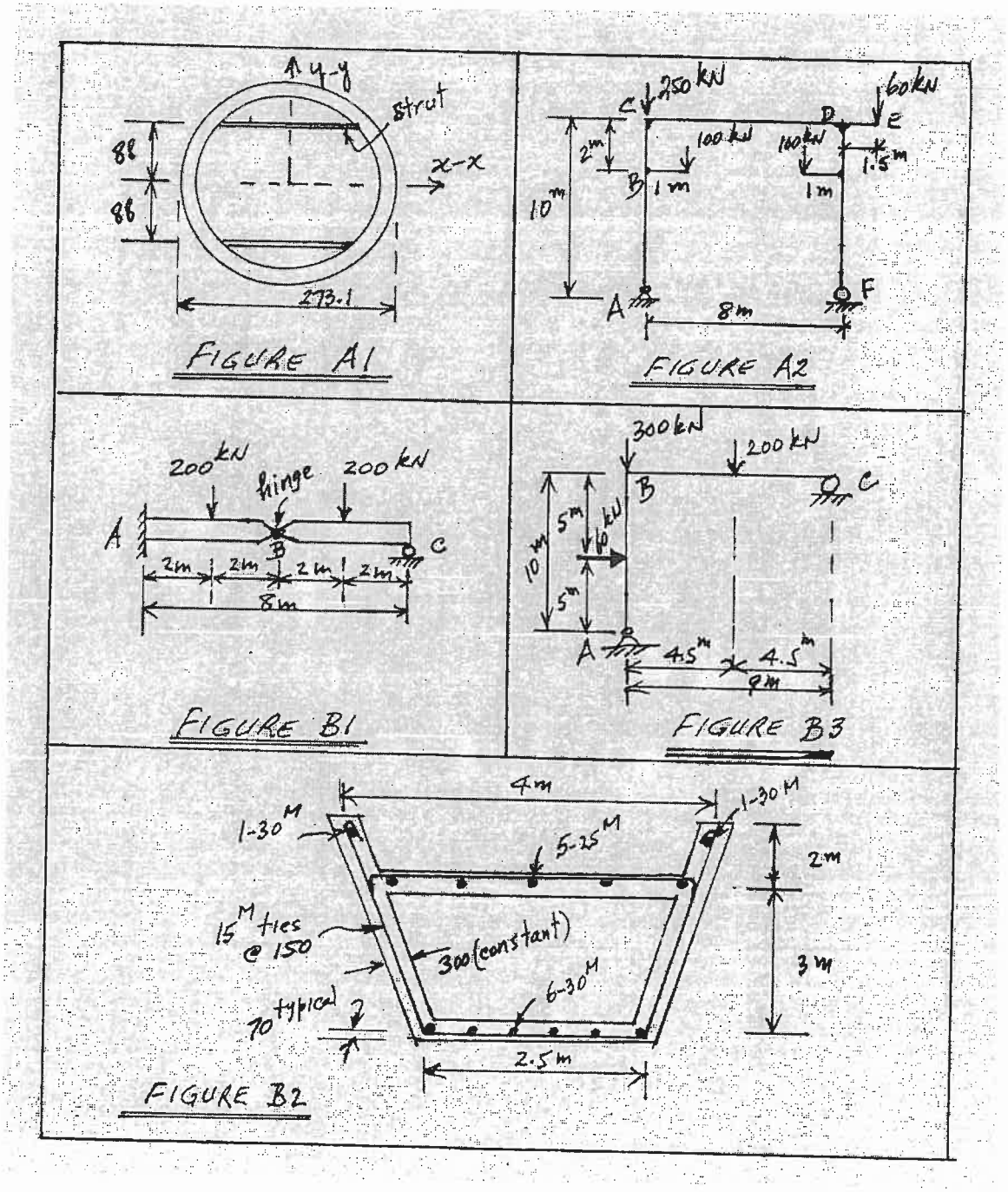
B2. A section of reinforced concrete channel-culvert structure is shown in Figure B2. Calculate the moment (M_r) and shear (V_r) resistances of the section. Use f_c' = 35 MPa and f_y = 400 MPa.

B3. The determinate frame, shown in Figure B3, is to designed in reinforced concrete construction. For the specified live loads shown, design a cross-section and the reinforcing steel for the column AB. (Ignore the self-weight of the frame.) Use f_c' = 35 MPa and f_y = 400 MPa.

Part C (Do question C1)

C1. Check whether a 265 x 532 mm Spruce-Pine glulam beam is satisfactory for the following conditions: Specified dead load (including self weight) = 2.5 kPa; Specified live load = 3 kPa; beam spacing = 6.0 m; beam span = 8 m; permanent load duration and dry service conditions.

[<u>Assume any other data that may be required</u>].


y-y
strut
x-x
88
86
273.1
250 kN
60 kN
100 kN
100 kN
2m
10m
1m
1m
1.5m
A
8m
F
FIGURE A1
FIGURE A2
200 kN
hinge
200 kN
A
B
C
2m
2m
2m
2m
8m
FIGURE B1
300 kN
200 kN
B
C
5m
10m
5m
A
4.5m
4.5m
9m
FIGURE B3
4m
1-30M
1-30M
5-25M
2m
15M ties @ 150
300 (constant)
3m
70 typical
6-30M
2.5m
FIGURE B2