

**UNIVERSITY OF TORONTO
Faculty of Applied Science and Engineering**

**FINAL EXAMINATION, DECEMBER 14, 2011
First Year - Programs 1,2,3,4,6,7, 8 and 9**

**CIV 100F - MECHANICS
Examiner: Staff in Civil Engineering**

FAMILY NAME: _____ **GIVEN NAMES:** _____

(Please print clearly)

STUDENT NUMBER: _____

CIRCLE THE NAME OF YOUR LECTURER AND YOUR GROUP LETTER

- | | | |
|----------------------------|---------------------------|-----------------------|
| A Kuhn, Eva | D El-Diraby, Tamer | G Guner, Serhan |
| B Zhang, Jinyue | E Zhang, Jinyue | H Seica, Michael |
| C Grasselli, Giovanni | F Kamaleddine, Fouad | J Packer, Jeff |

CIRCLE MODEL NUMBER OF CALCULATOR

CASIO 260

SHARP 520

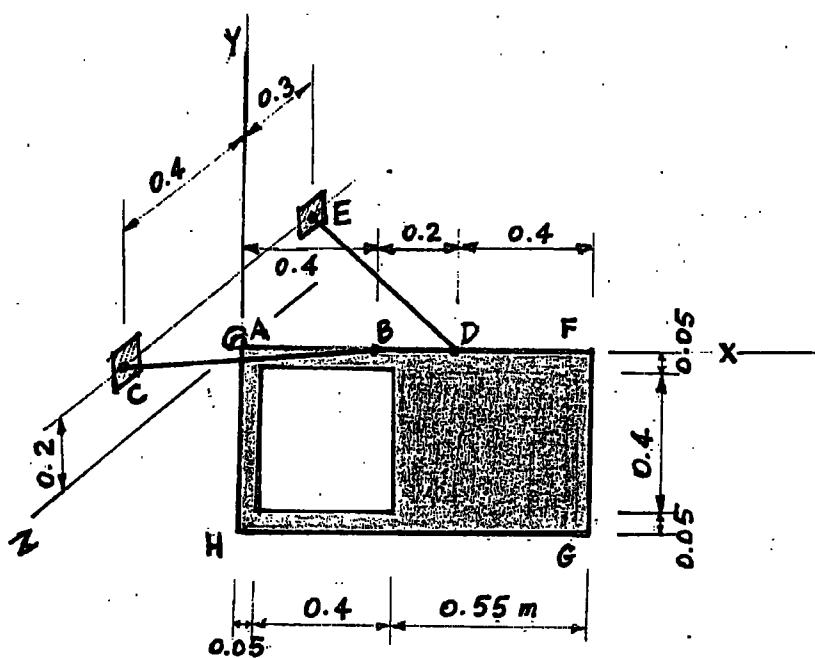
TI 30

- NOTES:**
1. Be sure you have all 7 sheets of this examination paper. Page 7 is blank. If you need more space for a question please use the back of the preceding question. In all cases indicate clearly where your calculations are continued.
 2. Answer all 5 (five) equal-valued questions.
 3. No other paper will be accepted for marking nor allowed on the desk.
 4. The permissible calculators are listed above.

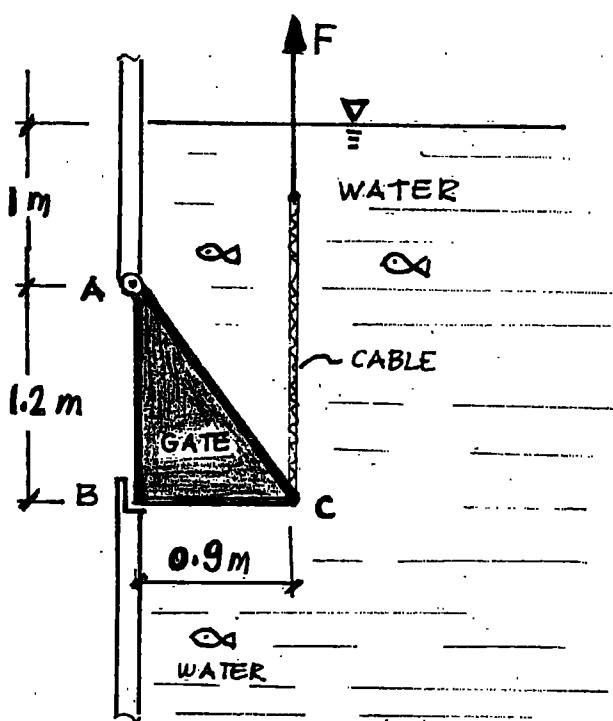
DO NOT WRITE IN THIS SPACE.

1.	/12
2.	/12
3.	/12
4.	/12
5.	/12
TOTAL	/60

1. The given vertical sign ABDFGH is homogeneous, has a uniform thickness, and weighs 340 N. There is a square hole (0.4×0.4) in the sign as shown. The sign is supported by a ball and a socket at A and by two cables BC and DE. Determine the forces in the two cables and the reaction components at A. All given dimensions are in metres.

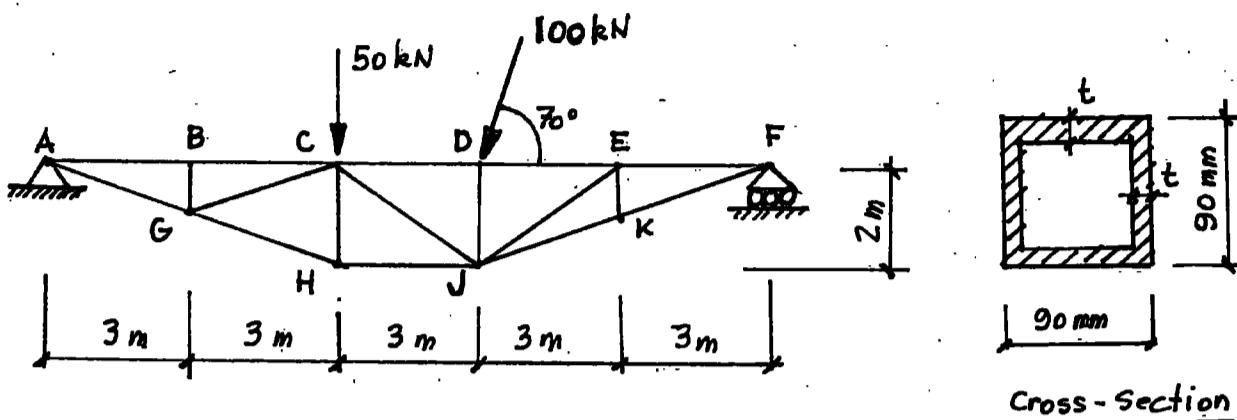


2. ABC shown below is the cross-section of a solid gate, 5 m wide (into the paper), within a fresh water channel. The homogeneous gate has a mass of 3000 kg, is pinned at A, and rests against a vertical wall at B, and can be opened by a cable at C. What force F is required, when the gate is just opening? Use a new free body diagram.

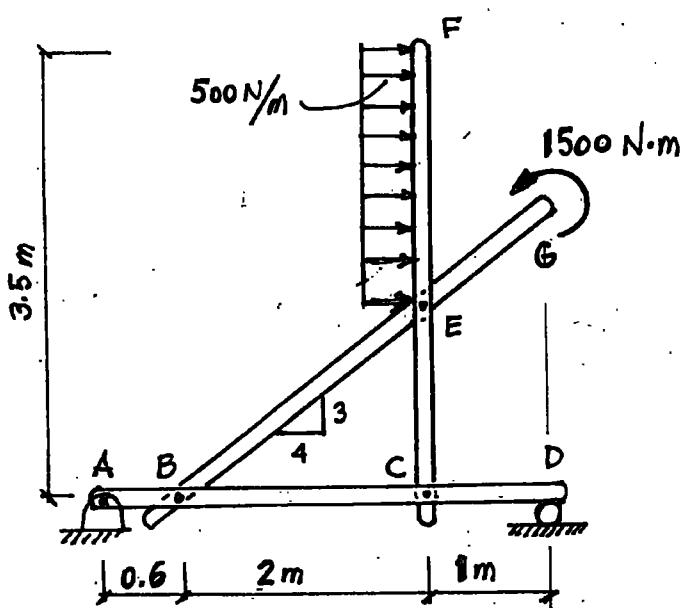


3. The steel truss below is supported by a pin at A and a roller at F. For the given truss determine:

- Reaction components at A and F.
- The forces in members GH and GC.
- For a different loading, member GH, which has a hollow cross-section as shown, is subjected to a tension force of 150 kN. The material has a yield stress of 360 MPa and a load factor is 1.8. Determine the wall thickness (t) of the cross section.
- Based on your results, determine the elongation of GH, if the modulus of elasticity (E) is 200 000 MPa.



4. The pin-connected frame is supported by a pin at A and a roller at D. Neglecting the weight of all members, determine all force components on member ABCD. Show your final answer on a new free body diagram sketch of ABCD.

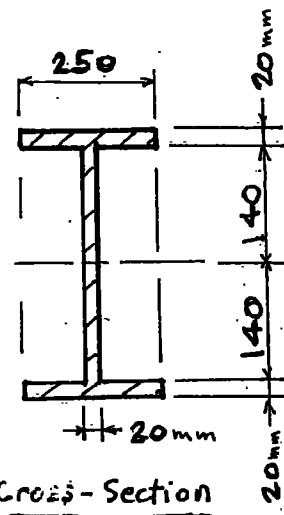
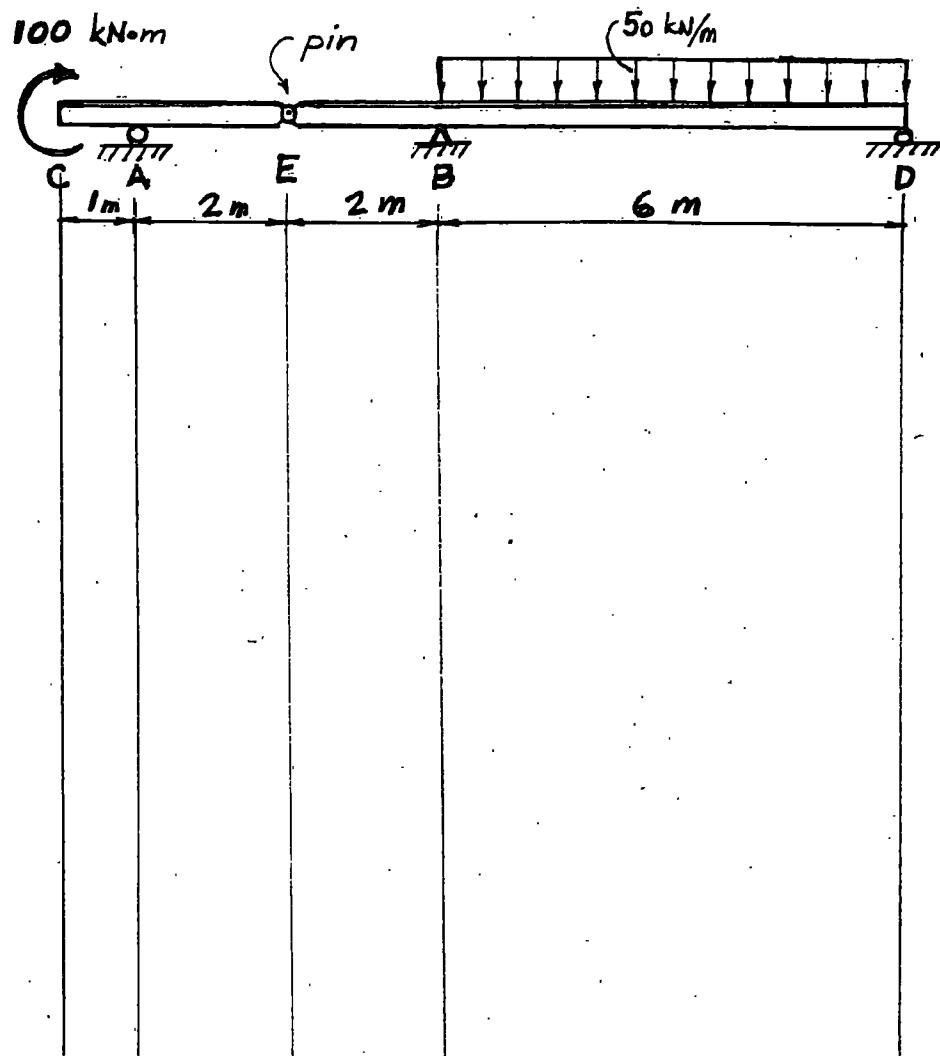


5. The steel beam shown below has an internal pin at E and is supported by a roller at A and D and by a pin at B.

a. Determine the reactions at A, B and D.

b. Draw neatly the shear and moment diagrams in the space provided below the beam.

c. If the yield stress for the material of the beam is 120 MPa and the load factor is 1.8, for the given cross-section below determine if this beam is safe.



Cross-Section

