UNIVERSITY OF TORONTO

Faculty of Applied Science and Engineering

CIV 100S – MECHANICS

Final Examination

26th April 2013

Examiner: Prof. Michael Seica

Time allowed: 2½ hours

FAMILY NAME:_____ **GIVEN NAME(S):**_____
(Please print clearly)

STUDENT NUMBER: _____

CIRCLE MODEL NUMBER OF YOUR CALCULATOR:

CASIO 260 **TEXAS INSTRUMENTS 30** **SHARP 520**

NOTES:

1. Make sure you have all 7 sheets of the examination paper. Page 7 is blank.
2. If you need more space for a question, please use the back of the preceding question. In all cases, please indicate clearly where your calculations are continued.
3. Answer all 5 (five) equal-value questions.
4. The only calculators permissible are listed above. Please circle your model.
5. No other paper will be accepted for marking or allowed on the desk.
6. Do not remove the staple.

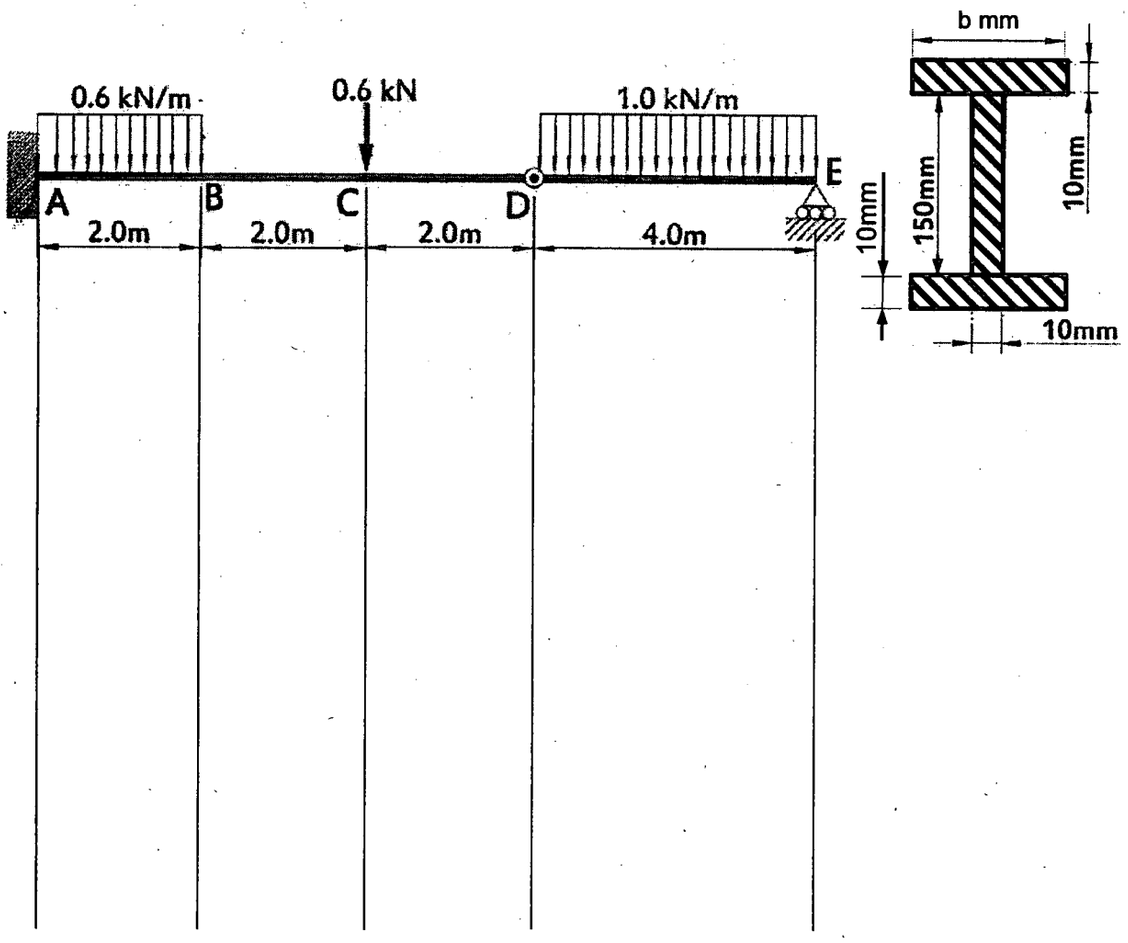
DO NOT WRITE IN THIS SPACE.

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

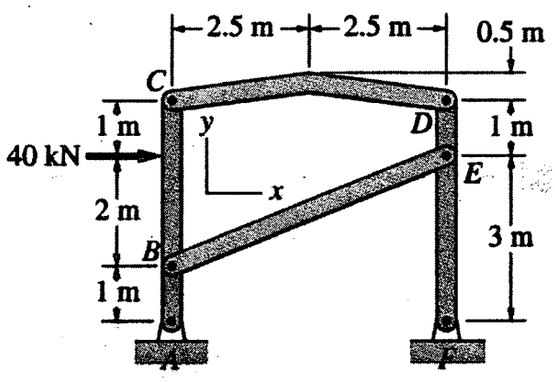
1. The beam presented below is supported by a fixed connection at *A* and a roller at *E*. The beam is also pinned internally at *D*. For the given loading:

(a) Draw the shear force and bending moment diagrams in the space provided. Indicate the values of the internal forces at points *A*, *B*, *C*, *D*, *E*, as well as local maxima and minima.

(b) If, as illustrated, the cross-section of the beam has an 'I' shape and is made of polycarbonate having an yield stress of 60 MPa, determine the width of the flange, b, given that the load factor for bending is 1.5. The material is available in 10 mm increments.



2. Determine the reactions at *A* and all forces acting on member *DEF* of the frame shown.



3. The aluminium truss illustrated is supported by pins at *D* and *G*.

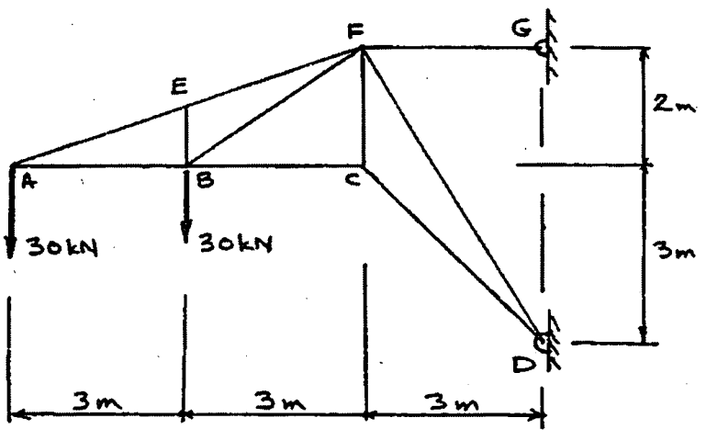
(a) Determine the reaction components at *D* and *G*.

(b) Determine the internal forces in members *BC* and *EF*.

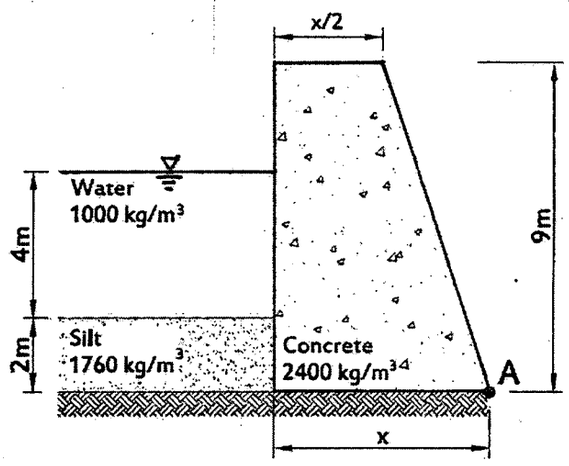
(c) Bar *FG* is fabricated from 12 mm thick plate having an yield stress of 240 MPa and the modulus of elasticity of 75×10^3 MPa.

(i) Determine the width of the plate given that the material is only available in width increments of 10 mm. The load factor for tension is 1.3.

(ii) Determine the elongation of bar *FG*.



4. A long, concrete dam is used to retain fresh water and a deposited layer of silt. Determine the minimum width of the dam, x, if the factor of safety against overturning about point A is 1.75.



5. A 100-kg uniform rectangular plate is supported in the position shown by hinges at *A* and *B*, and by cable *DCE* which passes over a frictionless pulley at *C*. Assuming that the tension is the same in both segments of the cable, determine the magnitude of the tension in the cable and the Cartesian expressions for the reactions at *A* and *B*, assuming that the hinge at *B* allows free movement along the *x* axis.