Delft Applied Mechanics Course:
Statics

AE1-914-I

1 November 2004, 14:00–17:00

This is the English exam.

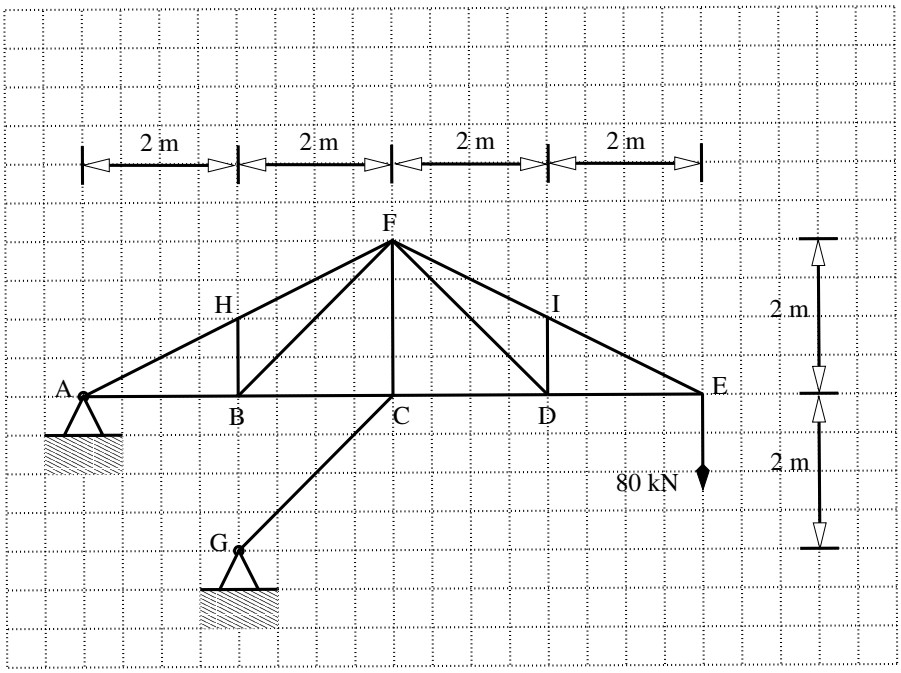
Only the answer sheets will be collected
Any other sheets will be rejected.

Write down your name and student number !
Answers without name and student number are not graded.

Check your intermediate answers to prevent arithmetical errors

Problem 1 (Weight 1.5, approx. 30 min.)

The truss structure given in the figure is loaded by a force of 80 kN in node E.



a) Determine *graphically* the direction of the reaction force in A.

b) Calculate the reaction forces in the supports A and G.

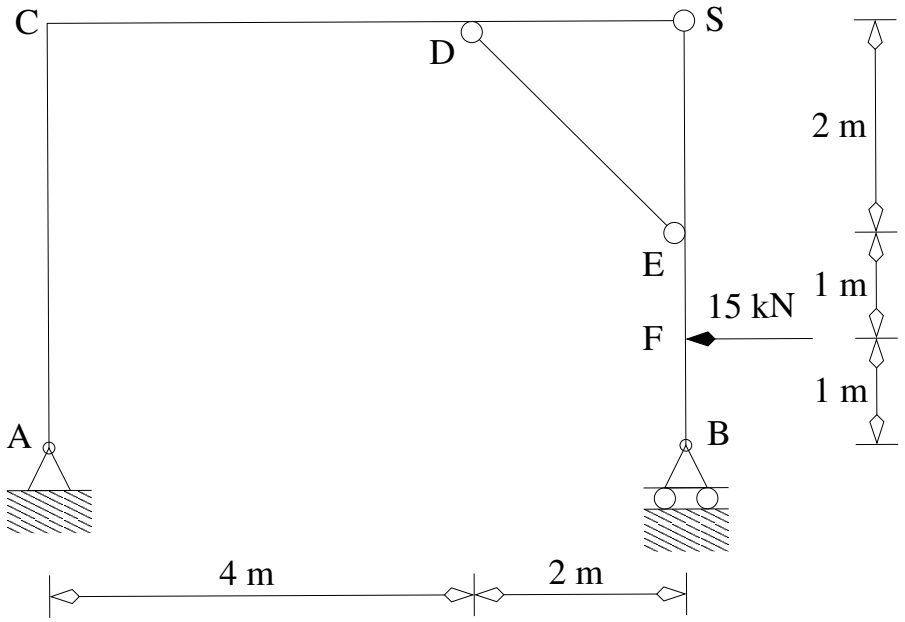
c) Which members are zero-force members?

d) Calculate the forces in all members.

e) Draw the force polygon of node F.

Problem 2 (Weight 2.5, approx. 40 min.)

A frame consists of a bracket ACS, a column BS and a link DE, connected as shown in the figure. The structure is supported by a pin in A and a horizontal roller in B. A horizontal force of 15 kN is applied at point F.



a) Calculate the force in member DE.

b) Calculate the reaction forces in the supports A and B.

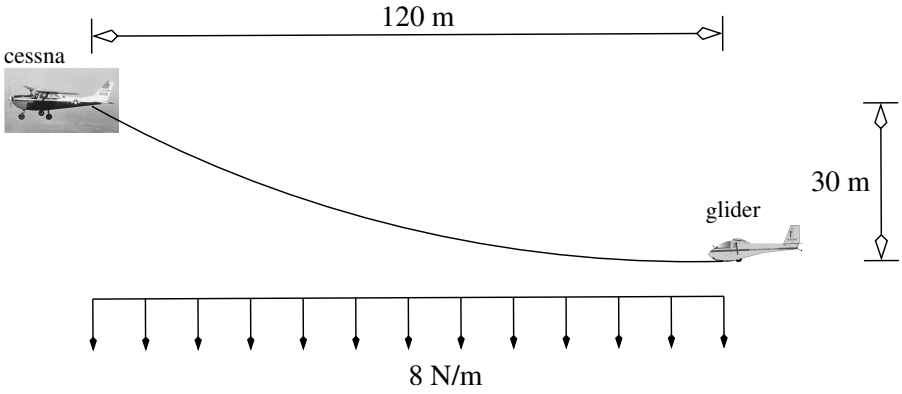
c) Draw the normal force diagram for the entire structure. Use the correct signs for tension and compression.

d) Draw the shear force diagram for the entire structure and use the deformation signs.

e) Draw the bending moment diagram for the entire structure and use the deformation signs.

Problem 3 (Weight 1.5, approx. 30 min.)

A sail plane is being towed in level flight and is 120 m behind and 30 m below the Cessna. The tangent to the cable at the sail plane is horizontal. The mass of the cable is modeled as a uniform vertical distributed load of 8 N/m measured *horizontally*. The load on the cable due to air resistance is neglected.

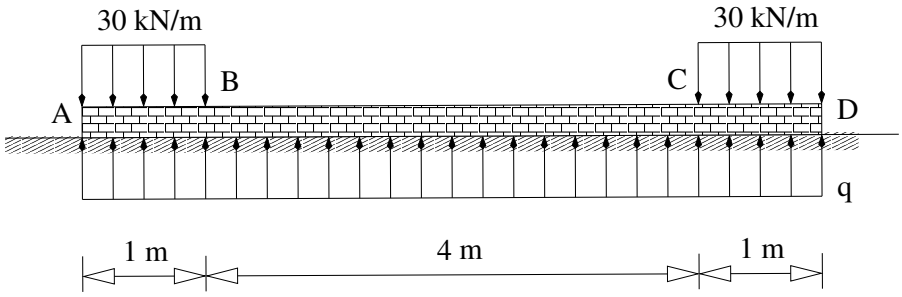


a) Calculate the force in the cable at the glider.

b) Calculate the maximum force in the cable. Where does it occur?

Problem 4 (Weight 2.5, approx. 40 min.)

A beam of length 6 m is at rest on the ground. The weight of the beam is neglected. A uniform distributed load of 30 kN/m acts on AB and CD. As a reaction, the beam experiences a uniform distributed load q from the ground.



a) Calculate the magnitude q of the uniform distributed load.

b) Draw the resulting distributed load acting on the beam.

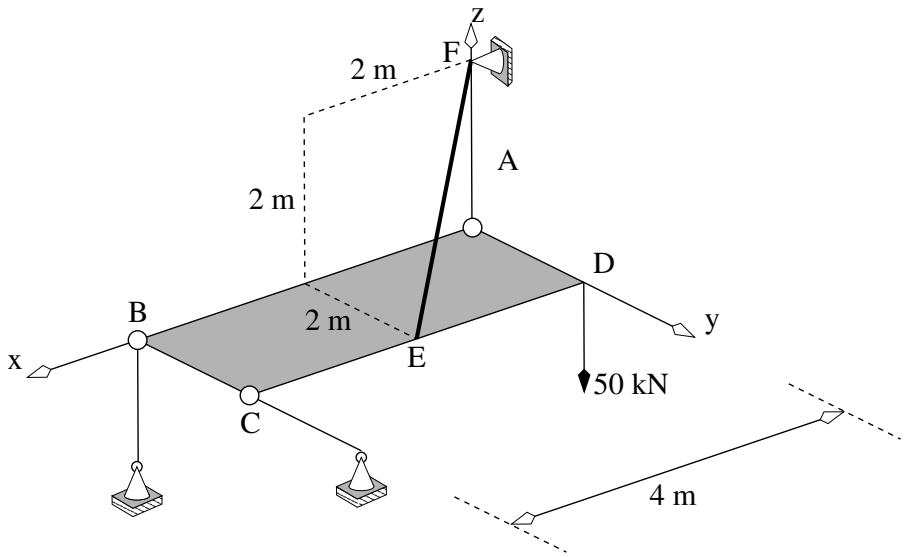
c) Draw the shear force diagram of the beam and use the deformation signs.

d) Draw the bending moment diagram of the beam and use the deformation signs. Draw the tangents to the diagram in points A, B, C and D and clearly indicate where they intersect.

e) Where does the maximum bending moment occur and what is the value of this maximum?

Problem 5 (Weight 2, approx. 40 min.)

The plate in the figure is supported by a ball-and-socket support in A, a link parallel to the z-axis in B, a link parallel to the y-axis in C, and a cable EF. The plate is loaded by a force of 50 kN in the negative z-direction in D.



a) Calculate the force in the cable.

b) Calculate the forces in the links at B and C.

c) Calculate the reaction forces in A.

d) Draw a free body diagram of plate ABCD and draw all forces in the way they act on the plate.