

Delft Applied Mechanics Course Statics

AE1-914 part I – 22 January 2009 09.00h - 12.00h

Answer sheets

Last name and initials:

Study no.:

Only hand in the answer sheets! Other sheets will not be accepted

Write your name and study number on every page Sheets without name or study number will not be accepted.

Write relevant calculations on the answer sheet Use the blank sides of the answer sheets if necessary. Answers without calculations or motivation will not be taken into account.

> Use possible checks to avoid calculation errors The order of answering the questions is free NOTE: **this exam consists of 5 problems.**

The **neatness of the presentation** of the answers will be considered in the marking.

All answers must be given mentioning the correct SI units.

Answer sheets	Student no:				
Exam Ae1-914 part I	Name:				

Problem 1 (Weight 2 - approx. 35 minutes)

The structure below consists of beam OAB with arms AC and AD attached perpendicularly. The weight of the structure may be neglected. Point O is a ball and socket joint. The ball that is attached to point B slides over a frictionless slope. The angle α of the slope with respect to the x-axis is equal to tan $\alpha = 3=4$. The structure is kept in equilibrium by means of the cables AE and CG which are parallel to the x-axis. A mass with a weight of W = 4 kN is attached to point D.



a) Calculate the reaction(s) in B. Draw them in the figure as they act on the structure in reality.



Answer sheets	Student no:	
Exam Ae1-914 part I	Name:	
b) Calculate the forces in cat	bles AE and CG.	
Answer		

Answer sheets	Student no:	
Exam Ae1-914 part I	Name:	
 c) Calculate the reaction(s) in they act on the structure in Answer 	n the ball- and socket joint O	. Draw them in the figure as

Name:

Problem 2 (Weight 2 - approx. 30 minutes)

Exam Ae1-914 part I

The truss represented in the figure below has a hinged support in A and a roller support in B. Dimensions can be read from the figure using the grid, the grid distance is 1 m. The loads can be read from the figure as well.



a) Determine the horizontal and vertical component of the reaction forces in A and B. Sketch these forces in the figure in the directions in which they act and give their values. **Answer**

Student no:



Name:



b) Determine by means of the method of sections the force in bar (1). Clearly indicate

Answer sheets	Student no:							
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Exam Ae1-914 part	I Name:							<u></u>
d) Determine by measure section used.	ans of the method of sections the force in ba	ar (3).	Cle	arly	ind	icate	e the	
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Answer sheets

Student no:





e) Determine the force in bar (4). The choice of method is free.

Answer

f) Assemble the previous results in the table with the correct signs for tension and compression

Answer sheets	Student no:	
Exam Ae1-914 part I	Name:	

Member	N(KN)
1	
2	
3	
4	

Student no:



Exam Ae1-914 part I

Name:

Problem 3 (Weight 2 - approx. 40 minutes)

The structure in the figure consists of two parts (ABCS and SDE) which are hinged together in S.



a) Graphically determine the direction of the reaction force in A.



Answer sheets	Student no:							
Exam Ae1-914 part I	Name:							<u></u>
 b) Calculate the reactions previous question. 	s in A and E. It is permitted to us	e the	sol	utio	n frc	om tl	he	
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Answer sheets	Student no:					
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Exam Ae1-914 part I	Name:					

c) Draw the moment-diagram (M-diagram) of part ABCS using the correct deformation signs. Mention all relevant values and draw the tangents when necessary. **Answer**



d) Draw the shear force diagram (V -diagram) of part ABCS using the correct deformation signs. Mention all relevant values.





Exam Ae1-914	part I
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Name:

e) Isolate the corner at C and draw all forces and moments as they act on it in reality. State all values of these forces and moments.



Answer sheets	Student no:						
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Exam Ae1-914 part I	Name:						

Problem 4 (Weight 2 - approx. 35 minutes)

The structure depicted in the figure consists of a beam AS of length 5 m connected with a pin to a beam BS of length 10 m. The structure is loaded by a force of 30 kN and a couple of 20 kNm halfway along beam BS.



a) Using the principle of virtual work, calculate the reaction force in support B. Clearly indicate the virtual displacement field and the direction of the reaction force.

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Ex	am Ael-914 part I	Name:												
b)	Using the principle of virtu Clearly indicate the virtua	ual work, calculate the bending Il displacement _eld and the sig	momer In conv	nt in enti	sup on ւ	opor Ised	t A. I.							
	Answer													
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Exam Ae1-914 part I

Name:

Problem 5 (Weight 2 - approx. 35 minutes)

The cable ABCD in the figure is loaded by a distributed load of 4 kN/m acting on part AB and a single force of 40 kN in C. The sag of point C is 10 meters.



a) Determine the reaction forces in points A and D. Draw them in the figure as they act on the cable in reality.

Answer sheets	Student no:	
Exam Ae1-914 part I	Name:	
b) Determine the sag h	n _B of point B.	
Answer		

Answer sheets		Student no:	
Exam Ae1-914 part I		Name:	
c)	Where in the cable cable force in that p	does the maximum cable force occur? point?	What is the value of the
	Answer		
d)) Where in the cable does the sag reach its maximum? What is the maximum sag in thi point?		
	Answer		

Answer sheets	Student no:	
Exam Ae1-914 part I	Name:	