Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Student number\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Assignment 3**

1

2

1

*X*

*Z*

*z*

*x*

*z*

*x*

3

*p*

2

*L*

*L*

Beam structure of the figure is loaded by distributed force acting on beam 1. Determine the critical value  causing beam 2 to buckle. Assume that beam 1 is inextensible in the axial direction. Displacements are confined to the plane. Cross-sectional properties and of the beam structureand Young’s modulus  of the material are constants.

**Solution template**

The aim of the stability analysis is to find the condition for a non-zero transverse displacement solution for beam 2. Solving for the axial displacement of beam 2 is not necessary as the axial force in terms of the loading parameter *p* follows from the (moment) equilibrium of beam 1

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As beam 1 is inextensible in the axial direction The non-zero displacement/rotation component for beam 2 is . Element contribution, taking into account the beam bending mode and the interaction of the bar and beam bending modes, are given by

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Virtual work expression is sum of the internal and stability parts

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Principle of virtual work and the fundamental lemma of variation calculus imply the equilibrium equation

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A non-trivial solution is possible (something that is non-zero) only if the expression in parenthesis vanishes. Therefore, the critical value of the loading parameter , making the solution non-unique, is

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