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

**Assignment 5 (4p)**

Derive the range of the hold force for a rope of length *L* around a bollard so that equilibrium is possible. Assume that the rope is inextensible in the direction of the mid-curve and flexible with respect to bending (). Consider the fully developed Coulomb friction when the load is about to move up or down. Start with the equilibrium equations of beam in system. *Hint*: External force  is the unknown of the problem and  is opposite to the pending motion ( is the coefficient of friction).

*R*

*s*





**Answer**

**constitutive**