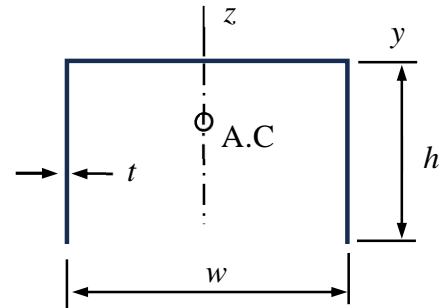


Name \_\_\_\_\_ Student number \_\_\_\_\_

## Assignment 4

Consider the cantilever on pages 7-10 of the lecture notes. Use the beam model to find the vertical displacement  $w$  and axial rotation  $\phi$  of the cantilever at the free end and, thereby, the spring coefficients  $k_b$  and  $k_t$  of the bending and torsion relationships  $F = k_b w$  and  $T = k_t \phi$  where  $F$  and  $T$  are the force and torque resultants of the loading. The cross-sectional properties needed are the second moment of area  $I$  with respect to the *area centroid* and polar moment  $J$  according to St. Venant's torsion theory. Use the simplified formulas for thin open profiles ( $t/a \ll 1$  and  $t/b \ll 1$ ) and for  $J$ .



First, find the expressions of  $k_b$  and  $k_t$  in terms of the geometrical and material parameters. After that, calculate the spring coefficients using the values of the parameters given on page 9 of the lecture notes.