

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

### Assignment 3 (4p)

Derive the component forms of cylindrical shell force equilibrium equations in the  $(z, \phi, n)$  coordinate system starting from the invariant form  $\nabla_0 \cdot \vec{F} - \kappa \vec{e}_n \cdot \vec{F} + \vec{b} = 0$ . The force resultant representations and kinematic quantities of the cylindrical shell  $(z, \phi, n)$  coordinate system are

$$\vec{F} = N_{zz} \vec{e}_z \vec{e}_z + N_{z\phi} \vec{e}_z \vec{e}_\phi + N_{\phi z} \vec{e}_\phi \vec{e}_z + N_{\phi\phi} \vec{e}_\phi \vec{e}_\phi + Q_z \vec{e}_z \vec{e}_n + Q_z \vec{e}_n \vec{e}_z + Q_\phi \vec{e}_\phi \vec{e}_n + Q_\phi \vec{e}_n \vec{e}_\phi,$$

$$\vec{b} = b_z \vec{e}_z + b_\phi \vec{e}_\phi + b_n \vec{e}_n, \quad \nabla_0 = \vec{e}_z \frac{\partial}{\partial z} + \vec{e}_\phi \frac{1}{R} \frac{\partial}{\partial \phi}, \quad \frac{\partial}{\partial \phi} \vec{e}_\phi = \vec{e}_n, \quad \frac{\partial}{\partial \phi} \vec{e}_n = -\vec{e}_\phi, \quad \vec{I} = \vec{e}_z \vec{e}_z + \vec{e}_\phi \vec{e}_\phi + \vec{e}_n \vec{e}_n.$$