Name__________________________ Student number__________________

Assignment 3 (4p)

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

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

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