Equations Materials & Structures

The student should know the following equations (incl. units of the parameters)

Loaded spring	$P = k\Delta L$
Stress and strain (incl. shear)	$\sigma = \frac{F}{A} \quad ; \quad \varepsilon = \frac{\Delta L}{L} \quad ; \quad \varepsilon = \frac{\sigma}{E} \quad ; \quad \gamma = \frac{\tau}{G}$
Hooke's law for biaxial load in anisotropic sheet (to be simplified for isotropic sheet)	$\varepsilon_x = \frac{\sigma_x}{E_x} - \nu_{yx}\frac{\sigma_y}{E_y}$ $\varepsilon_y = \frac{\sigma_y}{E_y} - \nu_{xy}\frac{\sigma_x}{E_x}$
Stresses in pressure vessel	$\sigma_{circ} = \frac{pR}{t} \quad ; \quad \sigma_{long} = \frac{pR}{2t}$
Torsional moment	$M_T = 2qA$
Specific strength and specific modulus (representative for tensile load)	$\frac{\sigma_u}{\rho} \quad ; \quad \frac{E}{\rho}$
Relevant parameter for sheet stability (compression)	$\frac{\sqrt[3]{E}}{\rho}$
Natural frequency	$f_n = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$
Stress concentration factor	$K_t = \frac{\sigma_{peak}}{\sigma_{nom}} = 1 + 2\frac{a}{b} = 1 + 2\sqrt{\frac{a}{r}}$