MECH326 Chapter 3 – Load and Stress Analysis

3-1 Equilibrium and Free-Body Diagrams

$\sum F = 0$ (N - force), $\sum M = 0$ (Nm - moment), $V = \dfrac{dM}{dx}$ (N - shear force), $q = \dfrac{dV}{dx}$ (Nm^{-1} load intensity).

3-10 Normal Stresses for Beams in Bending

$\sigma_x = -\dfrac{M_z y}{I_z}$ where the bending moment M_z is on the xy-plane about the z-axis. (When $M_z > 0$, it bends towards $+y$.)

The *neutral* axis is the x-axis, and the *neutral* plane is the xz-plane. $I_z = \displaystyle\int y^2 \, dA$ $\left(\dfrac{\pi}{4} r^4 \text{ for circular cross section } A.\right)$

$\sigma_{max} = \dfrac{Mc}{I} = \dfrac{M}{Z}$, where $Z = I/c$ is called the section modulus.