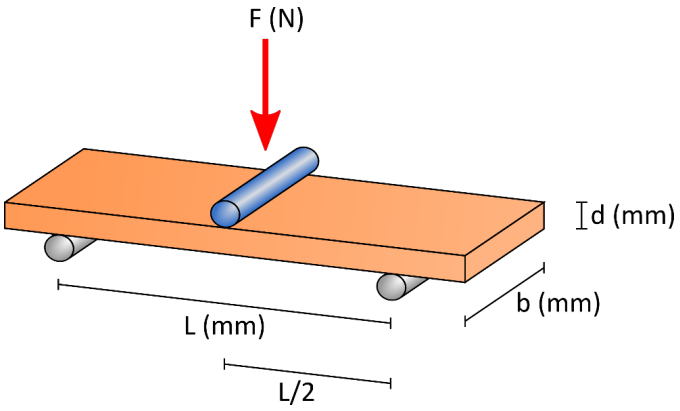
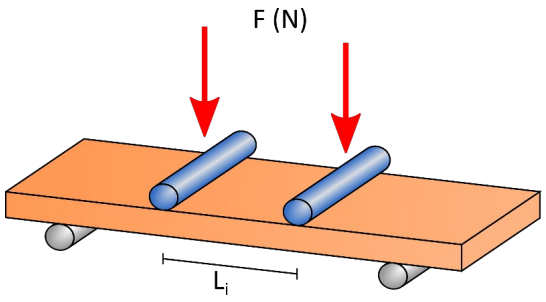
School of Materials Science and Engineering

Bending Test – Formulas





$E_f = Elastic\ Modulus\ (MPa)$
$\sigma_f = Flexural\ stress$
$\epsilon_f = Flexural\ strain$
$L = length\ of\ beam\ between\ supports\ (mm)$
$L_i = distance\ between\ loading\ span\ (4-point\ bend)$
$b = width\ of\ beam\ (mm)$
$d = thickness\ of\ beam\ (mm)$
$F = load\ applied\ (N)$
$D = deflection\ of\ beam\ at\ load\ (mm)$
$x = distance\ away\ from\ support$
$m = \frac{N}{mm}\ initial\ straight\ line\ of\ load\ deflection$

Property	**Formula**
Elastic Modulus	$E_f = \frac{L^3 m}{4bd^3}$
Flexural Stress (3-point)	$\sigma_f = \frac{3FL}{2bd^2} \quad Rectangular$ $\sigma_f = \frac{FL}{\pi R^3} \quad Circular$
Flexural Stress (4-point)	$\sigma_f = \frac{3F(L - L_i)}{2bd^2}$
Flexural Strain – outer surface (surface under tension)	$\epsilon_f = \frac{6Dd}{L^2}$
Bending Moment (3-point)	$M = \frac{Fx}{2}$
Second Moment of Area	$M = \frac{FL}{4} \quad moment\ at\ load$