Level 3 Technical Level
DESIGN ENGINEERING
MECHATRONIC ENGINEERING

Unit 3 Mathematics for Engineers

Formula sheet

Area of a circle $A = \pi r^2$ or $A = \frac{\pi D^2}{4}$	Density $\rho = \frac{m}{V}$
Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$	Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$ $b^2 = a^2 + c^2 - 2ac\cos B$ $c^2 = a^2 + b^2 - 2ab\cos C$
Angular measure $360^0 \equiv 2\pi$ radians	Newton's second law $F = ma$
Trigonometry $\sin = \frac{opp}{hyp}$, $\cos = \frac{adj}{hyp}$ and $\tan = \frac{opp}{adj}$	Quadratic equation $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ where $ax^2 + bx + c = 0$
Mean value $\bar{x} = \frac{\sum x}{n}$	Standard deviation $\sigma = \sqrt{\left\{\frac{\sum (x - \bar{x})^2}{n}\right\}}$
Cartesian to polar conversion $r = \sqrt{x^2 + y^2}$ $\tan\theta = \frac{y}{x}$	Polar to Cartesian conversion $x = r\cos\theta$ $y = r\sin\theta$
Straight line graph $y = mx + c$	Energy $PE = mgh$ and $KE = \frac{mv^2}{2}$
The gravitation constant: $g = 9.81\ m\ s^{-2}$	Young's Modulus $\sigma = \frac{F}{A}$, $\epsilon = \frac{\Delta L}{L_o}$ and $E = \frac{\sigma}{\epsilon}$

Standard Derivatives

$f(x)$	$\frac{dy}{dx}$
ax^n	anx^{n-1}
$\sin ax$	$a\cos ax$
$\cos ax$	$-a\sin ax$
$\ln ax$	$\frac{1}{x}$
e^{ax}	ae^{ax}

Standard Integrals

$f(x)$	$\int f(x)\,dx$
ax^n	$\frac{ax^{n+1}}{n+1}+c$ if $n\neq 1$
$\sin ax$	$-\frac{1}{a}\cos ax+c$
$\cos ax$	$\frac{1}{a}\sin a\,x+c$