

Systems Engineering

Formula Sheet

Please remove from the centre of this book during reading time.

You may keep this Formula Sheet.

Mechanical

$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}} \times 100\%$	$\text{efficiency}_{\text{total}} = \text{efficiency}_1 \times \text{efficiency}_2$
$F = ma$	$\text{force due to gravity} = \text{mass} \times \begin{matrix} \text{acceleration due} \\ \text{to gravity} \end{matrix}$
$P = \frac{W}{t}$	$\text{work done} = \begin{matrix} \text{force in} \\ \text{direction} \\ \text{moved} \end{matrix} \times \text{distance}$
$\text{torque} = \text{twisting force} \times \begin{matrix} \text{perpendicular distance} \\ \text{to pivot point} \end{matrix}$	$\text{moment} = \text{force} \times \begin{matrix} \text{perpendicular distance} \\ \text{to pivot point} \end{matrix}$
$F_1 d_1 = F_2 d_2$	$P = \frac{F}{A}$
$\text{speed} = \frac{\text{distance}}{\text{time}}$	$\text{mechanical advantage} = \frac{\text{load}}{\text{effort}}$
$\text{gear ratio final} = \text{gear ratio 1} \times \text{gear ratio 2}$	$\text{gear or pulley ratio} = \frac{\text{speed of driver (rpm)}}{\text{speed of driven (rpm)}}$
$\frac{\text{Gear A rpm}}{\text{Gear B rpm}} = \frac{\text{Gear B number of teeth}}{\text{Gear A number of teeth}}$	$\frac{\text{Pulley A rpm}}{\text{Pulley B rpm}} = \frac{\text{diameter of Pulley B}}{\text{diameter of Pulley A}}$
$\text{velocity ratio} = \frac{\text{distance moved by effort}}{\text{distance moved by load}}$	

Electrical

electrical energy efficiency $= \frac{\text{useful energy output}}{\text{total energy input}} \times 100\%$		$I = \frac{V}{R}$	
$P = VI$		$P = \frac{E}{t}$	
$f = \frac{1}{T}$		$V_x = \frac{R_x}{R_{\text{total}}} \times V_{\text{supply}}$	
$\frac{N_1}{N_2} = \frac{V_1}{V_2} = \frac{I_2}{I_1}$		$V_{\text{peak}} = \sqrt{2}V_{\text{RMS}}$	
resistors in series	$R_t = R_1 + R_2 + R_3 + \dots$	resistors in parallel	$\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$
two resistors in parallel	$R_t = \frac{R_1 \times R_2}{R_1 + R_2}$	capacitors in series	$\frac{1}{C_t} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \dots$
capacitors in parallel	$C_t = C_1 + C_2 + C_3 + \dots$		

General

area of circle = πr^2 ($\pi = 3.14$)
circumference of circle = $2\pi r$

Resistor colour codes

Colour	Value	Colour	Value	Colour	Tolerance
black	0	green	5	brown	1%
brown	1	blue	6	red	2%
red	2	violet	7	gold	5%
orange	3	grey	8	silver	10%
yellow	4	white	9		

