SYSTEMS ENGINEERING

Written examination

FORMULA SHEET

Instructions

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

This formula sheet is provided for your reference.

Systems Engineering formulas

Mechanical

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

Electrical

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

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		

END OF FORMULA SHEET