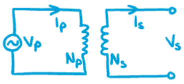
① TRANSFORMERS

$\boxed{\dfrac{V_p}{V_s} = \dfrac{N_p}{N_s} = \dfrac{I_s}{I_p}}$ IDEAL TRANSFORMER



$\boxed{\eta = \dfrac{P_{OUT}}{P_{IN}} \times 100\%}$ EFFICIENCY

$\boxed{P = IV = I^2R}$

$\boxed{\begin{aligned} rpm \times \tfrac{\pi}{30} &= rads^{-1} \\ rads^{-1} \times \tfrac{30}{\pi} &= rpm \end{aligned}}$

$\boxed{P = \dfrac{V_m I_m}{2} \cos(\theta_v - \theta_i)}$ POWER DELIVERED TO LOAD

$V_m = V_s$

angles for complex V_s, I_s

$\boxed{R_2' = a^2 R_2}$

$\boxed{x_2' = a^2 x_2}$

EQUIV. CIRCUIT

KEY
- equations used in the SGTA weekly submission
- other potentially useful equations

② DC MOTORS

$\boxed{V = E_a + I_a R_a}$ DEVELOPED VOLTAGE IN PMDC MOTOR

emf armature

$\boxed{P_{IN} = V_{IN} I_{IN}}$ DC MOTOR

$\boxed{V = K_a \phi \omega + I_a R_a}$

$\boxed{P = \tau \omega}$ MECHANICAL POWER

$\boxed{P_{IN} = V_{IN} I_{IN} \cos\phi}$ SINGLE PHASE MOTOR

$\boxed{K_a = \dfrac{PZ}{2\pi a}}$

$P \Rightarrow$ poles
$Z \Rightarrow$ conductors

$\boxed{P_d = E_b I_a}$ POWER DEVELOPED

$\boxed{P_{IN} = \sqrt{3}\, V_{IN} I_{IN} \cos\phi}$ 3-PHASE MOTOR

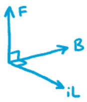
$\boxed{\tau = K_a \phi I_a}$

$\boxed{\tau \propto \omega_m^k}$

emf rads⁻¹ rpm

$\boxed{\dfrac{E_a}{E_b} = \dfrac{\omega_a}{\omega_b} = \dfrac{N_a}{N_b}}$

$\boxed{F = BIL}$ FORCE IN MOTOR

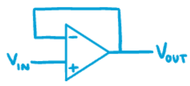


left hand rule

③ DC MOTOR SPEED CONTROL

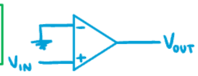
$\boxed{E_a I_a = \tau \omega_m}$ DEVELOPED TORQUE

$\boxed{V_{OUT} = V_{IN}}$



$\boxed{E_b = K_b \phi \omega}$

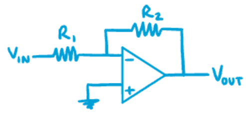
$\boxed{V_{OUT} = V_{cc} \sin(V_{IN})}$



$\boxed{\tau = K_t I_a}$ LOAD

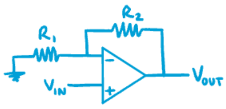
armature torque const.

$\boxed{V_{OUT} = -\dfrac{R_2}{R_1} V_{IN}}$



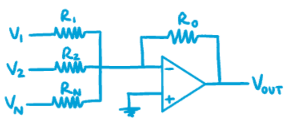
$\boxed{D = \dfrac{\tau_1}{\tau_2} \times 100\%}$ DUTY RATIO

$\boxed{V_{OUT} = \left(1 + \dfrac{R_2}{R_1}\right) V_{IN}}$



$\boxed{DV_s = K_t \omega + I_a R_a}$

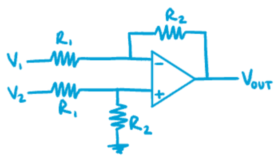
$\boxed{V_{OUT} = -\left(V_1 \dfrac{R_0}{R_1} + V_2 \dfrac{R_0}{R_2} + \cdots + V_N \dfrac{R_0}{R_N}\right)}$



$\boxed{E_b = K\omega}$ ELEC. MOTOR BACK EMF

$\boxed{\tau_m = K I_a}$ ELEC. MOTOR TORQUE

$\boxed{V_{OUT} = \dfrac{R_2}{R_1}(V_2 - V_1)}$

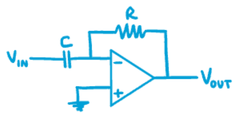


$\boxed{V = E_b + R_a I_a + L_a \dfrac{dI_a}{dt}}$ electrical

$\boxed{\tau_m = \tau_1 + B\omega + J \dfrac{d\omega}{dt}}$ mechanical

DIFF. EQUATIONS GOVERNING DC MOTOR

$\boxed{V_{OUT} = -\dfrac{R}{1/j\omega C} V_{IN}}$



$\boxed{\begin{aligned} x &= Ax + Bu \\ y &= Cx + Du \end{aligned}}$ STATE-SPACE

u = input
x = output

$\boxed{V_{OUT} = -\dfrac{1}{j\omega CR} V_{IN}}$