Monday, April 11, 2016

Formulas needed for the final exam

A separate formula sheet is not allowed in ENGG 225.

Here's what you will be provided on the exam paper itself.

Machine equations and conversions:

$$T_{dev} = K\phi I_A$$
$$E_A = K\phi \omega_m$$
$$P = T\omega_m$$

GIVEN

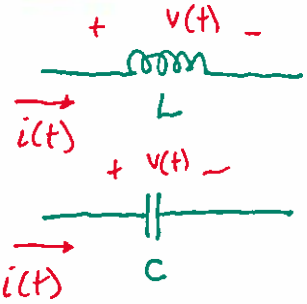
Also given: 1 HP = 746 W

$$\omega_m \text{ (rad/sec)} = n_m \text{ (revs/min)} \times 2\pi \text{ (rads/rev)} \times \frac{1}{60} \text{ (mins/sec)}$$

$$\omega_m = n_m \frac{2\pi}{60} \quad \longleftrightarrow \quad n_m = \frac{60}{2\pi}\omega_m$$

Important stuff to remember (which is not given)

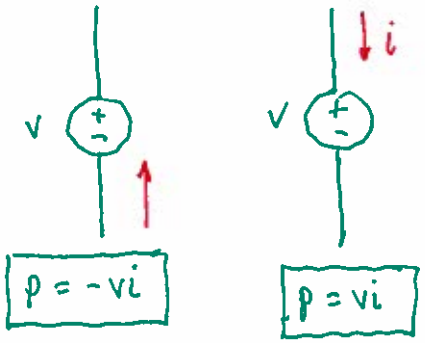
Ls and Cs



$$v(t) = L\frac{di(t)}{dt}, \quad Z_L = j\omega L$$

$$i(t) = C\frac{dv(t)}{dt}, \quad Z_C = \frac{1}{j\omega C}$$

DC Power



$p > 0$	absorbed
$p < 0$	delivered

Passive reference convention applies to AC circuits as well.

AC Power

P (power, or average power) $\quad P = \frac{V_{rms}^2}{R} = I_{rms}^2 R$

Q (reactive power) $\quad Q = \frac{V_{rms}^2}{X} = I_{rms}^2 X$

where $X = |Z_L| = \omega L$ for an inductor

$X = |Z_C| = 1/\omega C$ for a capacitor

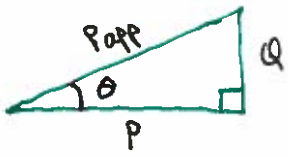
$P = I_{rms} V_{rms} \cos(\theta)$

$Q = I_{rms} V_{rms} \sin(\theta)$

θ: power angle, $\theta = \theta_V - \theta_I$

Complex power $\bar{S}$ $\quad \bar{S} = P + jQ = \frac{1}{2}\bar{V}\bar{I}^*$

Power triangle



Apparent power

$P_{app} = \sqrt{P^2 + Q^2} = |\bar{S}|$

Past exams are very helpful!

Questions to ignore on past exams

- all questions with switches (i.e., transient analysis problems) – not covered any more in ENGG 225.
- all questions with diodes (never an ENGG 225 topic)

Tips on AC circuit analysis

1. Properly setting up and manipulating equations is the most important part
   - Smaller weighting on correct answers
2. If you struggle through pages of complex number manipulation...

GIVE UP!

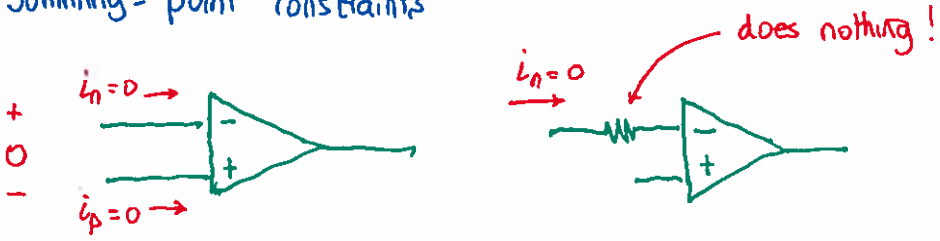
Tips on solving op-amp circuits

Casual observation:

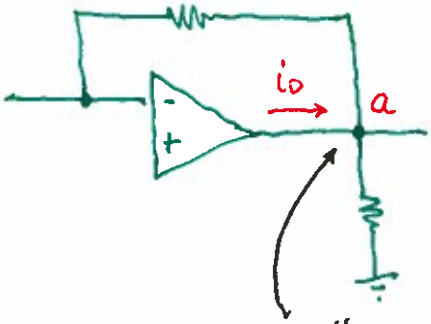
- The difficulty of solving op-amp circuits is inversely proportional to size.

Tips:

1. Node-voltage equations at op-amp input terminals are often all that's needed.
2. Summing-point constraints



3. Don't write an equation at the output unless you need to



write an equation at node a only if you need to find i_o
— equation is wrong without it.