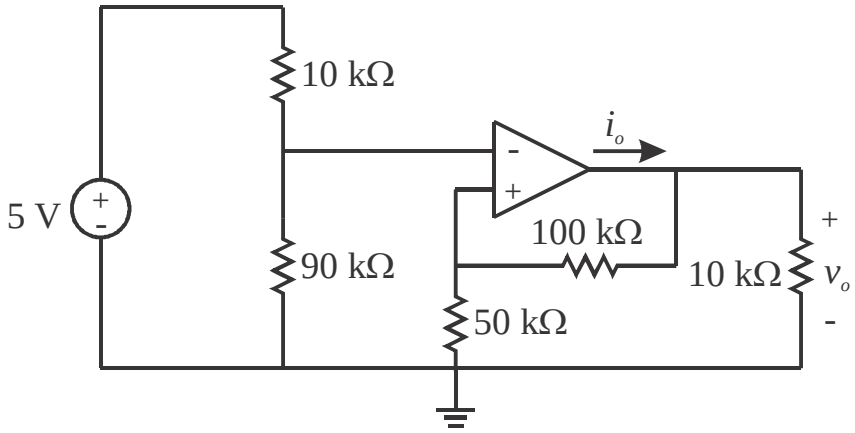
EE 220/220L Circuits I Final Examination example problems

Name _____

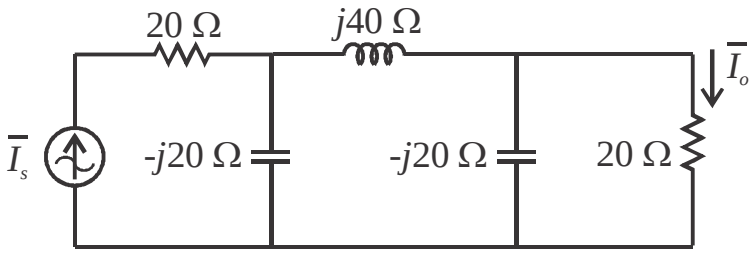
Instructions: Show all work for full credit. Write answers in indicated places. Put all phasors in polar form with angle in degrees. Put all admittances and impedances in rectangular form.

1) For the ideal op-amp circuit shown, find v_o and i_o.



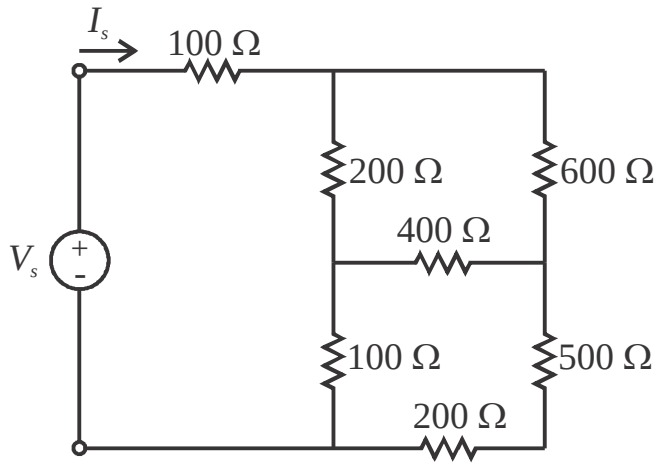
v_o = **13.5 V** i_o = **1.44 mA**

2) Given $\bar{I}_S = 0.5\angle 0°$ A, find the impedance seen by the source and the phasor current $\bar{I}_o$.



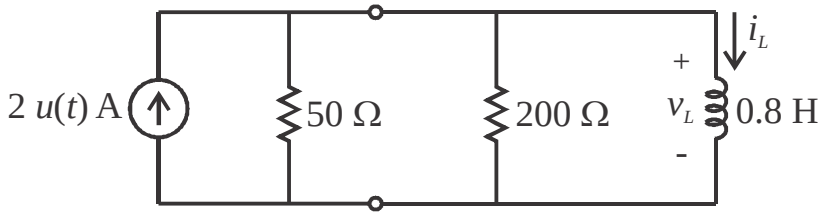
$\bar{Z}_{eq}$ = ___**40 - *j* 40 Ω**___ $\bar{I}_o$ =___500∠180° mA____

3) Calculate the equivalent resistance R_{eq} seen by the source and source current I_S, when $V_S = 24\,V$.



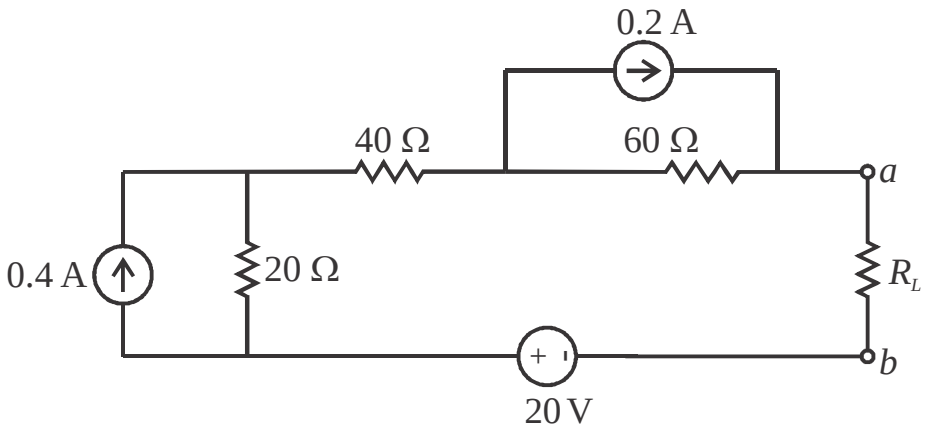
R_{eq} = **340.625 Ω** I_S = **70.46 mA**

4) Find $i_L(t)$ and $v_L(t)$ for $t > 0$.



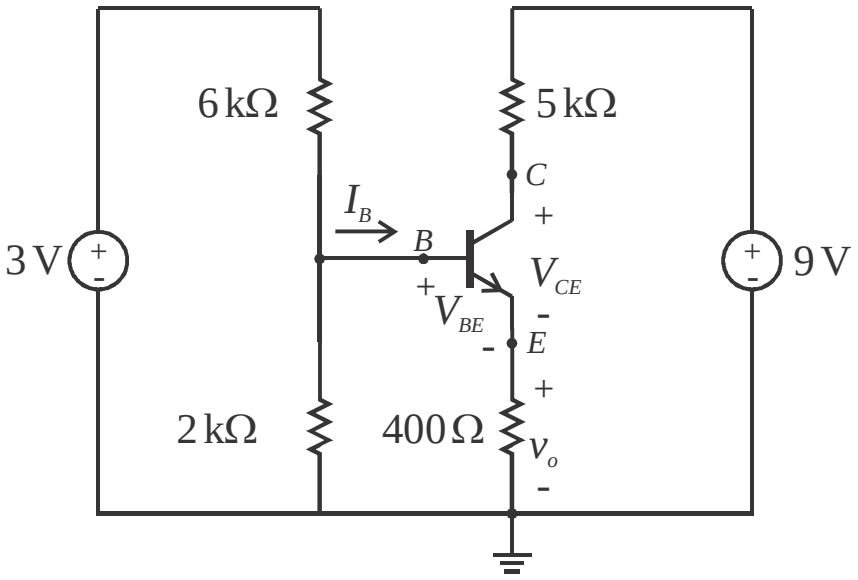
$i_L(t)$ = **$2 - 2\,e^{-50t}$ A $t > 0$** $v_L(t)$ = **$80\,e^{-50t}$ V $t > 0$**

5) Find the Thevenin equivalent circuit for the circuit shown. Then, determine the load resistance $R_{L,\max}$ for maximum power delivered and the maximum load power $P_{L,\max}$.



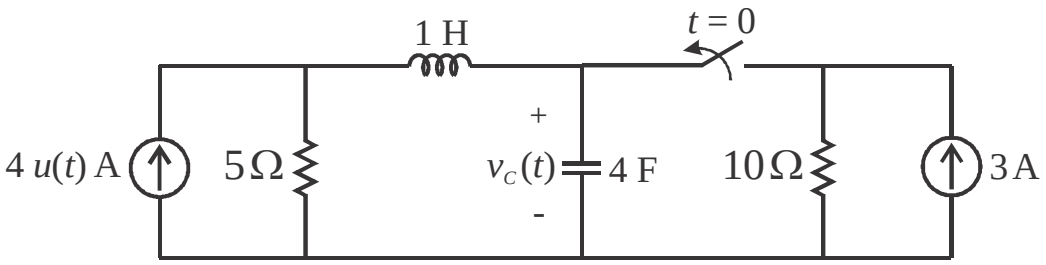
V_T = **40 V** R_T = **120 Ω** $R_{L,\max}$ = **120 Ω** $P_{L,\max}$ = **3.33 W**

6) For the npn DC transistor circuit shown, find I_B, V_{CE}, and v_o **using mesh analysis** when β = 200 and V_{BE} = 0.7 V.



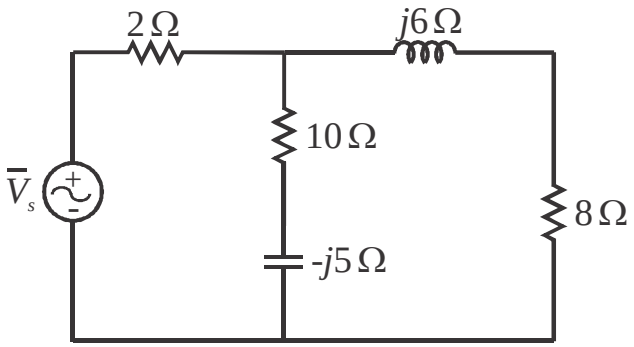
I_B = **_610.5 nA_** V_{CE} = **_8.34 V_** v_o = **_49.08 mV_**

7) For the circuit shown, the switch **opens** at $t = 0$ after being closed for a long time. Find $v_C(t)$ for $t > 0$.



$v_C(t)$ = **$20 - 10.205\,e^{-0.0505t} + 0.205\,e^{-4.9495t}$ V $t > 0$**

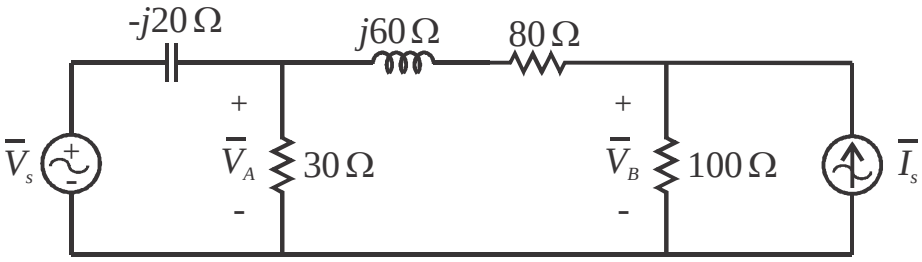
8) Given $\bar{V}_S = 16\angle 45^\circ \text{ V}_{\text{rms}}$, find the power factor *pf*, average P_{ave}, reactive *Q*, apparent *S*, & complex $\bar{S}$ powers delivered by the source.



pf = **0.9956 *lagging*** P_{ave} = **31.119 W** *Q* = **2.936 VAR**

S = **31.257 VA** $\bar{S}$ = **31.119 + *j* 2.936 VA**

9) For the circuit shown, use **nodal analysis** to find the labeled phasor voltages when $\bar{V}_S = 4\angle 30°$ V and $\bar{I}_S = 0.5\angle 0°$ A .



$\bar{V}_A = 2.835\angle -20.65°$ V $\bar{V}_B = 27.18\angle 15.78°$ V