Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (please print)

Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

ECE 2300 – Final Exam

December 13, 2014

Keep this exam closed until you are told to begin.

1. This exam is closed book, closed notes. You may use one 8.5” x 11” crib sheet, or its equivalent.

2. Show all work on these pages. Show all work necessary to complete the problem. A solution without the appropriate work shown will receive no credit. A solution that is not given in a reasonable order will lose credit. Clearly indicate your answer (for example by enclosing it in a box).

3. It is assumed that your work will begin on the same page as the problem statement. If you choose to begin your work on another page, you must indicate this on the page with the problem statement, with a clear indication of where the work can be found. **If your work continues on to another page, indicate clearly where your work can be found. Failure to indicate this clearly will result in a loss of credit.**

4. Show all units in solutions, intermediate results, and figures. Units in the exam will be included between square brackets.

5. Do not use red ink. Do not use red pencil.

6. You will have 170 minutes to work on this exam.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/20

2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/30

3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/30

4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/30

5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/20

6. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/35

7. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/35

 Total = 200

Room for extra work

1. {20 Points} Use the mesh-current method to write a complete set of equations that could be used to solve this circuit. Do not simplify the circuit. Do not attempt to simplify or solve your equations. Define all variables clearly.



Room for extra work

2. {30 Points} Use the node-voltage method to write a complete set of equations that could be used to solve this circuit. Do not simplify the circuit. Do not attempt to simplify or solve your equations. Define all variables clearly.



Room for extra work

3. {30 Points} A device can be modeled as an ideal voltage source in series with a resistance. The device is shown in Figure 1. A multi-range voltmeter, shown in Figure 2, is made up of two resistors, *R1* and *R2*, and a 100[mV], 5[mA] full-scale meter.

The meter is connected to the device by connecting 'a' to the 5[V] terminal of the meter and 'b' to the common terminal of the meter. The meter reads 3.3[V] on the 5[V] scale. The meter is then connected to the device by connecting 'a' to the common terminal, 'b' to the 10[V] terminal. The meter reads 6.7[V] on the 10[V] scale.

What is the power absorbed by a 9[kΩ] resistor connected to the device as shown in Figure 3?



# Room for extra work

4. {30 Points} A device can be modeled by a resistor in series with a voltage source. The device is shown inside the dashed line in the circuit below.

a) Find the Thèvenin equivalent circuit seen by the device.

b) Attach the Thèvenin equivalent circuit that you found in part a) to the device. Find the power absorbed by *RS*.

Room for extra work

5. {20 Points} The switch was open for a long time before t=0, and then closed at t=0. Find *Rx* so that at t=10[μs] the energy stored in the inductor *LX* is twice the value it was at t=0.



Room for extra work

6. {35 Points} The circuit shown is in steady state. Find *vX* (t).



 $v\_{S1}\left(t\right)=47[V]$

 $v\_{S2}\left(t\right)=17\left[V\right]sin\left(470\left[\frac{rad}{s}\right]t+27^{o}\right)$

 $i\_{S1}\left(t\right)=35\left[A\right]cos\left(470\left[\frac{rad}{s}\right]t+33^{o}\right)$

Room for extra work

7. {35 Points} The circuit shown is in steady state.

Load 1 absorbs 680[VA], at a leading power factor of 0.75.

Load 2 delivers 500[VAR], and absorbs 450[W].

Load 3 absorbs  [VA].

a) Find *iX*(t).

b) Find *vS*(t).



 $ v\_{X}\left(t\right)=550 cos\left(300\left[\frac{rad}{s}\right]t\right) [V]$



























