ECE 2210/00 Exam 1 given: Spring 21

(The space between problems has been removed.)

Closed Book, Closed notes, Calculators OK, Show all work to receive credit

Circle answers, show units, and round off reasonably

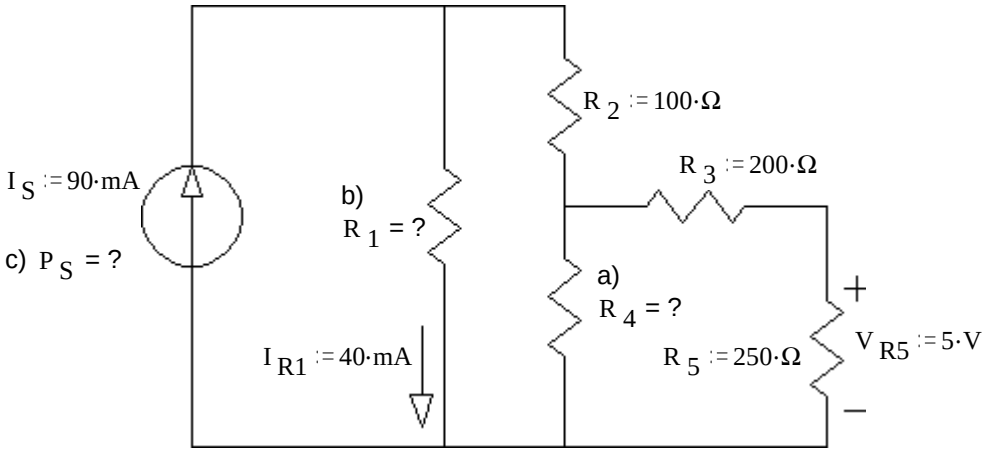
1. (26 pts) Find the values below.

   Note: feel free to show answers & work right on the schematic

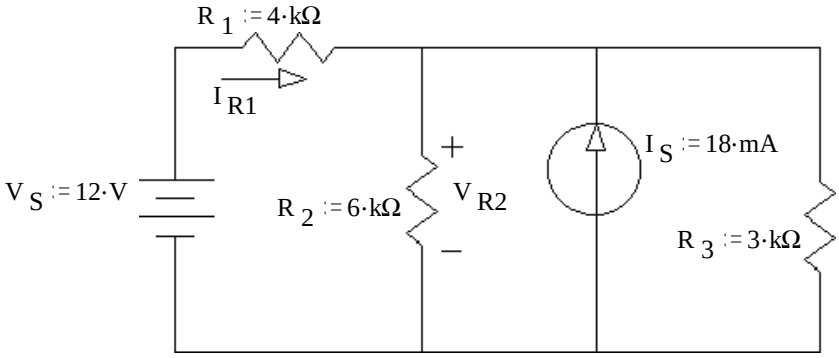
   a) R_4 = ?

   b) R_1 = ?

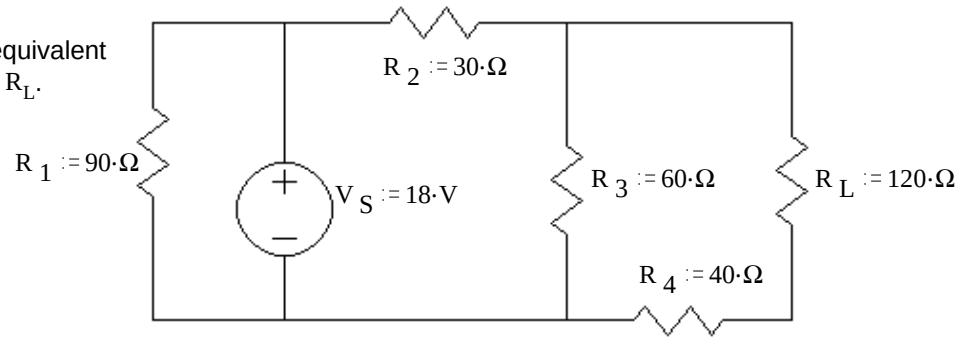
   c) P_S = ?



2. (25 pts) a) Use the method of superposition to find I_{R1} and V_{R2}. Be sure to clearly show and **circle** your intermediate results.



3. (26 pts) a) Find and draw the Thévenin equivalent of the circuit shown. The load resistor is R_L.



b) Find and draw the Norton equivalent of the same circuit.

c) Find the load voltage using your Norton equivalent circuit.

d) Choose a different value of R_L so as to maximize the power dissipated in R_L. Find that maximum power

4. (7 pts) A fully-charged Li-ion battery supplies $1A$ for 1 hour and then $0.5A$ for 3 more hours. After that it is empty (fully discharged).
   a) What is the capacity (C) of this battery?

   b) How many Joules of energy does this battery store?

5. (16 pts) The sticker on the back of a solar panel is shown below.
Since it may be difficult to read, I've repeated much of the information next to the image.

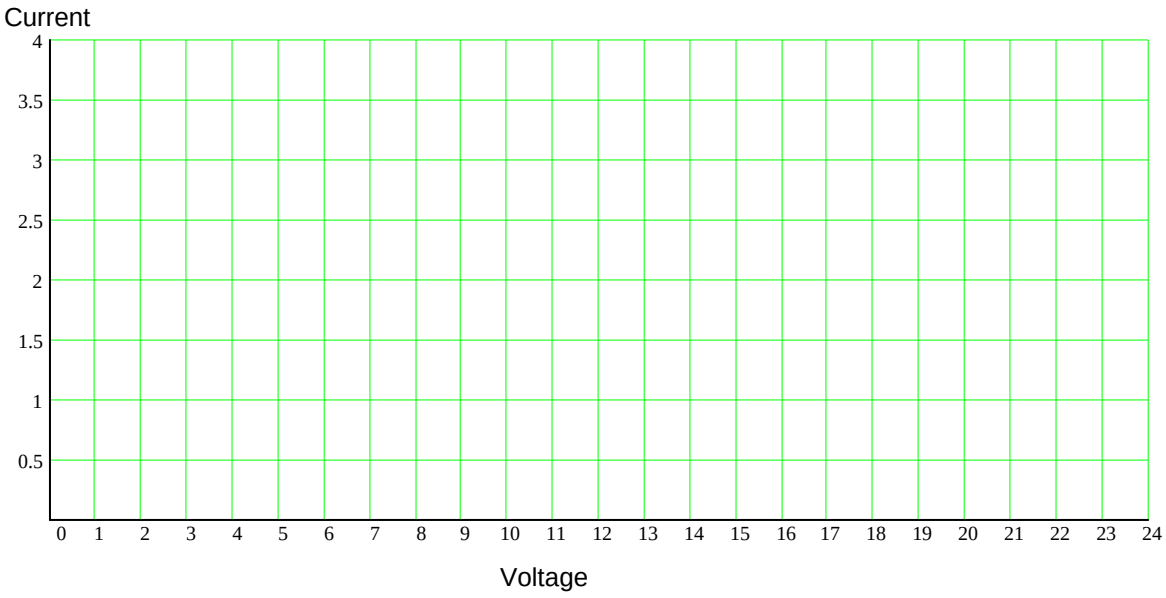
AS55
Electrical Data at Standard Test Conditions

(STC: 1000W/m^2, 25ºC, AM1.5)

$P_{MPP} := 55 \cdot W$
$V_{MPP} := 18.5 \cdot V$
$I_{MPP} := 3.0 \cdot A$
$V_{OC} := 21.2 \cdot V$
$I_{SC} := 3.4 \cdot A$

Maximum System Voltage: $50 \cdot V_{DC}$

a) Plot 3 important points on the Current vs Voltage grid below, clearly identify the points as they are normally labeled.



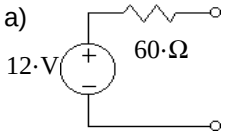
b) Using the important points to guide you, draw the Current vs Voltage (IV) curve above.

c) This panel is hooked directly to a lead-acid battery. The charging voltage is 14 volts.
Draw a 4th point on the curve above where the solar panel is operating.
Estimate the power provided by the panel to the battery.

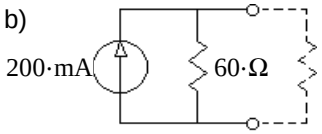
Answers

1. a) $300 \cdot \Omega$ b) $350 \cdot \Omega$ c) $1.26 \cdot W$ 2. $28 \cdot V$ $-4 \cdot mA$

3. a)



b)



c) $8 \cdot V$

d) $60 \cdot \Omega$
$600 \cdot mW$

4. a) $2.5 \cdot Ah$ b) $3.24 \cdot 10^4 \cdot joule$

5. a,b,c)