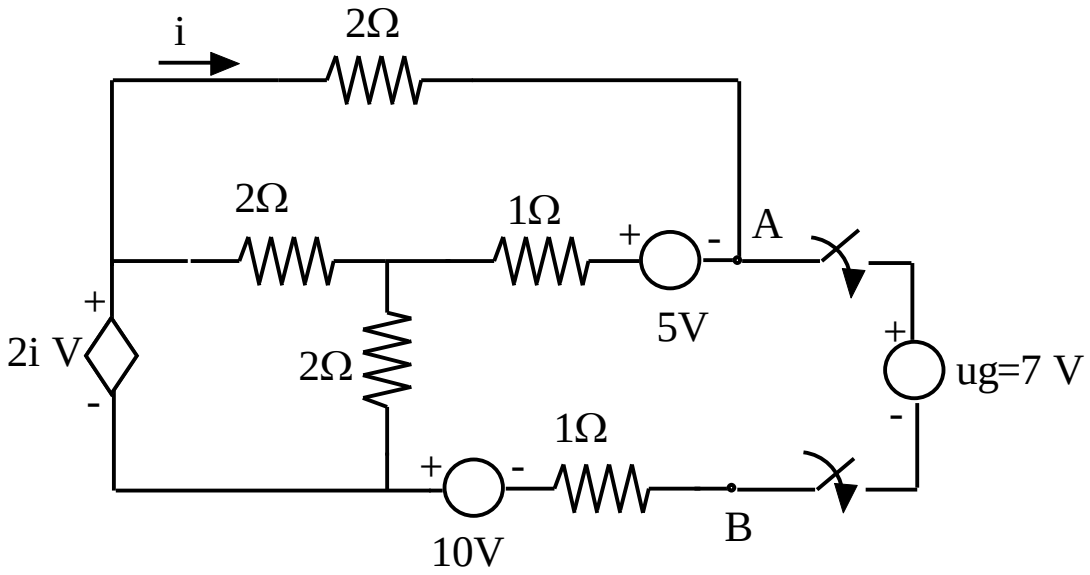
Electrical Power Engineering Fundamentals
First Partial Exam (1st March 2018)

1) Calculate the Thevenin equivalent of the circuit from terminals A B considering that the switches are open.

2) Use the obtained result to calculate the current, voltage and power of the source ug when the switches are closed. Indicate if the source absorbs or generates power.



Solution

Part 1

To obtain Thevenin voltage we calculate the voltage drop between A and B. Using mesh analysis:

2i1+2(i1-i2)+i1-5=0
2(i2-i1)+2i2-2i
i=i1

Solving the system:

i1=5/3A
i2=5/3A

Then:

uAB=uth=-5 + 5/3 +10/3 +10=10V

In order to calculate the Thevenin Resistance we place a short circuit between A and B and calculate the current flowing from A to B. Using mesh analysis again:

2i1+1(i1-i3)+2(i1-i2)-5=0
2(i2-i1)+2(i2-i3)-2i=0
2(i3-i2)+1(i3-i1)+5+1i3-10=0
i=i1

Solving the system:

i1=8.33A
i2=13.33A
i3=10A=icc

Then:

Rth=uth/icc=10/10=1Ω

Part 2

We connect the source of 7V to the Thevenin equivalent and analyse the circuit:
i = uth-ug/Rth=10-7 / 1= 3A
ug= 7V
pg = u·i=7·3=21 W Absorbed: Because the current flowing through ug goes from + to –