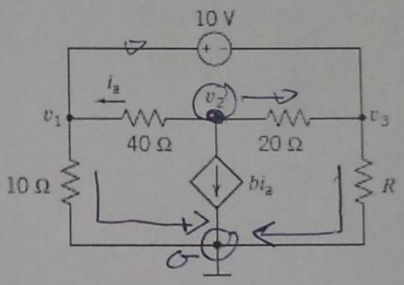
Course's Name :Electric Circuits 1
Course's Number :12110101
Questions' Number 5:
Total Mark :25
Section's Number:1,2

Palestine Technical University - Kadoorie

Typical Answers of the First Exam
2013/2014 Second Semester

Instructor's Name :Muntaser Al-Dabe
Exam's Period :60
Exam's Date :
Form :none
Page's Number :5

Question 1 : (6 marks)
Find values of R and b



$V1=4,\ V2=0,\ V3=-6$

$ia = \frac{V2-V1}{10} = \frac{0-4}{10} = -0.1\ A$

KCL at 2

$ia + b\,ia + \frac{V2-V3}{20} = 0$

$-0.1 + b(-0.1) + \frac{0+6}{20} = 0$

$-0.1 + b(-0.1) + 0.3 = 0$

$-0.1\,b + 0.2 = 0$

$-0.1\,b = -0.2$

$b = \frac{-0.2}{-0.1} = 2$

KCL at G

$\frac{V3}{R} + \frac{V1}{10} + b\,ia = 0$

$\frac{-6}{R} + \frac{4}{10} + 2(-0.1) = 0$

$\frac{-6}{R} + 0.4 - 0.2 = 0$

$\frac{-6}{R} + 0.2 = 0$

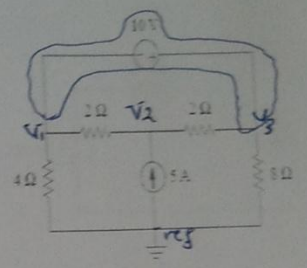
$\frac{-6}{R} = -0.2$

$6 = 0.2\,R$

$R = \frac{6}{0.2} = 30\ \Omega$

Question 1 : (7 marks)

Using nodal analysis, find the power of the current source



$V_3 - V_1 = 10$ ... ①

$\boxed{V_3 = 10 + V_1}$ ... * ... ①

KCL at Node 2

$5 = \frac{V_2 - V_1}{2} + \frac{V_2 - V_3}{2}$ ... ②

$10 = V_2 - V_1 + V_2 - V_3$

$10 = 2V_2 - V_1 - V_3$

$10 = 2V_2 - V_1 - (10 + V_1)$

$10 = 2V_2 - V_1 - 10 - V_1$

$20 = 2V_2 - 2V_1$

$20 = 2(V_2 - V_1)$

$10 = V_2 - V_1$

$\boxed{V_1 = V_2 - 10}$ ... ** ... ①

$V_2 = 10 + V_1$

KCL at super Node (1+3)

$\frac{V_1}{4} + \frac{V_1 - V_2}{2} + \frac{V_3 - V_2}{2} + \frac{V_3}{8} = 0$ ... ①

$\frac{2V_1}{8} + \frac{4(V_1 - V_2)}{8} + \frac{4(V_3 - V_2)}{8} + \frac{V_3}{8} = 0$

$2V_1 + 4V_1 - 4V_2 + 4V_3 - 4V_2 + V_3 = 0$

$8V_1 - 8V_2 + 5V_3 = 0$ ... ①

$6V_1 - 8(10 + V_1) + 5(10 + V_1) = 0$

$6V_1 - 80 - 8V_1 + 50 + 5V_1 = 0$

$3V_1 - 30 = 0$

$3V_1 = 30$ ... ①

$V_1 = \frac{30}{3} = \boxed{10V}$

$V_2 = 10 + V_1 = \boxed{20V}$ ... ①

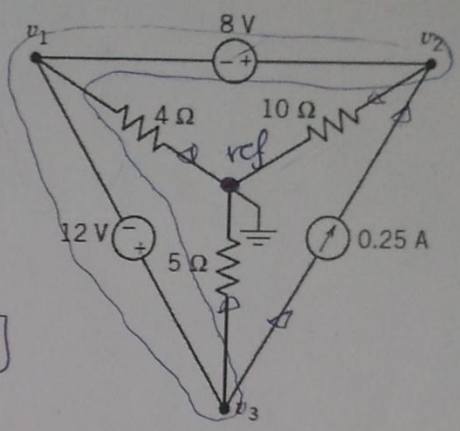
$V_2 = 10 + 10 = 20V$

$P = -5 \times 20$

$= -100W$ ... ①

Question 4: (7 marks)

Find nodal voltages V_1, V_2 and V_3



$V_2 - V_1 = 8$ --- (1) --- eqn (1)

$V_3 - V_1 = 12$ --- (2) --- eqn (1)

$\rightarrow V_2 = 8 + V_1$

$\rightarrow V_3 = 12 + V_1$

KCL at ref.

$$\frac{V_1}{4} + \frac{V_2}{10} + \frac{V_3}{5} = 0 \quad \text{--- (3) --- eqn (2)}$$

$\rightarrow V_1 = -5.82$ volt --- eqn (1)

$\rightarrow V_2 = 2.18$ volt eqn (1)

$\rightarrow V_3 = 6.18$ volt eqn (1)