香 港 中 文 大 學

The Chinese University of Hong Kong

二零二零至二一年度上學期科目考試

Course Examination 1st Term, 2020-21

科目編號及名稱
Course Code & Title : ELEG2202A – Fundamental of Electric Circuits

時間 小時 分鐘
Time allowed : 2 hours 0 minutes

學號 座號
Student I.D. No. : Seat No. :

Total of **FOUR** questions

Marks for each question are indicated next to it

Answers for all **FOUR** questions must be written on the provided answer book

Question 1

Calculate the power generated by each source for all voltage sources and current sources shown in Figure 1. Prove that principle of conversation of power is indeed true.

(35 marks)

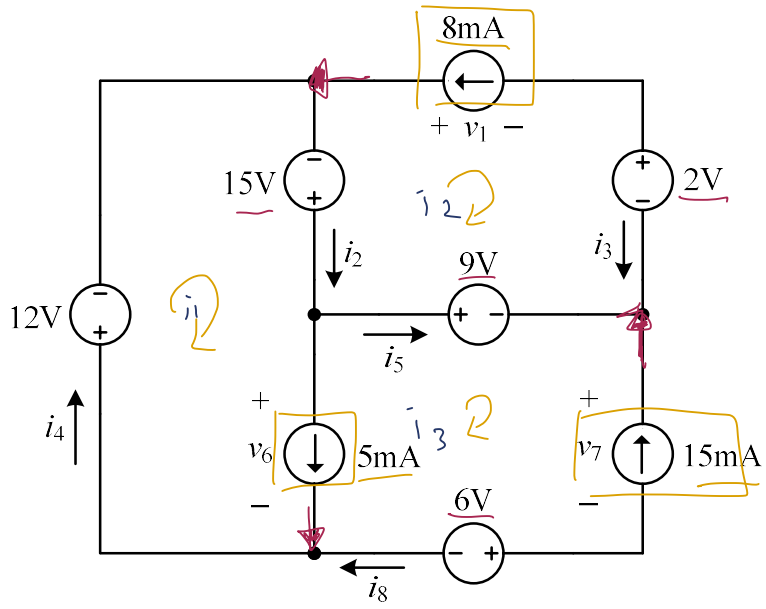

Figure 1

$(i_1 - i_2)$

For Mesh 1, $12i_1 - 15 - v_6 = 0$

Mesh 2 $15(i_2 - i_1) - 9(i_2 - i_3) + 2i_2 + v_1 = 0$

Mesh 3 $6i_3 + 9(3 - i_2) + v_6 + v_7 = 0$

supermesh 1, $12i_1 + v_1 + 2i_2 + 15i_3 + 6i_5 = 0$

supermesh 2, $15i_2 + v_1 + 2i_2 + v_7 + 6i_3 + v_6 = 0$

$12i_1 - 15(i_1 - i_2) + 9 = 0$ → (1)

$17i_2 + 6i_3 - 17 = 0$ → (2)

By 1, $-3i_1 + 15i_2 = -9$

$i_2 = \frac{-9 - 3i_1}{15}$

For $v_6 = 12 - 15 - 6 = -9V$

∴ current source Power $= -9 \cdot 5mA = -0.045W$

For $v_1 = -2 + -15 + 9 = -8V$

∴ current source Power $= -8 \cdot 8mA = -0.064W$

For $v_7 = -6 + -9 = -15V$

current source power $= -15 \cdot 15mA = -0.1225W$

By ②, $17i_2 + 6i_3 - 17 = 0$

$$i_3 = \frac{17 - 17i_2}{6}$$

Sub it to Mesh 3,

$$6\left(\frac{17-17i_2}{6}\right) + 9\left(\frac{17-17i_2}{6}\right)$$

$$-9 \cdot i_2 + -9 + -15 = 0$$

$\therefore i_2 = 0.35922$

$\therefore i_3 = 1.8155339$

$\therefore$ 9V Power $= 13.1\,W$

$\therefore$