UWA – ENSC2003 Engineering Electrical Fundamental

Please complete your details below:

Surname: WILKENSON

Given Name: ADAM WILLIAM

Signature: _[signature]_

Student ID: 23100559

12:00PM, Thursday, August 18

Class Test 1 (OPEN BOOK)

Time allowed: 40 minutes

Max mark: **30**

Assessment Weight: **6%**

This paper contains:
3 short questions and
4 calculation questions

Candidates should attempt **all** questions and show **all** working with numerical answers to **2** decimal places, show as much working as possible to gain maximum marks. You can use the blank pages for rough working, but these pages will not be marked.

Your test paper will be returned back to you in the week 6 practical class. Indicate below the day and time of your practical class. Select ONE only.
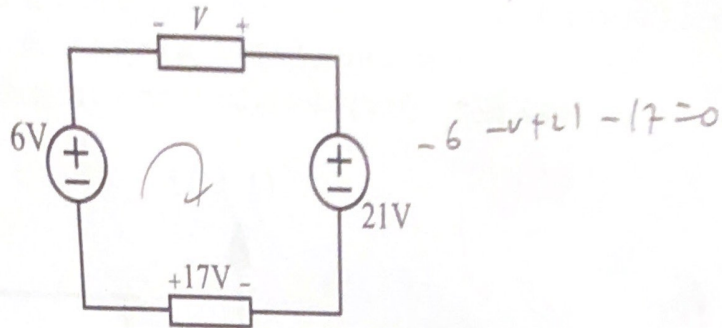
- ☑ Tuesday 3-5PM
- ☐ Wednesday 8-10AM
- ☐ Wednesday 11AM-1PM
- ☐ Thursday 10AM-12PM

- ☐ Friday 11AM-1PM
- ☐ Friday 2-4PM
- ☐ Friday 4-6PM
- ☐ I don't know

	Short Questions			Calculation Questions				Total (/30)	Marker
	Q1(/2)	Q2(/2)	Q3(/2)	Q1(/6)	Q2(/6)	Q3(/6)	Q4(/6)		
	0	1	2	3	1	2	5	14	

Test Marker Use Only

Part A: Short Questions

Short Question 1. In the circuit shown below, Determine the voltage V. (2 marks)

$-6 - v + 21 - 17 = 0$

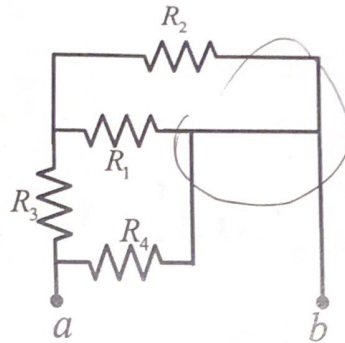(a) 1 V   (b) 2 V   (c) 11 V   (d) -2 V

Write your answer(s) in the answer box below

Short Question 1 Answer:	b) 2V (0)

Short Question 2. Which of the following statement(s) is(are) correct for the circuit given below. (2 marks)

(a) R_1 and R_2 are in series
(c) R_2 and R_3 are in series
(e) R_1 and R_4 are in series
(b) R_2 and R_3 are in parallel
(d) R_1 and R_2 are in parallel
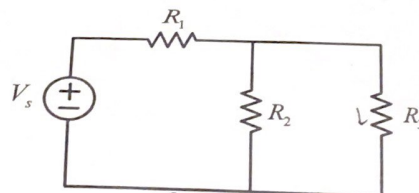(f) R_3 and R_4 are in parallel

Write your answer(s) in the answer box below

Short Question 2 Answer:	e) d) (1)

Short Question 3. In the circuit shown below, a decrease in R_3 leads to a decrease of, select all that apply. (2 marks)

(a) current through R_3
(c) voltage across R_3
(e) none of the above
(b) power dissipated in R_2
(d) voltage across R_1

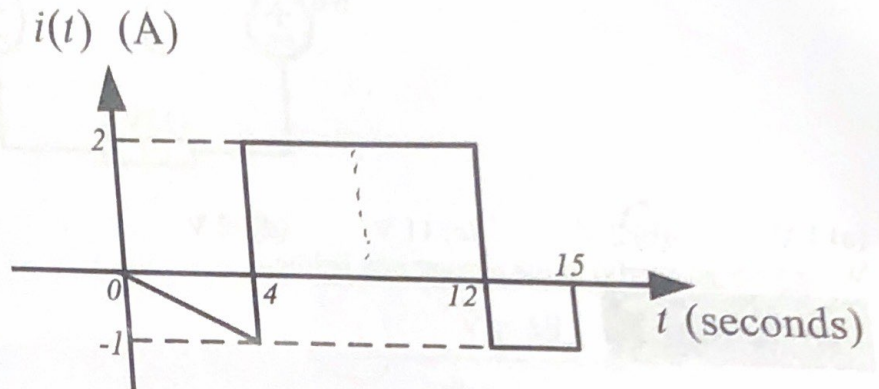Write your answer(s) in the answer box below

Short Question 3 Answer:	a) b) c) b) (2)

Part B: Calculation Questions

Calculation Question 1. A current through a conductor is measured to have the time relationship shown below. Given that 80 coulombs have passed a point A on the conductor at time t=0 second. Determine the total charge that has passed point A for a period of time from 0 seconds to 8 seconds. Show all works. (6 marks)

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$E_0 = 80$

$$\int_0^4 to -\frac{1}{4}t = \int_0 -\frac{1}{4}t\, dt = \left[-\frac{1}{8}t^2\right]_0^4 = -2\ tc$$

$$I = \frac{dc}{dt}$$

$$c = \int I\, dt$$

$$\int_4^8 2\, dt = (2t)_4^8 = 8\ tc$$

$$-2 t8 + 80 =$$

$$-2 t8 t 80 = 86 \text{ coulombs}$$

$$86 \times 1.6 \times 10^{-19} = \qquad 86 \text{ coulombs}$$

Calculation Question 2. In the circuit shown below, the datum node has been labelled. Use <u>node-to-datum</u> <u>analysis technique</u> to find the nodal voltages V_1. Show all works and label necessary details in sketch. (6 marks)

$$V_1 : 3V$$
$$V_2 : 8V$$
$$V_3 : -3V$$
$$V_4 : 0V$$

$$V_2 = V_1 + 8$$
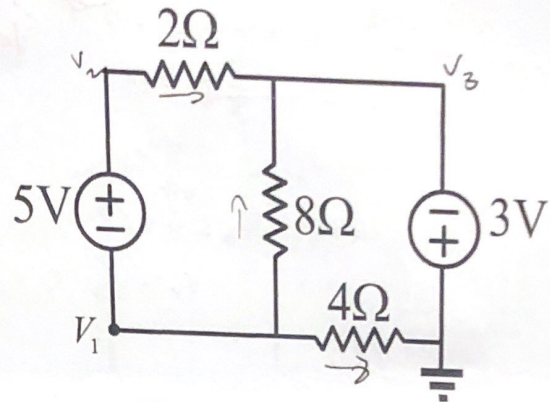
@ V_2 $\dfrac{V_2 - V_1}{2} + \dfrac{V_1 - V_3}{8} = 0$

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

$4V_2 - 5V_3 + V_1 = 0$

@ V_1 $\dfrac{V_1 + V_1 - V_3}{4} = 0$

$2V_1 = V_3$ $3V_1 - V_3 = 0$
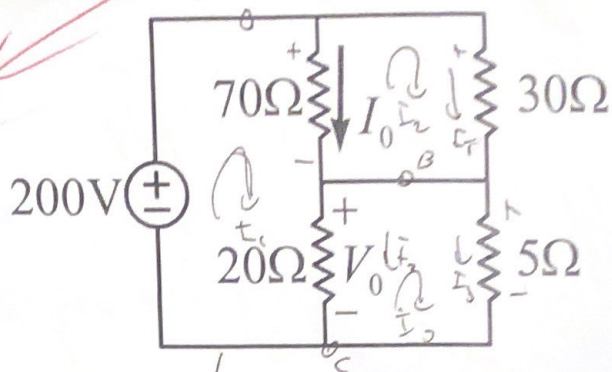
$3V_1 = 2V_3$ $V_1 = \dfrac{V_3}{3}$

$V_1 = 3V$ $= -1V$

$$V_1 = -1V$$

Calculation Question 3. Determine V_0 and I_0 in the circuit shown below. Show all works and label necessary details in sketch. (6 marks)

$$9I_1 - 7I_2 - 2I_3 = 20$$
$$9I_1 - 4.9I_1 - \frac{8}{5}I_1 = 20$$
$$I_1 = 8A$$

$$I_2 = 5.6A$$

A: (2008) $I_3 = 6.4A$

B:

C: $0V$ $V_0 = V_B - V_C$
           $= V_B$

@ V_B $I_0 = I_1 - I_2$
           $= 8 - 5.6$
           $= 2.4 A$ $V_0 = 32V$

@ B: $-200 + 70\left(I_1 - I_2\right) + 20\left(I_1 - I_3\right) = 0$

@ V_B : $I_0 + I_1 = I_2 + I_3$

$$\frac{V_A - V_B}{70} - \frac{V_A - V_B}{30} = \frac{V_B}{20} + \frac{V_B}{5}$$

$$\frac{200 - V_B}{70} + \frac{200 - V_B}{30} = \frac{V_B}{4}$$

$$\frac{V_B}{30} - \frac{V_B}{70} - \frac{80}{21} = \frac{V_B}{4}$$

$$\frac{V_B}{30} - \frac{V_B}{70} - \frac{V_B}{4} = \frac{80}{21}$$

$$V_B\left(\frac{1}{30} - \frac{1}{70} - \frac{1}{4}\right) = \frac{70}{21}$$

$$V_B = -16.49 V$$

$$V_0 = V_B - V_4 = V_B = \cancel{-16.49V} \cancel{16.49V}$$

@ I_1
$$-200 + 70(I_1 - I_2) + 20(I_1 - I_3) = 200$$
$$90 I_1 - 70 I_2 - 20 I_3 = 200$$

@ I_2 $-70(I_0) + 30(I_2 = 0$
$$60 I_2 = 7 I_1$$
$$I_2 = \frac{7}{60} I_1$$

@ I_3 $-20(I_1 - I_3) + 5I_3 = 0$
$$25 I_3 = 20 I_1$$
$$I_3 = \frac{4}{5} I_1$$

$$V_0 = 20(I_1 - I_3)$$
$$= 20(8 - 6.4)$$
$$= 32V$$

$$I_0 = \frac{V_A - V_B}{70}$$
$$= \frac{200 + 16.49}{70}$$
$$= 3.093 A$$

Calculation Question 4. For the circuit shown in the following figure,

(a) Find the equivalent resistance R_{eq} seen by the voltage source. Show all works and label necessary details in sketch. (5 marks)

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$35V \overset{+}{\underset{-}{\ominus}}$, 2.5Ω, 6Ω, 12Ω, 60Ω, 80Ω, 15Ω, 20Ω

$3\pi V$ $\underset{2.5\Omega}{\quad}$ 2.5Ω 15Ω

$35V \ominus$ 2.5Ω 15Ω 6Ω 12Ω 60Ω 20Ω 80Ω
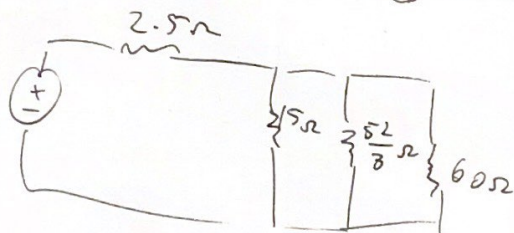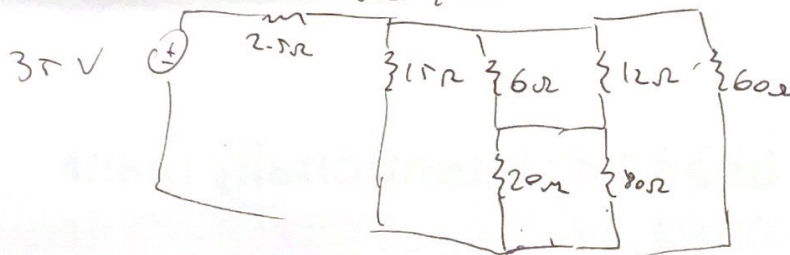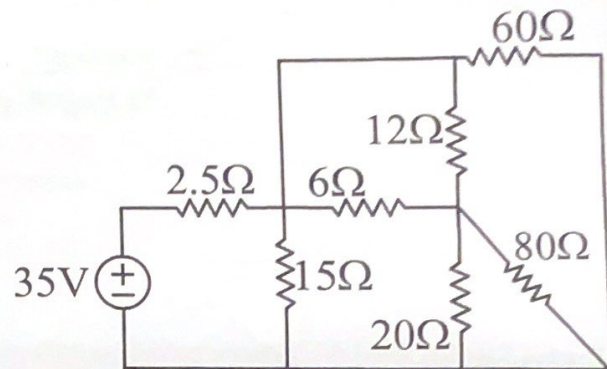
$6||12 = \dfrac{6 \times 12}{18} = \cancel{4\Omega} \dfrac{4}{3}\Omega$

$20||80 = \dfrac{20 \times 80}{100} = 16\Omega$

$16 + \dfrac{4}{3} = \dfrac{52}{3}\Omega$

2.5Ω

$\overset{+}{\underset{-}{\ominus}}$ 15Ω $\dfrac{52}{3}\Omega$ 60Ω

$15 || \dfrac{52}{3} || 60 = 7.091\Omega$

$2.5 + 7.091 = 9.591\Omega$

$R_{eq} = 9.591\Omega$

(b) Calculate power delivered by the source. (1 mark)

$P = V \times \cancel{I \, I} = \dfrac{V^2}{R} = \dfrac{30^2}{9.591} = 127.7 W$