



2012 VCE VET Integrated Technologies GA 2: Examination

GENERAL COMMENTS

Students who performed well on the 2012 VCE VET Integrated Technologies examination had a solid understanding of basic DC electrical fundamentals; however, many other students were unable to display this knowledge. The examination assessed essential knowledge and skills in the areas of identifying components, tools, electrical power generation, interpreting drawings, using engineering units, capacitance, single source series, parallel and series parallel circuits.

Section B of the examination required students to show calculations, formulas and engineering notation in their answers, but often this was lacking. In many cases, formulas from the formula sheet were either incorrectly transcribed in an answer or were used in the wrong context. A number of students had difficulty finding the total resistance in a parallel circuit as they were unable to use reciprocals on their calculator. The resistance values given in their answers demonstrated little understanding of parallel circuits. Future students need to understand Ohm’s law, Kirchoff’s voltage and current laws (KVL and KCL) and have used a multimeter to measure resistance, voltage and current in resistive circuits.

SPECIFIC INFORMATION

Section A – Multiple-choice questions

The table below indicates the percentage of students who chose each option. The correct answer is indicated by shading.

Question	% A	% B	% C	% D	% No Answer	Comments
1	4	9	77	10	0	In a hydro-electric power station, electricity is generated by magnetism.
2	6	58	0	36	0	
3	10	16	61	12	0	A grid interactive inverter converts DC to AC 230 VAC 50 Hz.
4	20	13	47	20	0	
5	28	13	19	40	1	
6	7	51	37	4	1	
7	37	23	16	23	0	An optocoupler provides electrical isolation.
8	4	2	64	30	0	A hammer drill is designed to drill into brickwork.
9	47	15	34	4	0	
10	49	44	1	5	1	
11	84	8	1	8	0	
12	11	15	23	51	0	
13	11	4	77	6	2	
14	76	9	11	4	0	
15	16	27	51	6	0	
16	22	22	12	44	1	
17	21	34	36	8	1	
18	38	25	10	26	1	
19	10	6	38	46	0	A piezo speaker requires an AC signal to generate sound.
20	9	57	19	15	1	



Section B

Note: Student responses reproduced in this report have not been corrected for grammar, spelling or factual information.

This report provides sample answers or an indication of what the answers may have included. Unless otherwise stated, these are not intended to be exemplary or complete responses.

Question 1

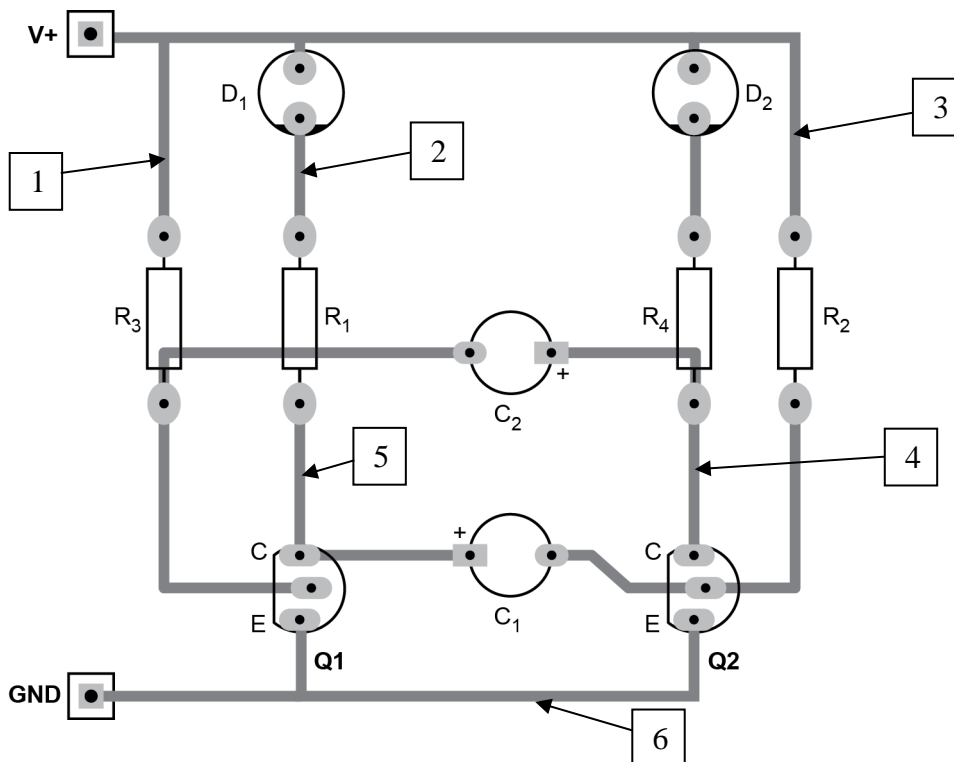
Marks	0	1	2	3	4	5	6	7	8	Average
%	0	1	1	1	8	15	26	34	16	6.3

Tool	Photo	What it is used for
tap	I	tapping a thread
scriber	C	marking out metal (a line) or scratching
pop riveter	G	fastening two metals, riveting/joining materials
pedestal drill	J	workshop drilling
needle-nose pliers	E	lightweight holding of components, bending leads
engineer's square	F	marking out a 90° edge , 45° , measuring , ruling a line
portable drill	H	general drilling , screwing
oddleg callipers	A	measuring an object, checking sizes

Most students were able to identify the photo of the tool but many struggled with the use of 'oddleg callipers' and 'tap'.

Question 2

Marks	0	1	2	3	4	5	6	Average
%	15	8	9	10	8	23	28	3.7



This question was generally well answered; however, many students made the assumption that the tracks on the printed circuit board needed to be laid out the same way as the wires on a schematic diagram. Some students had multiple grounds and others crossed over tracks, creating short circuits.

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Question 3a.

Marks	0	1	2	3	Average
%	83	6	0	11	0.4

$7 \text{ div} \times 5 \text{ v/div} = 35 \text{ volts}$ shown on the CRO
 $O/P \text{ of load cell} = 35 \div 100 = 350 \text{ mV}$

Students had difficulty interpreting the CRO display. One mark was given for the number of divisions, one mark for peak voltage on the CRO and one mark for the load cell output voltage. Some students tried to incorporate $\sqrt{2}$ when 'peak voltage' was mentioned.

Question 3b.

Marks	0	1	2	Average
%	65	12	23	0.6

$5.2 \text{ div} \times 5 \text{ mS/div} = 26 \text{ mS}$

Also accepted was $6.2 \text{ div} \times 5 \text{ mS} = 31 \text{ mS}$.

Interpreting the CRO graph and knowing when the load was placed on the 'load cell' was difficult for many students, and a variety of answers was given.

Question 3c.

Marks	0	1	Average
%	71	29	0.3

The strain gauge/resistance wire expands and contracts. 'Bouncing' is caused by the resistance change in the load cell.

Few students were aware that the load cell is a wheatstone bridge where the resistance wire (strain gauge) is placed in one leg of the bridge.

Question 3d.

Marks	0	1	2	Average
%	42	52	6	0.7

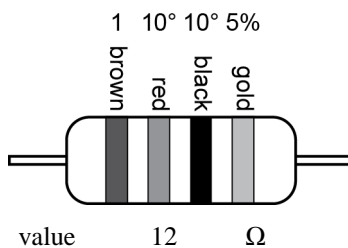
$525 \text{ mV} \times 100 \text{ gain} = 52.5 \text{ V}$ shown on CRO.

One mark was awarded for 525 mV. Students missed out on one mark if no unit was shown (for example, mV).

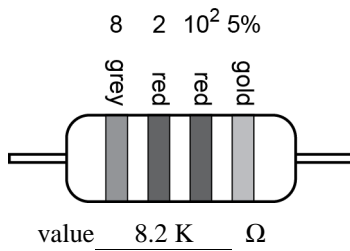
Most students who attempted the question interpreted the graph (525 mV) but ignored the gain of the amplifiers.

Question 4a.

Marks	0	1	2	Average
%	34	18	48	1.2



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8200 Ω was also accepted.

This question was poorly answered considering the colour-code chart was on the formula sheet. This is fundamental knowledge that students should have covered during their two-year program.

Question 4b.

Marks	0	1	2	3	Average
%	6	19	16	60	2.3

Resistor	Measured Value	Within tolerance? (Y/N)
12 KΩ 5%	11.56 KΩ	YES
82 KΩ 2%	80302 Ω	NO
180 Ω 5%	187.8 Ω	YES

This question was well answered.

Question 4c.

Marks	0	1	Average
%	51	49	0.5

Size/material (what it is made of)

Most students who attempted this question knew the relationship between power, size and the type of material.

Question 5

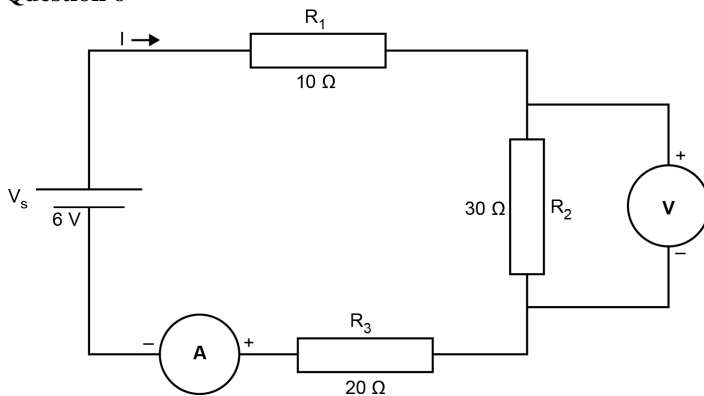
Marks	0	1	2	3	4	Average
%	4	3	8	36	49	3.2

Component	Symbol	Component	Symbol
voltage dependent resistor (VDR)	F	fixed resistor	C
light dependent resistor (LDR)	E	thermistor (PTC)	B

This question was well answered, although some students were confused with PTC and NTC thermistors.



Question 6



Question 6a.

Marks	0	1	Average
%	30	70	0.7

clockwise

Most students understood 'conventional current flow' as opposed to 'electron flow'.

Question 6b.

Marks	0	1	2	Average
%	62	5	33	0.7

The polarity of the meters is shown on the circuit above. One mark was awarded for both positives and one mark for both negatives.

The poor responses to this question suggest that students had not carried out practical activities to reinforce their learning.

Question 6c.

Marks	0	1	2	3	4	Average
%	47	1	19	2	31	1.7

$$R_t = R_1 + R_2 + R_3$$

$$= 60 \Omega \text{ (one mark was awarded for } R_t)$$

$$I = V_s \div R_t$$

$$= 6 \div 60 \times 10^3$$

$$= 100 \text{ mA} \text{ (one mark was awarded for } I)$$

$$VR_2 = I \times R_2$$

$$= 100 \times 10^{-3} \times 30$$

$$= 3 \text{ Volts (one mark was awarded for using the correct formula and one mark for the answer)}$$

Ammeter: 100 mA

Voltmeter: 3 V

This was the most fundamental circuit, yet many students did not gain a mark. Marks were not deducted if engineering units were not used.

Question 6d.

Marks	0	1	2	Average
%	51	8	41	0.9

$$P = VI$$

$$= 6 \times 100 \text{ mA}$$

$$= 600 \text{ mW}$$

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One mark was awarded for using the correct formula and one mark for the correct answer. The majority of students were unable to find the power dissipated in the circuit, despite the fact that the formula was on the formula sheet.

Question 7a.

Marks	0	1	2	Average
%	71	5	24	0.6

$$\begin{aligned} V_s &= IR_1 \times R_1 \\ &= 200 \times 10^{-3} \times 50 \\ &= 10 \text{ V} \end{aligned}$$

One mark was awarded for the formula and one mark for the workings. Many students found R_{total} in Question 7b. then used I to find V_s . This is a basic parallel circuit.

Question 7b.

Marks	0	1	2	Average
%	59	9	32	0.8

$$\begin{aligned} R_{\text{tot}}: 1 \div R_{\text{tot}} &= 1 \div R_1 + 1 \div R_2 + 1 \div R_3 \\ &= 1 \div 50 + 1 \div 330 + 1 \div 68 \\ &= 0.02 + 0.0030303 + 0.014705 \\ &= 0.037736 \\ &= 26.5 \Omega \end{aligned}$$

One mark was awarded for the correct formula and workings, and one mark for the answer. Many students had difficulty using reciprocals. Many had a result less than 1 Ω .

Question 7c.

Marks	0	1	2	Average
%	82	3	14	0.3

$$\begin{aligned} P_{R_3} &= V^2 \div R_3 \\ &= 10^2 \div 68 \\ &= 100 \div 68 \text{ W} \\ &= 1.47 \text{ W} \\ &= 1.47 - 2 \text{ W resistor} \end{aligned}$$

Students were asked for the minimum power rating of Resistor R_3 . For one mark, the formula had to be in the context as shown.

Question 7d.

Marks	0	1	Average
%	77	23	0.3

No effect

The parallel circuit concept was not understood by most students.

Question 8

In Question 8, there was no penalty for using incorrect data from an earlier incorrect response.

Question 8a.

Marks	0	1	2	Average
%	62	1	36	0.8

$$\begin{aligned} R_{\text{total}} &= R_1 + (R_4 \parallel (R_2 + R_3)) \\ &= 200 \Omega \end{aligned}$$

One mark was awarded for using the correct formula and one mark for the correct answer. In the combinational circuit, the parallel and series parts of the circuit must be simplified. Most students were unable to identify these aspects.

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Question 8b.

Marks	0	1	2	Average
%	41	8	51	1.1

$$\begin{aligned}
 I_s &= V \div R_{\text{tot}} \\
 &= 100 \div 200 \\
 &= 500 \text{ mA (0.5A was also accepted)}
 \end{aligned}$$

As part of a sequential question, students who obtained the incorrect answer in part a. were not penalised.

Question 8c.

Marks	0	1	2	Average
%	78	2	21	0.5

$$I_{R_4} = 250 \text{ mA} - \frac{1}{2} \text{ of } I_s \text{ flows through } R_4 \text{ and } \frac{1}{2} \text{ through } (R_2 + R_3) \text{ (accept } 0.25A, \frac{1}{4} A)$$

Many students had no understanding of Kirchoff's current law to solve the problem.

Question 8d.

Marks	0	1	2	Average
%	80	3	17	0.4

$$\begin{aligned}
 VR_3 &= IR_3 \times R_3 \\
 &= 250 \times 10^{-3} \times 50 \\
 &= 12.5V
 \end{aligned}$$

This question was poorly answered. Some students tried to use the 'voltage divider rule' to solve the task.

Question 9a.

Marks	0	1	2	Average
%	78	4	19	0.4

$$5 \mu\text{F}$$

$$\text{One mark was awarded for the formula } 1 \div C_{\text{total}} = 1 \div C_1 + 1 \div C_2$$

Overall, students had a weak understanding of capacitance.

Question 9b.

Marks	0	1	2	Average
%	59	6	35	0.8

$$\begin{aligned}
 C_{\text{tot}} &= C_1 + C_2 \\
 &= 10 \mu\text{F} + 100 \mu\text{F} \\
 &= 110 \mu\text{F}
 \end{aligned}$$

Many students were unsure which formula to apply.

Question 9c.

Marks	0	1	Average
%	89	11	0.1

To improve the voltage rating of the capacitor/create a lower value capacitor.

Many students did not know why capacitors might be placed in series.

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Question 9d.

Marks	0	1	2	3	Average
%	63	12	12	13	0.8

9di.

$$\begin{aligned}
 t &= CR \text{ (one mark)} \\
 &= 100 \times 10^{-6} \times 10 \times 10^{-3} \text{ sec} \\
 &= 1 \text{ sec (one mark)}
 \end{aligned}$$

9dii.

$$\begin{aligned}
 &5 \text{ time constants} \\
 &= 1 \times 5 \\
 &= 5 \text{ sec (one mark)}
 \end{aligned}$$

A number of students had difficulty with engineering notation and/or knowing which formula to use.

Question 10a.

Marks	0	1	Average
%	41	59	0.6

27 W

Students who answered this question seemed to understand efficiency.

Question 10b.

Marks	0	1	2	Average
%	65	11	25	0.6

$$\begin{aligned}
 I &= P \div V \\
 &= 27 \div 12 \\
 &= 2.25 \text{ A}
 \end{aligned}$$

One mark was awarded for using the formula $I = P \div V$ and the second mark for the correct answer. Some students overlooked the fact that the regulator was operating at 90% efficiency.

Question 10c.

Marks	0	1	2	Average
%	79	2	19	0.4

$$\begin{aligned}
 &I \times (\text{number of hours}) \\
 &= 2.25 \times 8 \\
 &= 18 \text{ A.hours}
 \end{aligned}$$

Many students had little concept of ampere/hours.

Question 10d.

Marks	0	1	2	3	Average
%	86	5	0	8	0.3

$$\begin{aligned}
 &\text{Panel supplies } 18 \text{ A.h per day} \\
 &\text{Load consumes } 28 \text{ A.h per day} \\
 &\text{Therefore, the battery supplies } 28 - 18 = 10 \text{ A.h (one mark)} \\
 &\text{AGM Battery} = 100 \text{ A.h, can discharge safely to half its capacity} = 50 \text{ A.h (one mark)} \\
 &\text{Number of days until the battery needs charging} = 50 \div 10 \\
 &= 5 \text{ days}
 \end{aligned}$$

Students needed a good understanding of batteries and loads on a battery to gain a good outcome in this question.

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Question 11a.

Marks	0	1	2	3	4	5	6	Average
%	8	6	13	19	27	16	13	3.5

Connection	Number	Connection	Number
PS2 mouse	1	IEEE1394 serial	5
LAN	7	USB	6
PCI bus	9	audio	8

Most students were able to identify a number of ports on the PC motherboard.

Question 11b.

Marks	0	1	2	Average
%	26	49	25	1.0

Any two of

- wrist strap
- ESD mat
- safety glasses.

Most students were aware of the need for static protection when handling any electronic component or assemblies.