2016 VCE VET Integrated Technologies examination report

General comments

The 2016 VCE VET Integrated Technologies examination consisted of two sections: Section A comprised 20 multiple-choice questions (20 marks), and Section B comprised 10 questions (80 marks) that required students to give written explanations and show working. Students were required to use correct engineering prefixes when providing answers where a value was required and complete electrical circuits showing connections in some questions.

Specific information

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

The statistics in this report may be subject to rounding resulting in a total more or less than 100 per cent.

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	74	18	8	0	0	
2	0	92	3	5	0	
3	95	0	3	2	0	
4	2	15	38	45	0	
5	18	21	21	38	2	
6	2	88	8	3	0	
7	17	9	17	58	0	
8	2	45	21	32	0	
9	77	5	8	11	0	
10	9	50	33	8	0	
11	30	17	24	27	2	Mains voltage is distributed to suburbs as three-phase AC voltage.
12	36	9	8	45	2	
13	38	36	20	6	0	
14	11	30	27	32	0	The ferrite core on the lead is designed to limit electromagnetic interference.
15	11	27	47	15	0	
16	11	85	5	0	0	
17	21	23	18	36	2	
18	26	27	5	42	0	
19	23	20	33	23	2	
20	26	5	47	23	0	

Section B

Some students completed Section B to a high standard. A number of students found difficulty in connecting wiring diagrams and applying Ohm's law in a basic circuit.

Question 1

Marks	0	1	2	3	4	5	6	7	8	Average
%	2	3	6	8	12	15	31	10	12	5.2

Component	Symbol letter	Component	Symbol letter
circuit breaker	**H.**	*potentiometer*	**E.**
rectifier diode	**B.**	*fuse*	**J.**
transformer	**L.**	*light-emitting diode (LED)*	**A.**
SPST switch	**C.**	*PTC resistor*	**K.**

Question 2

Marks	0	1	2	3	4	5	6	7	Average
%	43	13	4	6	4	8	8	14	2.4

Letter	Corresponding term	Action to be taken
D	danger	Ensure the area is safe for you, others and the patient – make sure there are no live cables, switch off the mains switch.
R	response (respond)	Check for response – ask name, squeeze shoulders. No response – send for help. Response – make comfortable, check for injuries, monitor response.
S	send for help	Call 000 for an ambulance or ask another person to make the call.
A	airway	Open mouth – if foreign material is present place in recovery position, clear airways with your fingers. Open airway by tilting head with a chin lift.
B	breathing	Check for breathing – look, listen, feel. Not normal breathing – start CPR. Normal breathing – place in recovery position, monitor breathing, manage injuries, treat for shock.
C	CPR (cardiopulmonary resuscitation)	Start CPR – 30 chest compressions : two breaths. Continue CPR until help arrives or patient recovers.
D	defibrillation	Apply defibrillator if available and follow voice prompts.

Question 3a.

Marks	0	1	2	3	4	5	6	Average
%	39	3	7	2	9	11	29	**2.9**

	Band colours				Resistance	Tolerance
Resistor	First	Second	Third	Fourth		
A	brown	black	red	silver	*1 k*Ω	*10%*
B	grey	red	gold	gold	*8.2* Ω	*5%*
C	brown	black	yellow	brown	*100 k*Ω	*1%*
D	blue	grey	green	gold	*6.8 M*Ω	*5%*
E	*white*	*brown*	*yellow*	*gold*	910 kΩ	5%
F	*red*	*violet*	*brown*	*silver*	270 Ω	10%

Question 3b.

Marks	0	1	2	Average
%	52	13	35	**0.9**

Type of resistor	Usage
wire-wound resistors	high-power resistors used in motor starters, testing power supplies
surface-mount resistors (could be called PCB resistors)	used on small PCBs where space is an issue
variable resistor/potentiometer	adjust resistance, voltage, volume control, temperature control, etc.
PTC/NTC resistor (thermistor)	temperature transducer
light-dependent resistor	ambient light monitoring
voltage-dependent resistor	protection device for overvoltage, surges
fixed resistors	in electronic circuits for current limiting and voltage dividers

Students needed to name two different types of resistors and describe their usage.

Question 4a.

Marks	0	1	Average
%	49	51	**0.5**

Silver

Question 4b.

Marks	0	1	Average
%	68	32	**0.3**

Metal alloy is a mixture of a metal and another element.

Question 4c.

Marks	0	1	Average
%	67	33	**0.4**

The resistivity of the aluminium alloy is higher than copper, therefore will need a greater cross-sectional area compared to a copper cable.

Question 4d.

Marks	0	1	2	Average
%	27	48	25	**1**

- corrosion and rust, therefore poor connections and shorter life of the cable
- will be heavier than copper or aluminium, larger cross-sectional area compared with copper or aluminium
- cost of infrastructure may be higher
- more transmission loss
- higher resistance for size of cable – resistivity too high
- large

Question 5a.

Marks	0	1	Average
%	54	46	**0.5**

Four

Question 5b.

Marks	0	1	2	3	Average
%	30	6	4	60	**1.9**

$V_{diodes} = (4 \times 0.6)\,\text{V} = 2.4\,\text{V}$

$V_A = 12 - 2.4\,\text{V} = 9.6\,\text{V}$

Question 5ci.

Marks	0	1	Average
%	65	35	0.4

Lamp LP_1 goes off.

Question 5cii.

Marks	0	1	Average
%	70	30	0.3

Diode D_1 is reversed bias.

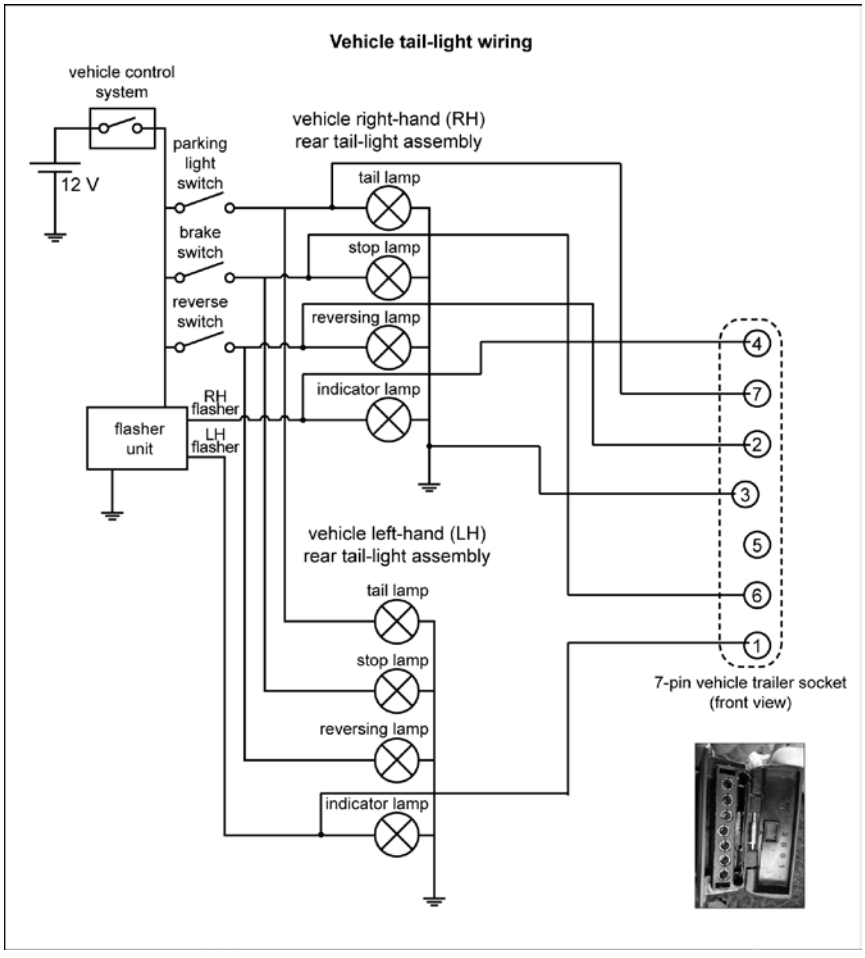
Question 5ciii.

Marks	0	1	2	Average
%	77	2	22	0.5

$V_A = 0$ V
$V_B = 0$ V

Question 6a.

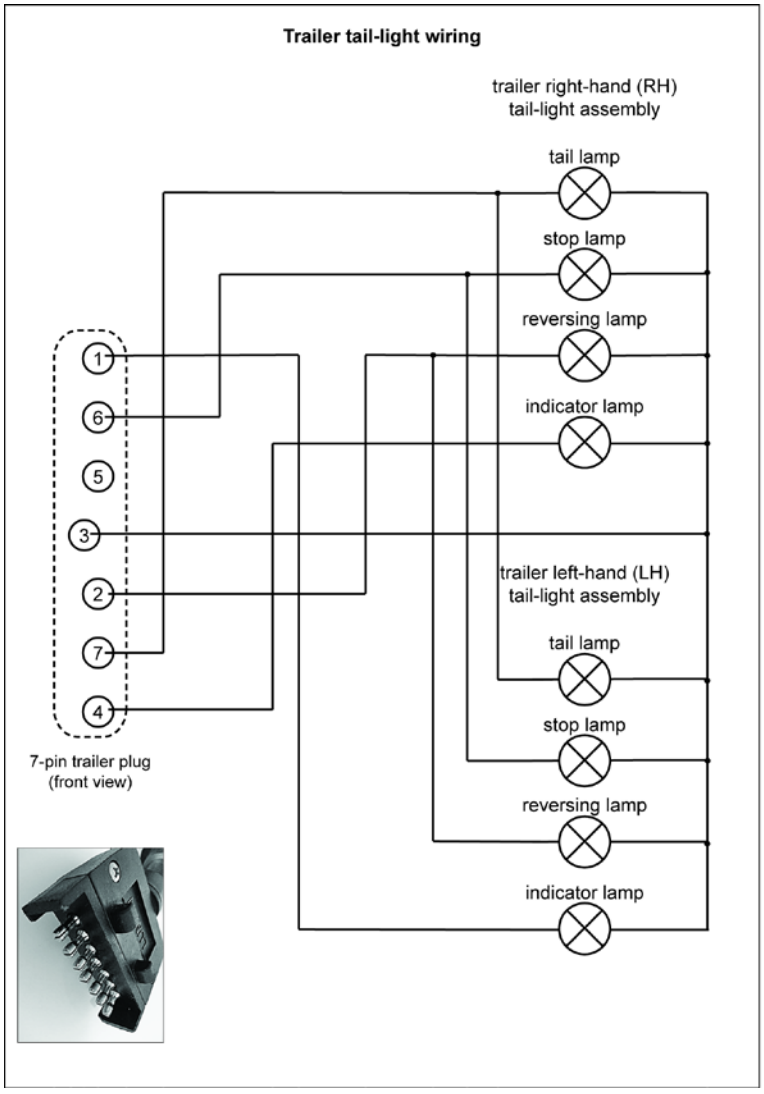
Marks	0	1	2	3	Average
%	88	4	0	8	0.3



This question was not well answered. Most students were unable to connect an active lamp wire to the 7-pin socket.

Question 6b.

Marks	0	1	2	3	4	5	Average
%	21	8	14	21	9	28	**2.7**



Question 7a.

Marks	0	1	2	Average
%	51	6	43	**0.9**

$I = \frac{V_{R2}}{R_2} = \frac{20}{100} = 200\ \text{mA}$

Question 7b.

Marks	0	1	Average
%	19	81	**0.8**

$R_{total} = R_1 + R_2 + R_3\ \Omega = 750\ \Omega$

Question 7c.

Marks	0	1	2	3	Average
%	46	5	8	41	1.4

$V_S = V_{R1} + V_{R2} + V_{R3}$ volts

$= (200 \times 10^{-3} \times 470) + 20 + (200 \times 10^{-3} \times 470)$ volts $= 150$ V

or $V_s = R_{total} \times I = (470 + 100 + 180) \times 200 \times 10^{-3}$ volts $= 150$ V

Question 7d.

Marks	0	1	2	Average
%	49	8	43	0.9

$P_{total} = V_s \times I$ watts $= 150 \times 200 \times 10^{-3}$ W $= 30$ W

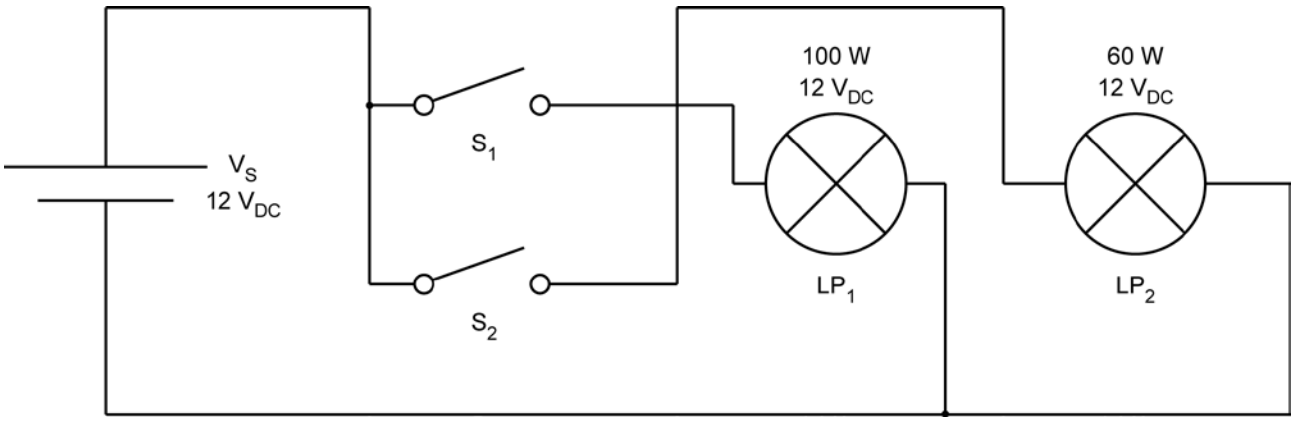
Question 7e.

Marks	0	1	2	Average
%	62	4	35	0.7

$P_{R2} = \frac{V^2}{R2} = \frac{20^2}{100} W = 4$ W

Question 8ai.

Marks	0	1	2	3	Average
%	24	15	4	58	2



Question 8aii.

Marks	0	1	2	Average
%	43	13	44	1

$P_{total} = P_{Lp1} + P_{Lp2} = 100 + 60 = 160$ W $I = \frac{P_{total}}{Vs} = \frac{160}{12} = 13.33$ A

Question 8bi.

Marks	0	1	Average
%	49	51	**0.5**

$R_1 = \frac{V_S}{I_1} = \frac{100}{200 \times 10^{-3}}\ \Omega\ =\ 500\Omega$

Question 8bii.

Marks	0	1	2	3	Average
%	57	13	5	25	**1**

$\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} : R_3 = \frac{Vs^2}{P_{R3}} = \frac{100^2}{2}\ \Omega\ =\ 5\ k\Omega$

$$\frac{1}{R_{total}} = \frac{1}{500} + \frac{1}{2.2 \times 10^3} + \frac{1}{5 \times 10^3}\ \Omega\ =\ 376.7\ \Omega$$

Question 9a.

Marks	0	1	2	Average
%	52	6	42	**0.9**

$R_5 = \frac{V_{R5}}{I} = \frac{10}{333.33 \times 10^{-3}}\ \Omega\ =\ 30\ \Omega$

Question 9b.

Marks	0	1	2	Average
%	61	5	34	**0.7**

R_3 and R_5 are both 30 Ω, therefore each has 333.33 mA flowing through it.

$I_{R4} = 1 - (I_{R3} + I_{R5}) = 1 - 666.66\ mA = 333.33\ mA$, therefore R_4 = 30 Ω

Question 9c.

Marks	0	1	2	Average
%	74	11	15	**0.4**

$R_3 \,||\, R_4 \,||\, R_5 = 10\ \Omega$, $R_1 = \frac{V_S}{I_{R1}} = \frac{60}{1} = 60\ \Omega$; $R_{total} = R_1 \,||\, (R_2 + 10)\ \Omega$

$R_{total} = 60 \,||\, (50 + 10)\ \Omega = 30\ \Omega$

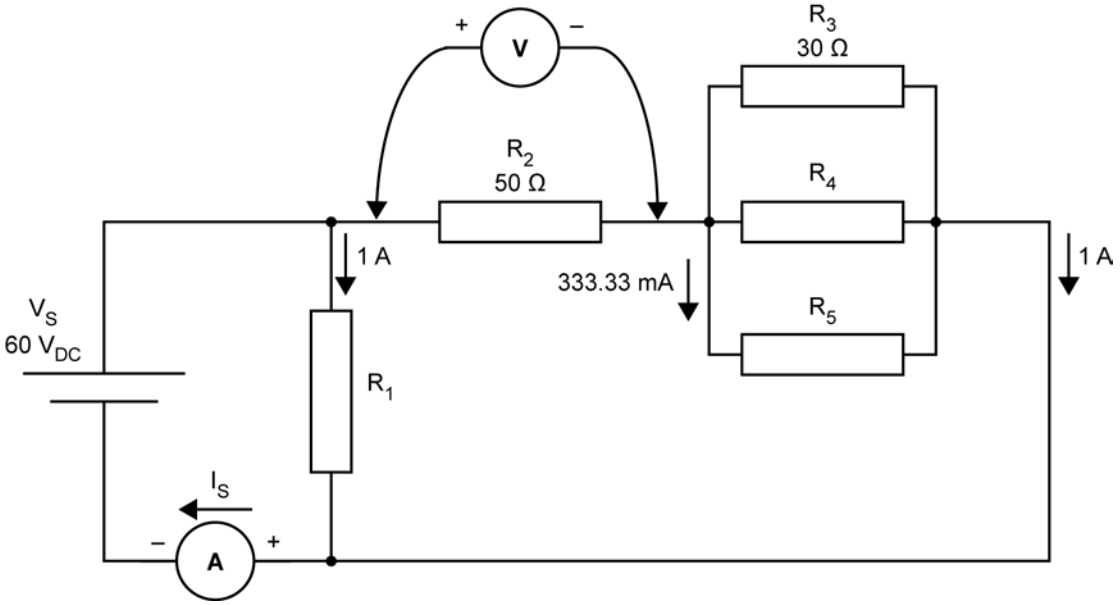
Questions 9d. and 9e.

Question 9d.

Marks	0	1	Average
%	62	38	**0.4**

Question 9e.

Marks	0	1	Average
%	68	32	**0.3**



Question 10ai.

Marks	0	1	2	3	Average
%	35	2	17	46	**1.8**

Device	Average daily usage (hours)	Current drawn by device	Daily ampere hour (Ah) requirement
computer tablet	*3*	*1 A*	3 Ah
lighting system	*4*	*400 mA*	1.6 Ah
12 V_{DC} refrigerator	*8*	*3.5 A*	28 Ah
VHF radio	*6*	*300 mA*	1.8 Ah
depth sounder	*4*	*1.5 A*	6 Ah
stereo system	*8*	*1 A*	8 Ah
		Total daily ampere hours	48.4 Ah

Question 10aii.

Marks	0	1	Average
%	55	45	**0.5**

5 day Ah = 48.4 × 5 = 242 Ah

Total ampere hour usage for five days	242 Ah

Question 10b.

Marks	0	1	Average
%	84	16	**0.2**

242 – 75 = 167 Ah

Total ampere hour usage for five days (from **part a.ii.**)	242 Ah
Battery ampere hour capacity at 50%	75 Ah
Five-day ampere hour solar panel	167 Ah

Question 10c.

Marks	0	1	2	Average
%	82	8	9	**0.3**

$daily\ solar\ panel\ requirements = \frac{167Ah}{5\ days} = 33.4\ \text{Ah}$

$hourly\ solar\ panel\ current = \frac{33.4Ah}{6hrs} = 5.5667\ \text{A}$

Current to be provided by the solar panel per hour during full sunlight	5.5667 A

Question 10di.

Marks	0	1	Average
%	84	16	**0.2**

Power rating of panel = $\text{V} \times \text{I} = 12 \times 5.5667\ \text{W} = 66.6\ \text{W}$

Question 10dii.

Marks	0	1	Average
%	39	61	**0.6**

$12V_{DC}$, 80 W

12 volt panel @ 5.5667 Ah = 66.6 W, therefore an 80 W panel would achieve the task. No inefficiencies are accounted for in terms of regulator and wiring.