2009 VCE VET Electrotechnology GA 2: Examination

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	27	21	41	11	0	Students may not have expected a question on batteries and may not have prepared adequately.
2	6	6	39	49	0	
3	24	34	2	41	0	Most students think of a normal fuse when answering questions such as this.
4	26	7	66	1	0	
5	19	3	7	71	0	
6	8	16	53	22	0	Students may not have been exposed to such hardware.
7	80	4	10	4	1	
8	30	20	35	14	0	This question involved writing a Boolean expression for each circuit and getting a reduced expression. Students who were unable to do this may have guessed the answer.
9	18	52	11	19	0	
10	8	15	52	24	1	
11	7	79	9	5	0	
12	9	32	45	14	0	
13	5	64	15	16	0	
14	5	82	9	5	0	
15	22	19	28	31	0	Many students may have not understood the meaning of surge.
16	43	13	32	12	0	
17	22	20	27	32	0	Students may not have studied magnetism in depth and this could have led to guess work.
18	5	83	5	6	1	
19	7	43	20	30	0	
20	43	41	9	7	0	Students may have selected option B as there were 12 hexadecimal digits in the MAC address. The question asked students to find the number of bits. Students needed to multiply 12 by 4 to get the correct answer.

Section B

Question 1

Marks	0	1	2	3	4	5	6	Average
%	0	1	3	8	13	15	60	5.2

COMPONENT	LETTER	COMPONENT	LETTER
Fuse	C	Diode	B/F
Power transistor	A	Integrated circuit	H
Potentiometer	D	High-power resistor	G

Students were expected to correctly identify commonly used electronic components and a good number of students were able to do so. Each correct response was given one mark. There were two possible answers for diode and both were accepted.

Question 2

Marks	0	1	2	3	4	5	6	Average
%	6	10	17	17	22	19	10	3.4

Transducer	Energy Input	Energy Output
Microphone	Sound-wave pressure	Electrical/voltage
LED	Electrical/current	Light
Piezo Sparker	Mechanical/weight pressure/compression of crystal	High-voltage spark
LDR	Light energy	Variable resistance
Solar cell	Light energy/solar/photo	Electrical/voltage

This question assessed students' basic understanding of commonly used transducers. Students were required to identify the missing aspects in the table. The majority of students failed to correctly identify the output energy for the transducer microphone and incorrectly gave sound energy as their answer.

Question 3a.

Marks	0	1	Average
%	78	22	0.2

2^8 = 256 output levels (255 was also accepted)

Many students failed to understand the general working of a Digital to Analogue Converter (DAC).

Question 3b.

Marks	0	1	2	Average
%	83	7	10	0.3

Output voltage increment or step voltage = maximum output voltage/number of steps

= 5/255 = 0.0196V or 19.6mV, Accept up to 20mV

Students were awarded one mark for substituting the correct values into the formula and one mark for obtaining the correct answer with units. Many students failed to understand the general working of a Digital to Analogue Converter.

Question 3c.

Marks	0	1	2	3	Average
%	21	18	24	38	1.8

CD player, DVD player, mobile phone, iPod, digital TV or TV, stereo, computer, digital watch, digital voltmeter, modem, telephone, radio, etc.

Students needed to understand that almost any electronic device or piece of equipment that stores data digitally does some processing and has an analogue output (devices involving sound, temperature, picture, etc. are very likely to have a Digital to Analogue Converter).

Question 4a.

Marks	0	1	2	Average
%	70	5	25	0.6

$\tau = RC = 10\Omega \times 1000\mu F = 10ms = 0.01sec$

Students were awarded one mark for the correct value substituted into the formula and one mark for obtaining the correct answer with units.

Timing circuit is an important concept in basic electronic circuits; however, only a minority of students were able to show their understanding of the concept and how to calculate charging and discharging circuit parameters correctly. More focus should be placed on this topic to help students better understand the concept.

Question 4b.

Marks	0	1	2	Average
%	69	10	21	**0.5**

T = 5τ = 5 X 10ms = 50 ms or 0.05S

One mark was awarded for the correct value and correct units and one mark was awarded for multiplying the answer (carried over) from Question 4a.

Many students failed to understand that it takes five time constants to fully charge a capacitor in a charging circuit.

Question 4c.

Marks	0	1	2	Average
%	65	7	29	**0.7**

Discharging time constant τ= RC = 15K X 1000μF = 15S

To get full marks, students needed to correctly identify the charging and discharging components in a circuit. Students were awarded one mark each for the correct value substituted into the formula and one mark for obtaining the correct answer with units.

Question 5a.

Marks	0	1	2	3	4	Average
%	46	1	14	4	34	**1.8**

Ammeter reading – 30V/15K = 2mA
Voltmeter reading – 2mA X 10K = 20V

For the ammeter reading, two marks were awarded for correct values substituted into the formula to give correct numeric value and units for calculating current. One mark was awarded where the student used the correct values but gave an incorrect answer.

For the voltmeter reading, two marks were awarded for the correct values substituted into the formula to give the correct numeric value and units for calculating voltage. One mark was awarded where students used the correct values substituted in formula but gave the incorrect final answer.

Question 5b.

Marks	0	1	2	3	4	Average
%	55	2	17	1	25	**1.4**

Ammeter reading – 30V/10K = 3mA
Voltmeter reading – 3mA X 5K = 15V

For the ammeter reading, two marks were awarded for the correct values substituted into the formula to give correct numeric value and units for calculating current. One mark was awarded where students used the correct values substituted in the formula but gave an incorrect final answer.

For the voltmeter reading, two marks were awarded for the correct values substituted into the formula to give correct numeric value and units for calculating voltage. One mark was awarded where students used the correct values but gave an incorrect final answer.

More emphasis needs to be placed on calculating the effective resistance of a series and/or parallel circuits. The focus should be on using and representing values with correct units. The use of a number of practical examples will help students respond better to applications where complex circuits are simplified for the purpose of analysis.

Question 6a.

Marks	0	1	2	3	4	5	6	Average
%	4	4	7	16	18	21	31	**4.3**

A	B	C	X
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

One mark was awarded for each correct entry.

Question 6b.

Marks	0	1	2	Average
%	69	7	24	**0.6**

$A\left(B+\bar{C}\right)$

Two marks were awarded for the correct expression. One mark was awarded for writing C instead of $\bar{C}$.

Students did not respond well to Question 6b. They may have been confused about the correct symbols for the logic gate or unsure of the correct symbol for logical operation. Students could improve this by practising writing Boolean expressions from circuit diagrams. Developing Boolean expressions is vital for understanding digital circuit principles.

Question 7a.

Marks	0	1	2	3	4	Average
%	50	12	21	3	14	**1.2**

The value of the voltage induced in a conductor which is moved in a magnetic field depends on four factors.

Any two of:

- factor 1 – the length of the conductor
  effect – the longer the conductor, the higher the voltage induced
- factor 2 – the speed of the moving conductor
  effect – the greater the speed, the higher the induced voltage
- factor 3 – the intensity of the magnetic field
  effect – the greater the intensity of the magnetic field, the higher the induced voltage
- factor 4 – the angle at which the conductor is moving relative to the magnetic field
  effect – maximum voltage is generated when the conductor moves perpendicular to the direction of the lines of magnetic field, and zero when the conductor moves along the direction of the magnetic field.

Students were awarded one mark for each correct factor and one mark each for the correct explanation.

Question 7b.

Marks	0	1	Average
%	69	31	**0.3**

Voltage changes its polarity or reverses

Students were required to give a direct explanation of the formula for voltage induced in a conductor in a magnetic field; however, the response to this question was poor. This could be due to students:

- not understanding the formula and expecting the formula to be provided on the exam paper
- failing to understand the basic principles of magnetism.

Question 8a.

Marks	0	1	Average
%	92	8	0.1

Ferrite core

Question 8b.

Marks	0	1	2	Average
%	76	17	7	0.3

A change in the current of one coil that affects the current and voltage in the second coil is quantified in the property called mutual inductance.

Device: transformer/radio

One mark each was awarded for the correct device name and explanation.

Question 8c.

Marks	0	1	Average
%	83	17	0.2

Silicon-plated iron/soft iron or iron

Question 8d.

Marks	0	1	Average
%	66	34	0.4

A practical application of an inductor such as neon or lithium light (as ballast), loudspeaker, deflective device in a CRO or analogue video TV set, all electrical motors, transformers, high frequency filters, proximity sensors, inverter, UPS.

Question 8e.

Marks	0	1	2	3	4	Average
%	42	1	31	3	23	1.6

Secondary voltage
$240/V_s = 1660/138$
$V_s = 240 \times 138 / 1660 \approx 20V$

Primary current
$10/I_p = 138/1660$
$I_p = 138 \times 10 / 1660 = 0.831A$ or 831mA

For both secondary voltage and primary current, two marks were awarded for the correct substitution and answer. One mark was awarded for the correct substitution even if students gave an incorrect final answer or did not give units.

Most students correctly calculated the secondary voltage, but failed to correctly calculate the current. However, the poor response to this question indicates that students had struggled to gain a good understanding of magnetism and its application. Understanding magnetism and its applications will have a greater impact on understanding how electronic circuits work and it is important that this concept is made clear.

Question 9

Marks	0	1	2	3	4	5	6	7	8	Average
%	0	1	2	9	16	28	16	12	15	5.4

Letter	Component or connector	Letter	Component or connector
H	Digital video output	I	CPU heatsink
D	Firewire IEEE1394 interface	C	Analogue video connector
E	USB interface	B	Parallel port
G	Audio input/output connection	F	Network interface connector

One mark each was awarded for the correct identification of the component.

The question assessed students' ability to identify parts of a computer. The question was well answered and the response was encouraging.

Question 10a.

Marks	0	1	2	3	4	Average
%	1	0	3	2	94	3.9

Tool	Usage
Soldering station	Soldering components to PCB
Side cutters	Cutting and trimming wires and component leads
Long-nose pliers	Bending wires and component leads
Bull nose pliers	Manipulating and cutting heavy gauge wire
Solder	Used to make electrical connection of the components to the PCB and holds the component in place
De-soldering wick	Undo soldering

Students needed to identify and describe two tools. Two marks were awarded for naming the two tools and two marks were awarded for describing their usage.

This question was well answered by many students and showed that students had done a large amount of practical work using these tools. They were able to correctly identify the tools and their purpose.

Question 10b.

Marks	0	1	2	3	4	Average
%	9	1	6	4	80	3.5

Risk	Control measures
Solder fumes	Ventilation, fume extractor
Solder splash	Safety glasses, protective clothing and footwear
Burns	Safe soldering techniques, tidy orderly bench, iron holder
Lead poisoning	Wash hands after handling solder

Students were expected to identify two risks and list the control measure for each identified risk. Two marks were awarded for correctly identifying two risks and two marks were awarded for listing two control measures.

Responses showed that students have an increased awareness of the occupational health and safety procedures that need to be followed when performing these tasks. However, a minority of students did not relate the control measure to the risk.

Question 11a.

Marks	0	1	Average
%	37	63	0.7

Full-wave rectifier, convert AC to pulsating DC

Key words such as rectifiers, AC-DC and prevent reverse current were also acceptable.

The response to this question was very good. This indicated that students have analysed power supply circuits to understand how they work.

Question 11b.

Marks	0	1	Average
%	37	63	0.7

Filter pulsating DC, smooth ripple, store electric charge

A very good number of correct responses were given to this question.

Question 11c.

Marks	0	1	2	3	Average
%	36	5	2	58	1.8

Vpeak = 1.414 x 9V = 12.73V

Full marks were awarded for correct voltage value and units. The response indicated that this was an area of strength for the majority of students.

Question 11d.

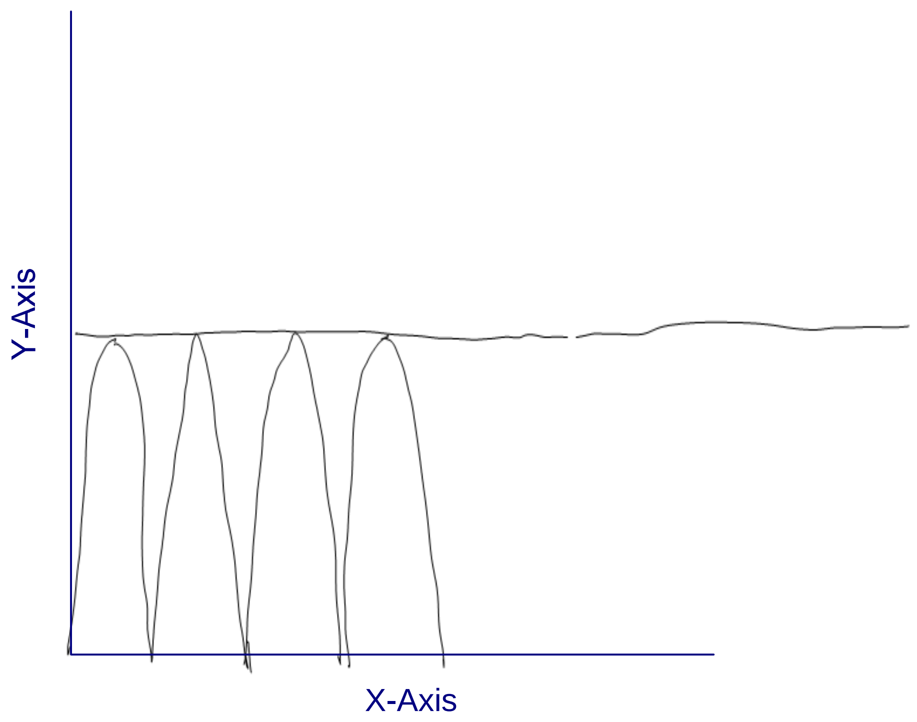
Marks	0	1	2	3	Average
%	64	19	11	6	0.6

Graph Vpk = 12.73 – 1.2V = 11.5V

One mark each was awarded for correct peak voltage (12.1V - 11.5V), correct time period (10ms) drawn and correct waveshape – pulsating full wave rectified.

Area of weakness included students:

- not taking into account diode voltage drops
- not able to determine the time period
- failing to understand the relation between frequency and time period
- failing to understand the relation between frequency of the input and output for full wave rectification.



Question 11e.

Marks	0	1	2	Average
%	55	7	38	0.8

$I_L = V/R$; $I_L = 5/15 = 0.33A$ or 333mA

Two marks were awarded for correct substitution into the formula and giving a correct numeric value with units. Students were awarded one mark where they used an incorrect value but their answer corresponded to the substituted value.

Students needed to read the question carefully and understand the circuit diagrams to get full marks. For the majority of the students, this was an area of strength as they correctly calculated the load current. A small number of students used the incorrect voltage of 9V. These students may have carried over the input voltage value from Question 11d. and used it as the output voltage in this question.