2005 VCE VET Electronics GA 2: Written examination

GENERAL COMMENTS

2005 was the last year for the VCE VET Electronics examination in this form. In 2006 the scored VCE VET program Certificate II in Electronics has been replaced with 21583VIC Certificate II in Electrotechnology (Shared Technology).

The 2005 examination was based on the VET modules designated as VCE VET Units 3 and 4. These modules were:

- NE178 DC Power Supplies
- VBB221 Analogue Systems
- VBB222 Digital and Systems
- NE179 Digital Electronics 1
- VBB229 Mathematics for Electronics 2.

The examination paper was divided into three sections: 'DC Power Supplies', 'Analogue Systems' and a combined section of 'Digital Electronics 1' and 'Digital Systems'. There was no separate section for 'Mathematics for Electronics 2', as an understanding of mathematics was incorporated into many of the questions.

The examination contained a variety of question types: multiple-choice questions, short-answer questions and those requiring drawings, waveforms or diagrams.

Students were able to gain full marks for the questions requiring a calculation if the correct answer was given with correct units. Some questions specifically asked the students to state the formula used and show the substitution and correct workings to achieve full marks.

Some students showed a poor understanding of basic electronic components and industry skills. In Units 3 and 4, students should be confident in applying these basic skills in assessment tasks.

SPECIFIC INFORMATION

Section 1 – DC power supplies

Overall, students generally provided much better responses to the questions in Section 2 and 3 than those in Section 1. Many responses in Section 1 seemed to indicate that students had not adequately covered the basic AC theory in NE161 – Electrical Principles 2, which was delivered in Units 1 and 2, and also had not undertaken enough practical exercises or product construction activities during Units 3 and 4.

Questions 1–2b.

Marks	0	1	2	3	Average
%	17	37	27	19	**1.5**

1

D. The output voltage should be constant for a change in load.

2a.

D4 and D1

2b.

The average level of voltage at V_O would decrease by half.

Alternatively, students could give some clear indication of how the negative cycle would be chopped off, including diagrams.

Questions 2c–d.

Marks	0	1	2	Average
%	36	33	30	**1.0**

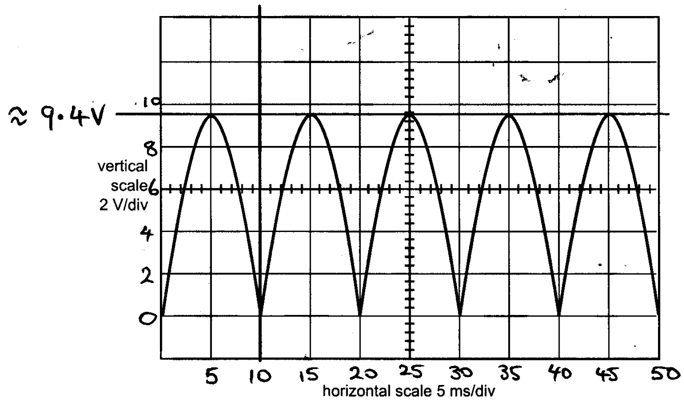
2c.

10 ms

This was a poorly answered question, indicating that students had little experience using CROs and did not understand the concept of a period (T) of a waveform. Answers given as a frequency in hertz were not accepted.

2d.
4.7×2V per div
$= 9.4$ V

A range of responses $\pm$ 0.4 V was accepted. The answer could be quite easily determined from the diagram provided below.



Question 2e.

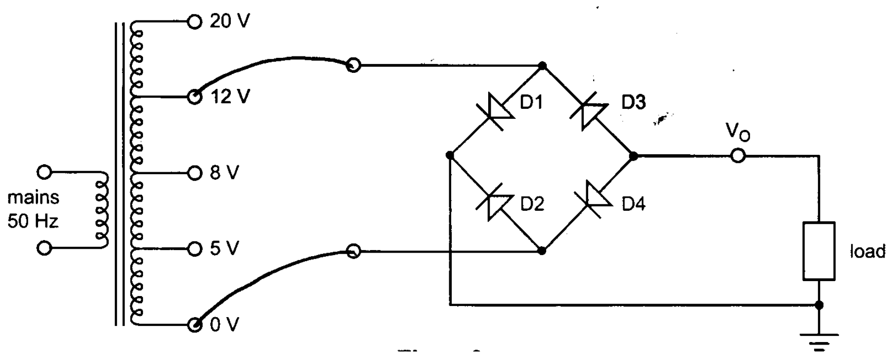
Marks	0	1	2	3	Average
%	17	5	5	73	**2.3**

$$V_{RMS} = \frac{V_{pk}}{\sqrt{2}}$$
$$= \frac{9.4}{\sqrt{2}}$$
$$= 6.65 \text{ V}$$

Although many students calculated the V_{pk} incorrectly, marks were awarded for applying the formula correctly.

Question 3a.

Marks	0	1	2	Average
%	62	1	37	**0.8**



This question required students to make some rough determinations about the stated RMS voltages on the multiple tapped transformer when converted to the possible peak voltages. Both the 0 V and the 12 V tap had to be connected to the bridge rectifier. The following mathematical solution proves the 0 V and 12 V connections are correct.

$$V_{pk} = \sqrt{2} \times 12$$
$$= 16.97 \text{ V}$$

Question 3b.

Marks	0	1	2	Average
%	89	0	11	**0.2**

10 VA = 5 × I
∴ I = 2 amps

Students showed a poor understanding of VA ratings in transformers. This question required an application of Ohm's law to determine the maximum current.

Question 4

Marks	0	1	2	3	Average
%	42	14	9	35	**1.4**

11.3 – 2 × (1 V diodes) = 9.3 V

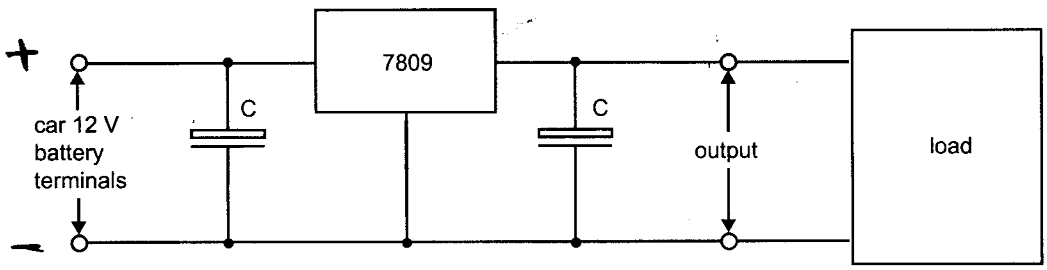
$$I = \frac{V}{R}$$
$$= \frac{9.3}{200}$$
$$= 46.5 \text{ mA}$$

One mark was awarded for correctly determining 9.3 V, one mark for the applying Ohm's law and one providing the correct answer with correct units.

Questions 5a–e.

Marks	0	1	2	3	4	5	6	Average
%	6	11	15	18	8	17	25	**3.6**

5a.



5b.
V (supply) – V (regulation) = V (reduct)
12 – 9 = 3 volts

Many students answered that 9 volts would be the reduction across the regulator, probably because it was a 9 volt regulator.

5c.
P = V × I
= 3 × 200 mA
= 600 mW (or 0.6 watts)

If students used 9 volts for V, as determined in Question 5b., but applied the formula correctly, full marks could be awarded.

5d.
Mount a heatsink on the regulator (or any other acceptable method of increased cooling).

This question was generally well answered.

5e.
Examples of suitable answers include radio, Discman, iPod and light globe.

This question was generally well answered.

Question 6a–d.

Marks	0	1	2	3	4	5	Average
%	11	18	24	21	13	14	**2.5**

6a.
24 volts

This question was poorly answered, and many students answered 12 volts.

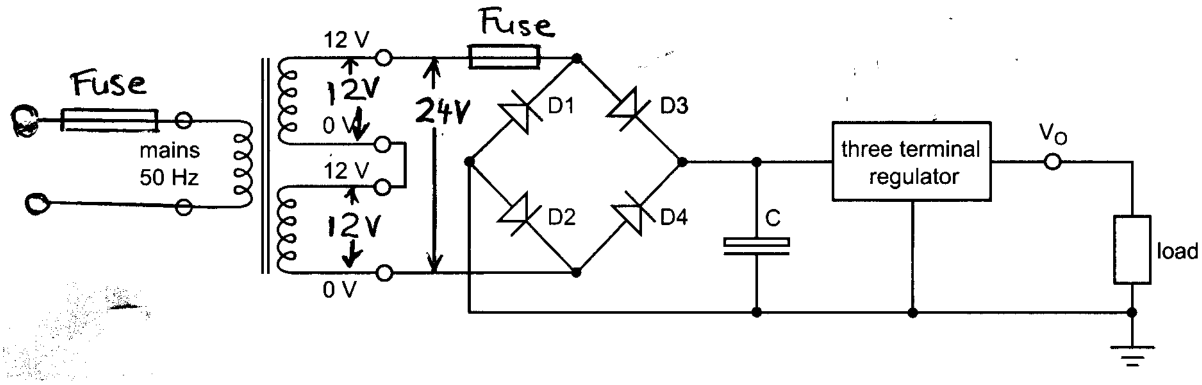
6b.

	Increased	Decreased	Unchanged
AC ripple		√	
average level of voltage	√		

6c.
a fuse

This question was generally well answered.

6d.



It was acceptable to place a fuse in either the primary or secondary part of the transformer.

Question 7

Marks	0	1	2	Average
%	5	69	26	**1.2**

Characteristics	Switch mode	Three terminal
more efficient	√	
produces switching spikes	√	

Questions 8a–b.

Marks	0	1	2	3	4	Average
%	4	10	21	23	42	**2.9**

8a.
Acceptable answers included computer and laptop power supply.

This question was generally well answered.

8bi.
transistor

8bii.
inductor

8biii.
LED

Most students answered Question 8biii. correctly; however, not all knew the appropriate parts for 8bi. and 8bii.

Section 2 – Analogue Systems

Questions 1a–b.

Marks	0	1	2	Average
%	44	29	27	**0.8**

1a.
B. 470 R

Many students answered A (472 Ω) or D (47 k). These answers were not accepted, as the nominal value of resistance is 470 Ω or 470 R. Students at this level should be able to read a resistance colour code value correctly.

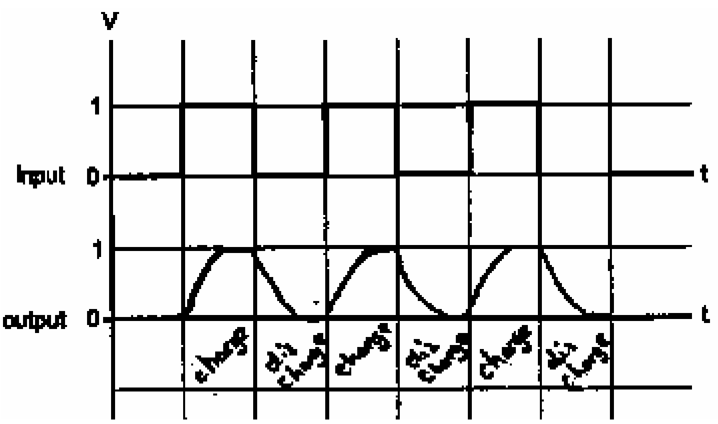
1b.
D. 0.1 µF

104 K read as 10 0000 pF, 100 nF or 0.1 µF. The letter 'K' in this case was irrelevant in relation to capacitance value.

Many students responded incorrectly with A (100 µF) or C (104 pF), showing little understanding of how capacitance is determined.

Question 1c.

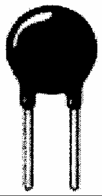
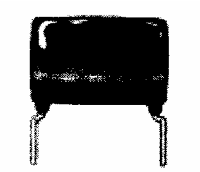
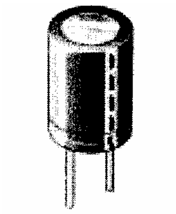
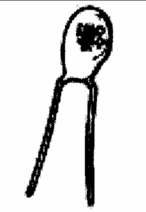
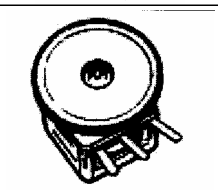
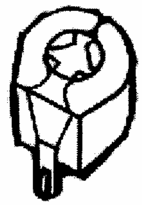
Marks	0	1	2	Average
%	67	21	13	**0.5**



A variety of waveforms were accepted, including those that were similar to the input. Many students sketched an inverted square wave, which was not accepted.

Question 1d.

Marks	0	1	2	3	4	5	6	Average
%	11	20	22	15	10	9	12	**2.7**

picture of capacitor	type	polarised or non-polarised
	ceramic disc	non-polarised
	polyester	non-polarised
	electrolytic	polarised
	tantalum	polarised
	variable tuning	non-polarised
	trimming	non-polarised

One mark was awarded for identifying both the correct type and polarisation of each capacitor type; students who wrote that all the capacitors were either polarised or non-polarised were deemed to be incorrect.

This question was not answered as well as expected. Students who have completed Certificate II in Electronics should have had a good exposure to most common electronic components and, even through a process of elimination, should have been able to determine what these capacitors were.

Questions 2a–d.

Marks	0	1	2	3	4	Average
%	16	17	19	24	24	**2.2**

2a.
Light Dependant Resistor

This question was generally quite well answered.

2b.
Examples of acceptable responses include an automatic bedroom nightlight, LED garden light or light level indicator.

Although this question asked for a practical application **for this circuit**, many students responded with other applications that were not appropriate for this circuit. However, if the answer was developed, such as, 'It could be adapted and modified with additional components and be used to control automatic street lighting', it was accepted.

2c.
transistor, BJT or NPN transistor

A range of appropriate answers was accepted; however, BC548 by itself was not accepted.

This question was generally well answered.

2d.
Darkness, reduced light or if the LDR was covered.

Acceptable answers had to mention darkness in some way.

Question 2e.

Marks	0	1	2	3	Average
%	39	29	16	16	**1.1**

The 33 k resistor and the LDR operate as a voltage divider; when the LDR is in the dark, voltage across the LDR provides bias to the BC548 transistor that turns on the LED.

For the full three marks to be awarded, students had to provide a three-step answer. A large variety of answers were given.

Questions 3a–b.

Marks	0	1	2	3	4	Average
%	30	19	9	26	16	**1.8**

3a.
To maximise the signal to the amplifier, or to not load down the source signal.

There were many acceptable answers to this question.

3b.

$$
\begin{aligned}
V_{IN} &= \frac{R_{IN}}{R_{IN} + R_S} \times V_S \\
&= \frac{950\ \text{k}\Omega}{950\ \text{k}\Omega + 50\ \text{k}\Omega} \times 20\ \text{mV} \\
&= 19\ \text{mV}
\end{aligned}
$$

Many students displayed a poor understanding of the units, and their application of engineering notation was often poor.

Question 3c.

Marks	0	1	2	Average
%	28	42	30	**1.0**

$$
\begin{aligned}
Av &= \frac{V_{OUT}}{V_{IN}} \\
&= \frac{285\ \text{mV}}{19\ \text{mV}} \\
&= 15
\end{aligned}
$$

Many students answered that the gain was 15 mV, rather than just a gain (Av) of 15.

Question 3d.

Marks	0	1	2	3	Average
%	16	28	23	33	**1.7**

Sound waves move the diaphragm, which in turn moves the voice coil. As the voice coil moves in a magnetic field, a small electrical current is induced into the coil winding. This is where the signal is taken from.

For the full three marks to be awarded, students had to provide a three-step answer. A large variety of answers were given.

Questions 4a–b.

Marks	0	1	2	3	Average
%	28	27	24	21	**1.4**

4a.
Amplitude Modulation

4bi.
It converts audio energy into electrical signals.

4bii.
transducer device

Questions 4c–e.

Marks	0	1	2	3	Average
%	15	27	39	19	**1.6**

4c.
B. vary the amplitude of the carrier at the audio signal rate

4d.
D. tuned radio frequencies only

4e.
C. 900 kHz

Section 3 – Digital electronics 1 and Digital systems

Question 1a.

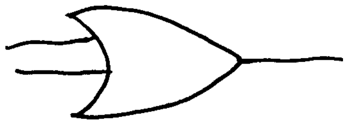
Marks	0	1	2	3	4	Average
%	60	6	9	6	19	**1.1**

B	**A**	$\bar{A}$	$\bar{B}$	**P =** $\overline{\bar{A}.\bar{B}}$ or **P =** $A + B$	**Q =** $\overline{\overline{\bar{A}.\bar{B}}}$ or **Q =** $\overline{A + B}$
0	**0**	**1**	**1**	0	1
0	**1**	**0**	**1**	1	0
1	**0**	**1**	**0**	1	0
1	**1**	**0**	**0**	1	0

Students showed a poor understanding of the logic of these gate configurations. A variety of unsimplified Boolean expressions for output P and Q were accepted as long as they were 'logically correct'. The truth table logic outputs were poorly answered.

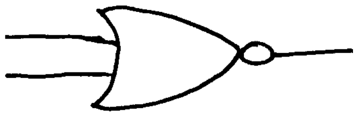
Question 1bi.

Marks	0	1	2	Average
%	60	7	33	**0.7**

Output P	
simplified logic gate type	**draw the simplified logic gate**
OR	

Question 1bii.

Marks	0	1	2	Average
%	71	5	24	**0.5**

Output Q	
simplified logic gate type	**draw the simplified logic gate**
NOR	

Students who had answered part a. incorrectly were still able to gain marks for this question. For example, students who drew an ‘AND’ gate for part bi. were given the marks if they had determined in Question 1a. that Output P was an ‘AND’ gate, and had consistently shown this through the Boolean expression and the truth table. However, full marks were not awarded if the same gate type was provided for both Output P and Output Q.

Question 1c.

Marks	0	1	2	Average
%	13	33	54	**1.4**

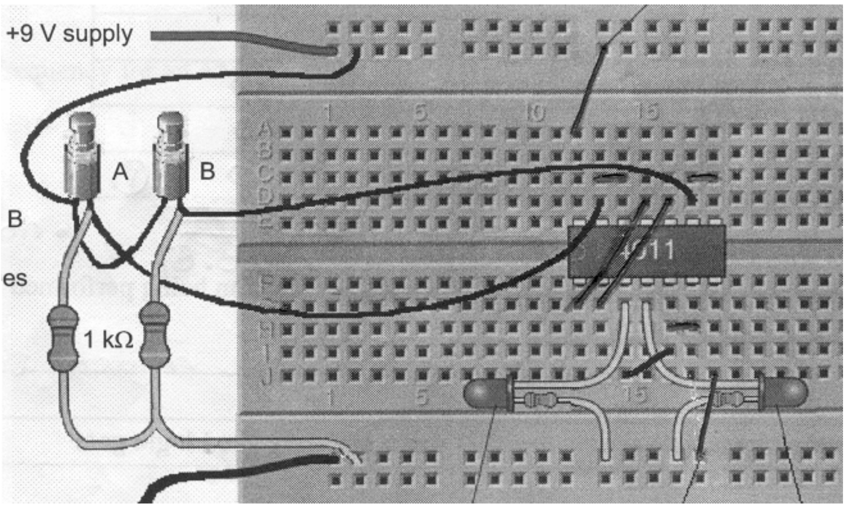
Examples of advantages of using the Breadboard technique rather than the conventional PCB manufacture include:

- the PCB does not have to be designed or made
- no chemicals are needed in the process
- no expensive equipment is required
- changes can be easily made
- no soldering is required
- quick to set up and test a circuit.

Generally, this question was answered well. Any two reasonable advantages were accepted for full marks.

Question 1d.

Marks	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Average
%	43	0	4	0	7	0	4	0	4	0	8	0	2	0	28	**5.8**



Many students appeared to be unfamiliar with using prototyping breadboards, even though it is part of the mandated equipment required for the course. A variety of answers were accepted, as long as the wiring that had been drawn in made the required connections. A large number of students brought wires back to the push buttons, which was acceptable. Two marks were awarded for each correct connection made. Additional wires that were surplus to the required wiring were generally disregarded.

Question 1e-f.

Marks	0	1	2	3	Average
%	61	30	4	5	**0.5**

1e.
The resistors pull the inputs to ground, '0 volts' when the push buttons are open.

Students showed a very poor understanding of this concept.

1f.
- CMOS
- 4000 series

Any reasonable responses were accepted.

Question 2a.

Marks	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Average
%	20	0	2	1	7	10	3	2	1	2	5	6	5	4	32	**8.0**

Character	**N**	u	m	b	**e**	r	?
ASCII Hex	4E	**75**	6D	**62**	65	**72**	3F
ASCII Binary Code	100 1110	111 0101	**110 1101**	110 0010	110 0101	111 0101	**011 1111**

Question 2b.

Marks	0	1	2	3	4	Average
%	38	15	18	8	21	**1.6**

decimal	binary	BCD
256	100000000	0010 0101 0110

hexadecimal	binary	decimal
C1A	1100 0001 1010	3098

Question 3a.

Marks	0	1	2	3	4	Average
%	22	8	5	15	49	**2.6**

Gate number	Gate type
gate 1	Not or Inverting
gate 2	XOR or exclusive OR
gate 3	NOR
gate 4	AND

Surprisingly, many students were unable to recognise and identify these basic gates by name. Overall, the students showed a poor knowledge of gate types.

Question 3b.

Marks	0	1	2	3	4	Average
%	64	4	4	4	26	**1.2**

$(\bar{A} \oplus B).(\overline{B+C}) = Q$

This was the most commonly provided correct answer. A variety of other logically correct Boolean expressions were also accepted. Marks were apportioned for correct parts of the Boolean expression. Overall this question was very poorly answered, with students showing minimal understanding of gate configurations and the related Boolean expressions.

Question 4

Marks	0	1	2	3	Average
%	7	15	34	44	**2.2**

Advantages of LCD screens over conventional Cathode Ray Tube type screens include:

- much more compact
- consume less energy
- provide greater graphics resolution
- emit lower radiation levels
- provide improved security; for example, in banks – if you are not directly in front of the screen it cannot be read.

Any three reasonable advantages were given full marks. This question was generally well answered.