GENERAL COMMENTS

The 2002 examination was based on the VCE VET modules within Units 3–4. These modules are:

- DC Power Supplies
- Analogue Systems
- Digital and Systems
- Digital Electronics 1
- 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 most questions. The examination contained a variety of questions types and required descriptive responses to short-answer questions as well as completion of drawings and diagrams. For the first time, the paper contained a number of multiple-choice questions at the start of each section.

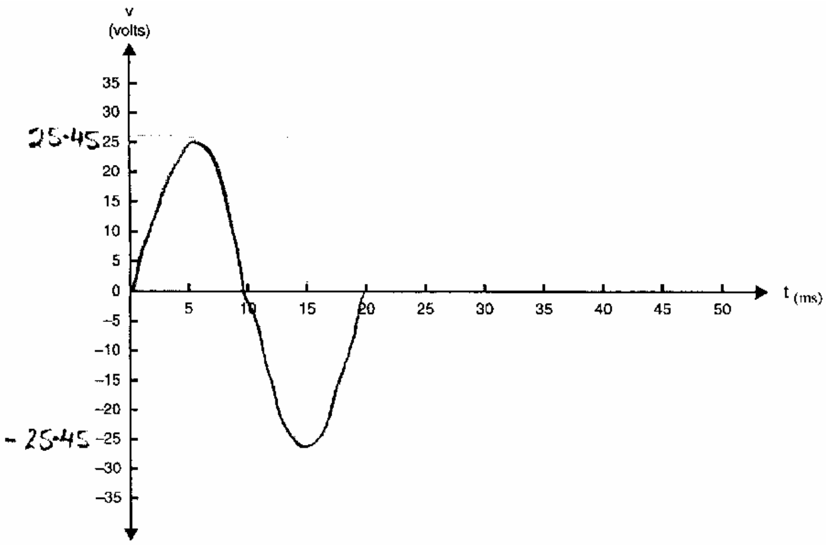
Students were able to gain full marks for the question requiring calculation if both the correct answer with correct units was given. Students should state the formula used, show the substitution and workings. When working is shown, a small error such as placement of the decimal point, may still be awarded some marks.

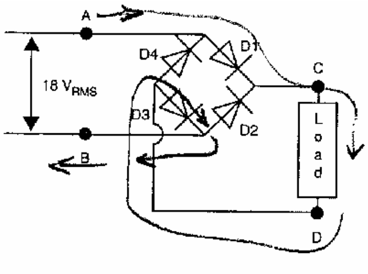
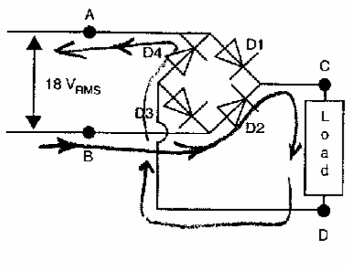
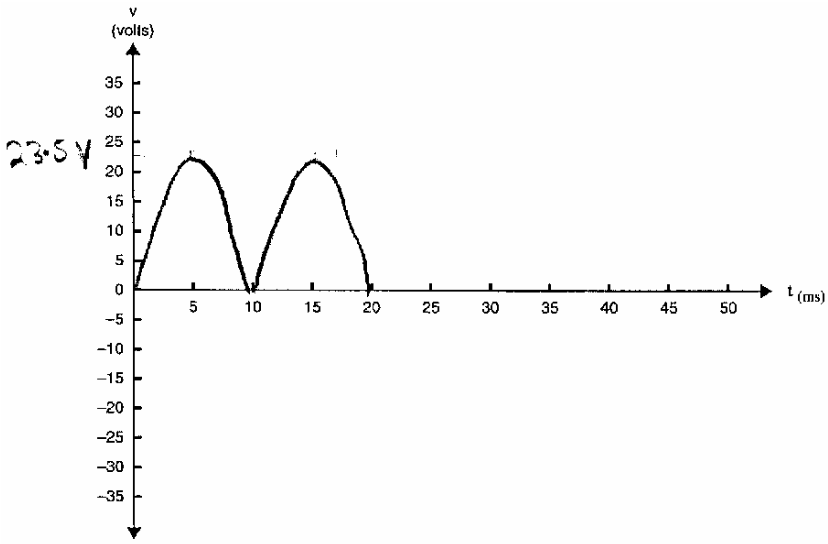
The responses indicated that students had not undertaken enough practical exercises or product construction activities during Units 3 and 4. When students successfully complete VCE VET Electronics Units 3–4 they should have the basic skills and be ready for employment in the electronics industry sector at technical assistant level.

SPECIFIC INFORMATION

Section 1 – DC Power supplies

Question	Marks	%	Response
Question 1	0/1 1/1 (Average mark 0.74)	26 74	Correct answer: D – All of the above
Question 2	0/1 1/1 (Average mark 0.51)	49 51	Correct answer: A – reverse biased
Question 3	Two marks were available for each description of each component; marks were awarded depending on the level of the response and the standard industry technical language used. Many students appeared to ignore the associated diagram that related to this question, which would have provided them with specific information to use.		
	i–iv 0/8 1/8 2/8 3/8 4/8 5/8 6/8 7/8 8/8 (Average mark 4.5)	 11 10 8 8 9 9 15 14 16	**Acceptable responses were:** **i** **Transformer** A step down transformer that had a mains 240V AC input which was stepped down to 18V RMS, which was a suitably low voltage for the circuit. **ii** **Rectifier** Able to direct (rectify) the current through the negative and positive cycles to flow in one direction only, so converting from AC to pulsating DC. This could also be shown through drawing and annotating a waveform diagram. **iii** **Filter** The charge and discharge of the capacitor during the pulsating cycle and the effect this had in producing a smoothed DC output. This could also be shown through drawing and annotating a waveform diagram. **iv** **Voltage Regulator** The voltage being set at 12 volts and the device allowing the voltage to remain constant at the output despite varying current demand.

Question 4	These questions required calculations to be performed. Students were able to receive some marks if they showed an underlying understanding of the circuit, although the calculations were not perfectly performed. Many students failed to observe that the V_{drop} for the diodes was specified at 1 volt.	
	a–c 0/8 7 1/8 3 2/8 2 3/8 10 4/8 10 5/8 16 6/8 19 7/8 6 8/8 26 (Average mark 5.24)	**a** Acceptable answer: (at A, B) $V_{peak}=V_{rms}$ x 1.414 = 18 x 1.414 = 25.45 Volts **b** Acceptable answer: (at C, D) $V_{peak} = V_{pk\ (A,B)} - 2 \times V_{drop}$ = 25.45 - 2 = 23.5Volts **c** Acceptable answer: T = 1/f = 1/50 = 0.02 seconds or 20 ms (milliseconds) Students should have expressed the answer in ms (milliseconds.)
	d–e 0/5 11 1/5 15 2/5 14 3/5 15 4/5 19 5/5 26 (Average mark 2.93)	**d**  **Figure 4**

		Students were required to apply the calculations performed in the previous questions to produce waveforms. If errors in the calculations had resulted in slightly different answers and these (incorrect) answers were applied in these questions to produce appropriate waveforms, full marks were still awarded. **e**  **First half cycle** **Figure 5**  **Second half cycle** **Figure 6** Both the path of current flow and arrows showing direction had to be shown for full marks to be awarded.
	f–h 0/5 8 1/5 22 2/5 13 3/5 13 4/5 17 5/5 27 (Average mark 2.88)	**f**  **Figure 7** **g** Correct answer: 2 **h** Correct answer: 100 Hz (Hertz) The unit (Hz) had to be stated for a mark to be awarded.
Question 5	0/2 38 1/2 32 2/2 30 (Average mark 0.92)	Acceptable answers: 1. PIV (Peak Inverse Voltage) 2. Current rating Students were awarded marks for any appropriate parameters identified.

Question 6	**a–d** 0/7 19 1/7 10 2/7 3 3/7 8 4/7 30 5/7 18 6/7 7 7/7 4 (Average mark 3.24)	**a** Correct answer: 5 V Students had to recognise the 7805 (IC1) has a 5 Volt DC output. **b** Acceptable answer: P = V x I = 5 x 0.5 = 2.5 W (Watts) Correct units were required for full marks to be awarded. **c** Acceptable answer: To provide stability to the regulator, particularly at higher frequencies. **d** Acceptable answer: Provide increased cooling to the regulator by attaching a heatsink.
Question 7	These were concept questions and students were often distracted by the diagrams rather than addressing the basic questions (as in Question 7a, maximum current flows under short circuit conditions).	
	a–b 0/4 50 1/4 3 2/4 4 3/4 25 4/4 18 (Average mark 1.59)	**a** Acceptable answer: zero Ω **b** Acceptable answer: $I_{s/c}$ = V/R = 5/0.8 = 6.25 A (Amps) Correct units were required for full marks to be awarded.

Section 2 – Analogue systems

Questions 1 to 3 were multiple-choice questions and were poorly answered. Students need to have the underpinning knowledge as the use of engineering notation is a core skill of the electrical and electronics industry.

Question 1	0/1 69 1/1 31 (Average mark 0.31)	Acceptable answer: 12kΩ
Question 2	0/1 93 1/1 7 (Average mark 0.07)	These capacitors indicate their capacitance value in Pico farads. Acceptable answer: 22nf The answer as 22 000 pf or 0.022 µf was also accepted.
Question 3	Most students showed an underlying knowledge of the resistor colour code (in relation to what colour related to the numerical value). However, many students were unable to apply this to a four band resistor (particularly in relation to the multiplier (third band) and responded incorrectly to Question 3a: B. 121Ω).	
	a–b 0/2 35 1/2 24 2/2 41 (Average mark 1.06)	**a** Correct answer: C 120 Ω **b** Correct answer: B 1.5k Ω
Question 4	0/3 19 1/3 4 2/3 44 3/3 33 (Average mark 1.91)	Acceptable answer: Q = C x V = 0.47 x 5 = 2.35 Coulombs. The unit had to be stated for full marks to be awarded.
Question 5	0/3 36 1/3 18 2/3 13 3/3 33 (Average mark 1.42)	**INPUTS** AC Electrical Signal - Audio Input → **PROCESS** Magnetic field created in the voice coil, creates a reaction between the permanent magnet → **OUTPUT** Mechanical movement produced in the speaker cone. - Noises given off.

		A block diagram or a description that identified the three essential parts of the conversion process was acceptable.
Question 6	**a–c** 0/5 30 1/5 10 2/5 10 3/5 6 4/5 18 5/5 26 (Average mark 2.5)	**a** Correct answer: Frequency Modulation (FM) **b** Acceptable answer: Higher frequency f = 1/T = 1/0.195 µs = 5.13 MHz It was preferred that the answer be expressed in MHz; (although 5 130 000 Hz or 5130 kHz were accepted). In Question 6b and 6c students had to recognise which part of the waveform was the higher frequency and which part was the lower frequency. Students who did not interpret the waveform correctly and opted for the higher number on the time line were incorrect in selecting it as the higher frequency. Marks were not awarded if the highest frequency and the lowest frequency were not identified. The unit of Hz had to be stated for full marks to be awarded. **c** Acceptable answer: Lower Frequency f = 1/T = 1/0.205 µs = 4.88 MHz The answer needed to be expressed in MHz (4 880 000 Hz or 4880 kHz was accepted).
Question 7	**a–b** 0/2 3 1/2 41 2/2 56 (Average mark 1.52)	**a** Correct answer: Resistor **b** Correct answer: Resistor
Question 8	**a–b** 0/2 20 1/2 50 2/2 30 (Average mark 1.09)	**a** LDR – Light Dependent Resistor **b** Correct answer: D – NPN transistor Although many students identified the symbol as a transistor, it was often incorrectly identified as a PNP transistor. The identification of simple electronic components is established within Units 1 and 2 and further reinforced in Unit 3 and 4 practical exercises.
	c–e 0/3 15 1/3 20 2/3 22 3/3 43 (Average mark 1.92)	**c** Correct answer: C – a voltage divider circuit **d** Correct answer: B – near zero volts Students had to have some understanding of how a single transistor amplifier worked, to respond to Question 8d and 8e. **e** Correct answer: A. near supply voltage.

Section 3 – Digital electronics 1 and Digital and computer systems

Question 1	0/1 33 1/1 67 (Average mark 0.67)	Acceptable answers: Less maintenance, no cleaning or works on different surfaces.

Question 2

a–b

Mark	%
0/2	6
1/2	42
2/2	52

(Average mark 1.45)

a
Correct answer: D – an input device
b
Correct answer: A – LPT1

Question 3

a–c

Mark	%
0/4	26
1/4	31
2/4	17
3/4	12
4/4	14

(Average mark 1.56)

a
Correct answer: NOR gates
b
Correct answer: ‘invert’ or ‘not’ function
c
Acceptable answer:
This is to provide supply to the IC. The circuit diagram shows +9 volts connected to pin 14 and 0 volts connected to pin 7, which are the supply inputs of the IC.

For full marks to be given in this question students needed to identify the 9 volts providing supply to the IC.

Question 4

a

Mark	%
0/8	17
1/8	3
2/8	10
3/8	7
4/8	5
5/8	8
6/8	15
7/8	19
8/8	16

(Average mark 4.53)

a

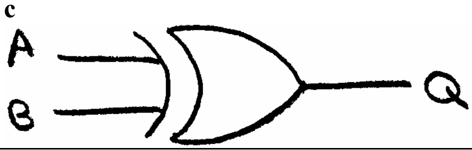
Table 1

B	A	$\overline{A}$	$\overline{B}$	$\overline{A}\cdot B$	$A\cdot\overline{B}$	Q
0	0	1	1	0	0	0
0	1	0	1	0	1	1
1	0	1	0	1	0	1
1	1	0	0	0	0	0

b

$Q = A \oplus B$ or $Q = \overline{A}B + A\overline{B}$

c



Question 5

a–c

Mark	%
0/4	21
1/4	34
2/4	13
3/4	30
4/4	2

(Average mark 1.58)

a
Correct answer: LCD: Liquid Crystal Display
b
Acceptable answer: The LCD (display) uses much less power than a LED display, this maximises the battery life of portable electronic equipment.

The response needed to be relevant to modern LCD technology and the commonly correct responses referred to the reduced power consumption of LCDs.
c
Acceptable answers: Ground, 0 volts or Active LOW

This question was poorly answered. Students needed to recognise that in common anode display all the anodes are held high and the cathode is switched. In this case a LOW (‘zero’ volts) on the cathode input illuminates the display segment.

Question 6

i–iii

Mark	%
0/6	34
1/6	3
2/6	21
3/6	5
4/6	26

A small section of the data sheets was all that was required to complete the table. The binary inputs were in part: (i) 0101 (5_{10}), (ii) 1001 (9_{10}), the data sheet showed the figure 9 displayed did not have a tail across the bottom (as the Channel 9 logo). Some students did not read the display diagram carefully enough.

In part: (iii) 1111 (15_{10}) unlike the two previous questions it stated

	5/6 2 6/6 9 (Average mark 2.26)	that LT (Lamp Test) was LOW. The Connection diagram showed LT as an active LOW and thereby all the segments would be illuminated regardless of what the binary input was. Students would benefit from being familiar with basic data sheets and being able to interpret them. The complete online data sheets for the MM54C48 (7448) can be viewed at www.national.com/pf/MM/MM54C48.html

INPUTS	DISPLAY SEGMENT							FINAL DISPLAY SHOWING (Shade illuminated segments)
msb lsb DCBA	a	b	c	d	e	f	g	
0101 Assume LT and BI/BRO held high	H	L	H	H	L	H	H	
1001 Assume LT and BI/BRO held high	H	H	H	L	L	H	H	
1111 Assume LT held low	H	H	H	H	H	H	H	

Question 7

a–b

0/4	17
1/4	13
2/4	23
3/4	20
4/4	27

(Average mark 2.27)

a.

Decimal	Binary	BCD
79	1001111	0111 1001

b.

Hexadecimal	Binary	Decimal
A3	10100011	163

Question 8

a–c

0/6	50
1/6	2
2/6	10
3/6	1
4/6	12
5/6	2
6/6	23

(Average mark 2.21)

a

Acceptable answers: 255 or 256

Students had to be aware of the number of steps between $0000\ 0000_2$ and $1111\ 1111_2$ for an 8 bit device.

N (steps) = 2^8 -1
= 256 -1
= 255

b

Acceptable answer:

voltage step = voltage full scale/number of steps
= 1.02/255
= 4 mV (milli Volts)

Other answers were also accepted if 256 was used.

c

Acceptable answer:

Δ V input = Δ output x Δ voltage step
= 4 x 4mV
= 16mV (milli Volts)

The change in binary $1000\ 0000_2$ to $1000\ 0100_2 = 4_{10}$