2003 Assessment Report

VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

2003 VCE VET Electronics GA 2: Written examination

GENERAL COMMENTS

The 2003 examination was based on the VCE VET modules within Units 3 to 4. These modules are:

- 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 questions.

The examination contained a variety of question types –multiple-choice, descriptive responses to short-answer questions and completion of drawings, waveforms and diagrams.

Students were able to gain full marks for the questions requiring calculation if both the correct answer with correct units was given. However, students need to state the formula used, show the substitution and workings. When working out is shown, and the student makes a small error, marks may still be awarded; whereas an unelaborated answer receives no marks at all.

Many responses indicated that students had not undertaken enough practical exercises or product construction activities during Units 3 and 4. Also, it is a concern that students show a poor understanding of basic electronic industry skills such as reading the colour code values of a resistor. This should have been comprehensively taught in Units 1 to 2 to allow the students to be fully competent in using resistor colour codes in Units 3 and 4 practical assessment tasks.

SPECIFIC INFORMATION

Section 1 – DC power supplies

Question 1

A–b

Marks	0	1	2	3	Average
%	16	14	30	40	**1.94**

a

The end of the diode with the band had to be labelled ‘Cathode’ or ‘K’ while the other end was labelled ‘Anode’ or ‘A’. Many students labelled the ends of the diode incorrectly.

The arrow had to indicate the direction of conventional current flow and most students correctly indicated this.
Correct answer:

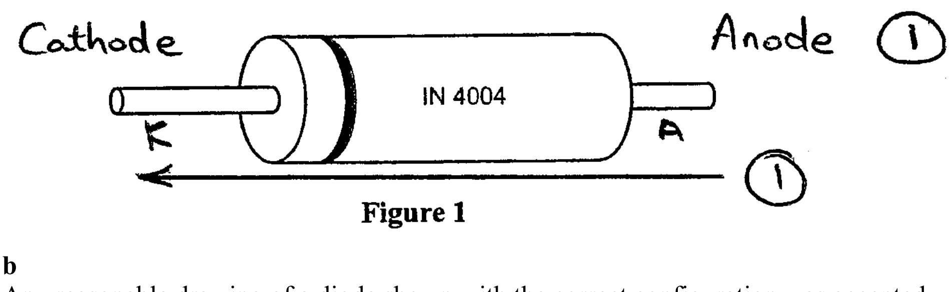
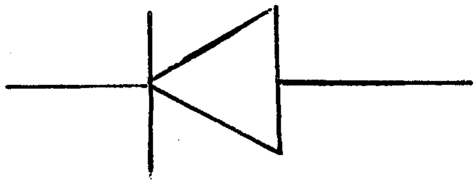


Figure 1

b

Any reasonable drawing of a diode shown with the correct configuration was accepted.

Correct answer:



Question 2

Marks	0	1	2	3	Average
%	43	27	4	26	**1.13**

This was a two part question using Ohm's Law. Many students did not allow for the volt drop of V_f and only used 6V rather than 4.2V when determining I_R and consequently did not gain full marks.

Correct answer:

$V_R = V_s – V_f$

= 6 -1.8

= 4.2V

$$I_R = \frac{V_R}{R} = \frac{4.2}{330} = 12.73\text{mA}$$

Approx. 13mA or 0.013Amps was also accepted.

Question 3

a–b

Marks	0	1	2	Average
%	17	44	39	**1.22**

a

The ratio of transformer was simply expressed as the Voltage Primary: Voltage Secondary.

This could be simplified but the raw answer was accepted.

Correct answer:

Vp:Vs

240:25 or 9.6:1

b

The most appropriate diode for the circuit was a common power diode.

Correct answer: B. 1N4004

c

Marks	0	1	2	Average
%	36	10	54	**1.18**

Correct answer:

$$T = \frac{1}{f} = \frac{1}{50} = 20\text{ms}$$

d

Marks	0	1	2	Average
%	28	1	71	**1.42**

As the formula was provided most students who responded to this were correct. Students received full marks for the correct answer with units stated (35.36 V).

$$V_S = \sqrt{2}V_{RMS} = \sqrt{2} \times 25 = 35.6\text{V}$$

e

Marks	0	1	2	Average
%	44	3	53	**1.09**

$$V_{DC}(\frac{1}{2}\text{ wave}) = \frac{1}{\pi}V_{pk}$$

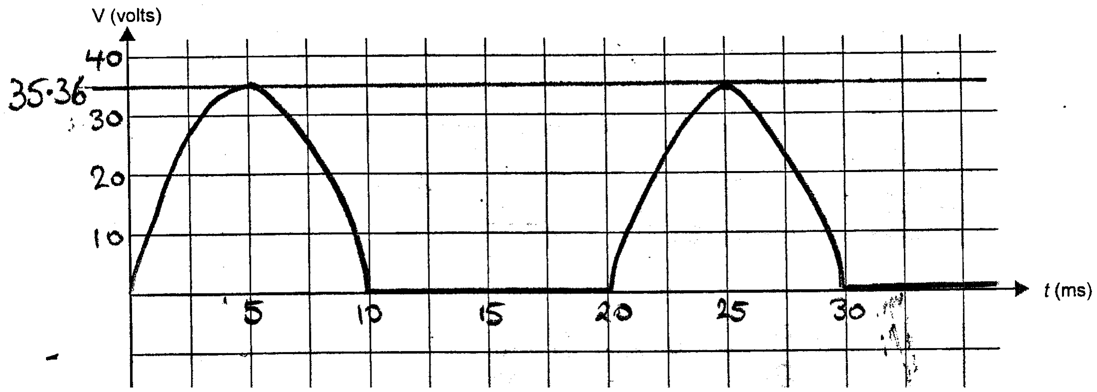
$$= \frac{1}{\pi} 35.36$$
$$= 11.24\text{V}$$

f

Marks	0	1	2	3	Average
%	39	15	21	25	**1.31**

From the calculations the students had to show a half cycle rectification with peak voltage, on the determined timeline. A common mistake was to draw a full wave cycle with only half of the cycle completed over 20 ms. If previous calculations were incorrect, but in turn applied correctly to the graph, marks were awarded.

Acceptable waveform:



Question 4

a

Marks	0	1	2	3	4	Average
%	12	2	20	2	64	**3.05**

DC power supply circuit.

The two parts to this question were to add a diode to the bridge rectifier and a main filter capacitor. While most students recognised where to add the diode, the capacitor was placed in a variety of positions.

Completed circuit diagram:

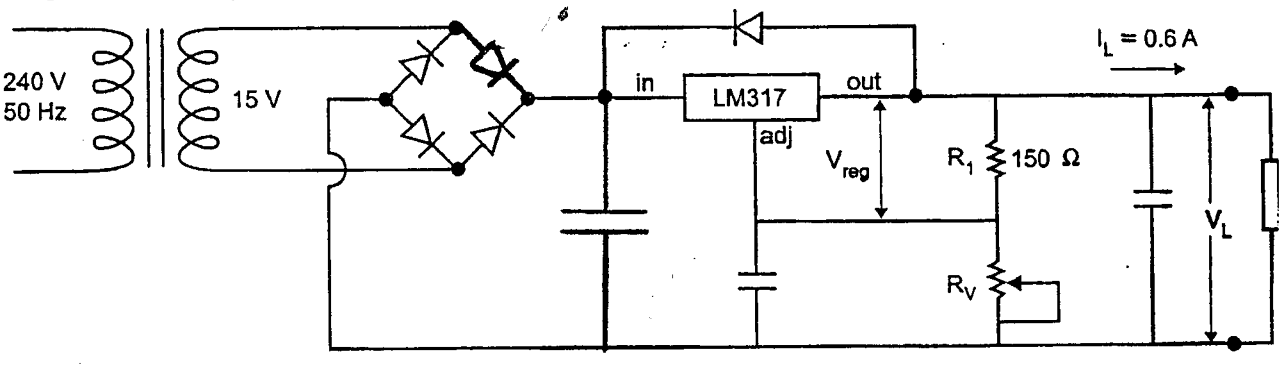


Figure 4

b

Marks	0	1	2	Average
%	50	5	45	**0.94**

This question used Ohm's Law and was generally well done.
Correct answer:

$$I_{RV} = \frac{V_{reg}}{R_1}$$
$$= \frac{1.25}{150}$$
$$= 8.33\text{mA}$$

c

Marks	0	1	2	3	Average
%	67	19	1	13	**0.61**

This question in two parts was one of the more difficult in the examination and was poorly answered by most students. Using the answer from the previous question V_{RV} was calculated using Ohm's Law which was then added to the known voltage V_{reg} to find the voltage at the output.

Correct answer:

$V_{RV} = I_{RV} \times R$
$= 8.33\times10^{-3} \times 700$
$= 5.81V$

$V_{out} = V_{reg} + V_{RV}$
$= 1.25 + 5.81$
$= 7.06V$

d

Marks	0	1	2	Average
%	30	2	68	**1.38**

This was a simple subtraction using the provided information.

Correct answer:

$V_{reg} = V_{in} – V_{out}$
$= 18 – 8.5$
$= 9.5V$

e

Marks	0	1	2	Average
%	62	5	33	**0.70**

Using the provided formula P = V x I, some marks were awarded if the students used an incorrect voltage determined in the previous question.

Correct answer:

$P_{reg} = V_{reg} \times I_L$
$= 9.5 \times 0.6$
$= 5.7Watt$

f

Marks	0	1	2	3	Average
%	57	21	5	17	**0.81**

Students had to recognise that a resistance of 0.2 Ω was close to a short circuit condition and as a consequence a large load current would be drawn, which would exceed the rating of the regulator.

A correct response would identify three aspects:

- the load current would suddenly increase beyond the rating of the LM317
- the LM317 regulator would heat up
- the LM317 regulator would go into thermal shutdown and limit the current drawn by the load.

Question 5

Marks	0	1	2	Average
%	35	25	40	**1.05**

Students who knew what SMPS were, responded with appropriate answers. Answers such as: 'They can switch AC and DC' were not awarded any marks.

Some correct responses were:

- they are smaller and lighter
- they are more efficient
- they can be designed to accommodate different input AC voltages, depending on the country it is being used in
- they can be cheaper to produce because they use less material and can be mass-produced for a world market.

Section 2 – Analogue systems

Question 1

a–b

Marks	0	1	2	Average
%	49	31	20	**0.70**

a

The only acceptable correct answer was 100 kΩ.

100 000 Ω was not accepted as the answer, because correct engineering notation was specified.

b

104 on a capacitor is read as 100 000 pf = 100 nf
Correct answer: A. 100 nF

Question 2
a–b

Marks	0	1	2	Average
%	14	30	56	**1.41**

a
Red Red Red Red: is read as 2200 Ω (2% tolerance) = 2 k 2 Ω
Correct answer: B. 2 k 2 Ω
b
Yellow Violet Black Gold: is read as 47 Ω (5% tolerance)
Correct answer: A. 47 Ω

Question 3 and 4

Marks	0	1	2	Average
%	14	29	57	**1.42**

Question 3
A single loop of wire rotating in a magnetic field will produce an AC sine wave.
Correct answer: C.

Question 4
Correct answer: The waveform is AM – Amplitude Modulation

Question 5

Marks	0	1	2	3	4	5	6	Average
%	36	3	14	3	19	4	21	**2.62**

These are appropriate examples of transducers, rather than a comprehensive list:

Transducer Device	Energy Input	Output
1 Red LED	3 Volts DC	Red Visible Light
2 Audio speaker	AC (audio) electrical signals	Sound waves
3 Electromagnet	12Volts DC	Strong magnetic field.

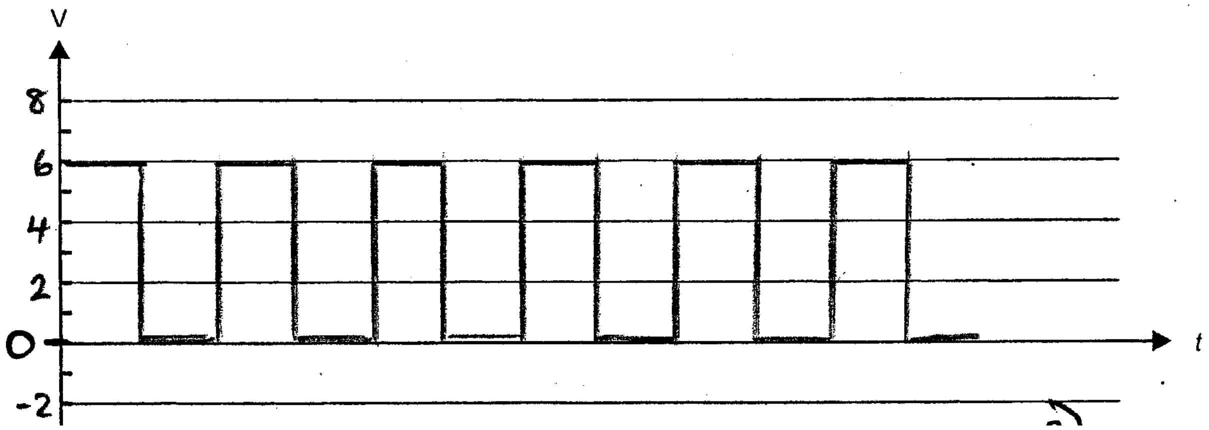
Question 6
a–c

Marks	0	1	2	3	4	5	6	7	Average
%	13	16	12	19	8	8	14	10	**3.22**

a
For 4 marks the assessors were looking for a reasonably comprehensive answer. At least four significant points had to be identified for full marks to be awarded. The response could be in point form.
An acceptable response could be:
- 6 Volts DC supplied to the solenoid via a normally closed connection of the micro switch
- solenoid creates magnetic field and draws plunger in, which pulls on bar to strike bell 2
- micro switch is activated by the adjustment screw, which opens the circuit; power is removed from the solenoid
- the spring pushed the plunger back, which pushes the bar to hit bell 1
- the cycle continues as the micro switch again allows electricity to flow to the solenoid.

b
A pulsating 6V DC voltage represented as a square wave was the expected response. Back EMF was not expected to be taken into consideration or shown, but would have been accepted for full marks if it was shown. Some students provided Sine waves or Triangular waveforms; these responses gained 1 mark if the +6 Volt peak was shown with no negative cycle. No students drew waveform with Back EMF shown.

Expected waveform:



c

The most appropriate switch for a door bell would be:
Momentary action, Push Button (Normally Open)
Correct answer: (c): momentary PB N/O

Question 7

a–b

Marks	0	1	2	3	4	5	Average
%	37	18	12	5	16	12	1.83

a

The 555 timer had appeared in previous examination papers and this question was essentially to test Mathematics for Electronics 2 knowledge. The students were required to apply the correct units for the provided formula. Many students did not recognise 150 nF = 150×10^{-9} and instead substituted 150×10^{-6} or may not have solved the equation in the correct sequence.

Calculate T when R_1 =1.5MΩ, R_2 =220 kΩ and C_1 = 150 nF

Correct Answer:

$T = 0.694\ (R_1 + 2\ R_2)\ C$

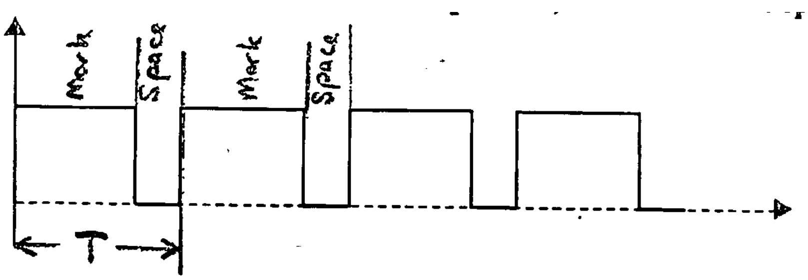
$= 0.694\ [1.5 \times 10^6 + (2 * 220 \times 10^3)]\ 150 \times 10^{-9}$

= 202 ms

200 ms or 0.2 sec were accepted for full marks as long as the formula and calculations were shown.

b

Correct Answer:



Question 8

a–b

Marks	0	1	2	Average
%	41	35	24	0.83

a

The students were asked to state a frequency range, where the speaker performs the best. Many students responded 1 kHz rather than giving a range.
Correct answer: 50 Hz. – 1 kHz.

b

The students were required to identify the low frequency response.

Acceptable answers included:
Woofer, Bass, or Low frequency speaker.

Section 3 – Digital electronics 1 and digital systems

Question 1

a

Marks	0	1	2	3	4	5	Average
%	59	5	8	10	0	18	**1.40**

Complete a wiring diagram to perform a logic OR function A + B = Q

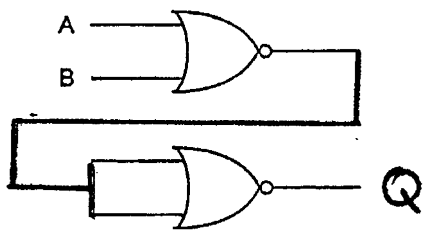
A data sheet was provided to provide some information and guidance to the students.

This type of question required the students to have knowledge of 'equivalent gates' which would be gained through coursework and practical tasks. Despite the instruction that no additional gates were to be added many students added inverters or gates and attempted to just join the outputs together. The question relied on using the gates as inverters by joining the inputs of the gates together.

ai

Using two NOR gates.

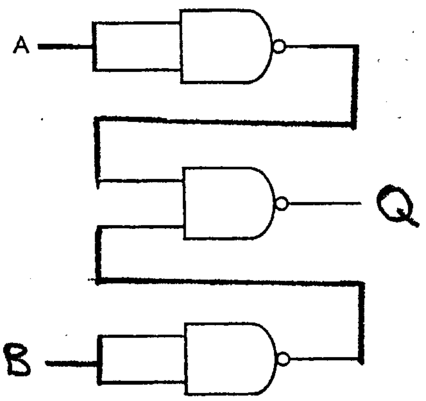
Correct answer:



aii

Using three NAND gates.

Correct answer:



b

Marks	0	1	2	3	Average
%	31	10	17	42	**1.70**

The benefits of using the CMOS version of the integrated circuit compared to the TTL version were evident through reading the supplied data sheet. Most students responded well to this question, with a range of interpretations from the data sheet.

Acceptable answers:

1. Wide supply voltage range 3 V to 15 V
2. High noise immunity
3. Low power consumption

Question 2

a–b

Marks	0	1	2	3	4	5	6	7	8	Average
%	4	5	7	9	31	6	6	11	21	**4.82**

a

While this question was generally well done, it was a concern that some students did not know the all the basic gates

Correct answers:

Gate number	Gate type
Gate 1	NOT or INVERTER
Gate 2	AND
Gate 3	OR
Gate 4	XOR or EXCLUSIVE OR

b

All the correct symbols had to be used to gain the full 4 marks.

Correct answer:

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

Question 3

Marks	0	1	2	3	4	Average
%	21	20	25	16	18	**1.88**

Number conversion answers:

Decimal	Binary	BCD
199	*11000111*	*0001 1001 1001*

Hexadecimal	*Binary*	*Decimal*
FEED	*1111 1110 1110 1101*	*65261*

Question 4

Marks	0	1	2	Average
%	55	2	43	**0.87**

This question required the students to understand the very large number of analogue levels that could be produced by a 32 bit DAC. Although the formula was provided it was generally poorly answered.

Correct answer:

$N = 2^{(\text{no. of bits})} - 1$

$= 2^{32} - 1$

$= 4\ 294\ 967\ 295$

4 294 967 296 or 4.3×10^9 was accepted.

Question 5

a–b

Marks	0	1	2	Average
%	26	27	47	**1.20**

a

Correct answer: ADC – Analogue to Digital converter.

b

The digital code for 32 V was read directly from the provided graph. Correct answer: 1000

Question 6

a–b

Marks	0	1	2	3	4	5	6	7	8	9	Average
%	0	1	1	4	10	13	24	27	13	7	**6.18**

a

Correct answer: ESD – Electro Static Discharge

b

While for some items it was somewhat difficult to determine their effect in relation to ESD, no particular answer was consistently wrong as indicated with a tick or cross.

Air dehumidifier	✗	Wrist strap – earthed	✓
Metallised (grey) plastic bags	✓	Grounded soldering iron tips	✓
Grounded metal workbenches	✓	Nylon floor carpet	✗
Polystyrene plastic packaging	✗	Laminated plastic data sheets	✗

c

Marks	0	1	2	3	4	5	6	Average
%	1	7	8	9	34	26	15	**4.05**

MOS devices	✓	High wattage resistors	✗
TTL ICs	✗	BC109 transistors	✗
CMOS ICs	✓	Microprocessor chips	✓

Question 7

a–b

Marks	0	1	2	3	Average
%	8	17	21	54	**2.20**

a

A range of possible meanings of ISP were provided by students but only one correct answer was acceptable. Correct answer: ISP Internet Service Provider

b

This question was generally well answered, even by those who were unable to state what the letters ISP stood for. Possible answers include:

- permanent connection – no need to dial up
- much higher speed connection
- telephone calls can still be made or received while maintaining the ADSL connection.

Question 8

a–b

Marks	0	1	2	3	4	5	6	7	8	9	10	Average
%	13	4	1	6	3	4	8	3	4	12	42	**6.85**

a

With the ASCII code given the corresponding character was read directly from the provided tables; the ASCII binary numbers converted to Hexadecimal and ASCII code binary numbers converted to Decimal.

	ASCII	Character	Hexadecimal	Decimal
Sample	*011 0000*	*0*	*30*	*48*
1	010 0011	#	23	35
2	011 0100	4	34	52
3	100 0001	A	41	65

b

This was generally well answered.

Correct answer: One bit would be added to make one byte (8 bits total).

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