



VCE VET Electrotechnology

Written examination – November

Introduction

The following sample examination is provided to demonstrate the format and types of questions which will be asked in an examination for this study. The duration of the examination will be 90 minutes plus 15 minutes reading time.

The examination is based on the underpinning knowledge and skills specified in the two core units of competence from Units 3–4 of the 21583VIC Certificate II in Electrotechnology (Shared Technology).

- UTENES050A Identify and select components/accessories/materials for electrotech work activities
- UTENES056A Apply technologies and concepts to electrotech work activities

The elective units of the program will not be examined.

Structure and format

All questions will be compulsory. The examination will comprise two sections.

Section A will consist of 20 multiple-choice questions worth 1 mark each.

Section B will consist of a series of short-answer questions, including calculations. This section will be out of approximately 80 marks.

The examination will be out of approximately 100 marks in total. The examination will be in the form of a question and answer book.

Other relevant references

Teachers should refer to the Examination section of the *VCE* and *VCAL Administrative Handbook 2006*, *VCE VET Electrotechnology Assessment Guide*, the VCE VET Electrotechnology Study page on the VCAA website and to the *VCAA Bulletin* for further advice during the year.



Victorian Certificate of Education 2006

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

Letter

Figures

Words

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VCE VET ELECTROTECHNOLOGY

Written examination

Day Date 2006**Reading time: *.** ** to *.** ** (15 minutes)****Writing time: *.** ** to *.** ** (1 hour 30 minutes)****QUESTION AND ANSWER BOOK****Structure of book**

<i>Section</i>	<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of marks</i>
A	20	20	20
B	17	17	84
			Total 104

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, one scientific calculator.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or white out liquid/tape.

Materials supplied

- Question and answer book of 23 pages including a formula sheet on page 23.
- Answer sheet for multiple-choice questions.

Instructions

- Write your **student number** in the space provided above on this page.
- Answer **all** questions in the spaces provided in this book.
- State all formulas and calculations.
- All units must be specified in the answers.
- All written responses must be in English.

At the end of the examination

- Place the answer sheet for multiple-choice questions inside the front cover of this book.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

SECTION A – Multiple-choice questions**Instructions for Section A**

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.

Choose the response that is **correct** or that **best answers** the question.

A correct answer scores 1, an incorrect answer scores 0.

Marks will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

Question 1

A piece of electronic equipment has a blown fuse. The fuse current rating is 1.25 A.

Select a suitable replacement.

- A. 1.0 A
- B. 1.25 A
- C. 1.50 A
- D. 2.0 A

Question 2

You enter the workshop to see a colleague slumped over an open computer case that she has been repairing. You suspect she is being electrocuted.

What should you do first?

- A. commence CPR
- B. ring emergency services
- C. switch off the power to the computer
- D. drag your workmate away from the workbench

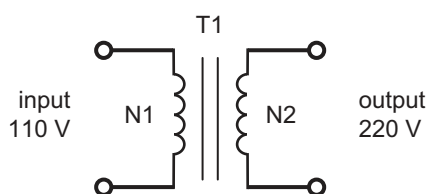
Question 3

Figure 1

In Figure 1 above, what type of transformer is T1?

- A. step-up transformer with a turns ratio of 2:1
- B. step-up transformer with a turns ratio of 1:2
- C. step-down transformer with a turns ratio of 2:1
- D. step-down transformer with a turns ratio of 1:2

Use the following information to answer Questions 4–5.

Figure 2 shows a motor that is controlled by a microcontroller via an electronic switch device, Q1.

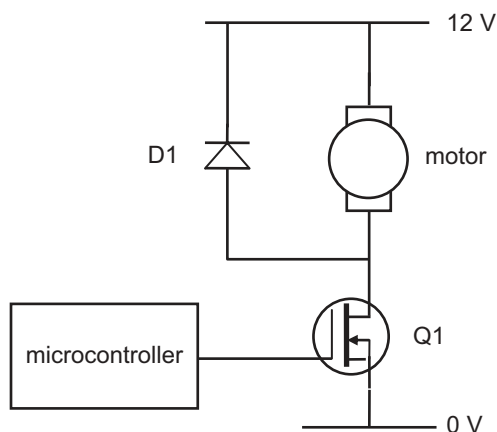


Figure 2

Question 4

The name of device Q1 is

- A. relay.
- B. mosfet.
- C. NPN transistor.
- D. silicon controlled rectifier.

Question 5

The function of D1 is to

- A. half-wave rectify the Q1 output.
- B. supply current to the motor when Q1 is OFF.
- C. protect Q1 by dissipating the back EMF of the motor.
- D. prevent accidental supply reversal from damaging Q1.

Question 6

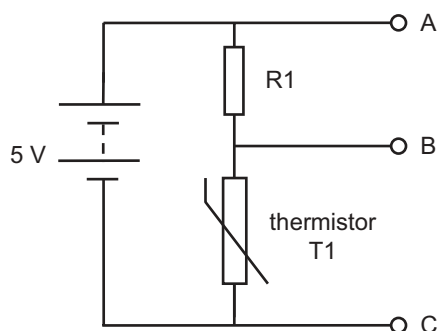
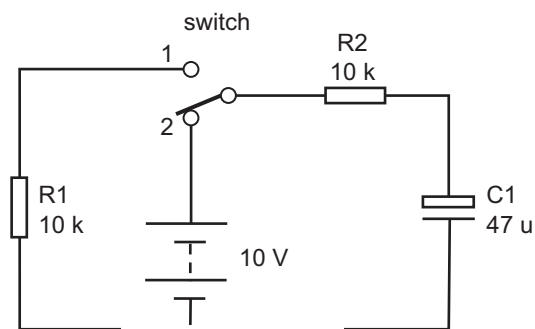


Figure 3

Thermistor T1 in Figure 3 has a negative temperature coefficient.

If there is a rise in temperature, the voltage across R1 will

- A. become negative.
- B. increase.
- C. decrease.
- D. stay at 5 V.

Question 7**Figure 4**

Refer to Figure 4. After being in position '2' for several minutes, the switch is moved from position 2 to position 1.

After the switch is changed to position 1, the voltage across R1 will

- A. settle on 5 V after an initial value of zero.
- B. decrease to zero from an initial value of 10 V.
- C. increase to 10 V from an initial value of 5 V.
- D. decrease to zero from an initial value of 5 V.

Question 8

To provide operator protection against electric shock, single insulated portable power tools rely on

- A. motor back-emf opposing any fault current.
- B. switchboard circuit breakers tripping before the fault current is harmful.
- C. an extra layer(s) of insulation preventing any fault current from flowing.
- D. effective earthing of exposed metal parts to offer a low resistance path for fault currents.

Question 9

A high resistance earth connection on a piece of equipment is most likely to

- A. create a potential electrical hazard.
- B. cause a fuse to 'blow' when switched on.
- C. prevent the equipment from operating.
- D. cause the equipment to run slowly.

Question 10

The main purpose of incorporating fuses into circuits is to

- A. offer electrical shock prevention against earth leakage fault currents.
- B. protect the circuit wiring against the effects of excessive fault currents.
- C. protect equipment from the effects of earth leakage currents.
- D. offer a discharge path to earth for static charge build up.

Question 11

According to the Occupational Health and Safety Act, which one of the following is legally responsible for providing a safe working environment?

- A. the employee
- B. the supervisor
- C. the employer
- D. the union

Question 12

The Victorian Occupational Health and Safety Act applies to

- A. factories and hospitals only.
- B. building and construction sites only.
- C. all Victorian workplaces.
- D. companies with greater than 100 employees.

Question 13

To change the size of the icons on a computer desktop

- A. go into the display settings accessed from the Control Panel.
- B. use any 'Office' application and change the font size.
- C. enter the bios settings at bootup and change the monitor settings.
- D. resize them by double clicking the right mouse button.

Question 14

Program data in a PC is stored in DRAM.

What does DRAM stand for?

- A. data read anytime memory
- B. dynamic read always memory
- C. dynamic random access memory
- D. data read/write available memory

Question 15

A polyester capacitor has the numbers **153** printed on it.

What is the value of the capacitor?

- A. 153 nanofarad
- B. 15 nanofarad
- C. 153 picofarad
- D. 15 picofarad

Question 16

What is the value of the surface mounted resistor shown above?

- A. 470 ohm
- B. 472 ohm
- C. 4.7 k ohm
- D. 47 k ohm

Use the following information to answer questions 17–20.

The voltage waveform across the load resistor R1 in Figure 5a is shown in Figure 5b.

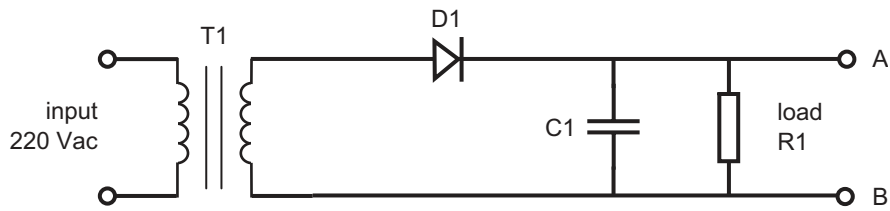


Figure 5a

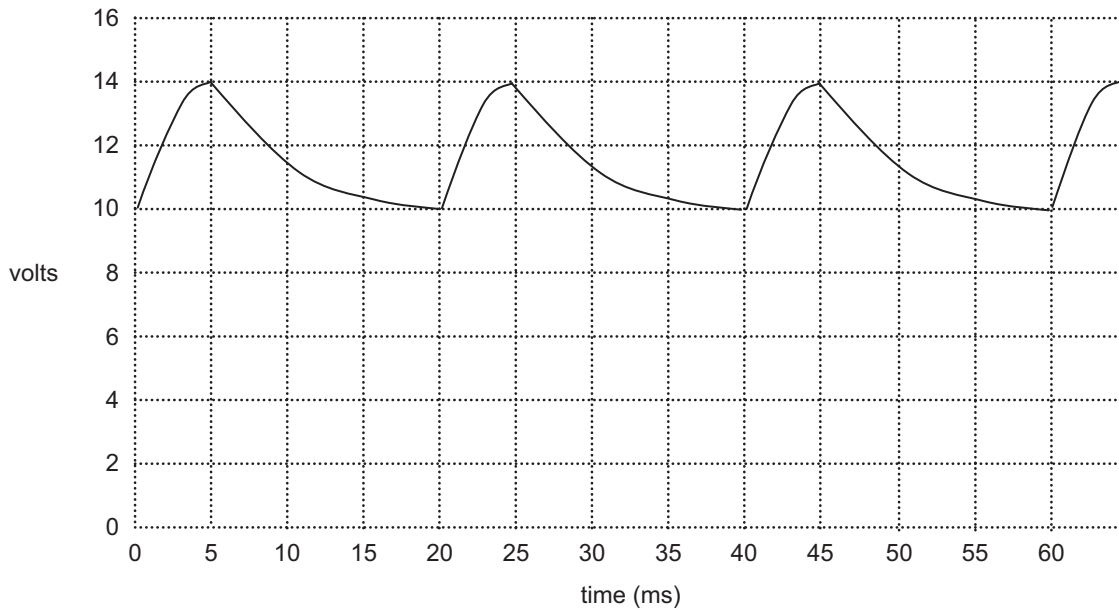


Figure 5b

Question 17

The circuit in Figure 5a is called a

- A. centre tapped rectifier.
- B. full-wave rectifier.
- C. half-wave rectifier.
- D. voltage doubling rectifier.

Question 18

A DC voltmeter placed across the load will read approximately

- A. 10 V.
- B. 12 V.
- C. 14 V.
- D. 16 V.

Question 19

The frequency of the 220 V supply voltage is

- A. 200 Hz.
- B. 66.7 Hz.
- C. 60 Hz.
- D. 50 Hz.

Question 20

If the load resistor R1 is removed from the circuit, the voltage across A–B will equal

- A. 0 V.
- B. 10 V.
- C. 12 V.
- D. 14 V.

CONTINUED OVER PAGE

**END OF SECTION A
TURN OVER**

SECTION B**Instructions for Section B**

Answer **all** questions in the spaces provided.

State all formulas and calculations.

All units must be specified in the answers.

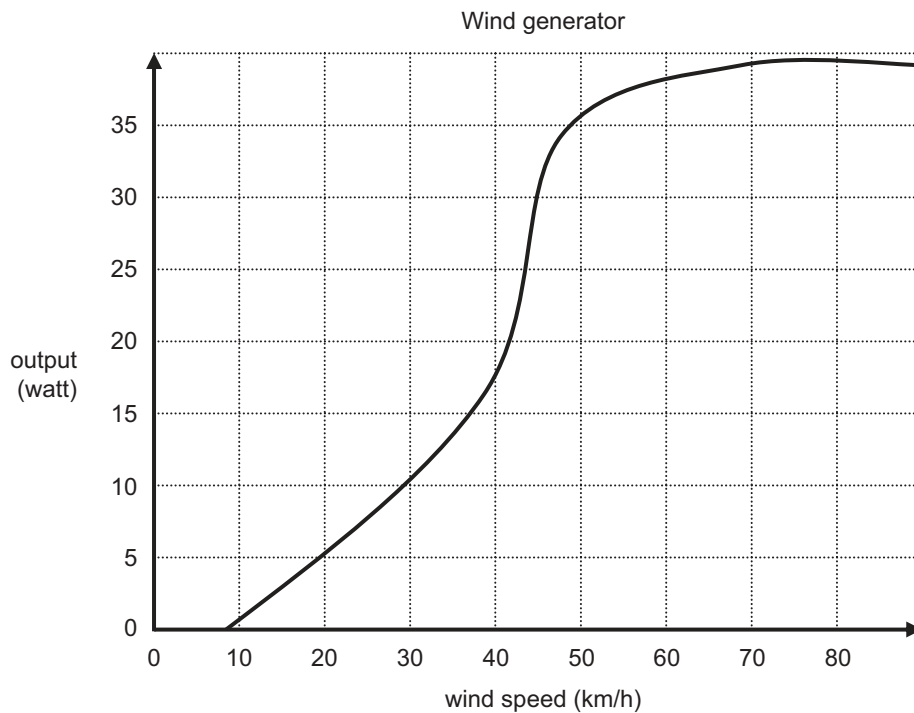
Question 1

Figure 6

Refer to the graph of wind generator output Vs wind speed shown in Figure 6.

- a. What is the minimum wind speed required before the wind generator starts producing output power?

_____ 1 mark

- b. What is the maximum wind generator output?

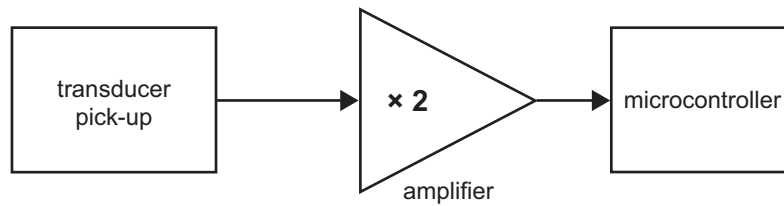
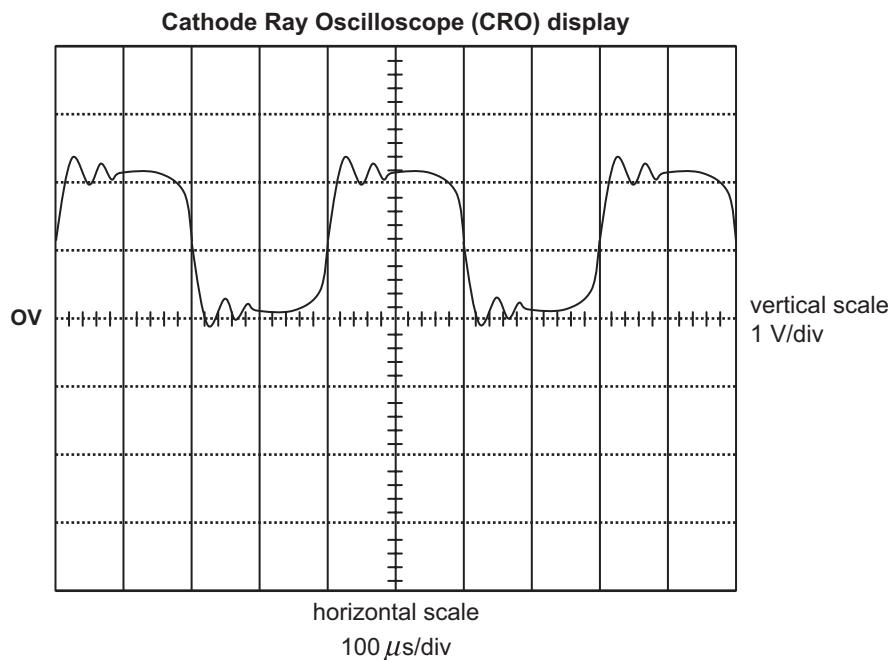
_____ 1 mark

- c. At what speed does maximum output occur?

_____ 1 mark

Question 2

The signal from a transducer is amplified before being connected to a microcontroller input, as shown in Figure 7a. The signal from the transducer is displayed on an Oscilloscope screen, refer to Figure 7b.

**Figure 7a****Figure 7b**

- a. From the oscilloscope settings given, determine the frequency of the signal from the transducer. Show your calculations.

2 marks

- b. State the approximate peak-to-peak voltage of the signal from the transducer.

2 marks

- c. Sketch the expected amplifier output waveform. Draw your sketch over Figure 7b.

2 marks

SECTION B – continued
TURN OVER

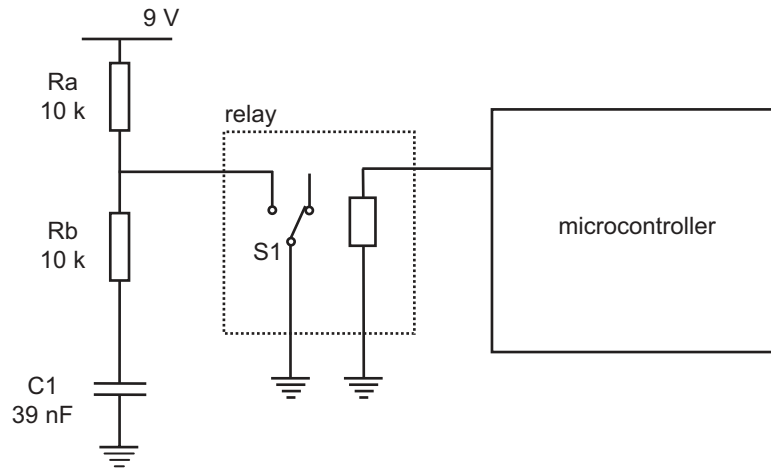
Question 3**Figure 8**

Figure 8 shows a relay that is operated by a microcontroller. When the voltage on C1 reaches 9 V, the relay switch toggles and C1 commences to discharge.

- a. Determine the charging time constant for the circuit containing Ra, Rb and C1.

2 marks

- b. Determine the charge stored on C1 when the voltage across C1 is 9 V.

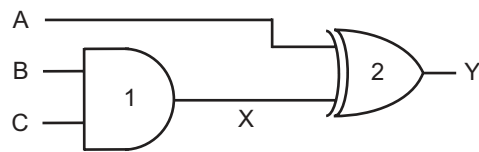
2 marks

- c. From the moment S1 closes, calculate the time taken for the voltage on C1 to become approximately zero.

3 marks

Question 4

The digital waveforms at inputs A, B and C are shown in Figure 9.



Complete the waveforms for points X and Y in the space provided below.

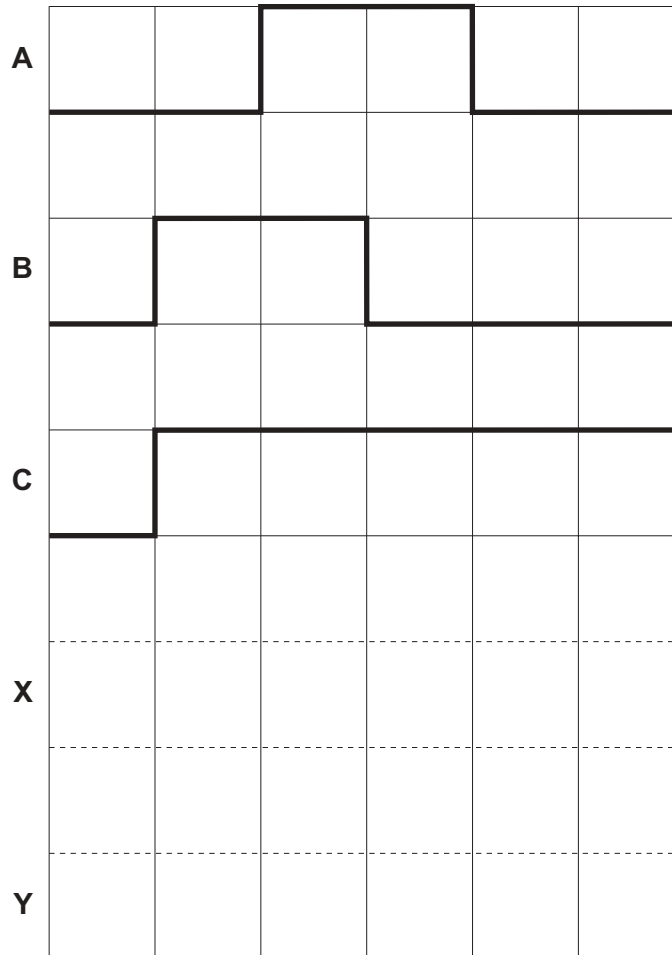


Figure 9

5 marks

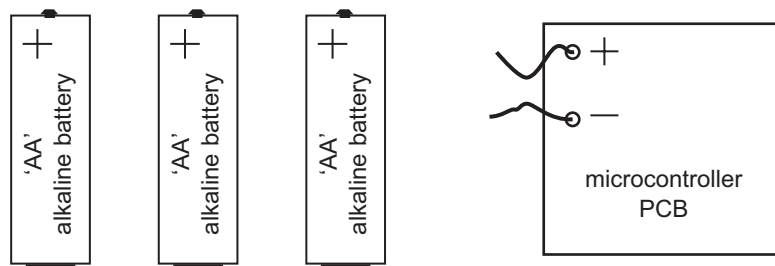
Question 5**Switchboard RCD****General purpose outlet incorporating RCD**

- a. What is another common name for a Residual Current Detector (RCD)?

1 mark

- b. Briefly describe how an RCD provides greater safety than a circuit breaker.

4 marks

Question 6**Figure 10**

The microcontroller circuit requires a supply voltage of 4.5 volts.







- a. Draw the appropriate connections from the batteries and make the connection to the microcontroller PCB. Draw your connecting lines on Figure 10.

4 marks

- b. State one reason why mercury is no longer used in alkaline batteries.

1 mark

- c. Refer to the table below and indicate two battery types which are **rechargeable** by placing a tick in the box.

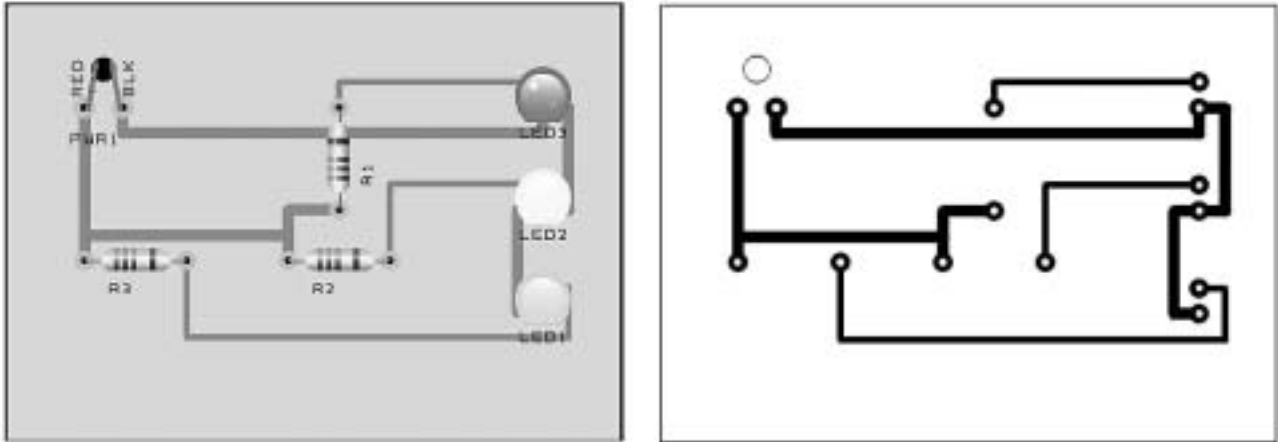
	Battery type	Applications/ performance	Standard cell voltage	Rechargeable
	carbon zinc	standard battery performance	1.5	
	alkaline	high performance	1.5	
	lithium	extra high performance	1.5	
	nickel metal hydride Ni-MH	high performance	1.2	
	lead-acid	high performance	2	
	silver oxide	high performance	1.6	

2 marks

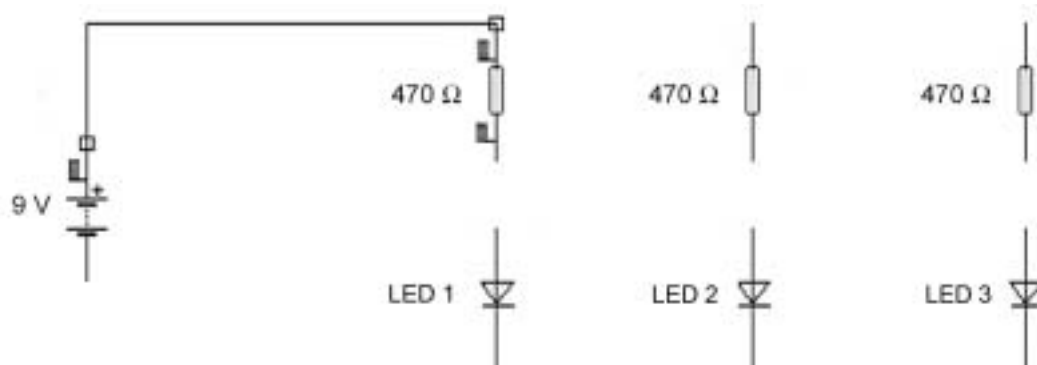
Question 7

Shown in Figure 11a is the circuit board layout of a light emitting diode (LED) display panel that you are developing as part of a project. The layout shows the component-side view together with the solder-side view looking from the top of the board.

Figure 11b shows the copper artwork as viewed from the component side.

**Figure 11a**

Complete the schematic diagram of the LED display panel on Figure 11b below. The resistors are 470 ohms. Clearly label each resistor (R1, R2 or R3).

**Figure 11b**

4 marks

Question 8

Flowcharting software is used to show a flow of ideas whether they be involved in project planning or planning a software program to be loaded into firmware in a robotic system.

The simple flowchart below shows a program sequence for a microcontroller.

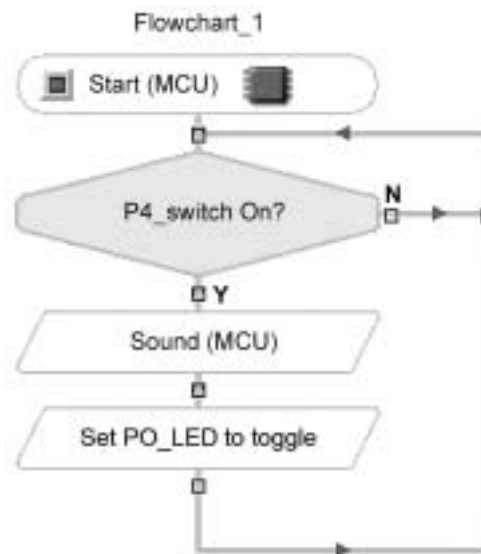


Figure 12

- a. State the flowchart symbol name of the shaded box in Figure 12.

1 mark

- b. Refer to the shaded box in Figure 12.
If 'P4_switch' is true, describe the program sequence.

3 marks

- c. If the P4_switch is false, describe the program sequence.

2 marks

Question 9

Analog to Digital Conversion (ADC) and Digital to Analog Conversion (DAC) are used in digital systems to gather, store and output information to and from the analog world.

- a. Name one subsystem in a personal computer where both Analog to Digital Converters (ADCs) and Digital to Analog Converter devices (DACs) are incorporated.

1 mark

- b. Name one other personal electronic device that might use a Digital to Analog Converter.

1 mark

- c. If an Analog to Digital Converter is an '8 bit' ADC, what is the resolution of the ADC? (Express your answer as a decimal fraction.)

2 marks

Question 10

Figure 13 shows the properties of the COM1 port on a PC. Refer to the I/O range of the port.



Figure 13

- a. Explain what is meant by the term I/O (input/output) port.

2 marks

- b. State the decimal value of the number 03F8H.

1 mark

- c. The I/O address range is listed in hexadecimal form. How many locations are reserved for the COM 1 port? State your answer as a decimal number.

3 marks

Question 11**ASCII code chart**

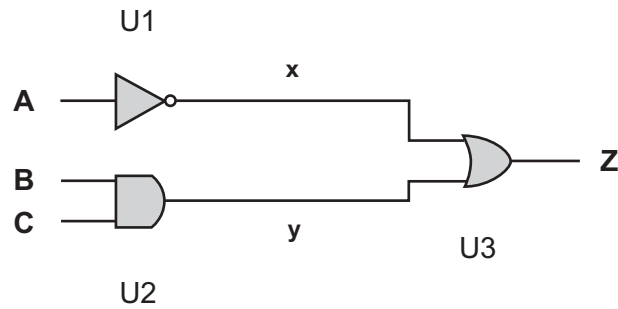
Least significant nibble

Most significant nibble		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	0	NUL	SOH	STX	ETX	EOT	ENQ	ACK	BEL	BS	HT	LF	VT	FF	CR	SO	SI
	1	DLE	DC1	DC2	DC3	DC4	NAK	SYN	ETB	CAN	EM	SUB	ESC	FS	GS	RS	US
	2	SP	!	“	#	\$	%	&	‘	()	*	+	,	-	.	/
	3	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
	4	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	5	P	Q	R	S	T	U	V	W	X	Y	Z	[\]	^	_
	6	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
	7	p	q	r	s	t	u	v	w	x	y	z	{		}	~	DEL

A microcontroller system acting as a data logger is sending data in ‘plain text’ to a remote computer. The plain text data is in ASCII code. Convert the text shown in the table to ASCII. (Refer to the ASCII code chart above.)

Characters	F	r	e	d	(sp)	1	5	A	Z	:
ASCII (in Hex)										

5 marks

Question 12**Figure 14**

- a. Identify the gate types shown in Figure 14.

Gate number	Gate type
U1	
U2	
U3	

3 marks

- b. Complete the truth table below for the circuit at Figure 14.

C	B	A	x	y	Z
0	0	0	1	0	1
0	0	1			
0	1	0			
0	1	1			
1	0	0			
1	0	1			
1	1	0			
1	1	1			

7 marks

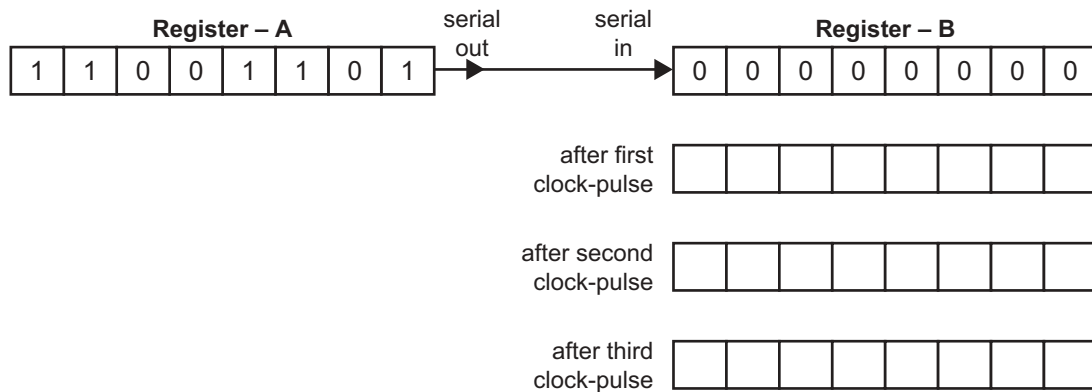
- c. For the circuit at Figure 14 write the Boolean expression for Z in terms of the inputs A B C.

3 marks

Question 13

Data is shifted from Register-A to Register-B in serial format as shown in Figure 15.

Determine the data in Register-B after clock pulses 1, 2 and 3. Write your answer in the boxes provided.

**Figure 15**

3 marks

Question 14

Your ATX style personal computer has failed to ‘boot’. You decide to measure the voltages on the power connector of the ATX system board using your multimeter. From the list below, select **three** voltages you would expect to read on this connector.

A	+3.3 volts	<input type="checkbox"/>
B	+4.5 volts	<input type="checkbox"/>
C	+5 volts	<input type="checkbox"/>
D	+9 volts	<input type="checkbox"/>
E	–9 volts	<input type="checkbox"/>
F	+12volts	<input type="checkbox"/>
G	–12 volts	<input type="checkbox"/>
H	+15 volts	<input type="checkbox"/>

3 marks

Question 15

A ‘UPS’ provides a backup power source in the event of a mains power failure.

What does the term **UPS** stand for?

1 mark

Question 16

The microprocessor (CPU) in your PC may be a pin grid array type device. To enable you to safely insert the CPU into your system board, it is socketed using a ‘ZIF’ socket.

What does the term **ZIF** stand for?

1 mark

Question 17

Figure 16 shows the system board (mother board) of a personal computer. Identify the connectors shown by placing the matching letter beside each item in the table.

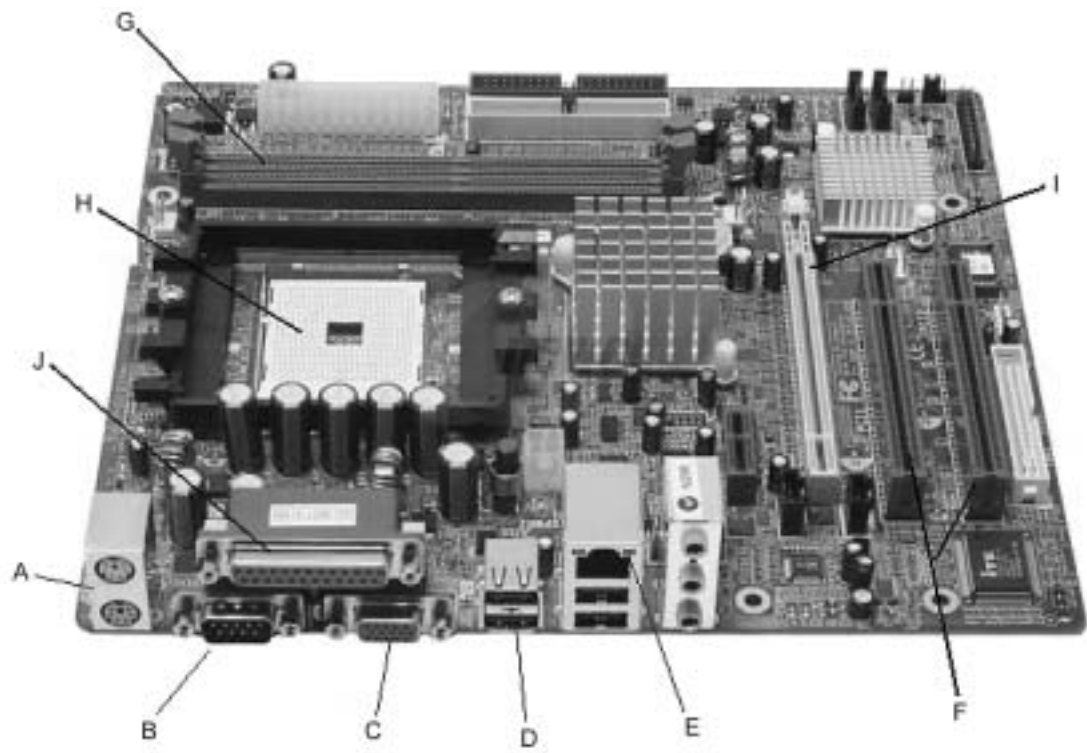


Figure 16

RJ45 network connector	
AGP slot	
video connector	
CPU ZIF socket	
mouse /keyboard	

PCI bus	
DRAM	
USB	
serial	
parallel	

5 marks

Formulas

$$V = I \times R$$

$$P = V \times I$$

$$V_{pk} = \times V_s$$

$$V_{reg} = V_{IN} - V_{OUT}$$

$$\text{Time constant } \tau = RC$$

$$\text{Time constant } \tau = \frac{L}{R}$$

$$Q = CV$$

$$f = \frac{1}{T}$$

$$\text{Turns ratio} = \frac{N_1}{N_2}$$