TASMANIAN ASSESSMENT, STANDARDS & CERTIFICATION

External Assessment 2026

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ELECTRONICS AND ADVANCED TECHNOLOGIES

EAT315124

Section A

Pages: 12
Questions: 6
Information Sheet: 1

Preparation time for this exam: 15 minutes

Suggested working time: 36 minutes

Instructions:

- Answer **all** questions and **all** items within each section.
- Write your answers in the spaces provided in this exam paper.
- A spare diagram has been provided at the end of this section. Indicate in the box provided if you have used the spare diagram.
- The exam is **three (3) hours** in length. The suggested working time for this section is **approximately 36 minutes**.
- The Electronics and Advanced Technologies Information Sheet can be used throughout the exam.
- TASC approved scientific calculators can be used throughout the exam.
- All answers must be written in **English**.
- You **must** make sure your answers address the listed criterion.

Marker use	
C3	/ 36

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Guide to Exam Structure

	Questions available	Questions to answer	Suggested working time	Marks available
Section A	6	6	36 minutes	36 marks
Section B	6	6	36 minutes	36 marks
Section C	6	6	36 minutes	36 marks
Section D	6	6	36 minutes	36 marks
Section E	5	5	36 minutes	36 marks
Totals	**29**	**29**	**180 minutes (3 hours)**	**180 marks**

Criterion

You **must** make sure your answers address:

- Criterion 3 apply professional electronic engineering practices to safely construct, test and evaluate electronic systems.

Question 1

Marker use

Circle the correct response for each of the following questions.

a) Why should large electrolytic capacitors be discharged before being handled? /1

i. To prevent magnetic field collapse.

ii. To reduce stored electrical energy that could cause injury.

iii. To stabilise logic voltage levels.

iv. To improve measurement accuracy.

b) A fuse blows while a circuit is operating normally. What does this most likely indicate? /1

i. The fuse was rated too high.

ii. The circuit briefly exceeded its safe current level.

iii. The supply voltage was too low.

iv. The fuse improved circuit efficiency.

c) Which type of fire extinguisher should be used on a switchboard fire? /1

i. Foam.

ii. Water.

iii. Wet chemical.

iv. Dry chemical powder ABE.

Question 1 continues

Marker use

d) Why is simulation software considered a safe environment for initial testing of electronic systems? /1

i. Simulation guarantees correct circuit operation.

ii. Diagnostic instruments can be used without risk of electrical injury.

iii. Components cannot fail in simulation.

iv. Power supplies are unlimited.

e) Which unit is used to measure weekly energy consumption in a home? /1

i. Ampere.

ii. Ampere-hour.

iii. Kilowatt.

iv. Kilowatt-hour.

f) Which description best matches a correctly formed solder joint? /1

i. A large blob of solder completely covering the pad and component lead.

ii. A dull, grainy joint with uneven edges.

iii. A smooth, shiny joint forming a concave fillet around the lead.

iv. A joint with solder only on the component lead.

Total Q1 /6

Question 2

Marker use

a) State **two (2)** pieces of protective equipment that are commonly used when constructing electronic systems. /2

.....

.....

.....

b) Name a component used to provide reverse-polarity protection and explain how it protects a circuit. /2

.....

.....

.....

c) Explain how and why continuity testing is undertaken with a multimeter to check an electronic circuit. /2

.....

.....

.....

d) Integrated circuits are often supplied in anti-static tubes with their legs inserted into conductive foam. Explain why this type of packaging is used. /2

.....

.....

.....

.....

Total Q2 /8

Question 3

Marker use

A light turns on when it is dark and motion is detected but won't turn on if a manual override switch is activated.

a) Draw a function block diagram showing the inputs, processing, and output for this system.

/2

b) Draw a circuit diagram for the processing block of this system using logic gates.

/3

Total Q3

/5

Question 4

Marker use

The top two (2) wires of the breadboarded circuit in Figure 1 are connected to a 9V battery.

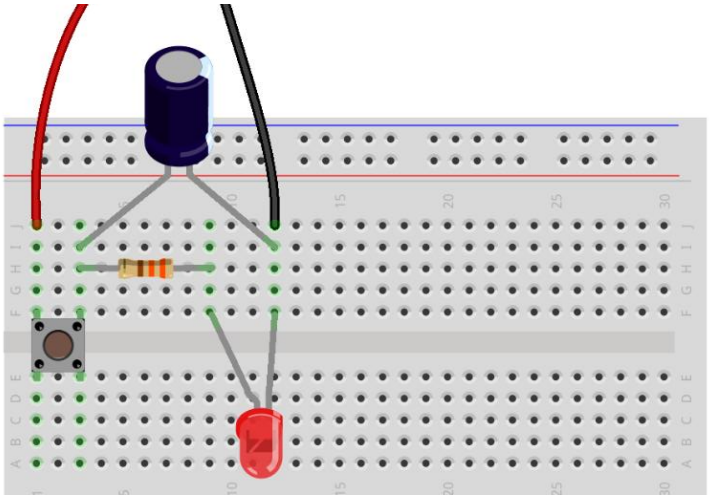


Figure 1: Illustration of a breadboarded circuit.

a) What is a common name for the switch used in Figure 1? /1

.....

b) Sketch a clear circuit schematic of Figure 1 using appropriate symbols. /3

c) State **one (1)** risk associated with incorrect installation of an electrolytic capacitor and explain why this risk occurs. /2

.....

.....

.....

d) Describe the behaviour of this circuit if it was operating as intended. /2

.....

.....

.....

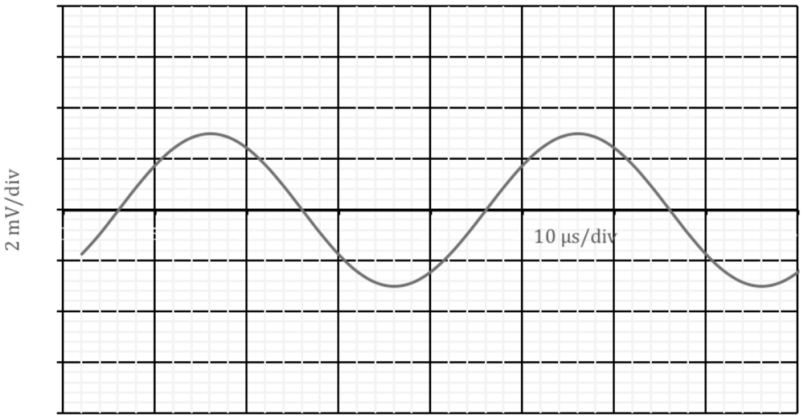
Total Q4 /8

Question 5

Marker use

In testing an amplifier, a student obtained the following images on a twin-trace oscilloscope as shown in Figure 2. Channel 1 is the input signal and Channel 2 is the output signal. The time base is set to 10 μs/div.

Channel 1



Channel 2

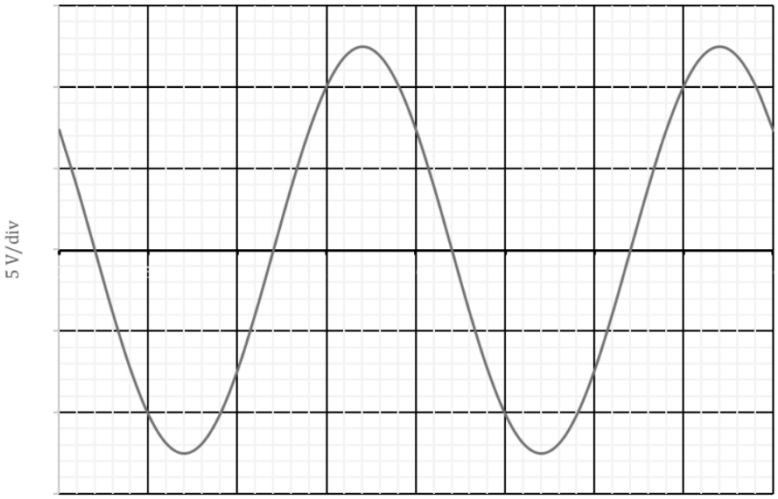


Figure 2: Capture from a twin-trace oscilloscope.

a) Calculate the period of the signal. /1

.....

b) Determine the frequency of the signal. /1

.....

c) By determining the peak-to-peak voltage of the input and output signals, find the gain of the amplifier. /3

.....

.....

.....

Total Q5 /5

Question 6

Marker use

A part of the datasheet for the MMBT489LT1, a high-current surface-mount silicon switching transistor, is in Figure 3. Use it to answer the following questions.

MAXIMUM RATINGS (T_A = 25°C)

Rating	Symbol	Max	Unit
Collector-Emitter Voltage	V_{CEO}	30	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage	V_{EBO}	5.0	Vdc
Collector Current – Continuous	I_C	1.0	A
Collector Current – Peak	I_{CM}	2.0	A

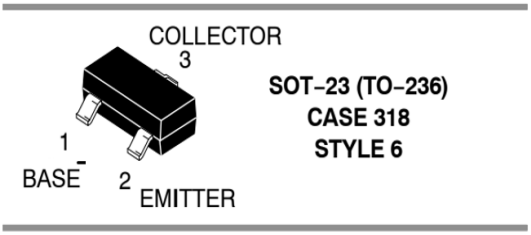


Figure 3: MMBT489LT1 datasheet.

a) Label Figure 4 with the numbers 1, 2 and 3 to represent the correct pin-up. /1

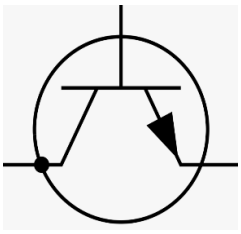


Figure 4: Diagram of a component symbol.

Spare diagram used (X) ☐

b) Is the transistor NPN or PNP? /1

.....

c) What is in the maximum safe voltage reading that could be obtained measuring between pin 2 and pin 3 of the MMBT489LT1? /1

.....

d) Explain what is meant by ‘surface mount’. /1

.....

.....

Total Q6 /4

Spare Diagram

Question 6 a)

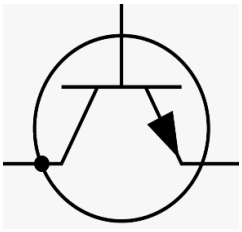


Figure 4: Diagram of a component symbol.

End of Section A



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ELECTRONICS AND ADVANCED TECHNOLOGIES

EAT315124

Section B

Pages: 12
Questions: 6
Information Sheet: 1

Suggested working time: 36 minutes

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Marker use	
C5	/ 36

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Section E	5	5	36 minutes	36 marks
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Criterion

You **must** make sure your answers address:

- Criterion 5 explain and apply mathematical concepts and scientific inquiry in relation to electronics.

Question 7

Marker use

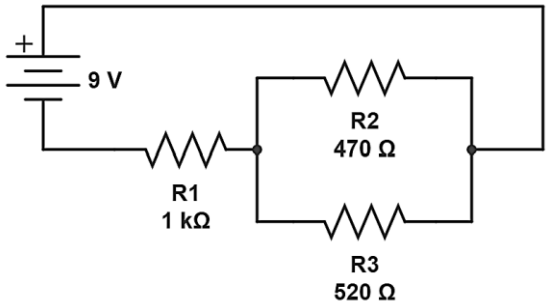


Figure 5: Circuit diagram of a resistor network.

a) Calculate the total equivalent resistance of the network in Figure 5. /3

.....

.....

.....

.....

b) Calculate the current supplied by the 9V battery. /1

.....

.....

c) Calculate the voltage drop across R1. /1

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.....

d) Calculate the power dissipated by R3. /3

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.....

.....

Total Q7 /8

Question 8

Marker use

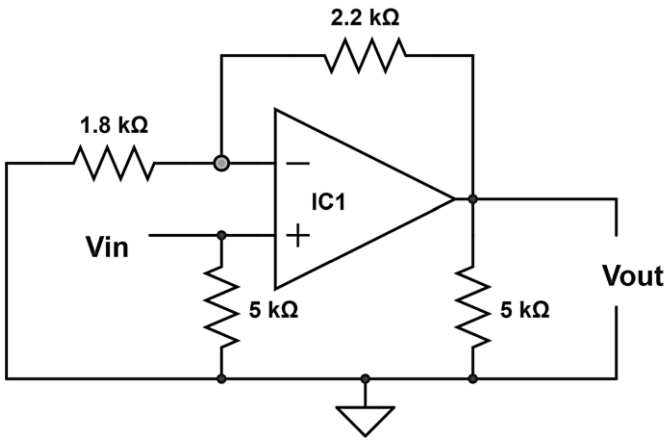


Figure 6: Diagram of an amplifier circuit.

a) Determine the gain of the circuit in Figure 6. /2

.....

.....

.....

b) What is the output voltage when V_{in} is 12V? /1

.....

.....

c) What is the input voltage when V_{out} is –5V? /1

.....

.....

Total Q8 /4

Question 9

Marker use

You wish to investigate the statement that changing the resistance in a circuit affects the relationship between voltage and current.

You have access to:

- a variable DC power supply
- an ammeter
- a voltmeter
- connecting leads
- a 1k, 2k and 5k resistor.

You begin using the 1k resistor.

a) Draw a circuit diagram showing how you could measure the relationship between voltage and current for the 1k resistor. /2

b) State the dependent variable in this investigation. /1

.....

c) Which variables can be considered to be control variables? /1

.....

d) Construct a table of results showing the likely data you would collect from the 1k resistor circuit. /2

Question 9 continues

Marker use

e) Sketch a graph showing the likely relationship between voltage and current **for all three (3) resistors**. Include a key that lists each resistor and label the axes (values or a scale on the axes are not required).

/2

f) State the expected conclusion that would be drawn from the experiment.

/1

.....

.....

Total Q9

/9

Question 10

Marker use

The circuit in Figure 7 has a sinusoidal input voltage V_{in} with peak voltage 5.0V, and 2 LEDs with forward voltage drop of 3.6V and a maximum current rating of 20mA.

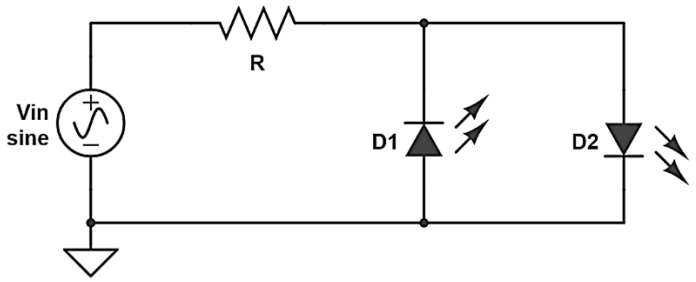


Figure 7: Circuit diagram.

a) What output would you expect to see if the circuit is functioning as intended? /1

.....

.....

b) Circle which diode will be conducting when V_{in} is –4.0V. /1

c) Determine the minimum value of the current-limiting resistor R. /2

.....

.....

.....

.....

Total Q10 /4

Question 11

Marker use

The output of an unknown circuit is connected to different resistive loads, producing the data shown in Table 1.

Load Resistance	Output Voltage
Open Circuit	5.0V
1 kΩ	4.0V
500 Ω	3.3V

Table 1

a) State the Thevenin equivalent voltage of the circuit. /1

.....

b) Using the data in Table 1, show that the Thevenin equivalent resistance of the circuit is 250 Ω. /2

.....

.....

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.....

c) Draw the labelled Thevenin equivalent circuit, including the location of where a load would be connected. /2

Total Q11 /5

Question 12

Marker use

A transistor switching circuit is used to control a 9V, 18W DC load.

The load is controlled by two (2) NPN transistors connected to form a single switching stage. The forward current gains of the transistors are β1 = 30 and β2 = 60.

Assume ideal conditions and negligible voltage drops across all components.

a) Draw a labelled circuit diagram showing how the **two (2)** transistors are connected to control the load. /2

b) State the name of the transistor configuration used. /1

.....

c) Calculate the current drawn by the load when it is operating at full power. /1

.....

d) Determine the minimum base current required at the input of the transistor pair to fully power the DC load. /2

.....

.....

.....

.....

Total Q12 /6

End of Section B

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ELECTRONICS AND ADVANCED TECHNOLOGIES

EAT315124

Section C

Pages: 16
Questions: 6
Information Sheet: 1

Suggested working time: 36 minutes

Instructions:

- Answer **all** questions and **all** items within each section.
- Write your answers in the spaces provided in this exam paper.
- Spare diagrams have been provided at the end of this section. Indicate in the box provided if you have used the spare diagram.
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Marker use	
C6	/ 36

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Section B	6	6	36 minutes	36 marks
Section C	6	6	36 minutes	36 marks
Section D	6	6	36 minutes	36 marks
Section E	5	5	36 minutes	36 marks
Totals	**29**	**29**	**180 minutes (3 hours)**	**180 marks**

Criterion

You **must** make sure your answers address:

- Criterion 6 analyse and apply concepts and principles relating to discrete components and analogue circuits.

Question 13

Marker use

a) Complete the capacitor values in Table 2. /2

pico-Farad (pF) Code	nano-Farad (nF)	Micro-Farad (µF)
104		
		0.22
	0.47	

Table 2

Spare diagram used (X) ☐

b) Determine the closest E12 value to the measured resistor values given in Table 3 and state their corresponding colour code. /2

Resistor value	E12 value	Colour code
533 Ω		
365,000 Ω		

Table 3

Spare diagram used (X) ☐

c) A resistor is labelled to have a value of 750 Ω but is measured to be 783 Ω. Assuming it is within its specified tolerance, what tolerance band colour would it most likely have? Justify your choice. /2

.....

.....

.....

Total Q13 /6

Question 14

Marker use

a) Write the name of the electronic component being described in each of the following:

i. A three-terminal component commonly used as a voltage divider to provide an adjustable input to an electronic circuit. /1

.....

ii. A component whose resistance changes significantly with temperature and is commonly used for temperature sensing. /1

.....

iii. A component that converts sound waves into an electrical signal. /1

.....

iv. A single-use protective component designed to break the circuit when the current becomes too large. /1

.....

b) Draw the circuit symbol for the components described in item a) i. and iv. /2

Total Q14 /6

Question 15

Marker use

A circuit is analysed as shown in Figure 8.

a) At what time was the switch closed? /1

.....

b) Determine an approximate time constant for the circuit. /2

.....

.....

c) Hence, determine the value of the R. /1

.....

.....

d) On the graph in Figure 8, show the expected curve if the value of R was doubled. /1

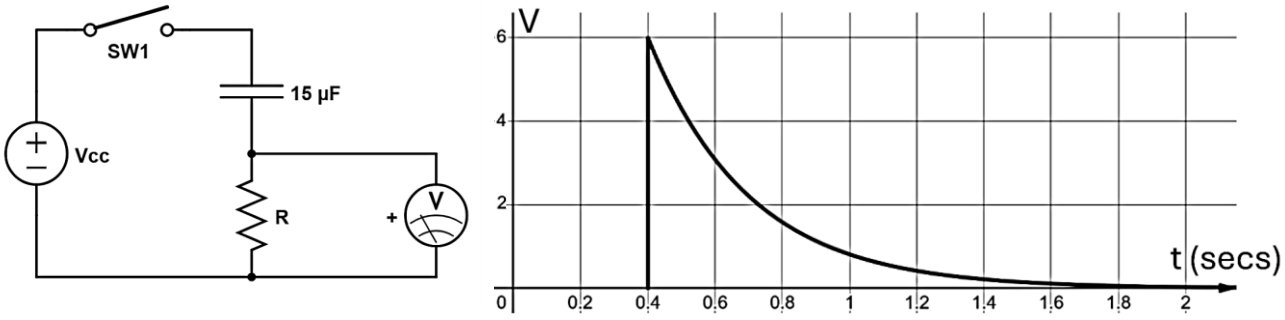


Figure 8: Circuit diagram and output of a RC network.

Spare diagram used (X) ☐

Total Q15 /5

Question 16

Marker use

There are occasions when it is desirable to run an op amp from a single-voltage supply.

a) State **one (1)** advantage and **one (1)** disadvantage of such a configuration.

/2

Advantage: .....

.....

Disadvantage: .....

.....

b) On Figure 9, sketch an inverting op amp circuit using a single voltage supply. Include bypass capacitors in an appropriate location.

/3

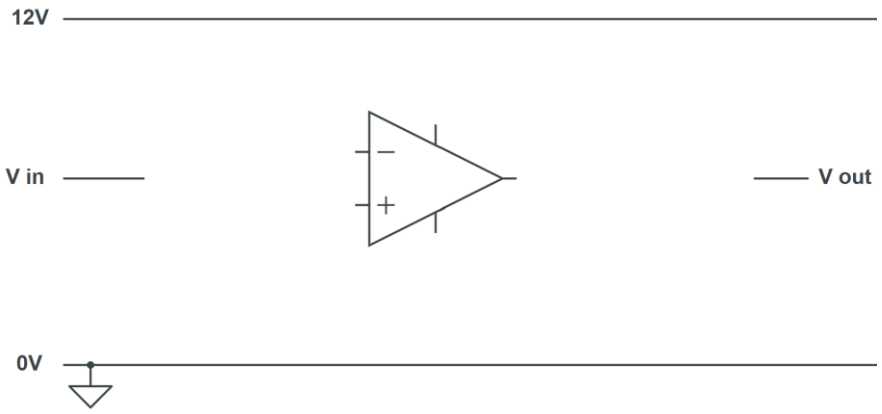


Figure 9: Circuit diagram of an op amp.

Spare diagram used (X) ☐

Total Q16

/5

Question 17

Marker use

The design of a cooling fan controller for an electronics enclosure includes the comparator circuit in Figure 10. Some components are missing from the circuit.

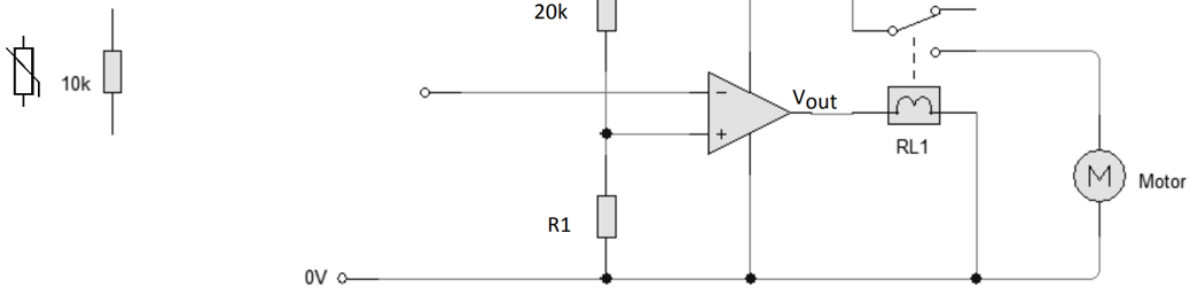


Figure 10: Circuit diagram of a comparator.

Spare diagram used (X) ☐

The characteristic curve of the thermistor is shown in Figure 11.

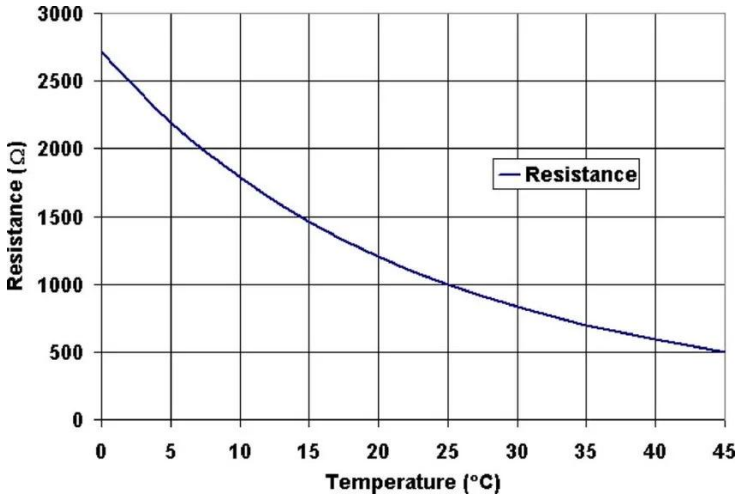


Figure 11: Graph of the characteristic curve of a thermistor.

When the temperature reaches 25 degrees the cooling fan motor switches on.

a) What is the resistance of the thermistor at this temperature? /1

.....

Question 17 continues

Marker use

b) Sketch a labelled graph with an appropriate scale using Figure 12 showing the output voltage against temperature. /2



Figure 12: Axes for sketching the answer to Q17 b).

Spare diagram used (X) ☐

c) Place the **two (2)** loose components correctly on the circuit in Figure 10 on page 8. /1

d) What would be the appropriate value for R1? /1

.....

.....

e) Small fluctuations in the temperature near 25 degrees can cause the fan to switch on and off rapidly. This problem can be reduced by a small modification to the circuit to introduce hysteresis.

i. Describe what is meant by hysteresis. /2

.....

.....

ii. Add a component to Figure 10 on page 8 in an appropriate position to introduce hysteresis. /1

.....

Total Q17 /8

Question 18

Marker use

The graph in Figure 13 shows the relationship between V_{CE} and V_{BE} in a silicon NPN transistor, for example the BC547.

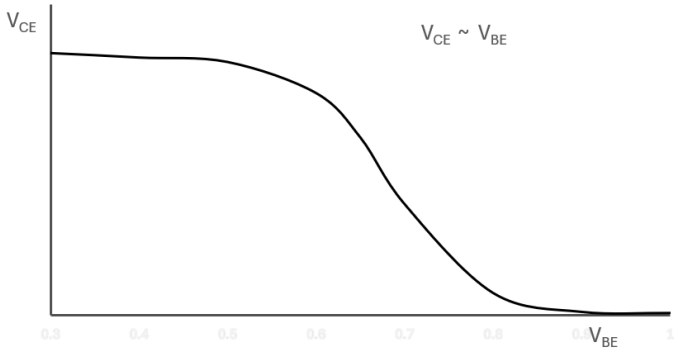


Figure 13: Graph of the V_{CE} V_{BE} relationship.

Spare diagram used (X) ☐

a) On the graph, clearly identify the saturation point, cut-off point and the active region of the transistor. /1

b) State the likely value of base-emitter voltage at the saturation point. /1

.....

c) With reference to Figure 13, explain the need for **bias** when a single transistor is used as a Class A AC amplifier. /2

.....

.....

.....

.....

Question 18 continues

Marker use

A popular method of bias is shown in Figure 14.

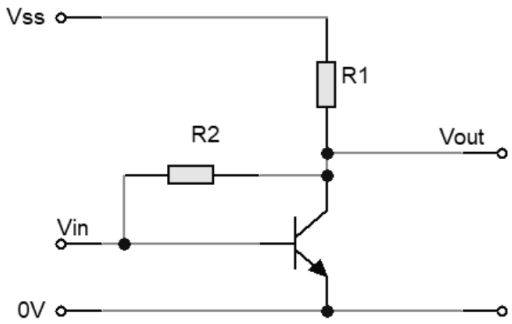


Figure 14: Diagram of transistor biasing.

d) Explain how the bias resistor stabilises this amplifier against changes in the gain (β) of the transistor (perhaps due to temperature variations).

/2

.....

.....

.....

.....

Total Q18

/6

Spare Diagrams

Question 13 a)

pico-Farad (pF) Code	nano-Farad (nF)	Micro-Farad (µF)
104		
		0.22
	0.47	

Table 2

Question 13 b)

Resistor value	E12 value	Colour code
533 Ω		
365,000 Ω		

Table 3

Question 15 d)

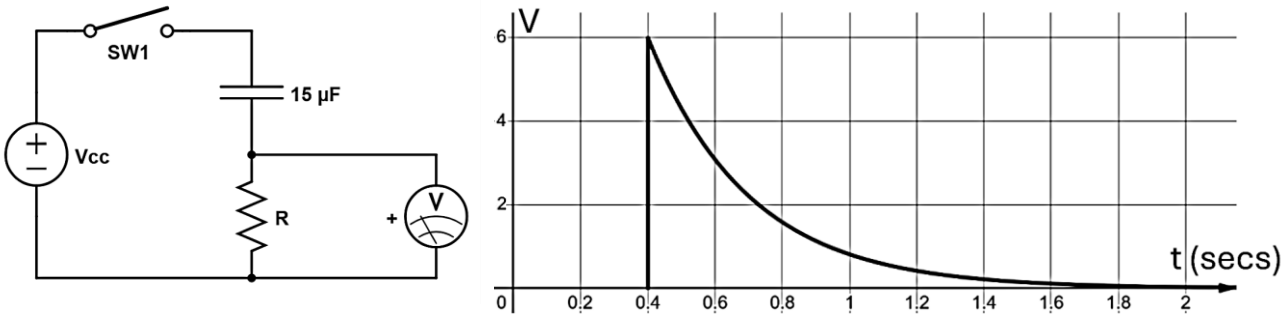


Figure 8: Circuit diagram and output of a RC network.

Spare Diagrams

Question 16 b)

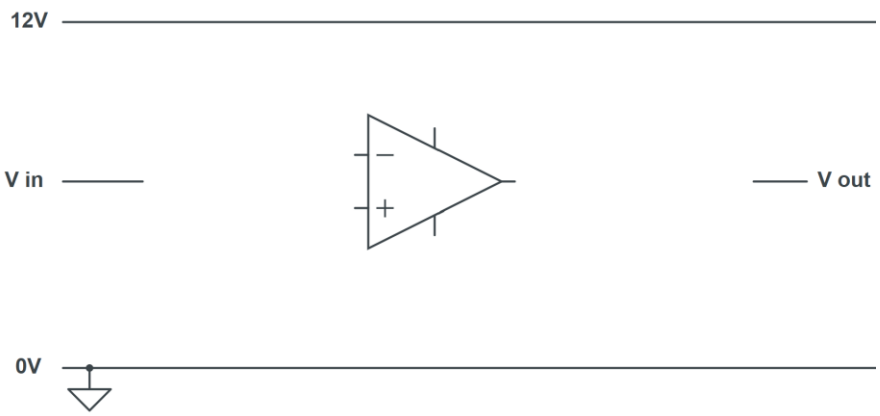


Figure 9: Circuit diagram of an op amp.

Question 17 b)



Figure 12: Axes for sketching the answer to Q17 b).

Question 17 c) and e) ii.

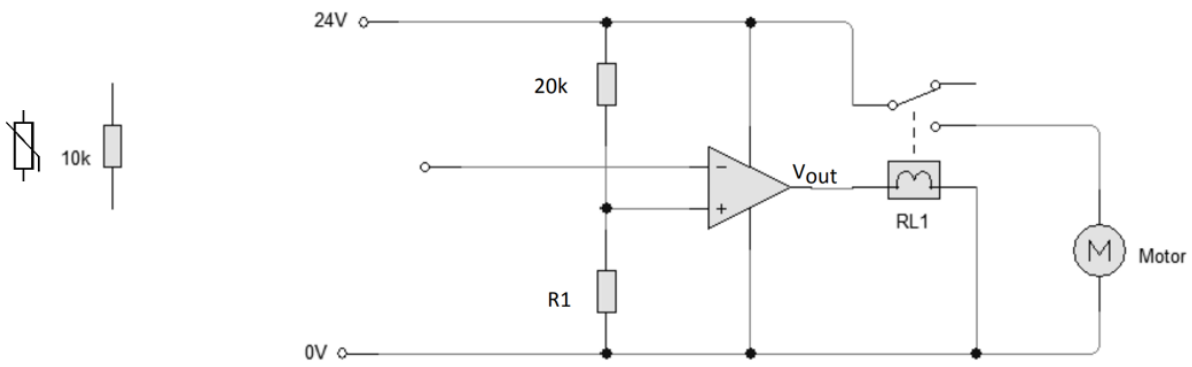


Figure 10: Circuit diagram of a comparator.

Spare Diagrams

Question 18 a)

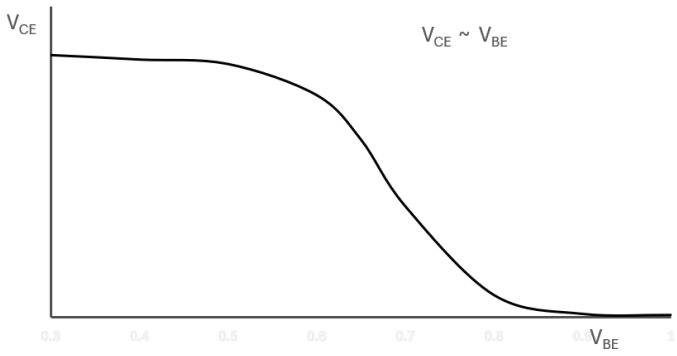


Figure 13: Graph of the V_{CE} V_{BE} relationship.

End of Section C

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ELECTRONICS AND ADVANCED TECHNOLOGIES

EAT315124

Section D

Pages: 12
Questions: 6
Information Sheet: 1

Suggested working time: 36 minutes

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Marker use	
C7	/ 36

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Guide to Exam Structure

	Questions available	Questions to answer	Suggested working time	Marks available
Section A	6	6	36 minutes	36 marks
Section B	6	6	36 minutes	36 marks
Section C	6	6	36 minutes	36 marks
Section D	6	6	36 minutes	36 marks
Section E	5	5	36 minutes	36 marks
Totals	**29**	**29**	**180 minutes (3 hours)**	**180 marks**

Criterion

You **must** make sure your answers address:

- Criterion 7 analyse and apply concepts and principles relating to integrated circuits.

Question 19

Marker use

Convert the following numbers:

a) 101101_2 to decimal. /1

.....

.....

b) 54_{10} to binary. /1

.....

.....

c) $2F_{16}$ to decimal. /1

.....

.....

d) 39_{10} to Binary-Coded Decimal. /1

.....

.....

Total Q19 /4

Question 20

There are different approaches that can be used to control the volume of an audio signal. /3
One approach is to use a potentiometer, whilst another is to control a logic module.

Identify which approach is the digital solution and state an advantage of each approach.

.....

.....

.....

.....

Total Q20 /3

Question 21

Marker use

A farmer notices rats are entering their shed to eat chicken feed. To fix this, an electronic system is designed to feed the chickens automatically after dawn if the door is closed and when the feed level gets below a particular point as judged by a sensor.

- The door sensor is HIGH when the door is closed.
- The light sensor is HIGH at dawn.
- The sensor is HIGH when the food level is low.

a) Complete Table 4 showing when food is released (HIGH). /3

Door	Light	Sensor	Feed
0	0	0	0
0	0	1	0

Table 4

Spare diagram used (X) ☐

b) Draw a logic gate circuit that will control the feeder motor under these conditions. Clearly label all inputs and the output. /3

Total Q21 /6

Question 22

Marker use

Figure 15 is a 74175 IC chip.

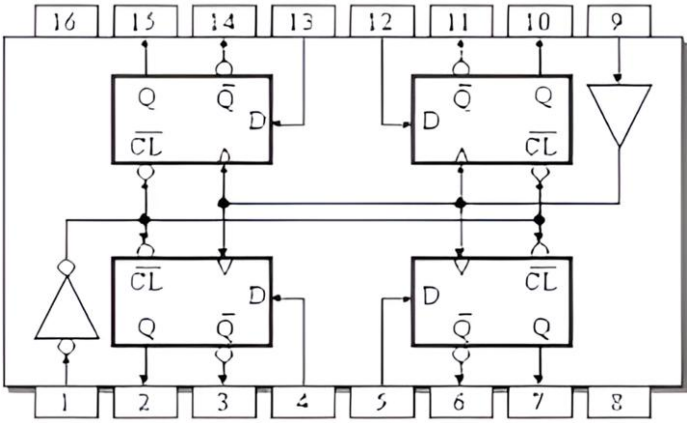


Figure 15: 74175 IC chip.

Spare diagram used (X) ☐

a) State the full name of the IC chip in Figure 15. /1

.....

b) What connection should be made to pin 8 and 16? /1

.....

c) Add wiring to Figure 15 to make it a down-counter. /3

d) Name a suitable subcircuit to be connected to pin 9 and sketch **or** describe its output. /2

.....

.....

.....

.....

Question 22 continues

Marker use

e) Which outputs need to be connected to **pin 1** for the counter to have modulus 8?

/1

.....

f) Latch-up occurs when an unintended low-resistance path forms between the power supply and ground inside a CMOS IC, causing excessive current flow that can damage the chip. What practice helps prevent this from occurring?

/1

.....

.....

Total Q22

/9

Question 23

Marker use

The following questions relate to the digital roulette shown in Figure 16.

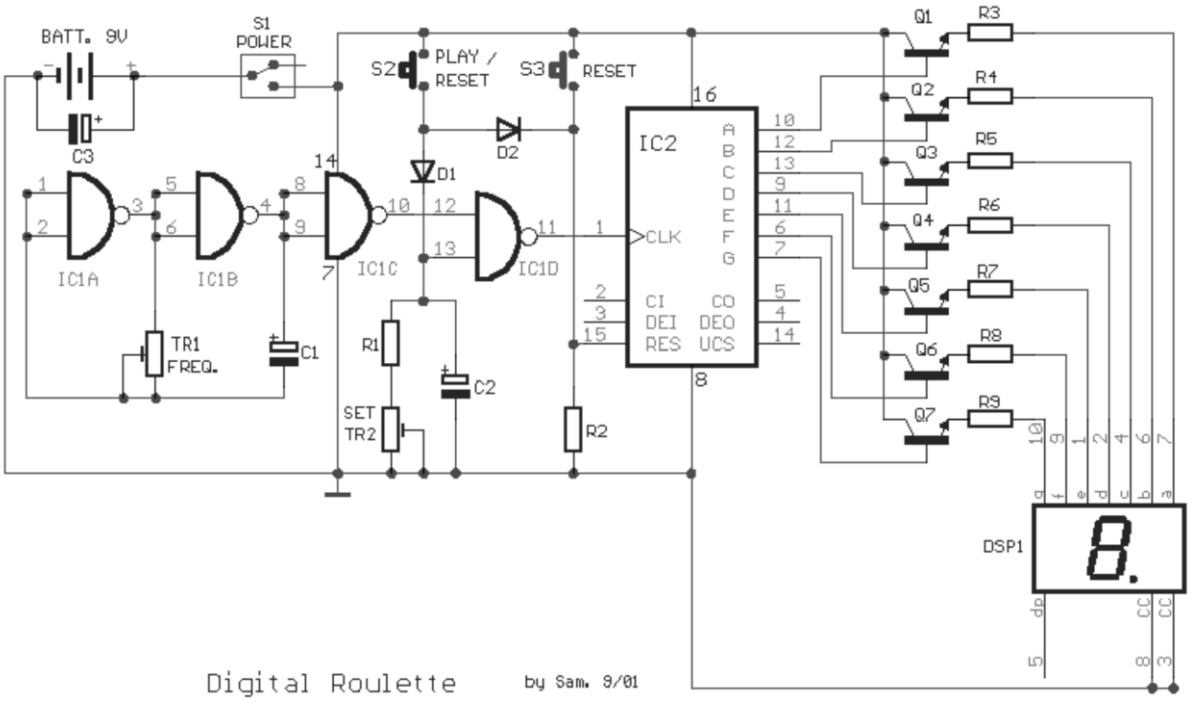


Figure 16: Circuit diagram of a digital roulette.

a) Explain the function of IC1B and IC1C, and how it can be adjusted. /2

.....

.....

.....

b) Explain the operation of IC1D and how it can be adjusted. /2

.....

.....

.....

c) Explain how the switches S2 and S3 differ in operation. /2

.....

.....

.....

d) What is the role of IC2 in the operation of the roulette display? /1

.....

Total Q23 /7

Question 24

Marker use

A microcontroller is used to generate an analogue control voltage using pulse-width modulation (PWM).

The PWM signal switches between 0V and 5V and is passed through a low-frequency filter to produce a smooth analogue output voltage.

The PWM frequency is high compared to the response time of the filter.

a) What is a limitation of this method of digital-to-analogue conversion? /1

.....

b) Explain why a filter is required when using PWM to generate an analogue voltage. /2

.....

.....

c) Calculate the approximate analogue output voltage after filtering if the PWM signal has a duty cycle of 60%. /1

.....

d) What duty cycle is required to produce an analogue output voltage of 4.5V? /1

.....

e) How does increasing the PWM frequency affect the analogue output after filtering? /1

.....

f) In the space below, sketch a 20% duty cycle. /1

Total Q24 /7

Spare Diagrams

Question 21 a)

Door	Light	Sensor	Feed
0	0	0	0
0	0	1	0

Table 4

Question 22 c)

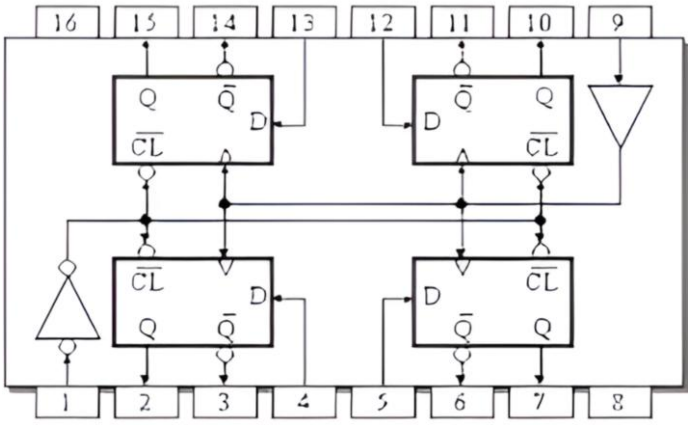


Figure 15: 74175 IC chip.

End of Section D

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External Assessment 2026

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ELECTRONICS AND ADVANCED TECHNOLOGIES

EAT315124

Section E

Pages: 12
Questions: 5
Information Sheet: 1

Suggested working time: 36 minutes

Instructions:

- Answer **all** questions and **all** items within each section.
- Write your answers in the spaces provided in this exam paper.
- The exam is **three (3) hours** in length. The suggested working time for this section is **approximately 36 minutes**.
- The Electronics and Advanced Technologies Information Sheet can be used throughout the exam.
- TASC approved scientific calculators can be used throughout the exam.
- All answers must be written in **English**.
- You **must** make sure your answers address the listed criterion.

Marker use	
C8	/ 36

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Totals	**29**	**29**	**180 minutes (3 hours)**	**180 marks**

Criterion

You **must** make sure your answers address:

- Criterion 8 analyse and apply concepts and principles relating to programmable circuits.

Question 25

Marker use

/6

Microcontrollers are widely used in modern systems.

Describe **three (3)** different applications of microcontrollers in everyday or industrial systems. For each application, explain what the microcontroller is controlling or monitoring.

.....

.....

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.....

.....

.....

.....

.....

.....

Total Q25

/6

Question 26

Marker use

a) Identify **three (3)** core components of a microcontroller.

/3

.....

.....

.....

Microcontroller systems often use a shield to add extra functionality.

/2

b) Explain what a shield is and give an example of its functionality.

.....

.....

.....

Total Q26

/5

Question 27

Marker use

The code on page 7 describes a microcontroller-based rubbish sorting system whereby an item is sorted every 2 seconds by a lever moving. An alarm triggers if the lever gets stuck.

a) Which line causes the system to repeat continuously while it is powered on? /1

.....

b) Name the inputs used in this program. /1

.....

c) Name the outputs controlled by this program. /1

.....

d) Which lines turn the alarm on if the lever does not move? /1

.....

e) Explain the purpose of line 22. /1

.....

f) Explain the purpose of lines 28–30. /1

.....

g) What happens if itemDetected is FALSE? /1

.....

h) Explain what would need to be changed if the green light should turn on for waste instead of recyclable items. /1

.....

Question 27 continues

Question 27 continued

Marker use

```
1.    alarm = OFF
2.    leverPosition = "centre"
3.
4.    WHILE systemOn == TRUE:
5.
6.    READ itemDetected
7.    READ recyclable
8.        READ leverMoved
9.
10.   IF itemDetected == TRUE:
11.
12.       IF recyclable == TRUE:
13.           leverPosition = "left"
14.           greenLight = ON
15.           redLight = OFF
16.       ELSE:
17.               leverPosition = "right"
18.               redLight = ON
19.               greenLight = OFF
20.           END IF
21.
22.           WAIT(2)
23.
24.           IF leverMoved == FALSE:
25.               alarm = ON
26.           END IF
27.
28.           leverPosition = "centre"
29.           greenLight = OFF
30.           redLight = OFF
31.
32.       END IF
33.
34.   END WHILE
```

Total Q27

/8

Question 28

Marker use

A microcontroller is used to control a solar hot water heating system in a house.

Temperature sensors are fitted to the solar tubes and the water tank, and a pump is used to move water through the system.

a) State whether the solar tube temperature sensor is most likely connected to an analogue or digital input and explain your answer. /2

.....

.....

b) Write a program that could be uploaded to the microcontroller. /5

Question 28 continues

Marker use

c) Describe **two (2)** improvements that could be made to the solar hot water control system. For each improvement, explain what additional electronics or inputs would be required, whether the change is analogue or digital, and how the control logic or program would be modified.

/3

.....

.....

.....

.....

Table 5 shows two (2) microcontrollers available for use in the solar hot water control system.

Microcontroller A	Microcontroller B
8-bit processor	32-bit processor
8 digital input/output pins	6 analogue input pins
No analogue inputs	20 digital input/output pins
Low power consumption	Higher power consumption

Table 5

d) Compare the specifications of the **two (2)** microcontrollers and determine which microcontroller is more suitable for this solar hot water system.

/4

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.....

.....

Total Q28

/14

Question 29

Marker use

Circle the correct response for each of the following questions.

a) Which communication protocol typically uses only **two (2)** signal wires to communicate with multiple devices on the same bus? /1

i. UART.

ii. SPI.

iii. I2C.

iv. PWM.

b) Which communication protocol is best suited for high-speed communication with short distances, such as with displays or memory chips? /1

i. UART.

ii. SPI.

iii. USB.

iv. I2C.

c) Why is UART generally simpler to implement than SPI or I2C? /1

i. It requires no software.

ii. It does not use a clock signal.

iii. It is faster than all other protocols.

iv. It allows unlimited devices.

Total Q29 /3

End of Section E

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