Electrotechnology

General Instructions
• Reading time – 5 minutes
• Working time – 2 hours
• Write using black pen
• Board-approved calculators may be used
• Write your Centre Number and Student Number at the top of pages 9, 11 and 13

Total marks – 80

Section I (Pages 2–5)
15 marks
• Attempt Questions 1–15
• Allow about 20 minutes for this section

Section II (Pages 9–14)
35 marks
• Attempt Questions 16–21
• Allow about 50 minutes for this section

Section III (Page 15)
15 marks
• Attempt Question 22
• Allow about 25 minutes for this section

Section IV (Page 16)
15 marks
• Attempt Question 23
• Allow about 25 minutes for this section
Section I

15 marks
Attempt Questions 1–15
Allow about 20 minutes for this section

Use the multiple-choice answer sheet for Questions 1–15.

1 Which of the following is the best instrument to use when testing the insulation resistance of an electrical cable?
   (A) A megger
   (B) An ohmmeter
   (C) A Wheatstone Bridge
   (D) A long shunt voltmeter

2 Which of the following is the most common hazardous substance found in domestic dwellings built before 1987?
   (A) Ceiling insulation
   (B) Asbestos wall panels
   (C) Rubber insulated cable
   (D) Uninsulated earth wire

3 Taps are usually provided in sets of three to allow for
   (A) spare taps in case of breakage.
   (B) threading of different materials.
   (C) cutting of different pitch threads.
   (D) progressive tapping of blind holes.

4 Which of the following is the best way to store liquid and solid hazardous substances in the same cupboard?
   (A) Place the liquids above the solids
   (B) Place the solids above the liquids
   (C) Use large labels on the containers
   (D) Place them in different coloured boxes
Which of the following is the most appropriate tool to scribe an arc on a metal surface?

(A) Dividers
(B) Jenny calipers
(C) A surface gauge
(D) A pair of compasses

What will happen if a short circuit occurs in the parallel branch of a series/parallel resistive circuit?

(A) The total circuit current will increase.
(B) The total circuit current will decrease.
(C) The total circuit resistance will increase.
(D) The total circuit resistance will remain the same.

What are fuses and circuit breakers primarily designed to protect?

(A) People
(B) Appliances
(C) Electrical cables
(D) The power supply

The diagram shows part of a circuit.

What is the total capacitance for this part of the circuit?

(A) 2.7 $\mu$F
(B) 5.45 $\mu$F
(C) 30 $\mu$F
(D) 60 $\mu$F
9. What is the term used to describe a hole that a screw will fit through without binding?
   (A) Clearance
   (B) Counterbored
   (C) Countersunk
   (D) Threaded

10. What is the name of a diagram that shows how a piece of equipment is assembled?
    (A) An oblique view
    (B) A composite view
    (C) An exploded view
    (D) An isometric view

11. What is the reading shown on the micrometer?
    (A) 15.18 mm
    (B) 15.68 mm
    (C) 19.18 mm
    (D) 19.68 mm

12. Which of the following is responsible for emitting the most greenhouse gases in Australia?
    (A) Coal mining
    (B) Vehicle emissions
    (C) Domestic dwellings
    (D) Electricity generation
13. What is the name of the part of a twist drill that does the cutting?
   (A) Flank
   (B) Flute
   (C) Land
   (D) Lip

14. What is the power dissipated by a basic DC circuit with a total resistance of 33\,\Omega when the circuit current increases from 250 mA to 600 mA?
   (A) 2.06 W
   (B) 8.25 W
   (C) 11.88 W
   (D) 19.80 W

15. What is created when a charge (Q) is stored in a capacitor?
   (A) An electric field across the plates
   (B) An electric field across the casing
   (C) An electric field within the dielectric
   (D) An electric field across the entire circuit
Question 16 (4 marks)

Outline ONE advantage and ONE disadvantage of the use of each of the given sources of power generation used in Australia.

<table>
<thead>
<tr>
<th>Source</th>
<th>Advantage</th>
<th>Disadvantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Question 17 (6 marks)

(a) Justify TWO safety instructions that should be given to an apprentice working in a roof cavity.

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(b) List THREE manual handling procedures a worker should use when lifting.

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Question 18 (5 marks)

(a) Some of the steps in the isolation of a circuit are shown in the table. Write in the TWO missing steps.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Identify circuit</td>
</tr>
<tr>
<td>2</td>
<td>Advise personnel</td>
</tr>
<tr>
<td>3</td>
<td>……………………………………………………………………………………………………………………</td>
</tr>
<tr>
<td>4</td>
<td>Isolate circuit</td>
</tr>
<tr>
<td>5</td>
<td>……………………………………………………………………………………………………………………</td>
</tr>
<tr>
<td>6</td>
<td>Test circuit</td>
</tr>
<tr>
<td>7</td>
<td>Verify test equipment on a known source</td>
</tr>
</tbody>
</table>

(b) Explain why Step 7 ‘Verify test equipment on a known source’ is carried out in the isolation of a circuit.

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Question 19 (5 marks)

Explain how government legislation affects the electrotechnology industry. In your answer, refer to relevant legislation that addresses ONE of the following legal issues:

- consumer safety
- environmental protection
- health and safety in the workplace.
Question 20 (4 marks)

Two domestic light fittings ($L_1$ and $L_2$) are to be two-way switched. Complete the wiring diagram to show this.
Question 21 (11 marks)

Use the diagram to answer parts (a)–(d).

(a) Calculate the value of the voltage drop across $R_5$.  

(b) Calculate the value of the total circuit current.  

(c) Calculate the value of the power dissipated by $R_4$.  

(d) Explain the reading on $\mathbb{G}$ when $S_1$ is closed.  

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Question 22 (15 marks)

A flush mount socket outlet is to be installed in a rendered single skin brick wall. An angle grinder is to be used to chase the conduit into the wall, and to fit a metal socket outlet wall box.

Justify each step of an efficient procedure and the associated safety aspects to complete the task before terminating the socket outlet.
Section IV

15 marks
Attempt Question 23
Allow about 25 minutes for this section

Answer the question in a SEPARATE writing booklet. Extra writing booklets are available.

Question 23 (15 marks)

Use the photograph showing an established park with shelters, a barbecue area, play area and security lighting to answer parts (a) and (b).

(a) Compare TWO possible lighting systems for the shelters, considering their suitability for the area and the overall efficiency of each system.

(b) Describe the process required to install a lighting system, from establishing the work site to being ready for use.

End of paper