**VCE VET ENGINEERING STUDIES**

**CERTIFICATE II**

**Written examination**

**Wednesday 18 November 2009**

Reading time: 9.00 am to 9.15 am (15 minutes)

Writing time: 9.15 am to 10.45 am (1 hour 30 minutes)

**QUESTION AND ANSWER BOOK**

### Structure of book

<table>
<thead>
<tr>
<th>Section</th>
<th>Number of questions</th>
<th>Number of questions to be answered</th>
<th>Number of marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>15</td>
<td>15</td>
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<tr>
<td>B</td>
<td>3</td>
<td>3</td>
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</tr>
<tr>
<td>C</td>
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<tr>
<td>D</td>
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</tr>
<tr>
<td>E</td>
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<td>2</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, a protractor, a set square and aids for curve sketching.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or white out liquid/tape.
- A scientific calculator is allowed in this examination.

**Materials supplied**

- Question and answer book of 32 pages.
- Answer sheet for multiple-choice questions.

**Instructions**

- Write your **student number** in the space provided above on this page.
- Check that your **name** and **student number** as printed on your answer sheet for multiple-choice questions are correct, and sign your name in the space provided to verify this.
- 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.**
Question 1
A digital ohmmeter is being used to measure a component. The meter indicates 3.725k Ω.
This is equivalent to
A. 0.3725 Ω
B. 37.25 Ω
C. 372.5 Ω
D. 3725 Ω

Question 2
The voltage measured across a closed switch equals
A. zero.
B. the total supply voltage.
C. half the supply voltage.
D. double the supply voltage.

Question 3
Electrical power is measured in
A. volts.
B. watts.
C. ohms.
D. amperes.

Question 4
What can cause excessive voltage drop?
A. using extra large-size wires
B. too much insulation on the wires
C. excessive resistance in part of the circuit
D. an open circuit bypassing the load being tested

Question 5
One use for a piezoelectric device would be for
A. temperature measurement.
B. high-voltage insulators.
C. gas ignition systems.
D. voltage amplifiers.
Question 6
If a fuse blows again after it has been replaced, the most likely cause is that
A. resistance in the circuit is too high.
B. an open circuit has occurred in a component.
C. the earth connector has become disconnected.
D. the current or amps through the circuit is too high.

Question 7
The factor that does not affect the resistance of a conductor is its
A. length.
B. voltage rating.
C. type of material.
D. cross-sectional area.

Question 8
A resistor with a gold tolerance band has an accuracy of
A. 1%
B. 2%
C. 5%
D. 10%

Question 9
Components that are connected in parallel form
A. several branches for current flow.
B. a single path for current flow.
C. a voltage divider.
D. an open circuit.

Question 10
A 12-volt battery is rated at 20 ampere hours.
This means that it can supply 2 amps for
A. 2 hours.
B. 10 hours.
C. 12 hours.
D. 20 hours.
Question 11

What is the name of this device?
A. transistor
B. capacitor
C. rectifier diode
D. light-emitting diode (LED)

Question 12
A safety switch installed on a switchboard will activate when
A. the current being drawn by the active and neutral is out of balance.
B. there is a short circuit between active and neutral.
C. there is an open circuit in the cable.
D. the circuit is overloaded.

Question 13
You are about to use a power drill and notice that the lead is damaged, exposing the wires. What is the most appropriate action to take?
A. use another power drill
B. repair the lead before using
C. place insulation tape around the drill before using
D. tag the drill as faulty and report the fault to your supervisor

Question 14

From the figure, select the letter that indicates a fuse.
A. a
B. b
C. c
D. d
Question 15

What is the current at $I_2$ for the circuit shown?

A. 6 amps  
B. 12 amps  
C. 23 amps  
D. 40 amps
SECTION B – VBN 773 Produce engineering sketches and drawings

Instructions for Section B

Answer all questions in the spaces provided. All dimensions are in mm (millimetres).

Question 1

Figure 1 shows an isometric view of a pin.

Figure 1
On the sketch below, complete the orthogonal views of the pin shown in Figure 1.
- use conventional drawing systems
- show views in third-angle projection
- show all hidden detail
- complete all missing dimensions

Ø 8 × 4 holes
Ø 40

80 square

4 marks
Question 2
Figure 2 shows a detailed drawing of a clamp screw used in a G Clamp.

Figure 2
a. What does CSK Ø 8 mean?  

b. What is the pitch of the M10 thread?  

c. How long is the head of the clamp screw?  

d. What are the maximum and minimum lengths the clamp screw can be made to?  

maximum __________________ minimum __________________  

2 marks  

e. Complete the table below showing details of the material required to make the clamp screw.  

<table>
<thead>
<tr>
<th>Type of material</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Material size</td>
<td></td>
</tr>
</tbody>
</table>

2 marks
Question 3
Figure 3 shows an orthogonal drawing of a tool block.

Figure 3 shows an orthogonal drawing of a tool block. In the space provided below, draw an isometric drawing of the tool block shown in Figure 3. (DO NOT DIMENSION THE DRAWING.)

In the space provided below, draw an isometric drawing of the tool block shown in Figure 3. (DO NOT DIMENSION THE DRAWING.)
Figure 1 shows an assembly drawing of a machinist’s jack.

Figure 2 shows a detailed drawing of two components, a screw and a lock nut from the machinist’s jack.

The questions in this section relate to the components shown in Figure 2.
Question 1

The lock nut will be made from a length of bar and will be parted off when completed.

a. From the following list, select the material best suited for making the lock nut.
   A. Ø 32 aluminium
   B. Ø 35 aluminium
   C. Ø 32 mild steel
   D. Ø 16 mild steel
   E. Ø 30 MS tube
   F. Ø 30 brass

   ________

   1 mark

b. What work-holding method would you use to hold the material for the lock nut in a lathe?

   ________

   1 mark

The following lists the operations to make the lock nut. They are not in sequence.

- drill hole
- turn outside diameter
- face and centre end
- knurl
- part off
- tap thread

c. Complete the table below showing the operations in correct sequence and tools required for each operation.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Operation</th>
<th>Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>knurl</td>
<td>knurling tool</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>tap thread</td>
<td>M16 tap, tap wrench</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4 marks
Question 2
The raw material for the screw is being measured with a rule as shown in Figure 3.

![Figure 3](image)

**a.**

i. How long is the raw material for the screw?

ii. Why has the raw material for the screw been cut off longer than the length shown on the drawing?

1 + 1 = 2 marks

Figure 4 shows the position of the centre line for the Ø 6 hole in the screw.

![Figure 4](image)

**b.** How should the screw be held for marking out the centre line?

1 mark
Figure 5 shows a vernier height gauge that will be used to mark the centre line of the Ø 6 hole in the screw as shown in Figure 4.

![Figure 5](image)

**Figure 5**

c. Describe how the vernier height gauge can be accurately set to the centre of the screw.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

2 marks

Figure 6 shows the position of the Ø 6 hole in the screw marked out.

![Figure 6](image)

**Figure 6**

d. What needs to be done to the hole position before drilling to make sure the drill does not move off the marked position?

__________________________________________________________________________

1 mark
Before drilling the hole, you need to set up the screw so that the centre line on the end of the screw is vertical, as shown in Figure 7.

![Figure 7]

**Figure 7**

**e. i.** What will happen if this centre line is not set up vertically before drilling?

**e. ii.** What tool can be used to set this centre line vertically?

1 + 1 = 2 marks

The spanner shown in Figure 8 will be used to tighten the nut when assembling the machinist’s jack.

![Figure 8]

**Figure 8**

**f.** What type of spanner is it?

1 mark

Total 15 marks

END OF SECTION C
SECTION D – VBN 777 Handle engineering materials in a safe and proper manner

Instructions for Section D
Answer all questions in the spaces provided.

Question 1
Which one of the signs shown below would you most expect to find at a bench grinder?

A. GARDS MUST BE IN PLACE BEFORE SWITCHING ON
B. EYE PROTECTION MUST BE WORN IN THIS AREA
C. SAFETY HARNESS MUST BE WORN
D. RESPIRATOR MUST BE WORN IN THIS AREA
E. HEAD PROTECTION MUST BE WORN IN THIS AREA

1 mark

Question 2
Which one of the signs shown below would you expect to find around an oxy-acetylene welding set?

A. SPONTANEOUSLY COMBUSTIBLE
B. TOXIC GAS
C. DANGEROUS WHEN WET
D. FLAMMABLE GAS
E. OXIDISING GAS

1 mark
Question 3
You need to make a 600 mm long axle from 25 mm square bar. The material you will be using is currently 4 metres long and is stored in vertical racks 10 metres away from the saw.

a. List **two** precautions you need to take when carrying the 4 metre bar to the saw to avoid injury to yourself and others.

   1. 
   
   2. 
   
   2 marks

b. Describe a possible safety hazard when handling the end of the cut bar immediately after it has been sawn.

   
   
   1 mark

c. The cut bar will be set up in a vice on a milling machine for machining. The vice weighs 25 kg and is currently on a bench.
   Describe one safe method of placing the vice onto the milling machine table.

   
   
   2 marks

Question 4
Why should you always use a piece of wood on the lathe bed when changing chucks?


   1 mark

Question 5
An eye bolt is shown below.


Which of the following articles is most likely to use an eye bolt as a lifting accessory?

A. vice
B. electric motor
C. 2 metre long steel bar
D. large piece of sheet metal
E. timber box


   1 mark
Question 6
A two-person lift is being used to carry a 1.8 m × 1.0 m piece of sheet metal through a machine shop.
List two hazards that exist for the two people who are lifting.
1. 
2. 
2 marks

Question 7
Before lifting a load manually, you need to ‘size up the load’.
Give two examples of what you would do when ‘sizing up the load’.
1. 
2. 
2 marks

Question 8
You are given the responsibility of buying a forklift which will be used to load and unload crates from inside a 20 metre shipping container.
Forklift motors can be any of the following.
• diesel
• electric
• petrol
• LPG
Which sort of forklift motor would be the most suitable in the situation above? Explain your answer.
Type of motor __________________________
Explanation ____________________________
2 marks
Total 15 marks
Question 1
Figure 1 shows an isometric drawing of an angle plate.

a. State one common use for an angle plate in engineering.

1 mark
Three marking-out tools that could be used to mark out the angle plate are shown below.

b. Name each of the tools shown and describe what they could be used for when marking out the angle plate.

<table>
<thead>
<tr>
<th>Tool</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 2 shows a metric thread chart.

<table>
<thead>
<tr>
<th>O.Dia.</th>
<th>Core</th>
<th>Pitch</th>
<th>Depth</th>
<th>Flat</th>
<th>Effec.</th>
<th>Tapp'g</th>
<th>CI'ance</th>
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</thead>
<tbody>
<tr>
<td>1.6</td>
<td>1.1706</td>
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<td>0.2147</td>
<td>0.04375</td>
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<td>0.4294</td>
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<td>4.5</td>
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<td>0.31250</td>
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<td>15.50</td>
<td>18.25</td>
</tr>
<tr>
<td>20.0</td>
<td>16.9328</td>
<td>2.50</td>
<td>1.5336</td>
<td>0.31250</td>
<td>18.376</td>
<td>17.50</td>
<td>20.25</td>
</tr>
<tr>
<td>22.0</td>
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<td>2.50</td>
<td>1.5336</td>
<td>0.31250</td>
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<td>0.37500</td>
<td>22.061</td>
<td>21.00</td>
<td>24.25</td>
</tr>
</tbody>
</table>

Figure 2

c. Use this chart to work out what size holes need to be drilled for the threaded holes in the angle plate.

The drill being used for the tapped holes is shown in Figure 3.

Figure 3

d. What is the name of this drill?
The drill being used for the holes needs to be sharpened on a bench grinder.

e. Which photo shows the work rest correctly adjusted?

A. B. C.

1 mark

When drilling the holes, swarf can form long strands that spin around close to the operator. This is a safety hazard.

f. Describe how to prevent these long strands of swarf from forming while drilling the holes.

______________________________________________________________________

______________________________________________________________________

1 mark

Figure 4 shows two tools that are commonly used with drills.

![Figure 4](image)

**Figure 4**

g. Describe what each tool is used for.

Drill sleeve __________________________________________________________

______________________________________________________________________

Drill drift ___________________________________________________________

______________________________________________________________________

2 marks
Use the nomogram shown in Figure 5 to calculate the approximate rpm for a Ø 16 hole drilled in the angle plate.
Before tapping, the drilled holes will be countersunk.

i. From the tools shown below, select the tool that is most suitable to countersink the holes.

A.  
B.  
C.  
D.  
E.  

A slot drill will be used to mill the slots in the angle plate.

j. Indicate with an arrow the correct direction of rotation of the slot drill.
k. The angle plate will be clamped to the milling machine table to mill the slots.
   i. Which diagram shows the correct position of the clamp?

   

   A. 
   B. 
   C. 

   ii. Which arrow shows the best position of the packing for maximum clamping pressure?

   A 
   B 
   C 

   iii. Which arrow shows the best position of the bolt for maximum clamping pressure?

   A 
   B 
   C 

   $1 + 1 + 1 = 3$ marks
When milling, you will use the tool shown in Figure 6 to measure the length of the slots.

![Figure 6](image_url)

1. i. What is the name of the measuring tool shown?

ii. What is the reading on the measuring tool?

After milling, you will need to file a 1 mm chamfer around the outside.

m. Which of the files shown below will be most suitable for this?

A. warding file
B. flat file
C. square file
D. round file
E. needle file
**Question 2**

Figure 7 shows a drawing of a spindle.

![Spindle Diagram](image)

<table>
<thead>
<tr>
<th>Tolerances</th>
<th>Name:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unless Otherwise Stated:</td>
<td>Spindle</td>
</tr>
<tr>
<td>Diameters: ± 0.05</td>
<td>Material:</td>
</tr>
<tr>
<td>Lengths: ± 0.25</td>
<td>Mild Steel</td>
</tr>
<tr>
<td>Finish: μ 3.2</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 7**
The material for the spindle will be cut from a 1 metre long bar using a hacksaw.

a. Which sketch shows the hacksaw blade correctly fitted? Give a reason for your answer.

A.  

B.  

b. What length should the material be cut for the spindle?

______________________________

1 mark

Figure 8 shows the material to make the spindle. In Figure 8 the material is **incorrectly** held in a vice for hacksawing.

Figure 8

Figure 8

![Figure 8](image)

1 + 1 = 2 marks

SECTION E – Question 2 – continued

TURN OVER
Figure 9 shows the spindle set up in the lathe to start turning the diameters.

Figure 9

d. What should be done to the set up to keep the spindle running true and more rigid when being turned? (You may describe below or sketch your answer on Figure 9 above.)

1 mark

e. Calculate the rpm to turn the 16 mm diameter using a cutting speed of 35 m/min (rpm = \( \frac{320v}{d} \)). Show all working out.

2 marks

f. For the same cutting speed, the larger the diameter, the faster the rpm should be set on the lathe.

A. true

B. false

1 mark
g. Explain what is wrong with the way the cutting tool has been set up in Figure 10.

Figure 10

h. Describe how the $2 \times 45^\circ$ chamfers are made.

i. Give two examples of what could cause inaccurate readings when using a micrometer.
The die shown in Figure 11 will be used to cut the M16 threads on the spindle.

Figure 11

j. i. Figure 12 shows the die ready to cut the thread. Complete the sketch to show how the spindle should be prepared before using the die.

Figure 12

ii. Does it matter which way the die is facing when cutting the thread? (Explain your answer.)

1 + 2 = 3 marks

Figure 13 shows a nut that will be used on the ends of the spindle.

Figure 13

k. Which letter indicates the spanner size required for the nut?

1 mark

Total 40 marks

END OF QUESTION AND ANSWER BOOK