2007 VCE VET Engineering Studies Certificate III GA 2: Written examination

GENERAL COMMENTS

Very few students sat the Engineering Certificate III examination in 2007. Because Sections A and B were the same as for the Certificate II exam, the comments for these two sections also reflect the Certificate II students' responses.

As with the Certificate II, overall, students' responses in this year's examination generally lacked the depth of knowledge required in the trade. Responses generally fell short in their understanding of basic engineering principles.

In the short answer section of the paper the following general approaches were followed in allocating marks.

- To gain marks, responses needed to be consistent with the level of knowledge expected of a trainee in the engineering industry at a Certificate III standard and with the knowledge covered in the competency statements.
- If a response did not address the subject of a question it was not given marks.

SPECIFIC INFORMATION

For each question, an outline answer (or answers) is provided. In some cases the answer given is not the only answer that could have been awarded marks.

Please note that due to the small enrolment in this study in 2007, statistics on students' mark distribution are not available.

Section A – VBN 771 Apply electrotechnology principles in an engineering environment

The table below indicates the percentage of students who chose each option. The correct answer is indicated by shading.

Question	Correct response
1	D
2	B
3	A
4	B
5	A
6	C
7	D
8	B
9	A
10	B
11	D
12	B
13	C
14	A
15	C

The multiple-choice section of the exam was answered reasonably well by most students.

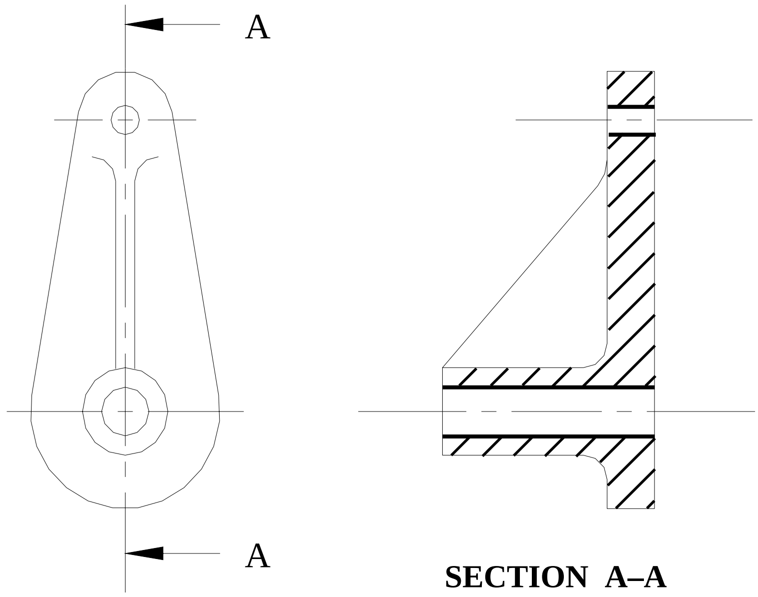
Section B – VBN 773 Produce engineering sketches and drawings

Question 1

One mark each was allocated for:

- holes drawn in solid lines and not sectioned
- correct section lines
- correct labelling (Section A–A).

Most students appeared to have little knowledge of what a section view is.



SECTION A–A

Question 2
Third-angle projection

A surprisingly large number of students did not know what this basic drawing symbol stood for.

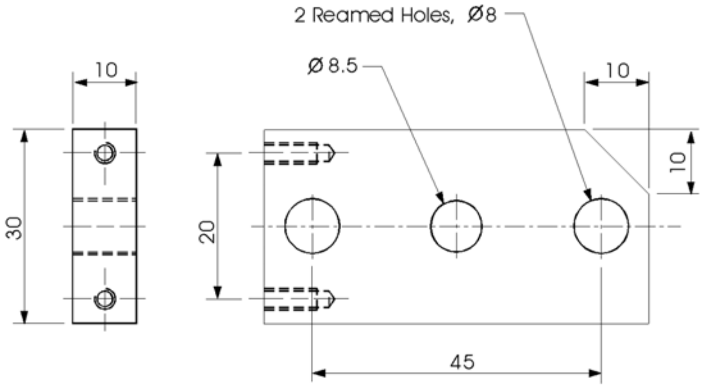
Question 3
3a.
M4 (4 mm was also accepted)

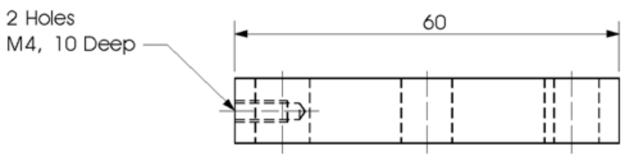
3b.
- maximum 60.25 mm
- minimum 59.75 mm

3c.
7.8–7.9 mm

Most students selected a drill size that was much too small, demonstrating a lack of understanding of reaming.

Question 4





Marks were allocated for:

- correct views in third angle projection
- hidden detail correctly shown
- use of conventional drawing systems (correct line types, placement of dimensions, etc.) as well as the general layout and neatness of the sketch.

Most students correctly sketched in the views using third-angle projection. Marks were lost when students left out dimensions, or over dimensioned (that is, dimensioning the same feature two or three times in different views).

Section C – VBN 787 Apply mathematical principles to engineering designs

Overall the mathematics section of the paper was answered reasonably well. A common mistake made by some students was to confuse the radius and diameter when calculating areas and circumference of circles.

Students had little trouble when given a triangle and asked to solve an unknown side (such as in Question 10). However, when students had to construct the triangle from the information given (such as Question 11), it was evident that they lacked ‘problem solving’ skills.

Question 1

$$\begin{aligned}\text{Area} &= \pi r^2 \\ &= \pi \times 45 \times 45 \\ &= 6362\text{mm}^2\end{aligned}$$

or

$$\begin{aligned}\text{Area} &= \frac{\pi D^2}{4} \\ &= \frac{\pi \times 90 \times 90}{4} \\ &= 6362\text{mm}^2\end{aligned}$$

Question 2

$$\text{Area of large circle} = \pi \times 8.6 \times 8.6 = 232.38$$

$$\text{Area of small circle} = \pi \times 4.4 \times 4.4 = 60.83$$

$$\begin{aligned}\text{Area of Annulus} &= \text{Area of large circle} - \text{Area of small circle}\\ &= 232.38 - 60.83\\ &= 171.55\text{mm}^2\end{aligned}$$

Question 3

$$\begin{aligned}\text{Area} &= 0.5 \times \text{Base} \times \text{Vertical Height}\\ &= 0.5 \times 100 \times 60\\ &= 50 \times 60\\ &= 3000\text{mm}^2\end{aligned}$$

Question 4

$$\begin{aligned}\text{Perimeter} &= \text{side} + \text{side} + \text{semi-circle}\\ &= 50 + 30 + \frac{\pi D}{2}\\ &= 80 + \frac{\pi \times 40}{2}\\ &= 80 + 125.7\\ &= 205.7\text{mm}\end{aligned}$$

Question 5

Total volume = Volume of block + Volume of spigot – Volume of holes

$$\begin{aligned}\text{Volume of block} &= l \times w \times h\\ &= 40 \times 25 \times 35\\ &= 35000\end{aligned}$$

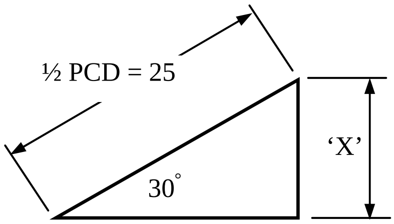
$$\begin{aligned}\text{Volume of spigot} &= \pi r^2 \times l\\ &= \pi \times 10 \times 10 \times 25\\ &= 7855\end{aligned}$$

$$\begin{aligned}\text{Volume of holes} &= 2 \times \left(\pi r^2 \times l\right)\\ &= 2 \times \left(\pi \times 5 \times 5 \times 35\right)\\ &= 5498\end{aligned}$$

$$\begin{aligned}\text{Total volume} &= \text{block} + \text{spigot} - \text{holes}\\ &= 35000 + 7855 - 5498\\ &= 37357\text{mm}^3\end{aligned}$$

Students were awarded one mark for each step in the calculation, and one mark for using the correct units.

Question 6



$$\begin{aligned}
\text{Sin}\theta &= \frac{\text{Opposite}}{\text{Hypotenuse}} \\
H\text{Sin}\theta &= \text{Opposite} \\
25 \times \text{Sin}30 &= \text{Opposite} \\
25 \times 0.5 &= \text{Opposite} \\
\text{Opposite}(\text{X}) &= 12.5\text{mm}
\end{aligned}$$

Question 7

$$\frac{2.0}{4} = 0.5\text{mm}$$

Question 8

0.85 × 638 = $542.30

or

638 – (638 × 0.15)
= 638 – 95.7
= $542.30

Question 9

Since the driven pulley will turn faster (as it has a smaller diameter)

$$\begin{aligned}
\text{Driven pulley speed} &= \frac{\text{larger diameter}}{\text{smaller diameter}} \times \frac{\text{RPM}}{1} \\
&= \frac{180}{120} \times \frac{1440}{1} \\
&= 1.5 \times 1440 \\
&= 2160 \text{ RPM}
\end{aligned}$$

Question 10

$$\begin{aligned}
\text{Sin}\theta &= \frac{\text{Opposite}}{\text{Hypotenuse}} \\
\text{H} &= \frac{\text{Opposite}}{\text{Sin } 30} \\
\text{H} &= \frac{80}{0.5} \\
\text{H} &= \text{A} \\
\text{A} &= 150\text{mm}
\end{aligned}$$

Question 11

$$\text{Tan}\theta = \frac{\text{Opposite}}{\text{Adjacent}}$$

$$\text{O} = \text{Adjacent} \times \text{Tan}\theta$$
$$\text{O} = 100 \times \text{Tan } 6.5°$$
$$\text{O} = 100 \times 0.1139$$
$$\text{O} = 11.39$$

$$\text{B} = 11.39 + 22$$
$$= 33.39\text{mm}$$

Question 12

$$\text{Cos}\theta = \frac{\text{Adjacent}}{\text{Hypotenuse}}$$
$$\text{Cos}\theta \times \text{Hypotenuse} = \text{Adjacent}$$
$$\text{Cos } 30 \times 50 = \text{Adjacent}$$
$$0.8660 \times 50 = \text{Adjacent}$$
$$\text{Adjacent} = 43.3$$

$$\text{Since AF} = 2 \times \text{Adjacent}$$
$$\text{AF} = 86.6\text{mm}$$

Question 13

$$\frac{7.5 \times 6 \times 12}{100} = \$5.40$$

or

$$7.5 \times 6 \times 0.12 = \$5.40$$

Question 14

$$180 - (56 + 60) = x$$
$$180 - 116 = 64°$$
$$180 - 2 \times 64 = \text{Y}°$$
$$180 - 128 = \text{Y}°$$
$$\text{Y}° = 52°$$

Question 15

$$\frac{15.2 \times \pi}{2.9 \times 5.7}$$
$$= \frac{47.771}{16.53}$$
$$= 2.89$$

Question 16

$$\frac{2600}{1100} \times \frac{100}{1}$$
$$= \frac{260}{11}$$
$$= 26.3\%$$

Question 17

$$\frac{13.6-6}{2} = 3.8$$

$$\text{Tan}\,\theta = \frac{\text{Opposite}}{\text{Adjacent}}$$

$$\text{Tan}\,\theta = \frac{3.8}{7.5}$$

$$\text{Tan}\,\theta = 0.5066$$

$$\theta = 26°52'$$

Since θ = semi angle
Included angle = $53°44'$

Question 18

i.

$$\frac{11''}{64} = 0.1719 \times 25.4 = 4.366\text{mm}$$

ii.

$$1\frac{7''}{16} = 1.43375 \times 25.4 = 36.513\text{mm}$$

Section D – VBN 788 Design and prototype components and/or small structures using engineering design principles

Because Questions 1–3 relate to a student design, no standard answers are available due to the wide variety of possible answers. Each design was assessed against the 'design features' criteria listed below

Question 1
Marks were allocated for the five design features specified in the question (see below), as well as the detail shown in the sketch, and size of materials used for the fixture.

Design features:

- accurate positioning of the product
- suitable clamping of the product
- suitable clamping of base to the drill table
- easy swarf removal
- easy (quick) to load and unload product.

Some students failed to read the drawing correctly and assumed that the part shown was round; however, it was clearly rectangular in shape. Despite Question 1 asking for a two dimensional drawing showing **two** views, some students sketched an isometric view. It is important for students to take the time to carefully read the requirements of each question, as marks are allocated on how well the requirements of the question are met.

Question 2
This question was, for the most part, answered satisfactorily by the students who attempted it.

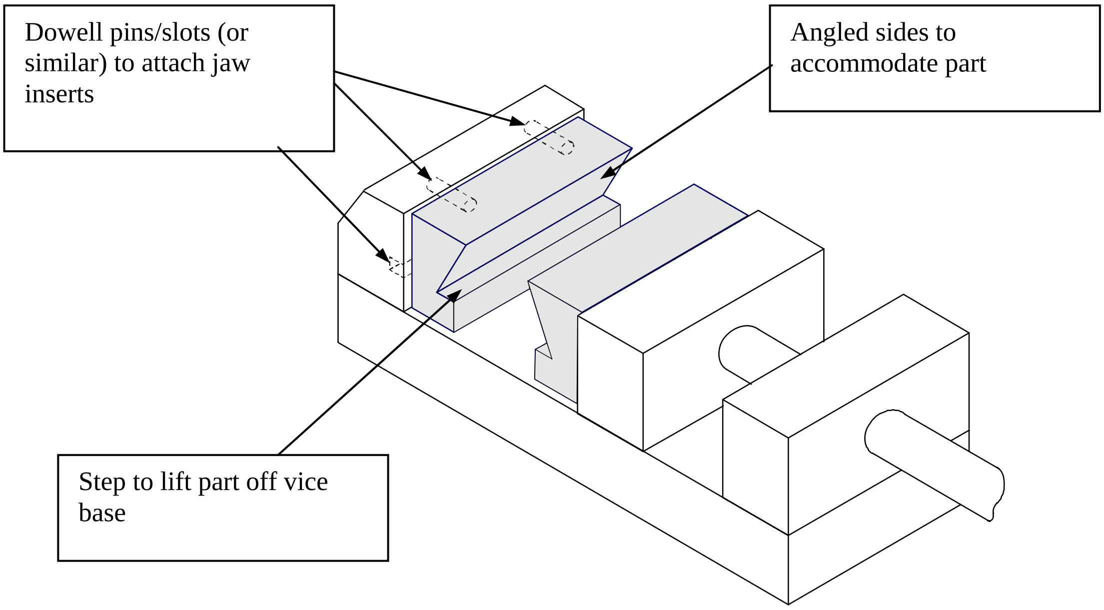
Question 3
As with the Certificate II question on operational planning, it was obvious that students' knowledge in this area needs to be strengthened.

Students need to realise that one reason for operational planning is so that tools and equipment can be organised in advance. Therefore, the plan needs to be completed in some detail.

Question 4a.
Appropriate answers included:
- the base may not sit flat, therefore the hole will not be square
- the corners of the base may be crushed or damaged.

Question 4b.
The drill will penetrate into the vice base, damaging the vice

Question 4c.



Overall, Question 4 was answered well by the majority of students who attempted it. Most designs addressed the main requirements to hold the component securely, without damage, and to lift it off the base of the vice.