The University of Melbourne
Semester 1 Assessment, 1999

Department of Mechanical and Manufacturing Engineering

436-105 ENGINEERING COMMUNICATIONS

Student Number: ………………..

Examination duration: 3 hours
Reading time: 15 minutes
This paper has: 9 pages

Authorised materials:
Electronic calculators and drawing instruments may be used.

Instructions to invigilators:
Candidates are to complete the examination by writing and drawing in this examination paper, which must be collected at the end of the examination. No additional script books should be required.

Instructions to students:
Attempt all of the five questions. All questions are of equal value.
Space is provided in this paper to complete all the questions. No additional script books should be required. The whole paper must be left for collection by the invigilators at the end of the examination.
Be sure to write your student number in the space provided above.

Library:
This paper is to be reproduced and lodged with the Baillieu Library.
Question 1

(a) In the following multiple-choice questions, select the one best answer by ticking the adjacent selection box (□).

1. What type of sketch shows the front in true shape?
   □ isometric
   □ perspective
   □ oblique
   □ axonometric

2. What type of line has precedence over all other types of lines?
   □ hidden line
   □ centre line
   □ visible line
   □ none of the above

3. Which of the following is typically represented in a drawing, but does not have a true physical counterpart on the object?
   □ edge of a planar surface
   □ edge of a circular face
   □ corner of a rectangle
   □ limiting element of a curved surface

4. All of the following are considered weaknesses of wireframe modelling except
   □ lack of computing efficiency
   □ lack of solidity
   □ lack of uniqueness
   □ ambiguity

5. Which type of Boolean operation depends on knowing the overlap between the two solids?
   □ union
   □ intersection
   □ difference
   □ all of the above

6. Which type of Boolean operation creates a different result depending on which solid is listed first in the operation?
   □ union
   □ intersection
   □ difference
   □ all of the above

7. All of the following statements about multiview drawings are true, except
   □ each view is a 3-D pictorial image
   □ are based on orthographic projection
   □ contain at least two views of the object
   □ views are defined by planes of projection
8. Which is not a principal view?
   - bottom
   - left side
   - auxiliary
   - front

9. In orthographic projection, lines of sight for a given view are mutually
   - perpendicular
   - oblique
   - normal
   - parallel

10. Inclined planes in a three-view drawing will appear as
    - two surfaces and one edge
    - two edges and one surface
    - three edges
    - foreshortened in each view

11. Oblique planes in a three-view drawing will appear as
    - two surfaces and one edge
    - two edges and one surface
    - three edges
    - three surfaces

12. When a surface of an object is inclined to a plane of projection, it will appear in the view
    - foreshortened
    - in true size and shape
    - as a line
    - as a point

13. The top view of an object should typically be drawn
    - to the right of the front view
    - anywhere on the same page
    - directly above the front view
    - on a separate piece of paper

14. The top and right side views have which common dimensions?
    - height and width
    - width and depth
    - height
    - depth
(b) Having studied the assembly drawing of a support bracket in figure 1, answer the following questions:

1. If you ordered a complete support bracket, how many individual parts would you get?

2. If the bracket (part 1) were mounted on a vertical wall, how far would the shaft be from the wall?

3. How many fasteners are required to mount the support bracket?

4. What is their nominal size?

5. What is the outside diameter of the bearing? the inside diameter?

6. What diameter shaft does this assembly support?

7. How are the flange and bushing held together?

8. What would you order for a replacement bearing?

9. What manufacturing process is used to form the basic shape of the bracket (part 1)?

10. What provision is made to ensure good contact with the mounting fasteners?

11. What diameter cap screws are used to fasten the cover to the assembly?

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**Figure 1**

<table>
<thead>
<tr>
<th>PART NO</th>
<th>NAME</th>
<th>MATERIAL</th>
<th>NO. REQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BRACKET</td>
<td>C.I.</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>COVER</td>
<td>C.I.</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>RUSHING</td>
<td>SAE 1030</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>FLANGE</td>
<td>SAE 1030</td>
<td>1</td>
</tr>
</tbody>
</table>
Question 2

Given the three standard orthogonal projections of an object in figure 2, make neat sketches of isometric and oblique projections of the object. Dimensions may be scaled from the figure. Do not erase any construction lines used.

Figure 2
Question 3

Given the top and front views of an angled bracket in figure 3, determine

(i) the thickness of the upright flange,
(ii) the dihedral angle between the base and the upright flange, and
(iii) the true shape of the face ABCD of the upright flange.

Figure 3
Question 4

Complete the front view in figure 4, showing the complete line of intersection between the prism and the cylinder. Clearly indicate which parts are visible, and which parts are hidden.

*Hint: An inclined section of a cylinder will, in general, be elliptical. For a particular inclination it may be circular.*
Question 5
Consider the angled bracket introduced in question 3, and shown here again in figure 5. This time, use **vector methods** to determine

(i) the dihedral angle between the base and the upright flange,
(ii) the thickness of the upright flange, and
(iii) the $z$-coordinate of the point D.

The coordinates of a number of points are given as follows:

<table>
<thead>
<tr>
<th>Point:</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
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<tbody>
<tr>
<td>$x$</td>
<td>7.70</td>
<td>51</td>
<td>60</td>
<td>30</td>
<td>57.69</td>
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<tr>
<td>$y$</td>
<td>39</td>
<td>14</td>
<td>55</td>
<td>60</td>
<td>25.59</td>
</tr>
<tr>
<td>$z$</td>
<td>10</td>
<td>10</td>
<td>55</td>
<td>?</td>
<td>10</td>
</tr>
</tbody>
</table>

Hint: Recall that the vector equation constraining the position vector of a point $(\mathbf{r})$ to lie in a plane is $\mathbf{r} \cdot \mathbf{n} = p$, where $\mathbf{n}$ is a unit vector normal to the plane, and $p$ is the perpendicular distance from the origin of coordinates to the plane.
Work sheet for question 5