

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE
General Certificate of Education Ordinary Level

METALWORK

6040/1

PAPER 1 Theory, Drawing and Design

OCTOBER/NOVEMBER SESSION 2001

2 hours 45 minutes

Additional materials:

- Answer paper
- A2 drawing paper (1 sheet)
- Standard drawing equipment

TIME 2 hours 45 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the answer paper/answer booklet.

Section A

Answer any **three** questions.

Write your answers on the separate answer paper provided.

Section B

Answer **all** questions.

Use the A2 sheet of drawing paper prepared prior to the examination for your answers.

At the end of the examination, fasten together the separate answer paper for Section A and place it within your folded drawing paper for Section B.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [] at the end of each question or part question.

All dimensions are in millimetres unless otherwise stated.

Except where pictorial views are used **all** diagrams are in First Angle Projection.

This question paper consists of 8 printed pages.

Section A Theory

Answer any **three** questions in this section.

Use bold sketches to illustrate your answers wherever possible.

You are advised to spend 1 hour 15 minutes on Section A.

- 1** A school has been given a mixed lot of metal bars consisting of:
- mild steel
 - high carbon steel
 - cast iron
 - aluminium alloy
 - copper
- (a) State how each type of metal could be identified without using heat. [5]
- (b) An attempt was made to heat each metal to bright red heat and quench in water. State what would happen to each metal. [5]
- (c) Name an appropriate use for each type of metal. [5]
- (d) Mild steel is sometimes case-hardened. Give the meaning of the term case-hardened and explain why it is carried out. [2]

- 2 Fig. 1 shows details of a drawer handle turned from a length of $\text{Ø}30$ brass rod.

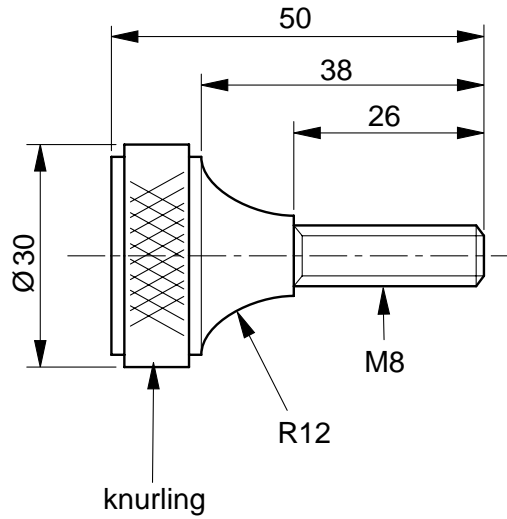


Fig. 1

- (a) After the $\text{Ø}8$ spigot has been turned, describe in detail how to:
- produce the R12 curved profile;
 - form the knurling;
 - cut the thread using a die, without removing from the lathe;
 - part off the drawer handle from the $\text{Ø}30$ rod. [8]
- (b) After the drawer handle has been parted off, it will need to be faced. With the aid of a diagram, show briefly, a method of holding the threaded spigot in a three-jaw chuck without damaging the thread. [3]
- (c)

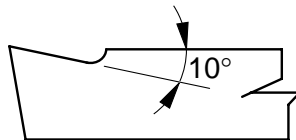


Fig. 2

Fig. 2 shows the side view of a lathe tool for cutting mild steel.

- (i) By means of a similar diagram show the side view of a lathe tool for cutting:
- brass;
 - aluminium. [4]
- (ii) What would be the result if the lathe tool for cutting aluminium was used on brass? [2]

3 Fig. 3 shows a bracket made from 30 x 3 x 60 long BDMS.

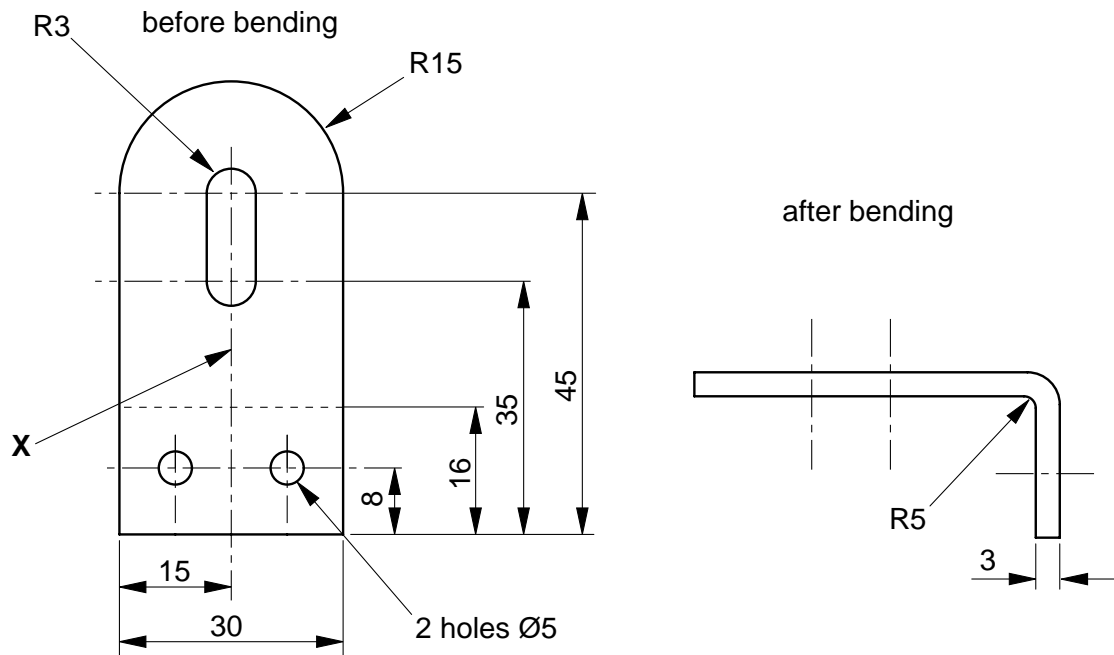


Fig. 3

- (a) Name the tools needed to:
- (i) mark out the centre line **X**;
 - (ii) mark out the R15 end;
 - (iii) define clearly the outline of the R15 end before removing waste;
 - (iv) mark the position of the Ø5 holes before drilling. [4]
- (b) Show by means of a diagram, how the marking tool used in part (a)(i) is set to 15 mm. [2]
- (c) With the aid of a diagram, show how the bracket should be set up for drilling. [3]
- (d) Describe in detail how to make the slot. [4]
- (e) Show clearly how the R5 bend would be formed. [4]

4 (a) A pattern has to be made for a simple one-off casting. Give reasons for:

- (i) the use of wood for the pattern;
- (ii) the addition of fillets;
- (iii) a contraction allowance;
- (iv) a good surface finish.

[4]

(b) Casting of aluminium alloy can be dangerous and so only a trained person may control the pouring of molten metal.

Copy the chart below listing:

- (i) **five** additional safety precautions that must be taken during casting;
- (ii) the reason for each precaution.

(Note: an example has been completed for you)

| | precaution | reason |
|----------|---|--|
| | <i>Restrict access to furnace area.</i> | <i>To prevent people entering the furnace area, risking an accident.</i> |
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

[5]

(c) While preparing a mould for aluminium casting, the following two faults were found. Give a reason for each fault and state how to prevent it happening again.

- (i) The moulding sand would not bind together when squeezed.
- (ii) The pattern was difficult to remove and sand fell into the mould cavity.

[4]

(d) After removing the finished aluminium casting from the mould, the following two faults were found. Give a reason for each fault and state how to prevent it happening again.

- (i) The surface of the casting was very rough.
- (ii) The molten metal had failed to run to all parts of the mould cavity.

[4]

- 5 (a) Describe briefly why each of the following problems occurred and state how they could be prevented in future.
- (i) In attempting to silver solder two pieces of copper together, the solder fails to run and forms into little balls. [2]
 - (ii) The end of a newly made screwdriver chips when first used. [2]
 - (iii) Piping occurs when forging a round taper. [2]
 - (iv) The end of a drill becomes blue when drilling a hole. [2]
 - (v) A rivet becomes mis-shapen, as shown in Fig. 4, when using a snap. [2]

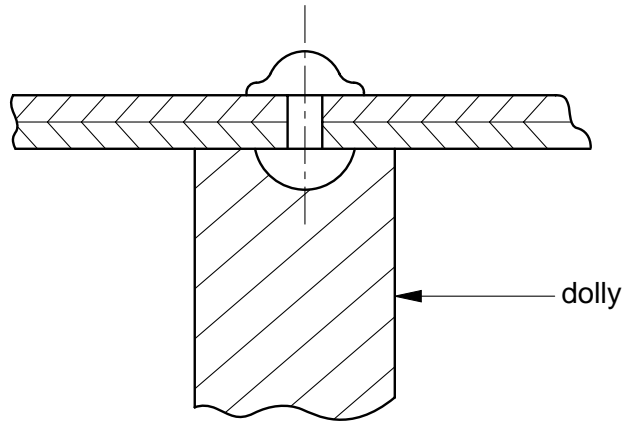


Fig. 4

- (b) Fig. 5 shows two $\text{Ø}8$ rods to be joined together. Show, with the aid of diagrams, **two** methods of joining the $\text{Ø}8$ rods without the use of heat or adhesives. The two rods may be modified and additional components may be used in order to solve the problem.

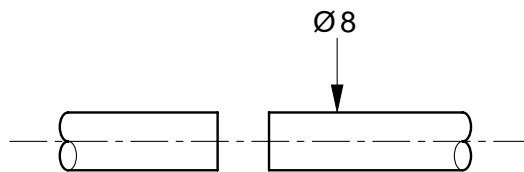


Fig. 5

[7]

Section B Drawing and Design

Answer **all** questions in this section.

You are advised to spend 1 hour 30 minutes on this section.

One sheet of drawing paper of A2 size prepared prior to the examination is to be used.

Set the paper with the long edge to the top of your drawing board and use the space to the right of the line on your paper to make your freehand sketch solutions in answer to Question 6.

Use only one side of your paper.

Use your own discretion where dimensions are not given.

Fig. 6 shows incomplete details of a router table and fence.

Fig. 7 shows a section through the table casting. An electrically powered router (shown in outline) is fixed to the underneath of the table. Various shaped cutters ranging from $\text{Ø}5\text{--}\text{Ø}40\text{ mm}$ are inserted in the router. In use, pieces of timber ranging in width from $20\text{--}100\text{ mm}$ are slid along the fence to produce required shapes. Side pressure is applied to the timber to ensure accurate cutting.

- 6 To the right of the line on your paper make a series of freehand sketches leading to the solution of the design problems **(a)**, **(b)** and **(c)** below.

It should be possible for the Examiner to understand your solutions from these freehand sketches. **Brief** notes should be added only to identify details such as materials and important sizes. You may modify the given parts to solve the problems.

Welding and adhesives are not to be used.

Design Problems

- (a)** A means of securing the fence to the table allowing adjustment of $0\text{--}80\text{ mm}$ from the centre of the cutter as shown in Fig. 7.
- (b)** A method of reducing the $\text{Ø}50$ hole in the table to $\text{Ø}20$ when small cutters are being used.
- (c)** A method of ensuring steady pressure is exerted against the side of the timber so that it is kept pressed against the fence during routing as shown in Figs. 6 and 7.
- 7 Draw half full-size in 1st or 3rd angle projection the following views of the router table. Include your solutions to the design problems, but do **not** include the outlined router, cutter and timber.
- (a)** A front view in the direction of arrow **F**.
- (b)** A sectional end elevation through the centre of the router table in the direction of arrow **S**.

Mark allocation:

Communication [24]

Design [25]

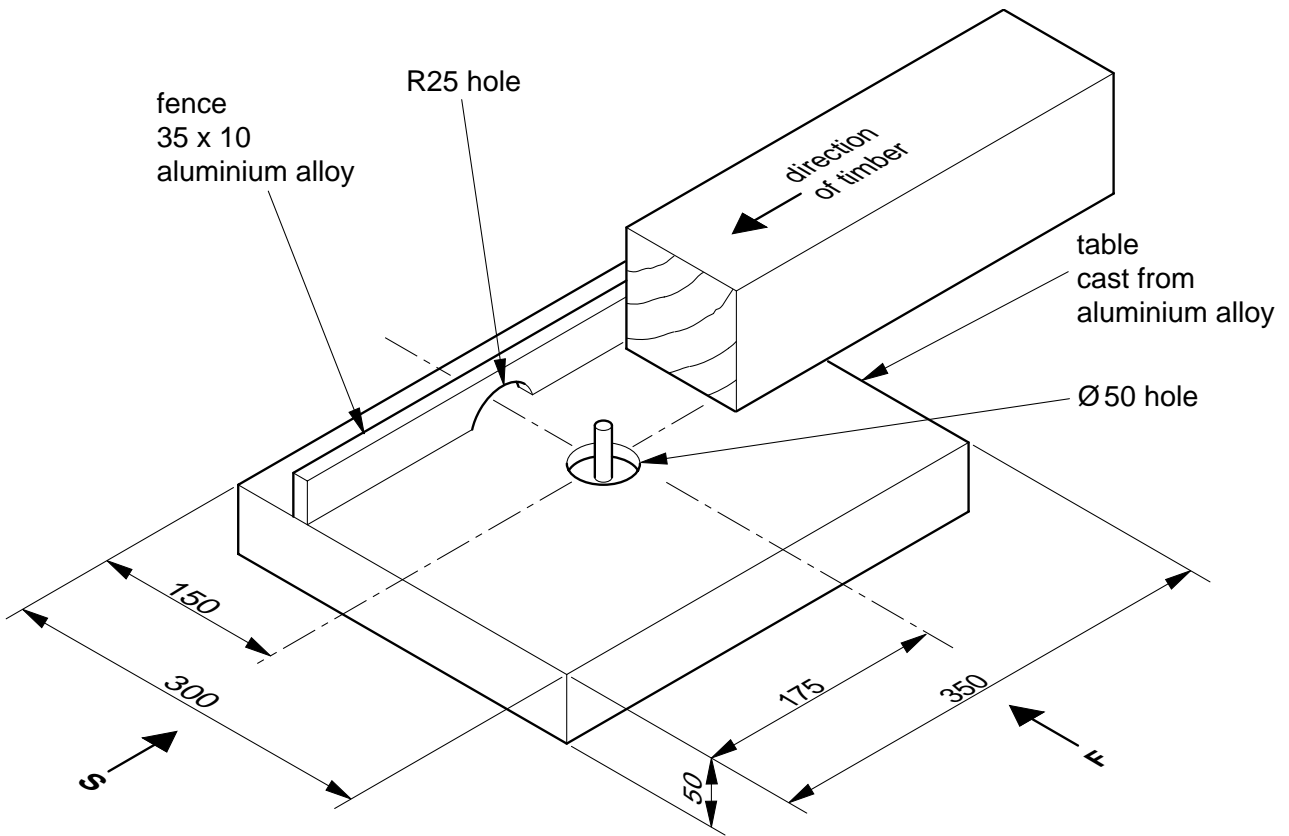
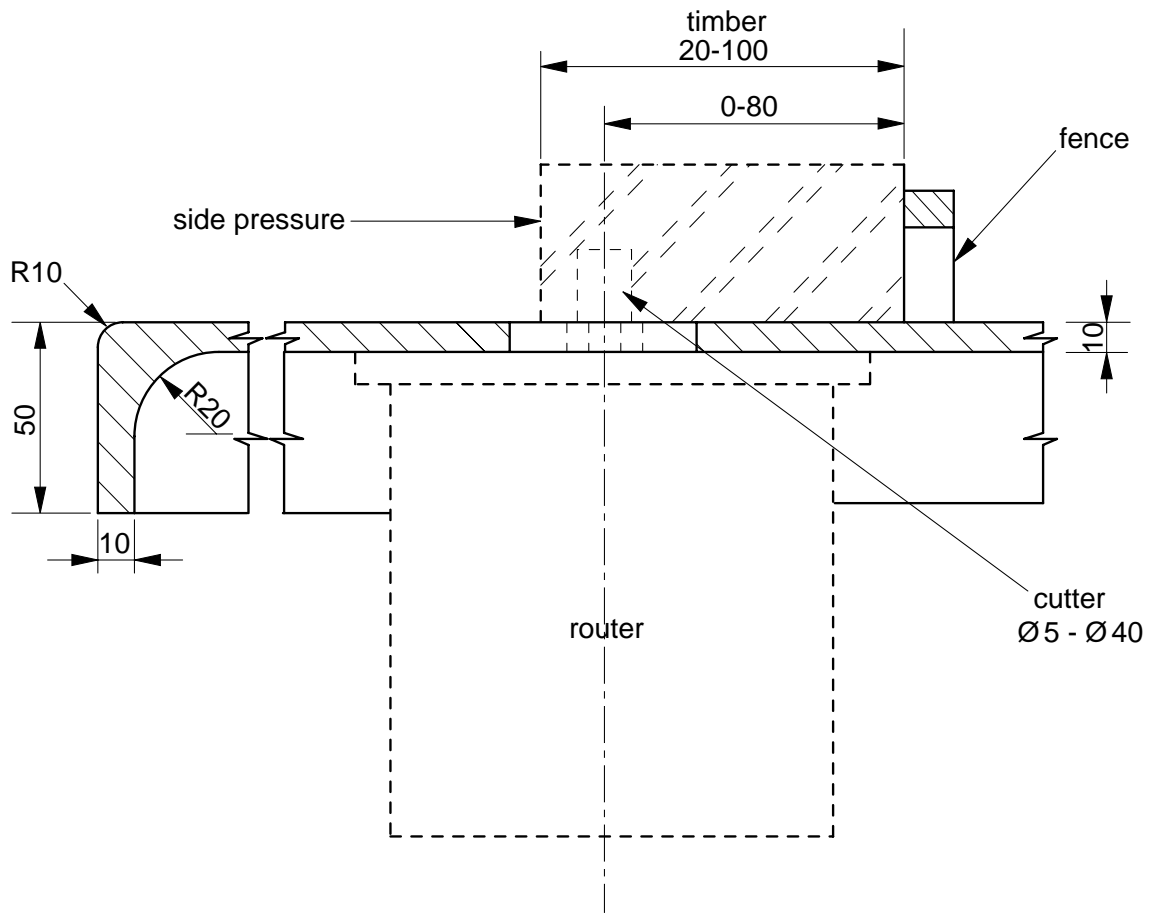


Fig. 6



section through router table

Fig. 7