M73

AN ROINN OIDEACHAIS AGUS EOLAÍOCHTA
LEAVING CERTIFICATE EXAMINATION, 2001

ENGINEERING – MATERIALS AND TECHNOLOGY

(Higher level - 300 marks)

THURSDAY, 21 JUNE – AFTERNOON, 2.00 – 5.00

OVER→

INSTRUCTIONS
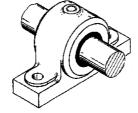
1.   Answer <u>Question 1, Sections A and B,</u> and <u>Four</u> other questions.

2.   All answers must be written in ink on the answer book supplied.

3.   Diagrams should be drawn in pencil.

4.   Squared paper is supplied for diagrams and graphs as required.

5.   Please label and number carefully each question attempted.

1. <div align="right">**(100 marks)**</div>

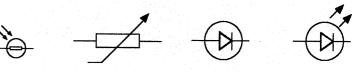**Give brief answers to any ten of the following.**

(a) What safety precautions should be observed when using cutting fluids?

(b) Describe the flotation separation method shown opposite.

(c) Identify in which cubic crystal form shown
at (i) and (ii) is slippage more likely
to occur and state why this is the case.

(d) Identify and outline the function of either
the transformer **or** rectifier shown in the
circuit diagram.

(e) Name **any three** essential differences
between metals and non-metals.

(f) Identify the main processes used to manufacture
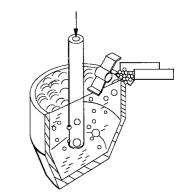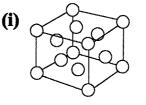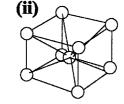**any one** of the items shown.

(g) Explain the term *elastic memory* with reference to thermoplastics.

(h) Name **any three** of the electronic symbols shown and
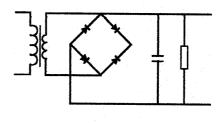briefly outline their function.

(i) Explain the term *creep* with reference to metals.

(j) What environmental factors hasten the corrosion rate of metals?

(k) Briefly describe **any two** common defects in metal crystals.

(l) Outline the advantages of compressed air over other forms of power supply.

(m) What contribution did **any one** of the following make to technology?
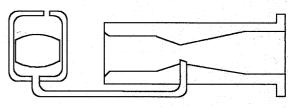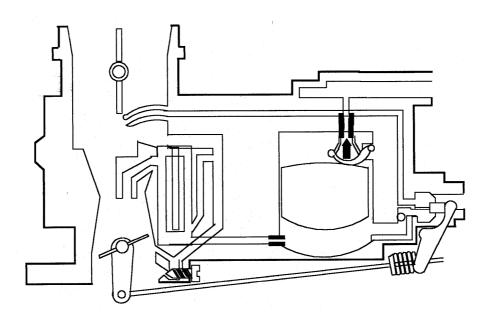(i) Gottlieb Daimler; (ii) Daniel Bernoulli; (iii) Robert Boyle.

<div align="right">**OVER→**</div>

SECTION B - 50 marks

Answer **all** of the following.
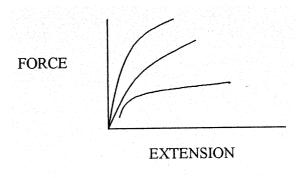
(n)   **(i)**   Outline the principle of carburation using the sketch opposite.

       (ii)   Describe **two** main functions of the carburettor?

(o)   **(i)**   Explain the difference between Down Draught and Side Draught carburettors.

       (ii)   Describe **one** design consideration governing the use of a Side Draught carburettor.

(p)   What is meant by the term mixture strength and why is it necessary to provide a variety of strengths.

(q)   Describe the operation and function of the float chamber in the diagram given below.

(r)   Utilising the given diagram describe the purpose of **any three** of the following.

       (i)   Throttle lever;
       (ii)   Throttle butterfly;
       (iii)   The choke control lever;
       (iv)   Venturi;
       (v)   Emulsifying tube;
       (vi)   Idling adjustment screw.

2.   **(50 marks)**
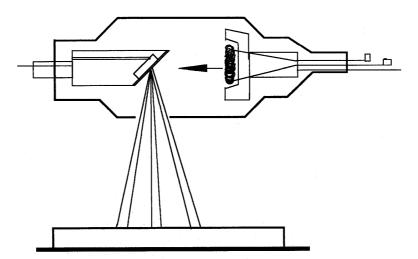
(a)   The force-extension graphs for three non-ferrous metals are shown. Redraw the graphs into your answer
            book matching the metals listed below with a corresponding graph and briefly outline the ductility of each.

   (i)   Soft Copper;
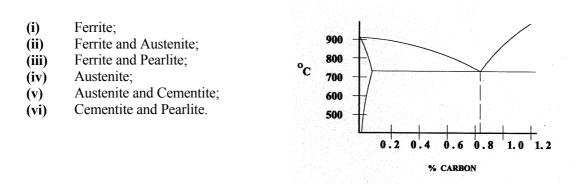   **(ii)**   Aluminium;
   (iii)   Soft Brass.

FORCE

EXTENSION

(b)   Answer **each** of the following.

   (i)   Define **any two** of the following.
               Malleability; Toughness; Hardness; Youngs Modulus of Elasticity.

   (ii)   Suggest a suitable inspection technique for detecting the following defects.
               Internal cavities in aluminium castings;   Surface cracks in cast iron plates;   Internal faults in
               welding joints.

(c)   A non-destructive test is represented diagrammatically in the drawing below.
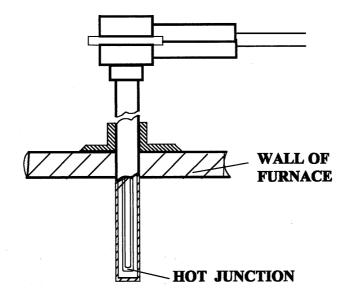
   (i)   Name the test;
   (ii)   Outline the principles of operation;
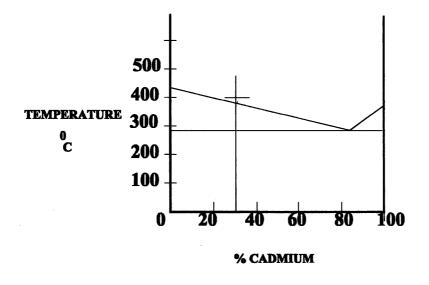   **(iii)**   Suggest a suitable application.

OVER→

3. (50 marks)

(a) Redraw the given iron-carbon diagram into your answer book and label the following phases.

  (i) Ferrite;
  (ii) Ferrite and Austenite;
  (iii) Ferrite and Pearlite;
  (iv) Austenite;
  (v) Austenite and Cementite;
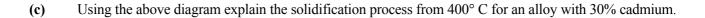 **(vi)** Cementite and Pearlite.

(b) **(i)** Define **any two** of the following terms.
       Ferrite; Pearlite; Cementite.

  (ii) Explain the effects on a 0.7% carbon steel when quenched rapidly from 900° C **and** cooled slowly from 900º C.

(c) Explain the operation of the thermoelectric pyrometer shown below.
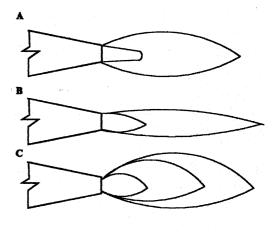
4.   **(50 marks)**

(a)   Select **any two** of the following terms and give a definition for each selected.

      (i)   Eutectoid point;

      (ii)   Dendritic growth;

      (iii)   Vacancy;

      (iv)   Solid solution.

(b)   Redraw the Cadmium - Zinc equilibrium diagram, given below, into your answer book and identify and explain each of the following terms.

      (i)   Liquidus;

      (ii)   Solidus;

      (iii)   Eutectic point.

(c)   Using the above diagram explain the solidification process from 400° C for an alloy with 30% cadmium.

5. **(50 marks)**

(a) Answer **any two** of the following.

    (i) What is meant by dissolved acetylene?

    (ii) Describe the three types of flame shown at (A), (B) and (C).

    (iii) Outline an application for each flame.

(b) Explain why it is necessary to protect the weld area from atmospheric contamination. Outline **three** main ways by which this protection is achieved.

(c) Describe, with the aid of a diagram, the main features, operation and application of **one** of the following welding processes.

    (i) Metal inert gas welding;
    (ii) Tungsten inert gas welding.

OR

(c) Explain the following terms in relation to robotic control in welding.

    (i) Lead through method of programming;
    (ii) Working envelope;
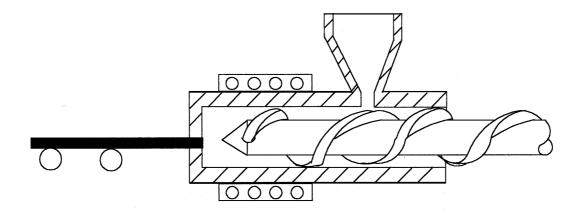   **(iii)** Machine vision.

6. (50 marks)

(a) Explain the type of polymerisation which occurs in the production of **each** of the following.

(i) Bakelite;
(ii) Polyvinylchloride;
(iii) Polyethylene.

(b) Describe the main differences between thermoplastics and thermosets under the following guidelines.
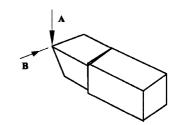
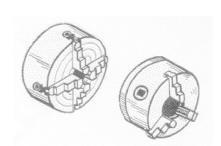(i) Chemical bonding; (ii) Properties; (iii) Internal structures.

(c) Describe, using the following guidelines, the process of extrusion shown below.
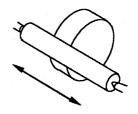
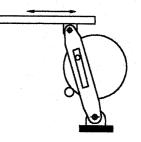(i) Equipment used;
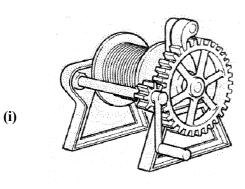(ii) Process;
(iii) A typical end product.

7. (50 marks)

(a) Answer **any three** of the following.

    (i) Identify the forces A and B acting on the cutting tool shown.
    (ii) Distinguish between Orthogonal and Oblique cutting forces.
    (iii) Describe an instrument for measuring cutting forces.
    (iv) Suggest how altering the rake angle would affect the shear plane angle.

(b) Answer **any two** of the following.

    (i) Distinguish between the two chucks shown and describe their applications.

    (ii) Name and outline the principles of operation of the grinding process shown.

    (iii) Describe the principles of operation of the quick-return mechanism shown.

(c) With reference to metrology, explain **any four** of the following terms.

    (i) Optical Projector;
    (ii) Sine Bar;
    (iii) Slip Gauges;
    (iv) Precision Balls;
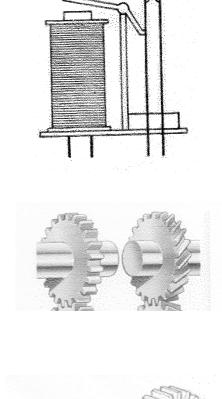   **(v)** Comparator.

OR

(c) With reference to CNC lathework, indicate the code used for **any four** of the following functions.

    (i) Tool change;
    (ii) Absolute dimensions;
    (iii) Spindle start/reverse;
    (iv) Continuation code;
    (v) Linear interpolation.

8.   **(50 marks)**

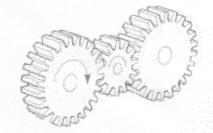**(a)**   Identify **any one** of the devices shown below and explain how it functions.

        (i)   **(ii)**
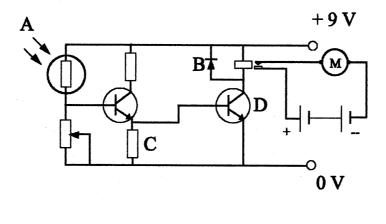
(b)   Answer **any two** of the following:

        (i)   State the advantages of helical toothed gears
                   over straight toothed gears as shown.

        (ii)   Describe **one** application of a rack and
                   pinion mechanism.

        (iii)   Name the gear train shown and describe the
                   purpose of the idler gear and outline
                   the relationship between driver
                   and driven gear.

(c)   Identify the electronic components labelled A, B, C, D, and outline an application for the circuit.

                                                   OR

(c)   Describe the operation of an automatic cross slide **or** an automatic carriage on a centre lathe.