M73

Coimisiún na Scrúduithe Stáit
State Examinations Commission

LEAVING CERTIFICATE EXAMINATION, 2006

ENGINEERING – MATERIALS AND TECHNOLOGY

(Higher level – 300 marks)

FRIDAY, 23 JUNE, MORNING 9.30 – 12.30

INSTRUCTIONS

1. Answer **Sections A and B of Question 1,** and **FOUR** 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. **(100 marks)**

SECTION A – 50 MARKS

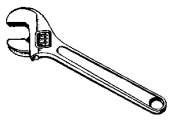
Give **brief answers** to **any ten** of the following:

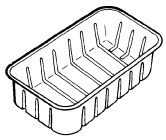
(a) State the purpose of **any one** of the safety symbols shown.

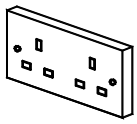
(b) State **two** factors that affect corrosion rates in metals.

(c) In oxy-acetylene welding what is meant by dissolved acetylene?

(d) Identify the main process used to manufacture **any two** of the items shown:







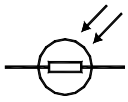
(i) **(ii)** **(iii)**

(e) Outline **two** safety precautions to be observed when working with toxic materials.

(f) Differentiate between a torsion force and a shear force.

(g) What contribution did **any one** of the following make to technology?
(i) Ivan Sikorsky, **(ii)** Theodore Maiman, **(iii)** Dugald Clerck.

(h) Identify and outline the function of **any one** of the electronic components shown:



(i) **(ii)**

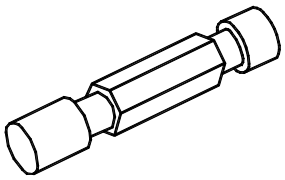
(i) List **two** essential advantages of using non-metals over metals.

(j) Describe the flotation separation method used in ore dressing.

(k) Explain the term copolymer.

(l) Select **any two** of the abbreviations shown and explain their meaning:
(i) CPU **(ii)** ISP **(iii)** CD-RW **(iv)** E-MAIL.

(m) Name and suggest a suitable application for the gauge shown.



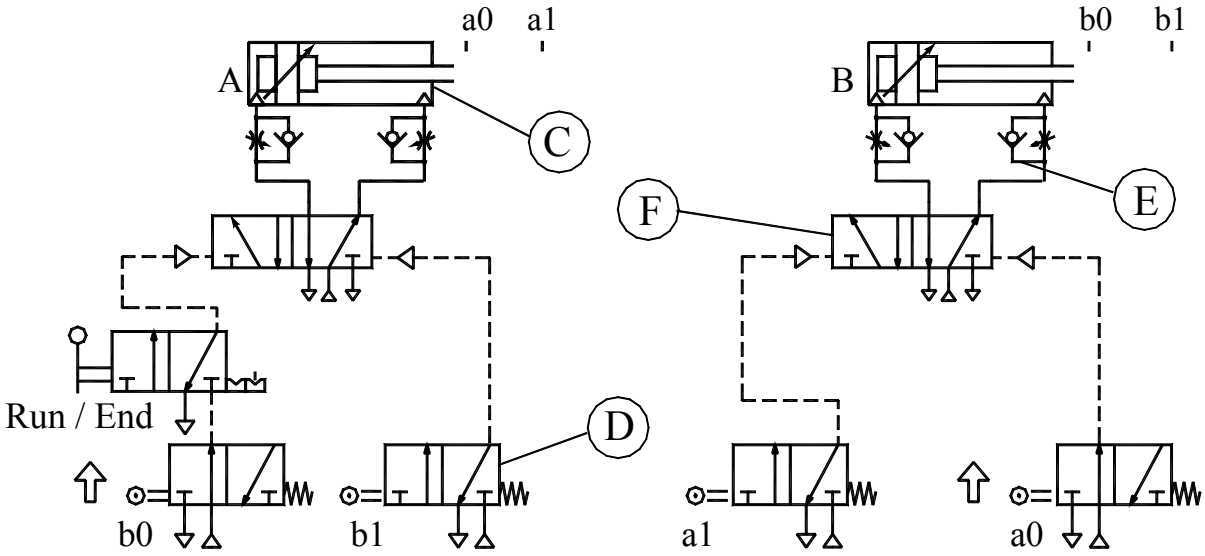
SECTION B – 50 MARKS
Answer **all** of the following:

(n) Outline **three** advantages of using pneumatic sequential control in industry.

(o) With reference to the pneumatic sequential control circuit shown:

(i) Name the components C, D, E and F;

(ii) Describe the function of **any two** components named.



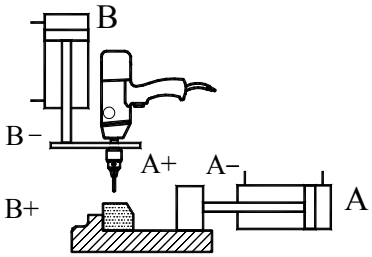
(p) With reference to pneumatic sequential control describe **any two** of the following:

(i) Cascade circuit, **(ii)** PLC, **(iii)** FRL.

(q) **(i)** State **two** industrial applications where pneumatic sequential control is used.

(ii) What are the benefits of using compressed air systems in industry?

(r) Utilising the diagram shown below, describe the sequence of operations which will ensure that the component is drilled safely.



2. **(50 marks)**

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

(i) Compare the indenters used in Brinell and Vickers hardness tests;

(ii) With reference to tensile testing, explain the elastic limit of a material;

(iii) Identify **two** factors necessary to prevent early fatigue failure in a component.

(b) The following data was obtained from a tensile test on a specimen of 10mm diameter and gauge length 60mm.

Load (kN)	**16**	**32**	**56**	**72**	**95**	**110**	**132**	**142**	**140**	**135**
Extension (mm)	**0.2**	**0.4**	**0.7**	**0.9**	**1.5**	**2.5**	**5.0**	**8.5**	**10.0**	**12.0**

Using the graph paper supplied, plot the load-extension diagram and determine:

(i) The tensile strength;

(ii) Young's Modulus for the specimen.

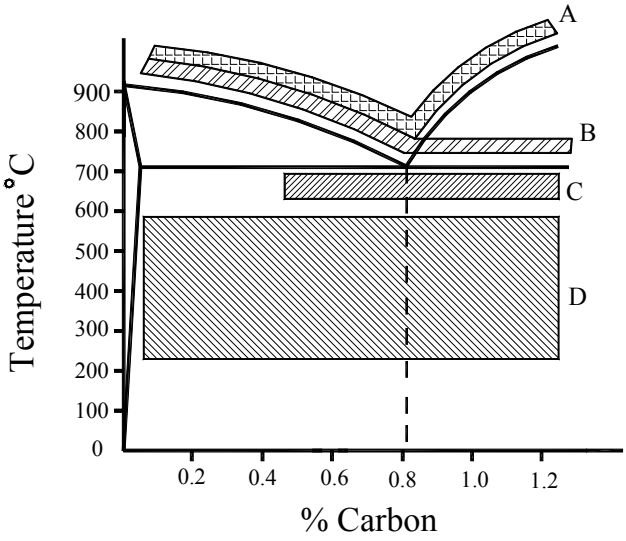
(c) **(i)** State **two** reasons why non-destructive tests are necessary in industry.

(ii) Describe, with the aid of a diagram, a test suitable for the detection of internal flaws.

3. **(50 marks)**

(a) Temperature zones, A, B, C and D, for a range of heat-treatment processes for carbon steel are shown below.

Select **any two** zones and explain the heat-treatment process that they represent.



(b) For **any two** of the following, differentiate between the terms:

(i) Ferrite and martensite;

(ii) Upper critical temperature and lower critical temperature;

(iii) Stainless steel and high speed steel;

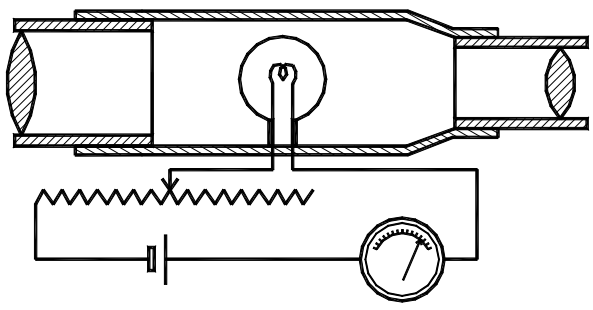
(iv) Eutectic and eutectoid point.

(c) With reference to the diagram shown below:

(i) Name the instrument;

(ii) State its function;

(iii) Outline the method of operation.



4. **(50 marks)**

(a) Explain **any two** of the following:

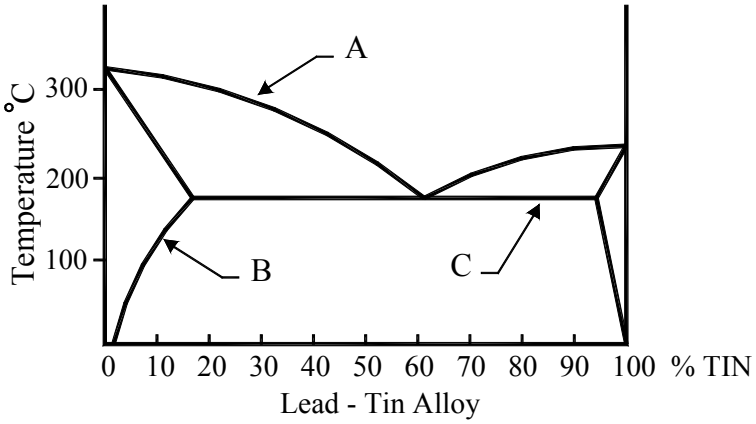
(i) Solid solution alloy;

(ii) Dendritic growth;

(iii) Allotropy;

(iv) Cooling curve.

(b) Copy the given lead-tin diagram into your answer book and answer **all** of the following:



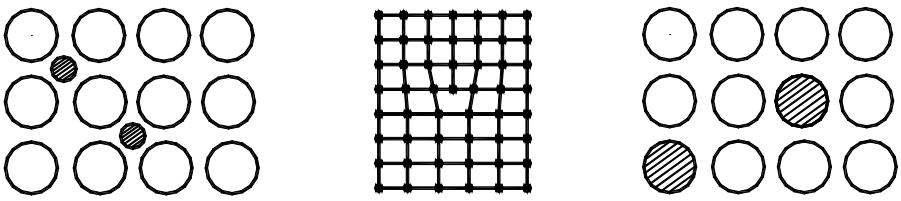
(i) Identify the lines labelled A, B and C;

(ii) Explain what **each** line represents;

(iii) For the alloy with 30% tin determine, from the diagram, the composition of the phases at 250°C;

(iv) Indicate clearly on your diagram the eutectic point.

(c) Describe **any two** of the crystal defects shown below.



(i) **(ii)** **(iii)**

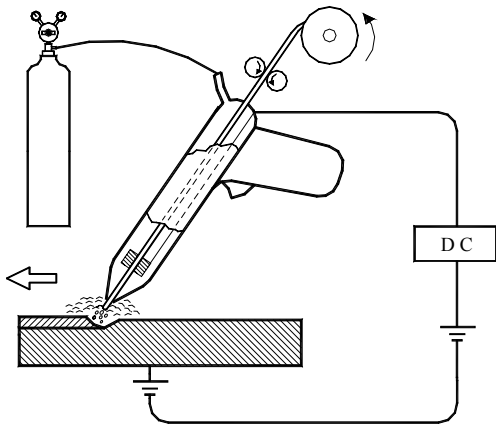
5. **(50 marks)**

(a) Describe the welding process shown using the following guidelines:

(i) Name;

(ii) Method of operation;

(iii) Applications.



(b) With reference to manual metal arc welding answer **any three** of the following:

(i) State **two** functions of the electrode coating;

(ii) Outline **two** important functions of the slag produced;

(iii) Explain the operation of a bridge rectifier;

(iv) Identify **three** potential safety hazards and suggest a suitable remedy for each.

(c) Describe, with the aid of a suitable diagram, the main features of **one** of the following:

(i) Resistance spot welding;

(ii) Tungsten inert gas welding.

OR

(c) **(i)** Outline the benefits of using robots in car assembly.

(ii) In robotic control explain the meaning of the working envelope.

6. **(50 marks)**

(a) Distinguish between thermoplastics and thermosetting plastics under **each** of the following guidelines:

(i) Chemical bonding;

(ii) Polymerisation process;

(iii) Internal structure;

(iv) Properties.

(b) State the function of **any three** of the following in relation to polymers:

(i) Filler;

(ii) Stabiliser;

(iii) Catalyst;

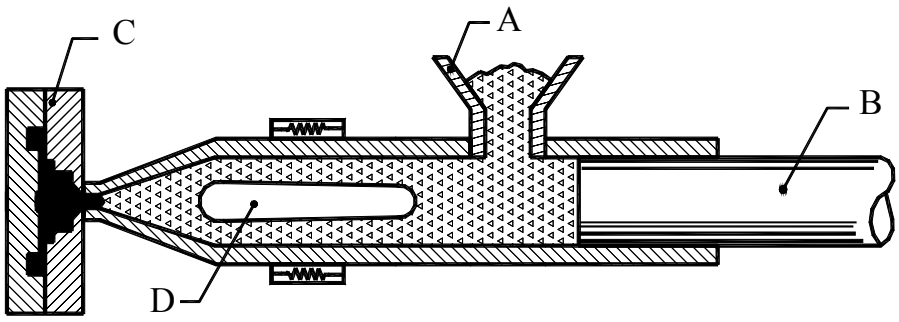
(iv) Foaming agent.

(c) Describe the process shown in the diagram below using the following guidelines:

(i) Name and describe the principle of operation;

(ii) Identify **one** component produced;

(iii) Name parts A, B, C and D.

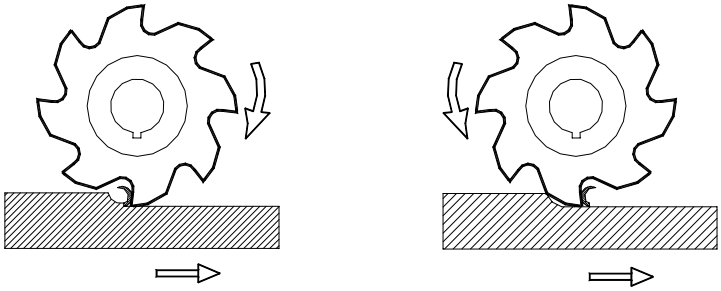


7. **(50 marks)**

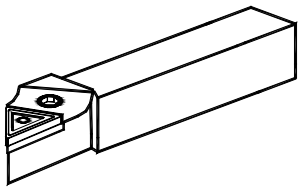
(a) Answer **any two** of the following:

(i) Identify **three** machining processes used to produce a cylindrical surface;

(ii) Differentiate between the milling operations shown below;



(iii) State **three** advantages of using the cutting tool shown below in a turning operation.



(b) Distinguish clearly between **any three** of the following:

(i) Loading and glazing;

(ii) Feeler gauge and drill gauge;

(iii) Rake angle and clearance angle;

(iv) Gang milling and straddle milling.

(c) Identify **two** safety hazards associated with **each** of the following:

(i) Using cutting fluids;

(ii) Machining mild steel.

OR

(c) With reference to CNC machining answer **any two** of the following:

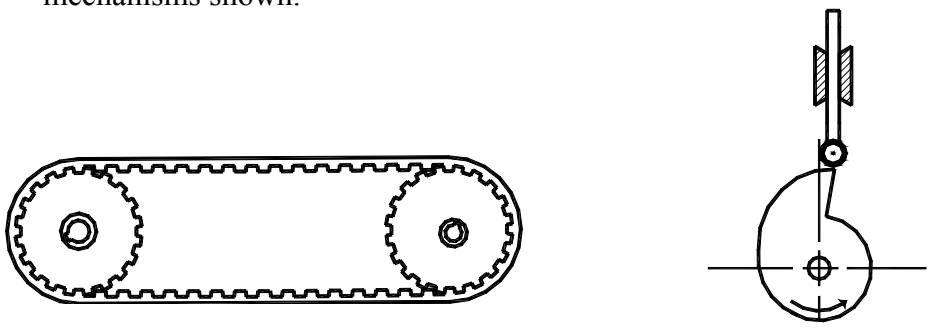
(i) Differentiate between incremental and absolute dimensioning;

(ii) Explain the operation of a stepper motor;

(iii) State **one** advantage of using a canned cycle when programming for machining.

8. **(50 marks)**

(a) Describe the operation and outline a suitable application for **one** of the mechanisms shown.



(i) **(ii)**

(b) Answer **any three** of the following:

(i) Explain the function of a compound gear train;

(ii) State **one** advantage of using gears over pulleys;

(iii) Outline the function of an idler gear;

(iv) Differentiate between bevel gears and worm gears;

(v) Describe **two** applications of a rack and pinion mechanism.

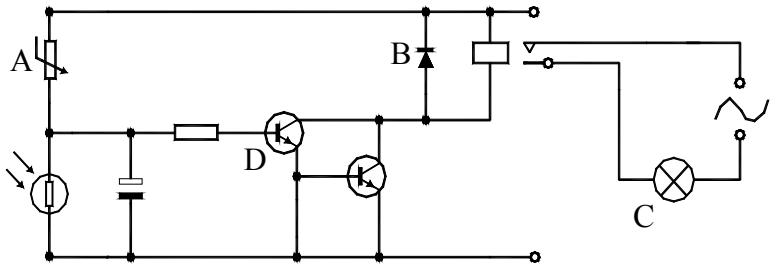
(c) Describe, with the aid of a diagram, the principle of operation of a power hacksaw.

OR

(c) With reference to the circuit shown below:

(i) Identify the electronic components A, B, C and D.

(ii) Explain the operation and suggest an application for the circuit.



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