Coimisiún na Scrúduithe Stáit
State Examinations Commission

LEAVING CERTIFICATE EXAMINATION, 2023

ENGINEERING – MATERIALS AND TECHNOLOGY

(Ordinary level – 200 marks)

THURSDAY, 8 JUNE MORNING 9:30 – 12:00

Answer any **FOUR** questions.

All questions carry equal marks.

The 2023 examination papers were adjusted to compensate for disruptions to learning due to COVID-19. This examination paper does not necessarily reflect the same structure and format as the examination papers of past or subsequent years.

Question 1. **(50 marks)**

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



remote-control technology

(a) State **one** application of remote-control technology.

(b) Explain the term *brittleness*.

(c) State **two** reasons why pilot holes are used when drilling.



thumbscrew

(d) List **one** advantage of using thumbscrews when assembling parts.

(e) Give **one** application of a strip heater when working with plastics.



tool A

(f) Identify tool **A** shown **and** give **one** application for it.

(g) Give **one** reason why it is important to wear ear protection when working in a workshop.

(h) Explain **any one** of the following:

(i) CAD Modelling, **(ii)** Artificial intelligence (AI), **(iii)** Electric vehicle.

(i) Explain the term *upcycling*.

(j) Describe the main operating features of **any one** of the following:



(i) Scissor jack,



(ii) Foot shears,



(iii) Soldering iron.

(k) Define *electrical conductor* in relation to the properties of metals **and** name **one** metal which is used as an electrical conductor.

(l) Explain **any one** of the following:

(i) Pop riveting, **(ii)** Countersinking, **(iii)** Blind hole.

(m) List **two** benefits of using cutting fluids when machining.



Question 2. **(50 marks)**

(a) Explain **any three** of the following furnace-related terms:

(i) Water-cooled oxygen lance, **(ii)** Pig iron, **(iii)** Carbon electrodes, **(iv)** Iron ore.

(b) With the aid of a labelled diagram, describe the operation of **any one** of the following furnaces:

(i) Blast furnace, **(ii)** Basic oxygen furnace, **(iii)** Electric arc furnace.

(c) Electric go-karts have become popular in recent years. You have been asked to manufacture an electric go-kart suitable for a teenager.

(i) Name a suitable material for **each** of the parts labelled on the electric go-kart below.

(ii) State **one** reason for the selection of **each** material.



(d) Car wheel rims are often manufactured from a metal alloy.



(i) Explain the term **alloy**.

(ii) Name **one** metal alloy **and** name the metals used in its production.

Question 3. **(50 marks)**

(a) Explain **any two** of the following heat treatment procedures:

(i) Annealing, **(ii)** Case hardening, **(iii)** Quenching.

(b) Kitchen knives are hardened and tempered during manufacture.



(i) What effect does hardening have on steel?

(ii) Describe the tempering process.

(c) Identify **two** safety precautions to be observed when working with hot metals.



(d) Explain **any two** of the following metal properties:

(i) Toughness, **(ii)** Ductility, **(iii)** Malleability.

OR

(d) **(i)** Describe **two** areas where robotic technology is used in health care.

(ii) State **two** ways in which exoskeleton suits can help the recovery process.



Question 4. **(50 marks)**



(a) **(i)** Name **two** common gases used in gas welding.

(ii) Name **two** types of flame produced when gas welding.

(iii) State **two** safety precautions that should be followed when gas welding.

(b) State the function of **any three** of the following in manual metal arc welding:



(i) Welding plant,



(ii) Chipping hammer,



(iii) Leather apron,



(iv) Electrode holder.

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



(i) Explain why a passive flux is used when soldering electrical circuits.

(ii) Name **one** process that can be used to permanently join sheet metals.

(iii) Give **one** reason why it is important to clean grease and corrosion from joints before soldering.

(iv) Name the cutting tool shown **and** state a suitable use for it.

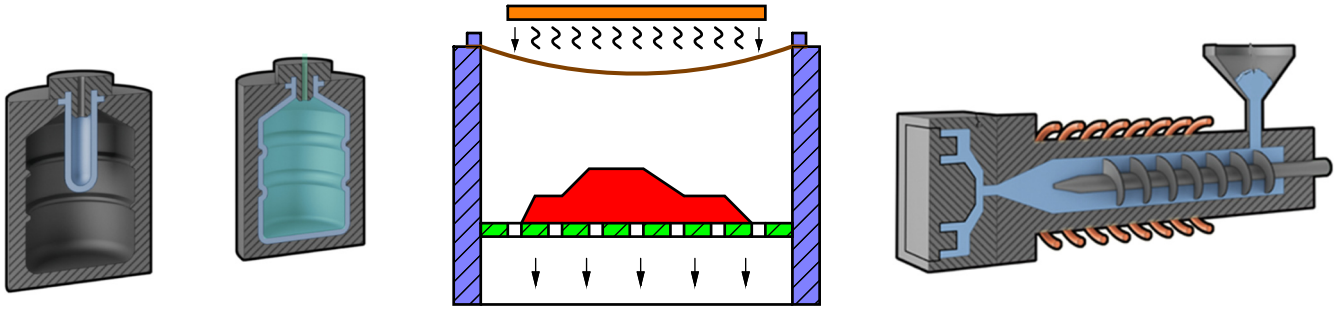


cutting tool

(d) State **two** safety precautions to be observed when working with adhesives.

Question 5. **(50 marks)**

(a) **(i)** Name the **three** plastic manufacturing processes shown at **A**, **B** and **C**.



A **B** **C**

(ii) Describe with the aid of a labelled diagram **any one** of the manufacturing processes named by you at **5(a)(i)** above.

(b) In relation to plastic technology, describe **any three** of the following:

(i) Elastic memory;

(ii) Thermosetting plastics;

(iii) Plastic dip coating;

(iv) Thermoplastic.

(c) Select **any two** of the products shown below and name a plastic material which is suitable for the manufacture of **each** product:



(i) Toy car, **(ii)** Bevel gears, **(iii)** Electrical socket, **(iv)** Food container.

(d) State **two** safety precautions to be observed when working with hot plastics.

Question 6. **(50 marks)**

(a) Name **any three** of the lathe parts shown at **A**, **B**, **C** and **D**.



A



B



C



D

(b) Explain **any three** of the following in relation to machining:

(i) Clearance angle, **(ii)** Spindle speed, **(iii)** Rake angle, **(iv)** Feed.

(c) The thumbscrew shown opposite was manufactured on a lathe.



thumbscrew

(i) Name **two** lathe processes used in the manufacture of the thumbscrew.

(ii) Describe **one** of the processes named by you, at **6(c)(i)** above.

(iii) Name **two** items of personal protective equipment (PPE) that should be worn when operating a lathe.

OR

(c) 3D printing is now a popular CNC process.



(i) What does CNC stand for?

(ii) Identify **one** other CNC process.

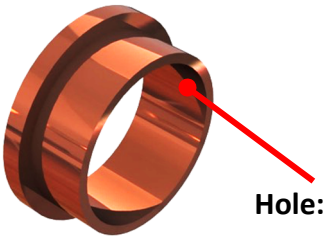
(iii) List **two** advantages of using CNC machines in manufacturing.

Question 7. **(50 marks)**

(a) Explain **any two** of the following terms in relation to limits and fits:

(i) Clearance fit, **(ii)** Upper limit, **(iii)** Transition fit.

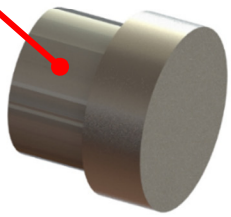
(b) A copper fitting and a steel shaft are machined to the dimensions shown below.



Hole: Ø16.0 ± 0.03 mm

copper fitting

Shaft: Ø16.0 ± 0.05 mm



steel shaft

State the: **(i)** Largest diameter of the **hole** in the copper fitting.

(ii) Nominal diameter of the **shaft**.

(iii) Smallest diameter of the **shaft**.

(iv) Tolerance of the **hole** in the copper fitting.

(c) Name **any three** of the instruments shown **and** give **one** application of **each** instrument named.



(i)



(ii)



(iii)



(iv)

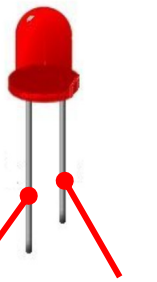
OR

(c) Answer **all** of the following:

(i) State **one** use of a solenoid.

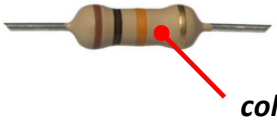


(ii) Why does the light emitting diode shown have one long leg and one short leg?



long leg ***short leg***

(iii) State the function of the colour bands on the fixed resistor shown.



colour bands