

1501/105
FABRICATION TECHNOLOGY,
MATERIALS AND METALLURGY
June/July 2020
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL
CRAFT CERTIFICATE IN MECHANICAL ENGINEERING
(PRODUCTION OPTION)

MODULE I

FABRICATION TECHNOLOGY, MATERIALS AND METALLURGY

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

Answer booklet;

Drawing instruments;

Mathematical tables/Scientific calculator.

This paper consists of EIGHT questions in TWO sections; A and B.

Answer FIVE questions choosing at least TWO questions from each section.

All questions carry equal marks.

Maximum marks for each part of a question are indicated.

Candidates should answer the questions in English.

This paper consists of 4 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

SECTION A: FABRICATION TECHNOLOGY

Answer at least TWO questions from this section

1. (a) (i) Explain the importance of safety in the workshop.
(ii) State **two** factors which enhance safety in the workshop. (4 marks)
- (b) Outline the first aid procedure for a victim of electric shock. (4 marks)
- (c) Describe each of the following types of fire and state **two** extinguishers for each:
(i) class A;
(ii) class B. (4 marks)
- (d) (i) Define soft soldering.
(ii) List **two** soldering tools.
(iii) Differentiate between active and passive fluxes.
(iv) State **two** applications of soldering. (8 marks)
2. (a) (i) State **two** applications of vernier caliper.
(ii) With the aid of a sketch, show how 0.02 mm accuracy of a vernier caliper is obtained. (6 marks)
- (b) Illustrate the location of the centre of a round bar by the use of a combination set. (4 marks)
- (c) (i) Illustrate the use of studs as applied to mechanical fastening.
(ii) Sketch single riveted double strap butt joint. (6 marks)
- (d) With the aid of a sketch, explain swaging with regard to hand forming operations. (4 marks)
3. (a) (i) List **two** components of oxyacetylene gas welding equipment.
(ii) State **three** ways of caring for the oxyacetylene gas hoses. (5 marks)
- (b) Outline the procedure for testing for leaks in oxyacetylene welding equipment. (5 marks)
- (c) (i) Define hemming as applied to sheet metal work.

- (ii) Illustrate the application of paned down seam in sheet metal work. (4 marks)
- (d) Sketch each of the following sheet metal work tools and state two applications of each:
- (i) hatchet stake;
 - (ii) creasing iron.
- (6 marks)
4. (a) (i) State **three** types of arc welding processes.
- (ii) State **three** personal protective equipment for arc welding personnel. (6 marks)
- (b) Sketch each of the following welding joints:
- (i) single vee butt joint;
 - (ii) corner joint;
 - (iii) edge joint;
 - (iv) lap joint.
- (8 marks)
- (c) Make sketches to show each of the following welding defects:
- (i) underact;
 - (ii) overlap;
 - (iii) lack of penetration.
- (6 marks)

SECTION B: MATERIALS AND METALLURGY

Answer at least TWO questions from this section.

5. (a) (i) Differentiate between elasticity and plasticity as applied to material properties.
- (ii) State **two** forms of supply of engineering materials. (4 marks)
- (b) (i) Define thermal equilibrium diagram.
- (ii) Differentiate between liquids and solids on a thermal equilibrium diagram. (4 marks)
- (c) State **two** applications of each of the following types of cast iron:
- (i) grey;
 - (ii) blackheart;
- (4 marks)

- (d) (i) Sketch and label the cupola furnace.
(ii) List the material charged into the cupola furnace for the production of cast iron. (8 marks)
6. (a) (i) Describe the process of pack carburising of steels.
(ii) Differentiate between full annealing and tempering as applied to heat treatment. (9 marks)
- (b) (i) Explain anodising of aluminium alloys.
(ii) With the aid of a sketch, explain cathodic protection of a boat hull. (7 marks)
- (c) State **four** categories of bearing materials. (4 marks)
7. (a) (i) State **two** properties and **two** applications of copper.
(ii) State **one** application of each of the following copper alloys:
(I) admiralty gun metal;
(II) gilding metal; (6 marks)
- (b) (i) List **two** types of rubber.
(ii) State **two** properties and **two** applications of rubber. (6 marks)
- (c) Distinguish between:
(i) ceramics and composites;
(ii) thermoplastics and thermosetting plastics. (8 marks)
8. (a) State **three** effects of each of the following alloying elements on steel:
(i) chromium;
(ii) nickel. (6 marks)
- (b) (i) List **two** applications of stainless steels.
(ii) Explain **three** advantages of alloy steels over plain carbon steels. (8 marks)
- (c) Describe the following classes of steel and state **one** application of each:
(i) mild steel;
(ii) high carbon steel. (6 marks)

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