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2509/106
WORKSHOP TECHNOLOGY,
MATERIALS AND METALLURGY
June/July 2016
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN MECHANICAL ENGINEERING (PLANT OPTION, CONSTRUCTION PLANT OPTION) DIPLOMA IN AUTOMOTIVE ENGINEERING

MODULE I

WORKSHOP TECHNOLOGY, MATERIALS AND METALLURGY

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

- *Answer booklet;*
- *Drawing instruments.*

*This paper consists of **TWO** sections **A** and **B**.*
*Answer any **THREE** questions from section **A** and any **TWO** questions from section **B**.*
Maximum marks for each part of a question are indicated.
Candidates should answer the questions in English.

This paper consists of 3 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: WORKSHOP TECHNOLOGY (60 marks)

*Answer any **THREE** questions from this section.*

1. (a) Define the following terms as used in metal working processes:
   (i) hot working;
   (ii) cold working. (2 marks)

   (b) List **four** advantages of a "hot worked" metal product. (4 marks)

   (c) With the aid of a sketch, illustrate the use of top and bottom chisels to cut a metal bar. (5 marks)

   (d) With the aid of a diagram, illustrate the following mills:
   (i) four-high rolling mill;
   (ii) two-high rolling mill. (9 marks)

2. (a) (i) List **three** types of files classification according to the cut of the teeth.

   (ii) Using a sketch, illustrate the following:
   - single cut file;
   - double cut file. (5 marks)

   (b) Outline the procedure of tapping a blind hole. (5 marks)

   (c) (i) Explain **three** classifications of fires.
   (ii) State the applicable fire extinguisher for each type of fire in (i) above. (10 marks)

3. (a) (i) Sketch a labelled diagram of an outside micrometer;
   (ii) Illustrate a reading of **7.22 mm** on an outside micrometer. (7 marks)

   (b) (i) With the aid of sketches, explain the **two** bases of limit systems;
   (ii) Illustrate **three** types of fits giving a typical application for each fit. (13 marks)

4. (a) (i) Define the term 'brazing'.
   (ii) Outline the procedure of brazing two pieces of metal. (4 marks)

   (b) Sketch the following gas welding flames and state on application for each.
   (i) neutral flame;
   (ii) oxidising flame;
   (iii) carburising flame. (6 marks)

   (c) Illustrate the following types of weld joints and state an application for each:
   (i) double U-butt;
   (ii) double V-butt;
   (iii) fillet weld;
   (iv) spot weld. (10 marks)

SECTION B: MATERIALS AND METALLURGY (40 marks)

Answer any TWO questions from this section.

5. (a) State **three** properties of a good bearing material. (3 marks)

(b) (i) Define the term "heat treatment".

(ii) State **four** reasons why heat treatment is done on metals.

(iii) Explain the following heat treatment processes stating an application for each:

(I) case hardening;
(II) nitriding;
(III) tempering. (17 marks)

6. (a) (i) Explain the difference between ferrous metals and non-ferrous metals stating an example for each.

(ii) List **four** types of plain cast irons. (5 marks)

(b) Explain the following types of steels and state an application for each:

(i) heat resisting steels;
(ii) stainless steels;
(iii) high speed steels. (6 marks)

(c) Illustrate the following space latices stating **two** examples for each:

(i) body centred cubic;
(ii) face centred cubic;
(iii) close packed hexagonal. (9 marks)

7. (a) Explain the effect of the following elements in cast iron:

(i) silicon;
(ii) sulphur;
(iii) manganese;
(iv) phosphorous. (4 marks)

(b) (i) State the purpose of flux in a blast furnace;

(ii) With the aid of a sketch, describe the operation of the direct arc electric furnace. (16 marks)

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