# THE UNITED REPUBLIC OF TANZANIA
# NATIONAL EXAMINATIONS COUNCIL
# CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

**092** **WORKSHOP TECHNOLOGY**

(For Both School and Private Candidates)

**Time: 3 Hours** **Wednesday, 13th November 2013 a.m.**

**Instructions**

1. This paper consists of sections A, B and C.
2. Answer **all** questions in sections A and B, and **three (3)** questions from section C.
3. Calculators and Cellular phones are **not** allowed in the examination room.
4. Write your **Examination Number** on every page of your answer booklet(s).

## SECTION A (10 Marks)

Answer **all** questions in this section.

1. For each of the items (i) – (x), choose the correct answer from among the given alternatives and write its letter beside the item number.

(i) Synthetic materials fall under the group of
A metals B non-metals C alloyed metals
D light metals E non-ferrous metals.

(ii) The main three products obtained from pig iron are
A round bars, square and wire B cast iron, mildsteel, aluminium
C tool steel, mild steel, copper D cast iron, wrought iron, steel
E iron ore, coke, limestone.

(iii) Three case hardening methods used in heat treatment are
A spherodizing, black heart and preheating
B cyaniding, nitriding and spherodizing
C carburizing, nitriding and flame hardening
D black heart, gas carburizing and spherodizing
E spherodizing, gas carburizing and nitriding.

(iv) Medium carbon steel alloyed with chromium is known as
A high carbon steel B silver steel C stainless steel
D alloyed steel E high speed steel.

(v) The right procedure of mixing coolant oil to make cutting fluid is to
A add water to coolant oil and steer
B warm the coolant oil and mix with water
C warm both coolant oil and water to 5 $^0$C and mix them
D mix soapy water with coolant oil at a ratio of 1:1
E mix sulphurised fatty oil with coolant oil.

(vi) In the workshop, rusted metallic materials can be identified by
A colour, weight and shape B sound, grinding and cutting
C shape, grinding and cutting D punching and bending
E scraping the rusted area.

(vii) Toughness gives metals the ability to
A resist force or plastic change
B spring out when acted upon by a force
C return to original shape when unloaded
D withstand shock or impact
E resist wear when they slide on each other.

(viii) Limit gauges are used as

A hole measuring tools
B stopping tools
C surface measuring tools
D inspection tools
E threads measuring tools.

(ix) What type of fit occurs when a shaft is made equal in diameter to the hole?

A Transition
B Interference
C Clearance
D Neutral fit
E Free-fit

(x) Upsetting is the process of

A reducing cross-section of a bar and increasing length
B increasing the length of a bar and the cross-section
C reducing the diameter of a tube and length
D increasing the cross-section of a bar and shortening the length
E reducing the weight of a bar by making it hollow.

## SECTION B (30 Marks)

Answer **all** questions in this section.

2. (a) Name any three types of plain carbon steel which are commonly used.
   (b) What are the three metals which cannot be ground during spark testing for metal identification purposes?

3. (a) What is the purpose of processing the iron ores in the crushing machine before smelting?
   (b) Define the term 'sintering of iron ore'.

4. (a) Compare cast iron and mild steels in visual identification of metals.
   (b) A piece of carbon steel is tested by grinding giving white short sparks in cloud form. What type of carbon steel is it?
   (c) What is malleable iron?

5. State the properties imparted by the following metals when alloyed to steel:
   (a) Tungsten
   (b) Manganese
   (c) Copper

6. Recommend one type of material suitable for making each of the following components:
   (a) Drilling machine base
   (b) Coil springs
   (c) Cold chisels

7. Define the following terms used in steel processing:
   (a) Ingots
   (b) Killing the steel
   (c) Segregation

8. What are the correct methods of cooling when the following heat treatment processes are carried out?
   (a) Normalizing
   (b) Annealing
   (c) Hardening

9. (a) Distinguish the applications of white bearing metals from that of bronze bearing metals.
   (b) What is red shortness of steel?

10. Determine the appropriate type of fit to be used for the following components:
   (a) Bearing's outer ring in its housing
   (b) Locating plugs and dowels
   (c) Keyed pulley on a shaft
   (d) Wheels and hubs on shafts
   (e) Drilling machine spindle in its housing
   (f) Idler pulleys on their shafts

11. (a) Distinguish elasticity from plasticity.
   (b) What happens to a material when the force applied to it exceeds elastic limit?

## SECTION C (60 Marks)

Answer **three (3)** questions from this section.

12. (a) (i) When will you recommend carburizing of steel? Give two outstanding reasons.
   (ii) Briefly explain how pack carburizing process is carried out. **(10 marks)**

   (b) (i) List down any six layout instruments.
   (ii) What is the difference between a vernier caliper and an inside caliper? **(06 marks)**

   (c) Explain three advantages and one disadvantage of soluble oil over straight oil (neat cutting mineral oil). **(04 marks)**

13. (a) Distinguish between the following:
   (i) Quenching and tempering.
   (ii) Steel and cast iron with reference to their carbon content and tensile strength.
   (iii) Hot working and cold working regarding the temperature, hardness and finish. **(09 marks)**

   (b) Briefly explain how toughness of a material can be measured by Charpy test. Use a sketch to elaborate the specimen setup. **(05 marks)**

   (c) (i) When steel is heated to the critical range solid solution of carbon (austenite) occurs. Explain other three changes which occur during this process.
   (ii) Account for responsibility of cracking and warping of metals during quenching process. **(06 marks)**

14. (a) (i) Why hole basis system is preferred to shaft basis system?
(ii) Explain unilateral and bilateral tolerances. State their advantages and disadvantages. **(08 marks)**

(b) What do the following terms mean when used in limits and fits systems.
(i) Basic size
(ii) Actual size
(iii) Allowance
(iv) Fit **(04 marks)**

(c) It is difficult and sometimes not possible to obtain an exact dimension of a component during manufacturing. Justify this statement by giving four reasons. **(04 marks)**

(d) (i) What do you understand by the term corrosion of metals?
(ii) Compare the corroding of steel to that of nickel.
(iii) Distinguish tinplating from galvanizing processes. **(04 marks)**

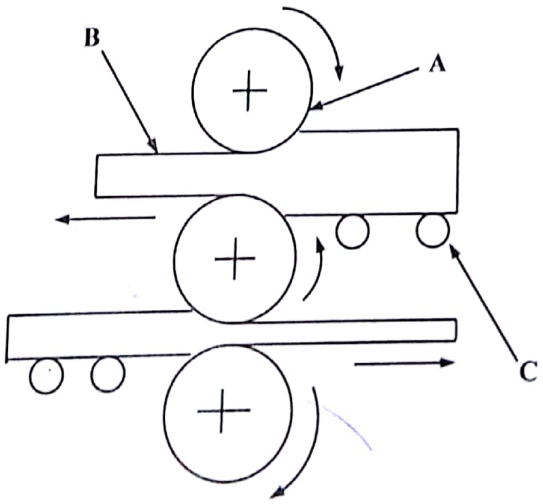
15. (a) How does the use of cutting lubricants promote production in metal works? Explain four factors. **(08 marks)**

(b) Explain two ways in which heat is generated during metal cutting. **(02 marks)**

(c) What is the function of the following cutting fluid additives?
(i) Amines and nitrites
(ii) Phosphates and borates
(iii) Soaps and wetting agents
(iv) Glycols
(v) Germicides **(05 marks)**

(d) State any five factors to be observed so as to achieve successful and safe sawing with a hand hacksaw. **(05 marks)**

16. (a) The Figure below represents one type of steel processing machine arrangement.




(i) Give the name of the machine.

(ii) State what is represented by parts labeled A, B and C.
(iii) What is the name of this arrangement.
(iv) Briefly explain how it works. **(09 marks)**

(b) Enumerate three advantages and two disadvantage of hot steel processed by this machine. **(7.5 marks)**

(c) (i) How can you overcome the deflection problem on part A of the machine?
(ii) Distinguish between forging and casting. **(3.5 marks)**