THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

095 FITTING AND TURNING

(For Both School and Private Candidates)

Time: 3 Hours **ANSWERS** **Year: 2015**

Instructions

1. This paper consists of SIXTEN questions.

2. Answer all questions in section A and B and three questions from section C.

1. (i) The algebraic difference between the minimum limit and the basic size is called
A. Actual deviation
B. Upper deviation
C. Lower deviation
D. Fundamental deviation
E. Basic deviation

Correct answer: C. Lower deviation
Reason: Lower deviation is the difference between the minimum size and the basic size.

(ii) The cold chisels are made by
A. Drawing
B. Rolling
C. Piercing
D. Forging
E. Turning

Correct answer: D. Forging
Reason: Cold chisels are formed by forging high-carbon steel to shape and harden them.

(iii) A two high rolling mill consists of two rolls which rotate at
A. The same speed but in opposite direction
B. Different speeds and in the same direction
C. The same speed and in the same direction
D. Different speeds and in the opposite direction
E. The same speed but one is following behind

Correct answer: A. The same speed but in opposite direction
Reason: The rolls rotate toward each other to pull the workpiece between them for compression.

(iv) In the sheet metal work, the cutting force on the tool can be reduced by
A. Increasing the hardness of the tool
B. Grinding the cutting edges sharp
C. Increasing the speed of cutting
D. Decreasing the hardness of the tool
E. Increasing the hardness of the die

Correct answer: B. Grinding the cutting edges sharp
Reason: Sharp edges reduce friction and cutting resistance, thereby reducing force.

(v) When drilling on a lathe machine, the drill is forced into the work by
A. Engaging the cross feed
B. Turning the tailstock hand wheel

C. Turning the compound rest handle
D. Engaging the longitudinal feed
E. Using carriage hand wheels

Correct answer: B. Turning the tailstock hand wheel
Reason: The tailstock holds and feeds the drill into the rotating workpiece.

(vi) The combination of several cutters in the milling operation is called
A. Double angle milling cutters
B. Multiple milling cutters
C. Straddle milling cutter
D. Gang milling cutters
E. Heavy milling cutter

Correct answer: D. Gang milling cutters
Reason: Gang milling uses multiple cutters mounted on an arbor to perform different cuts in one pass.

(vii) During marking exercise, dividers are used for
A. Scribing centres and lines
B. Scribing circles and arcs
C. Scribing centres and circles
D. Scribing centres and arcs
E. Scribing circles and lines

Correct answer: B. Scribing circles and arcs
Reason: Dividers are designed to create arcs and circles by rotating one leg around the center.

(viii) Which of the following are examples of permanent metal joining?
A. Bolts and Brazing
B. Brazing and Riveting
C. Riveting and Screwing
D. Gas Welding and Bolts
E. Gas Welding and Brazing

Correct answer: E. Gas Welding and Brazing
Reason: Both gas welding and brazing produce permanent joints by fusing or bonding materials together.

(ix) The instrument which has all the features of try-square, level, protractor, rule and scriber is known as
A. Outside micrometer
B. Inside micrometer
C. Depth gauge micrometer
D. Vernier caliper
E. Combination set

Correct answer: E. Combination set
Reason: A combination set includes multiple tools integrated for measuring, checking levels, and marking angles.

(x) The name of a file is derived from
A. Cross sectional area
B. Longitudinal length
C. Width surface area
D. Traverse width
E. Length of shank

Correct answer: E. Length of shank
Reason: Files are named based on the length of their cutting surface or shank, not including the tang.

SECTION B

2. Name the three most useful materials to make lathe cutting tools.
High-speed steel – commonly used for general-purpose cutting due to its hardness and heat resistance.
Carbide – offers superior wear resistance and is used for high-speed and heavy-duty cutting.
Ceramics – used in high-speed finishing operations for their hardness and ability to retain sharpness.

3. List three parts of the shaper used in setting the position of stroke.
Ram – carries the cutting tool and moves back and forth.
Saddle – supports and allows horizontal movement of the table.
Table – holds the workpiece and adjusts vertically and horizontally for setting stroke position.

4. Sketch the diagrams of the following operations performed in a drilling machine:
(a) Spot facing – smooths a flat surface around a hole for bolt heads or washers.
(b) Counter sinking – creates a conical hole to allow screws to sit flush with the surface.

5. (a) What factors determines the performance of power hacksaw blade?
Material of the blade, teeth per inch, blade tension, and feed rate.

(b) What is the purpose of clapper box of shaping machine?
The clapper box allows the cutting tool to lift slightly on the return stroke, preventing drag or damage to the workpiece.

6. Name the three categories of safety.
Mechanical safety – related to moving parts and machinery operation.
Electrical safety – involving correct insulation and grounding of machines.
Personal safety – includes wearing PPE and safe working behavior.

7. (a) Briefly state the use of hammers in fitting and turning workshops.
Hammers are used for driving tools, assembling parts, marking, and shaping workpieces in fitting and turning operations.

(b) Find the tolerance of the dimension $10.00^{+0.025}_{-0.035}$
Tolerance = upper limit - lower limit = 0.025 + 0.035 = 0.060 mm

8. Mention three ways on how rivets are classified.
By head shape (e.g., pan head, snap head)
By material (e.g., aluminum, steel, copper)
By application method (e.g., solid rivets, blind rivets)

9. Give three advantages of a radial drilling machine over the other type of drilling machine.
It can drill large and heavy workpieces without moving them.
The arm and head can be adjusted for drilling at different angles and positions.
It allows multiple operations like boring, tapping, and counterboring on large jobs.

10. Differentiate Accuracy from Precision.
Accuracy refers to how close a measurement is to the true value.
Precision refers to how consistent repeated measurements are, regardless of how close they are to the true value.

11. Give two reasons for providing folded edge on items made from sheet metal.
To increase the strength and stiffness of the edge.
To eliminate sharp edges for safety and better appearance.

12. (a) State five grades of file and for each grade state its application.
Rough file – used for removing large amounts of material quickly on rough surfaces.
Second cut file – used for shaping and general-purpose filing with moderate material removal.
Smooth file – used for finishing work with fine material removal.
Dead smooth file – used for fine finishing and delicate filing.
Bastard file – intermediate between rough and second cut, used for rapid stock removal on harder materials.

(b) State five precautions that must be taken to keep a file in good cutting condition and properly.
Avoid using a file without a proper handle to prevent hand injuries.
Do not use excessive pressure; let the file cut naturally.
Store files separately to prevent teeth damage from contact.
Clean files with a file card to remove metal chips (pinning).
Apply chalk on the file before use to reduce clogging and wear.

13. (a) Name the parts labeled a, b, c, d, and e of the apparatus in Figure 1.
a – Square head
b – Workpiece

c – Pulley or belt
d – Tool post
e – Center

(b) Briefly explain the functions of the parts of the apparatus in Figure 1.
a – Square head guides and supports linear movement.
b – Workpiece is the material being machined.
c – Pulley or belt transmits rotational power from the motor to the spindle.
d – Tool post holds the cutting tool during machining.
e – Center supports the end of the workpiece for alignment and rotation.

(c) Describe the steady rest as used with lathe machine.
The steady rest is a fixed support used to hold long, slender workpieces during turning to prevent deflection or vibration. It consists of adjustable arms with rollers or bearings that rest against the workpiece surface, keeping it stable during rotation.

14. (a) Explain five functions of coolant used in machining processes.
Cools the cutting tool and workpiece to prevent overheating.
Lubricates the cutting zone to reduce friction.
Washes away metal chips from the cutting area.
Improves surface finish by reducing tool wear.
Extends tool life by maintaining temperature and cleanliness.

(b) Briefly describe the importance of soap and straight oils in cutting fluids.
Soap oils act as emulsifiers and help create stable oil-water mixtures, improving lubrication and cooling.
Straight oils provide excellent lubrication and are used in heavy-duty operations to minimize tool wear and friction.

(c) Briefly describe the two accessories of a lathe machine in Figure 2 (i) and (ii).
(i) Three-jaw chuck – a self-centering chuck used to hold round or hexagonal workpieces symmetrically.
(ii) Four-jaw chuck – an independent chuck where each jaw moves separately, used for irregularly shaped or square workpieces.

15. (a) Enumerate four methods used to hold the workpiece in a milling machine.
Using machine vice – secures flat and square workpieces.
Using T-bolts and clamps – holds large or irregular workpieces directly on the table.
Using angle plate – supports vertical or angled workpieces.
Using fixtures – specially designed devices for repeatable holding and machining.

(b) Describe hand lapping and machine lapping.
Hand lapping involves rubbing the workpiece manually with abrasive and a lapping plate to produce a fine finish or accurate surface.

Machine lapping uses mechanical equipment with rotating or oscillating lapping plates to automate and control the lapping process for precision work.

(c) Calculate the number of complete revolutions and parts of a revolution that the index crank must be turned for a workpiece to be divided into 15 parts.

Use the formula:
Crank movement = 40 / N = 40 / 15 = 2 10/15 = 2 2/3 revolutions
Choose a plate with holes divisible by 3, such as 27.

Partial rotation: 2/3 of 27 = (2 × 27)/3 = 18 holes

So, 2 full revolutions + 18 holes on 27-hole circle.

16. (a) (i) Sketch a fully labeled ball-pein hammer.
[Sketch not shown here, but labels include: handle, face, neck, pein, and head]

(ii) Identify the material used for making a ball-pein hammer and briefly describe how ball-pein hammer is made.
The head is made from high carbon steel or forged steel, hardened and tempered. The process includes forging, machining, heat treating, and polishing the surface.

(iii) Briefly explain two safety precautions to be observed when using ball-pein hammer.
Ensure the handle is tightly fixed to the head to avoid detachment during use.
Always strike with the correct part (face) and avoid using the hammer on hardened or brittle surfaces that may chip.

(b) Briefly describe the following with regard to grinding wheel:
(i) Grit – Refers to the size of abrasive particles. Smaller grit numbers mean coarser particles, while higher numbers indicate finer grit.
(ii) Grade – Indicates the strength with which the bond holds abrasive grains. Soft grades release grains easily, while hard grades retain them longer.
(iii) Structure – Describes the spacing between abrasive grains. Open structures have wider spaces for chip removal, while dense structures give smoother finishes.
(iv) Bond – Refers to the material holding abrasive particles together, such as vitrified, resin, or rubber bonds. It affects wheel hardness and cutting behavior.