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: 2014**

Instructions

1. This paper consists of SIXTEN questions.

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

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1. (i) Which of the following are two groups of the reamers?
A. Machine and Hand reamers
B. Soft and Hand reamers
C. Hard and Hand reamers
D. Machine and Hard reamer
E. Hard and Soft reamer

Correct answer: A. Machine and Hand reamers
Reason: Reamers are categorized based on how they are operated—either by hand (manually) or with a machine.

(ii) In Fitting and Turning the screw driver is used for
A. Testing the electric current in screws
B. Tightening and loosening grub screws
C. Tightening screws with electric current
D. Tightening and loosening the screws
E. Loosening electric screws in a circuit

Correct answer: D. Tightening and loosening the screws
Reason: A screwdriver is designed to apply torque to turn screws either to fasten or unfasten them.

(iii) What is the purpose of land on the twist drill?
A. Increases drill strength
B. Provide drill hole diameter
C. Provide body clearance of the drill
D. Protecting jamming of the drill
E. Allow coolant to penetrate to lips

Correct answer: C. Provide body clearance of the drill
Reason: The land is the surface between the flutes that provides clearance and support for the drill while cutting.

(iv) Metal fasteners can be divided in three main groups, these are
A. Temporary, permanent and gluing joints
B. Riveting, screws and welding
C. Welding, pinning and riveting
D. Bolts, screws and riveting
E. Bolts and nuts, screws and patterns

Correct answer: D. Bolts, screws and riveting
Reason: These are the main types of fasteners based on how they hold components together.

(v) When drilling a hole on a workpiece by lathe machine, it is advised to start the hole with

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A. Prick drill
B. Centre drill
C. Offset drill
D. Twist drill
E. Flat drill

Correct answer: B. Centre drill
Reason: A center drill provides a precise starting point for a twist drill, preventing it from wandering.

(vi) Which of the following is the cutting stroke of a shaper?
A. Returning stroke
B. Forward stroke
C. Idle stroke of the ram
D. Back and forth
E. Driving stroke

Correct answer: B. Forward stroke
Reason: The forward stroke of the ram is the cutting stroke in shaping operations.

(vii) Which type of the following hammer is suitable for riveting?
A. Sledge hammer
B. Straight pein hammer
C. Cross pein hammer
D. Ball pein hammer
E. Brass hammer

Correct answer: D. Ball pein hammer
Reason: The ball pein hammer is specially designed for riveting and shaping metal.

(viii) The long work on lathe machine is supported against the pressure of cut by the use of
A. Three jaw chuck
B. Four jaw chuck
C. Steadies
D. Face plate
E. Collet chuck

Correct answer: C. Steadies
Reason: Steady rests support long workpieces during turning to prevent deflection and vibration.

(ix) Soldering is a process of joining two pieces of metal together by an intermediate layer of a filler alloy called
A. Brazing
B. Welding

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C. Metal
D. Flux
E. Solder

Correct answer: E. Solder
Reason: Soldering uses solder (a low melting alloy) to join metals without melting the base materials.

(x) The purpose of dowel pins in Fitting and Turning is to
A. Levate pieces of works by bolting them
B. Locate pieces of works by rotating them
C. Join pieces of works by welding
D. Join and locate pieces of work by screws
E. Locate one piece of work accurately with another

Correct answer: E. Locate one piece of work accurately with another
Reason: Dowel pins are precise locating tools that align or hold parts in accurate alignment during assembly.

SECTION B

2. State and briefly explain three factors which must be considered when selecting speeds and depth of cut for shaper machine.
Material type: Harder materials require lower speeds and shallower cuts.
Tool material: High-speed steel allows faster cutting speeds than carbon steel.
Surface finish: Finer finishes require lower speeds and smaller depths of cut.

3. (a) List down three types of natural abrasives.
Diamond
Emery
Corundum

(b) List down three types of bonding materials used for making grinding wheels.
Vitrified bond
Resin bond
Rubber bond

4. Enumerate any three methods for producing tapers on a lathe.
Using compound rest
Tailstock offset method
Taper turning attachment

5. Mention three uses of surface gauges in the workshop.
Scribing parallel lines on workpieces

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Setting up tools or workpieces to a specific height
Checking the flatness or alignment of surfaces

6. State three safety precautions to be observed before starting to drill a hole.
Ensure the workpiece is clamped securely
Wear protective goggles
Check drill bit condition and machine setup

7. Write down three advantages of a radial drilling machine.
Can drill large workpieces without moving them
Easier tool positioning due to movable arm
Versatile for multiple operations

8. List down six common tools used in sheet metal work.
Snips
Mallet
Stakes
Groover
Punch
Bending bar

9. Name three factors which affect the surface finish of the machined workpiece on lathe machine.
Cutting speed
Feed rate
Sharpness and condition of cutting tool

10. Write down six operations that can be performed on a lathe.
Turning
Facing
Thread cutting
Drilling
Boring
Knurling

11. (a) Enumerate three types of chisel which are used in the workshop.
Flat chisel
Cape chisel
Round nose chisel

(b) Read and indicate the size of the diameter of the shaft measured by micrometer screw gauge Figure 1.
Reading from Figure 1 = 3.13 mm

12. (a) Briefly describe the following parts of the drilling machine:

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(i) Base – The bottom-most part of the drilling machine that supports the entire structure and absorbs vibration.
(ii) Column – The vertical post mounted on the base; it supports the table and the drilling head.
(iii) Table – The adjustable platform where the workpiece is clamped for drilling operations.
(iv) Spindle – The rotating shaft that holds and drives the drill bit during the drilling process.

(b) Explain four functions served by the flutes of a twist drill.
Flutes act as passageways for chips to be removed from the hole.
They allow coolant to flow to the cutting zone.
They reduce the contact area between the drill and workpiece.
They form the cutting edges (lips) of the drill.

(c) Sketch a twist drill with taper tang used in drilling machine and label the following parts:
(i) Land
(ii) Drill lips
(iii) Taper tang
(iv) Flute length

[Sketch not shown, but the drill includes helical flutes with labeled land (between flutes), drill lips (cutting edges), taper tang (narrowed end), and flute length (cutting portion)]

13. (a) Explain five significance of the cutting fluid as used in machining operations.
Cools the cutting tool and workpiece, preventing overheating.
Lubricates the cutting zone, reducing friction and wear.
Washes away chips, maintaining cutting efficiency.
Improves the surface finish of the machined part.
Extends tool life and improves dimensional accuracy.

(b) Provide five essential properties of cutting fluids in order to be of practical value in metal cutting operations.
High thermal conductivity to dissipate heat quickly.
Low viscosity to flow easily into the cutting zone.
Chemical stability to remain effective under high temperatures.
Corrosion resistance to protect both tool and workpiece.
Non-toxicity and safety for operators and the environment.

(c) (i) Define soluble oil and briefly explain the function of its agents.
Soluble oil is a type of cutting fluid that forms an emulsion when mixed with water. It cools, lubricates, and cleans the cutting area. Emulsifiers in the oil help maintain the stable oil-water mixture.

(ii) What is the use of straight oils?
Straight oils are used in heavy-duty machining for their superior lubricating ability, reducing tool wear and friction, though they provide limited cooling.

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14. (a) (i) What is the name of the machine shown in Figure 2 with regard to machine shop?
Lathe machine

(ii) Give the names of the parts of the machine given in terms of letters a – j.
a – Headstock
b – Bed
c – Carriage
d – Tailstock
e – Dead centre
f – Leadscrew
g – Feed rod
h – Cross-slide
i – Compound rest
j – Leg

(iii) Describe the parts indicated by letters a, c, f, h and i with consideration to their functions.
a – Headstock: Contains the spindle and gear system; provides power to rotate the workpiece.
c – Carriage: Supports and moves the cutting tool along the workpiece.
f – Leadscrew: Drives the carriage during threading operations.
h – Cross-slide: Mounted on the carriage; moves the tool perpendicular to the bed.
i – Compound rest: Mounted on the cross-slide; allows angular movement for taper turning.

(b) What is the use of the device in Figure 3 as used in machine shop?
It is a steady rest, used for supporting long slender workpieces during turning to prevent bending or vibration.

15. (a) Briefly explain the following terms used in grinding wheel selection:
(i) Grain size – Refers to the size of the abrasive particles. Coarser grains remove material quickly; finer grains produce smoother finishes.
(ii) Grade – Indicates how strongly the bond holds the abrasive grains. Soft grades release grains easily; hard grades retain them longer.
(iii) Structure – Refers to the spacing between grains. Open structure has more space for chip removal; dense structure provides a finer finish.
(iv) Bond – Material holding abrasive grains together, e.g., vitrified, resin. It affects wheel strength and cutting behavior.

(b) (i) What is a wheel dresser with regard to grinding activities?
A tool used to restore the wheel's shape and expose fresh abrasive grains by removing debris and worn-out grains.

(ii) Briefly state when a diamond dresser is preferred for use?

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Diamond dressers are used when high precision is required or for dressing hard wheels due to diamond's extreme hardness.

(c) Describe the procedure on how a grinding wheel is mounted on a spindle.
Inspect wheel and spindle for cracks or damage.
Place blotter discs on both sides of the wheel.
Mount the wheel on the spindle using flanges.
Tighten the nut securely but not excessively.
Test-run the wheel to ensure no vibration before use.

16. (a) Describe three types of shaper used in the workshop with regard to methods of drive of the machine.
Crank type shaper – Uses crank and slotted link mechanism.
Hydraulic shaper – Uses hydraulic fluid pressure to move the ram.
Geared shaper – Uses gears to transmit motion from motor to ram.

(b) Briefly explain how is the size of shaper specified?
By the maximum length of stroke the ram can travel, typically expressed in mm.

(c) Calculate the number of the cycles per minute for shaping cast iron if the cutting speed is 25 m/min and stroke length is 250 mm.
Speed = 25 m/min = 25000 mm/min
Cycle per minute = 25000 / 250 = 100 cycles/min

(d) (i) Briefly explain how helical and plain cutters operate during machining on milling machine.
Plain cutters cut with their periphery only and are used for horizontal surfaces. Helical cutters have angled teeth that engage gradually for smoother cutting.

(ii) How helical teeth engage with work during machining and what is the outcome of this engagement?
Helical teeth enter the cut gradually, producing less vibration and a smoother surface finish compared to straight teeth.

(e) Observe Figure 4 and answer the following questions:
(i) What is the name of the instrument given in Figure 4?
Try square

(ii) Give the names of the parts of the instrument indicated by letters 'a' and 'b' in Figure 4.
a – Blade
b – Beam

(iii) What is the use of the instrument in Figure 4?
Used to check and mark 90-degree angles on metal or wood workpieces.

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