



**TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND
CERTIFICATION COUNCIL (TVET CDACC)**

QUALIFICATION CODE : 071606T4MCT

QUALIFICATION : Mechatronic Technician Level 6

UNIT CODE : ENG/OS/MC/CC/03/6/A

UNIT OF COMPETENCY : Perform Workshop Processes and Practices

ASSESSOR TOOL

INSTRUCTIONS TO ASSESSOR:

1. The candidate has **THREE HOURS** to attempt all the questions.
2. Marks for each section are indicated in the brackets
3. The paper consists of **TWO** sections: **A** and **B**.
4. The candidate is required to attempt **ALL** questions from section **A** and **ANY THREE** questions from section **B**.
5. The candidate is provided with answer booklet for their responses.

SECTION A (40 marks)

(The candidate should answer all questions in this section)

1. List two functions of a tailstock as used on a lathe machine. (2 Marks)
 - **Helps supporting long workpieces.**
 - **Helps in operations done to the face of workpieces such as drilling and reaming and boring**
2. What does the following terms mean as used in filing? (4 Marks)
 - (i) **Straight Filing: The first and most basic filing technique is called straight-filing, and involves pushing the file lengthwise across the work, making contact only on the forward stroke. Straight-filing is typically used to rapidly remove material.**
 - (ii) **Draw-Filing: If a smooth surface is what you're aiming for, then it's best to use the draw-filing technique. In draw-filing, the file is held on both ends and is pulled and pushed across the material crosswise.**
3. Soldering flux plays an important role in soldering process. Which are the **three** functions of soldering flux? (3 Marks)
 - **It prepares metal surfaces for soldering by cleaning and removing metal oxides and impurities.**
 - **It protects metal surfaces from re-oxidation during soldering.**
 - **It helps soldering process by altering the surface tension of the molten solder**
4. State any two types of maintenance done to workshop tools and equipment. (2 Marks)
 - **Preventive maintenance**
 - **Corrective maintenance**
5. Explain the following drilling operations. (4 Marks)
 - (i) Reaming

Reaming is an operation of sizing and finishing a drilled hole, with the help of a cutting tool called reamer having a number of cutting edges. For this, a hole is first drilled, the size of which is slightly smaller than the finished size and then a hand reamer or machine reamer is used for finishing the hole to the correct size.
 - (ii) Boring

Process carried out on a drilling machine used to enlarge a pre-drilled hole using a boring tool

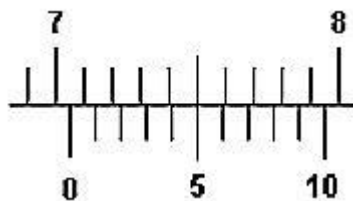
6. List four safety measures when using wrenches in workshop. (4 Marks)

- **Always pull on a wrench, never push.**
- **Always face wrench jaw openings in direction of pull.**
- **When pulling on a wrench, brace against a backward fall by placing one foot behind the other.**
- **Inspect ratchet wrenches periodically and replace worn or defective parts.**
- **Keep moving parts of adjustable wrenches clean and lubricated.**
- **Don't try to work with a wrench in a cocked position.**
- **Use angle connections so that the wrench will fit flat and square on the nut or bolt head.**
- **Don't use wrenches with spread-out jaw openings or sockets with battered or rounded walls.**
- **Don't use a wrench as a hammer.**
- **Don't pound on a wrench to loosen a frozen nut; use penetrating oil, a heavier wrench or one designed for impact work.**

7. Differentiate between dead centre and live centre as used in lathe machine. (4 Marks)

A centre which fits into the headstock spindle and revolves with the work is called live centre. The centre which is used in a tailstock spindle and does not revolve is called dead centre.

8. Draw a Vernier calliper scale to show a reading of 7.05 cm. (4 Marks)



9. Which **four** activities are carried out during workshop housekeeping? (4 Marks)

- **Tools and equipment arrangement.**
- **Disposal of wastes**
- **Cleaning of the floors**
- **Cleaning of machines**

10. Which are the three main types of taps used for generating threads? (3 Marks)

- Bottoming
- Plug
- Taper

11. State three importance of a technical drawing a workshop (3 Marks)

- **Used to develop the ability to produce simple engineering drawing and sketches based on current practice**
- **Used to develop the skills to read manufacturing and construction drawings used in industry.**
- **Used to develop a working knowledge of the layout of plant and equipment.**
- **Used to develop skills in abstracting information from calculation sheets and schematic diagrams to produce working drawings for manufacturers, installers and fabricator.**

12. List any three types of inspections that are done in a workshop? (3 Marks)

- **Safety inspections**
- **Failure finding inspections**
- **Lighting inspections**
- **Electrical inspections**
- **HVAC Inspections**

SECTION B (60 marks)

13.

a) Explain the following operations as used on a drilling machine. (10 Marks)

i. Trepanning

Process of cutting a large diameter hole using a trepanning tool

ii. Counter boring

It is the process of increasing the size of a pre-drilled hole at one end.

There should be a pilot shaft in front of the tool to guide the drilling operation

iii. Counter sinking

It is a process of making the end of a hole conical

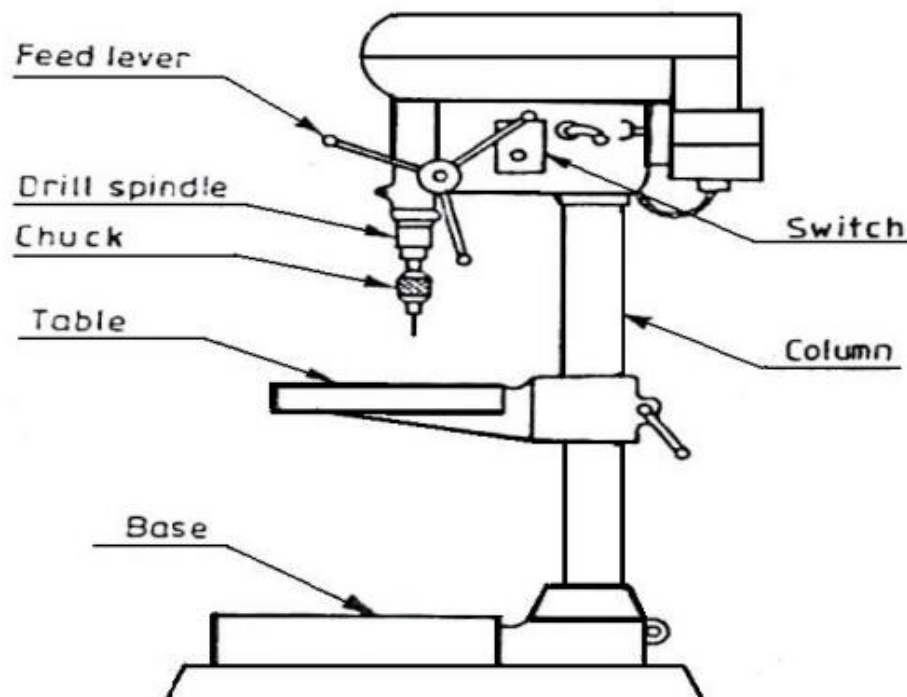
iv. Reaming

Process of smoothing the surface of a pre-drilled hole using a reaming tool

v. Boring

Boring is the process of increasing the size of a pre-drilled hole using the boring tool.

b) With a well labelled sketch, show a pillar drilling machine. (6 Marks)



c) What is the function of each of the following on a pillar drilling machine?

(4 Marks)

- i. Column- **Supports the table and head as well as other mechanisms attached to the head**
- ii. Spindle- **Used to hold and rotate the drill bit tools**

14.

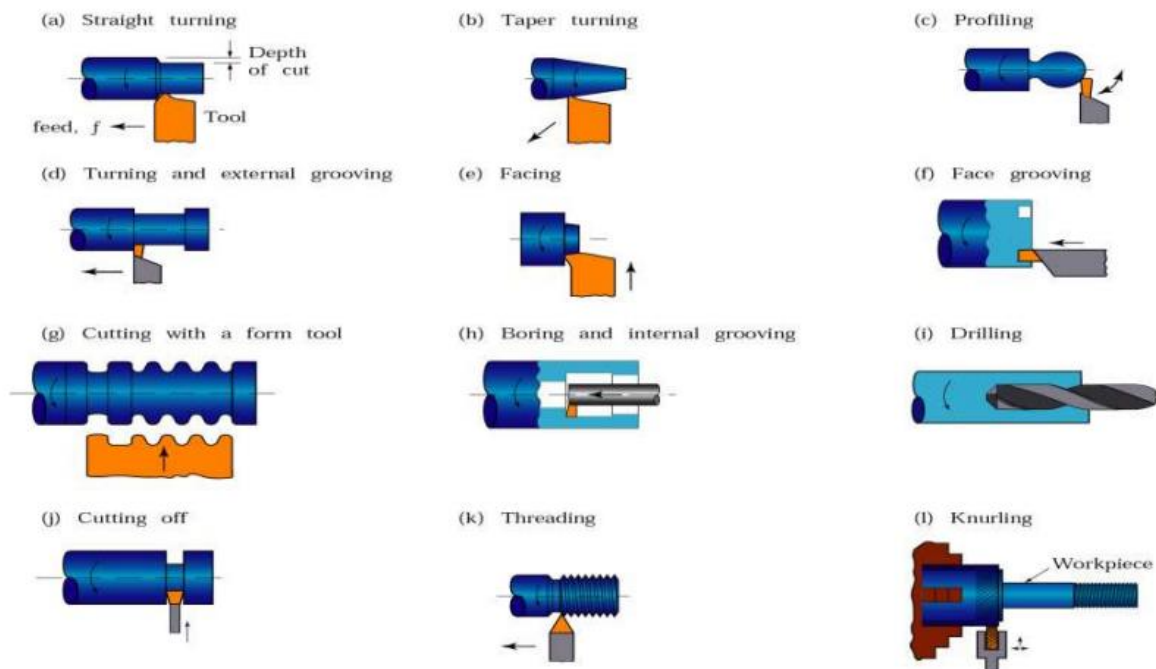
a) With five good points, discuss how does good housekeeping help in a workshop?

(10 Marks)

- **It makes the place presentable and conducive to work in-** Since is everything is found in the right place and the place is organised, workers find it conducive and appealing to work in.
- **Improved productivity-** Since people who are working enjoys the place and search time is reduced, productivity too is enhanced.
- **Searching time is eliminated-** Since everything is found in its place, one can just go directly to where what they need is there and thus search time is eliminated.
- **Discipline in the department-** The workers get disciplined as they know the place is organised are bound to keep the place clean and organised as it is expected.
- **Improved safety of people-** Since the place is cleaned and no tools are placed on top of machines, no injuries can occur since most hazards from recklessness have been eliminated.

a. With the aid of well labelled sketches, show five operations that can be done by Lathe machine. (10 Marks)

LATHE OPERATIONS



- **Turning**- Cylindrical shapes, both external and internal, are produced by turning operation. Turning is the process in which the material is removed by a traversing cutting tool, from the surface of a rotating workpiece. The operation used for machining internal surfaces is often called the boring operation in which a hole previously drilled is enlarged. For turning long work, first it should be faced and centre drilled at one end and then supported by means of the tail-stock centre.
- **Boring**- Boring is enlarging a hole and is used when correct size drill is not available. However, it should be noted that boring cannot make a hole.
- **Facing**- Facing is a machining operation, performed to make the end surface of the work piece, flat and perpendicular to the axis of rotation. For this, the work piece may be held in a chuck and rotated about the lathe axis. A facing tool is fed perpendicular to the axis of the lathe. The tool is slightly inclined towards the end of the work piece.
- **Taper Turning** A taper is defined as the uniform change in the diameter of a work piece, measured along its length. It is expressed as a ratio of the difference in diameters to the length. It is also expressed in degrees of half the included (taper)

angle. Taper turning refers to the production of a conical surface, on the work piece on a lathe. Short steep tapers may be cut on a lathe by swivelling the *compound rest* to the required angle. Here, the cutting tool is fed by means of the compound slide feed handle. The work piece is rotated in a chuck or face plate or between centres.

- **Drilling-** Holes that are axially located in cylindrical parts are produced by drilling operation, using a twist drill. For this, the work piece is rotated in a chuck or face plate. The tail stock spindle has a standard taper. The drill bit is fitted into the tail stock spindle directly or through drill chuck. The tail stock is then moved over the bed and clamped on it near the work. When the job rotates, the drill bit is fed into the work by turning the tail stock hand wheel.
- **Knurling-** It is the process of embossing a diamond shaped regular pattern on the surface of a work piece using a special knurling tool. This tool consists of a set of hardened steel rollers in a holder with the teeth cut on their surface in a definite pattern. The tool is held rigidly on the tool post and the rollers are pressed against the revolving work piece to squeeze the metal against the multiple cutting edges. The purpose of knurling is to provide an effective gripping surface on a work piece to prevent it from slipping when operated by hand.
- **Chamfering** It is the operation of bevelling the extreme end of a work piece. Chamfer is provided for better look, to enable nut to pass freely on threaded work piece, to remove burrs and protect the end of the work piece from being damaged.
- **Threading-** Threading is nothing but cutting helical groove on a work piece. Threads may be cut either on the internal or external cylindrical surfaces. A specially shaped cutting tool, known as thread cutting tool, is used for this purpose. Thread cutting in a lathe is performed by traversing the cutting tool at a definite rate, in proportion to the rate at which the work revolves.

15.

a) Compare between DC and AC welding machines

(10 Marks)

AC welding machines	DC welding machines
a. A.C. welding machine is cheaper, small in size, light in weight and simple to operate.	a. D.C. welding machine is two to three times costlier, larger in size, heavier in weight and is more complicated.
b. Maintenance of A.C. welding machine is easier and more economical, because there	b. Maintenance cost is higher because of

<p>is no moving parts in it.</p> <p>c. Heat generated is equal at both the poles, so it does not require changing of polarity.</p> <p>d. Welding machine is not suitable for welding all metals particularly non-ferrous metals and alloys.</p> <p>e. Bare electrode cannot be used. Only specially designed coated electrodes can be used.</p> <p>f. A.C. welding machine is not suitable for welding of sheet metals due to difficulty in starting the arc.</p> <p>g. The problem of arc-blow can be easily controlled.</p> <p>h. Voltage drop in A.C. is less, hence, can be used at a large distances from the power supply.</p> <p>i. It can only be used when A.C. power supply is available.</p> <p>j. Less electric energy consumption per kg of metal deposited (3 to 4 kWh.)</p> <p>k. A.C. Welding machine has high efficiency (0.8 to 0.85).</p> <p>l. Welding machine has lower operating cost.</p> <p>m. A.C. Welding machine has an disadvantage of using low power factor at the welding station, (0.3 to 0.4).</p>	<p>many moving parts in it.</p> <p>c. Heat generated is different at the work and the electrode by changing the polarity.</p> <p>d. D.C. welding machine is suitable for welding all types of metals by changing the polarity.</p> <p>e. Both coated and bare electrode can be used in D.C. welding machine.</p> <p>f. It is used for all sorts of work as starting of the arc is easier comparatively.</p> <p>g. Arc-blow is severe and difficulty to control.</p> <p>h. Voltage drop is relatively higher, it can be used only at a short distance from the power supply.</p> <p>i. It can be used anywhere with engine driven D.C. generator or by rectified A.C. supply.</p> <p>j. Higher electric energy consumption per kg of metal deposited (6 to 10 kWh).</p> <p>k. Efficiency of D.C. Welding machine is low only 0.3 to 0.6.</p> <p>l. It has higher operating cost.</p> <p>m. The motor in a D.C. Welding has an advantage of high power factor of 0.6 to 0.7.</p>
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- b) Suppose you are the head of department on a mechanical workshop and you have organized a meeting on personal safety. Discuss **four** points you are likely on your speech. (4 Marks)

- Use of PPEs
- Keep hands and tools wiped clean and free of dirt, oil and grease. Dry tools are safer to use than slippery tools.
- Do not carry sharp tools on pockets.
- Do not keep working tools at the edge of the table.
- Position the work piece such that the cut to be made is close to the vice. This practice prevents springing, saw breakage and personal injury.
- Apply force only on the forward (cutting) stroke and relieve the force on the return stroke while sawing and filing.
- Do not hold the work piece in hand while cutting.
- Use the file with a properly fitted tight handle.

c) Discuss the following surface finishing processes as used in workshop processes and practices. (6 Marks)

(i) Deburring

A burr is a raised edge or small piece of material that remains attached to a workpiece after a modification process. It is usually an unwanted piece of material and is removed with a deburring tool in a process called 'deburring'.

(ii) Tumbling

The tumbling process is used on an industrial scale for the removal of surface flaws caused by previous working processes and for the following polishing of the different materials surfaces. It usually requires a plastic or rubber-lined barrel loaded with a consignment of rocks, all of similar or the same hardness, some abrasive grit, and a liquid lubricant. Silicon carbide grit is commonly used, and water is a universal lubricant. The barrel is then placed upon slowly rotating rails so that it rotates. The optimal speed of rotation depends on the size of the tumbler barrel and materials involved. Vibratory finishing process can be used instead.

(iii) Painting

Powder coating and painting are two common finishing processes used in the manufacturing industry. They both involve the deposition of particulate matter onto the surface of an object or workpiece. Either powder or painting can be used to protect the underlying object or

workpiece from rust, corrosion and degradation while also creating a colourful and attractive appearance in the process.

16.

- a) You are to use a hacksaw to do cutting of materials in a workshop, what are the safety precautions that you will observe? (5 marks)
- i. Always ensure that the blade is securely mounted on the frame before use. A loose blade may lead to personal injury or damage.**
 - ii. Cut using strong steady strokes directed away from the user to prevent personal injury.**
 - iii. Hold the work securely in a vice and clamp small pieces that required edge cutting.**
 - iv. Use the entire blade length to avoid uneven tear and wear on the blade.**
 - v. Choose the correct blade for the material being cut.**
- (Award 1 mark for each correct answer)
- b) What are the factors to consider when purchasing a chisel to be used in the workshop processes? (5 marks)
- i. Area of use: The cutting edges of chisels have different shapes. A chisel may be chosen depending on the area where it is to be used.**
 - ii. The material to be worked on, either hot or cold.**
 - iii. Cost of the chisel**
 - iv. Size: Chisels are available in various sizes. Large chisels are used from heavy duty works while small chisels are used for small cutting operations.**
 - v. Nature of work, either heavy or light work**
- (Award 1 mark for each correct answer)
- c) You are a technician in a workshop and you are to perform a welding process. Differentiate between Horizontal welding position and Vertical welding position, giving a recommendation. (6 marks)
- i. Horizontal Welding Position- In this position the plane of the work piece is vertical and the welded deposits upon the vertical surface. The metal depositions rate in horizontal welding is next to that achieved in flat welding position. This position of welding is commonly used in welding vessels and reservoirs.**
 - ii. Vertical Welding Position- in this position, the plane of the work piece is vertical and the weld is deposited upon the vertical surface. Its difficult to produce satisfactory weld on this position due to the effect of the force of gravity on the molten metal. The welder must constantly control the metal so that it does not run/drop from the weld. Maybe of vertical up or vertical down.**
- (Award 3 marks for each correct answer)

d) Since metal combines with oxygen more rapidly at higher temperatures it is reheated to soldering temperature to prevent reforming and formation of metal oxide. What are requirements of a good soldering flux? (4marks)

- i. It must remain liquid at soldering temperature**
- ii. It should be readily displaced from the joint surfaces by the molten solder**
- iii. It must dissolve any oxide film present on the surface to be joined**
- iv. In its liquid state, it must act as a cover over the joint and exclude the air**
- v. It should not produce toxic fumes.**

(Award 1 mark for each correct answer)

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