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UNIT - 4

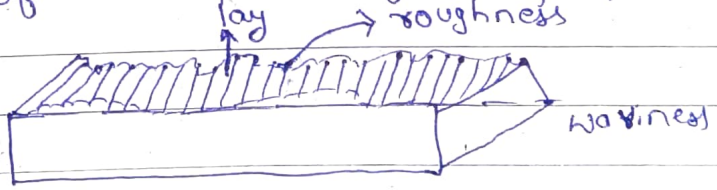
1 Introduction to Surface texture - refer to the physical characteristics of a surface, including its roughness, waviness and way. These prop. affect how a surface interacts ~~like~~ with its environment - influencing factors like friction, wear, lubrication and appearance. Surface texture can be a result of manufacturing processes such as grinding, polishing or machining.

- Key elements of Surface texture :

i) Roughness : The small, fine irregularities on the surface, typically caused by mp. measured using parameter like

- Ra (Arithmetic av) : The av. derivation of the profile from the mean line.

- Rq (Root mean Square) : The Square of the arith. mean of the Square of the profile deviation.



2) Waviness : larger, more periodic deviations from a flat surface, often caused by issues like machine vibration or the expansion. Waviness is distinct from roughness as it is typically on a large scale.

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3. Lay — The direction of the predominant Surface pattern, which is the result of the method used to machine or finish the Surface.

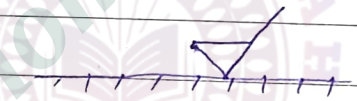
4. flatness and Geometry : The overall shape and form of a Surface, including deviations from perfect flatness or smoothness

role : friction and wear, fatigue life adhesion, Corrosion resistance, aesthetics.

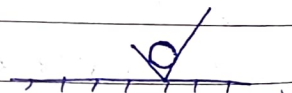
NOTE: Surface texture is typically measured using Specialized instruments Called profilometers.

- Indication of roughness Symbols :

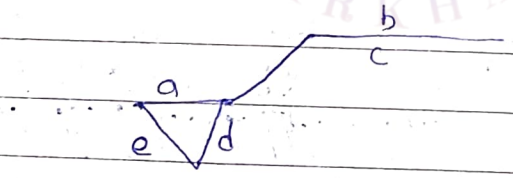
indicating the Surface



indicating a Surface that require material removal



indicating a Surface that does not required material removal



a = Roughness Value
b = Production method
c = Sampling length
d = duration of lay
e = Machining allowances.

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Tolerance – unilateral and bilateral

- Tolerance – The acceptable range of variation in a dimension or property from its ideal or nominal value.

- Types

1) Unilateral Tolerances : It allows variation in only one direction from the nominal size.

– It is indicated by either a "+" or "–"

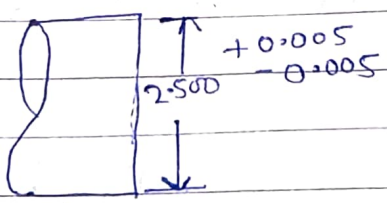
– Ex – 1) 20mm + 0.2mm (means the actual size can be betⁿ 20mm and 0.2mm)

2) 50mm – 0.1mm (means the actual size can be betⁿ 49.9mm and 50mm)

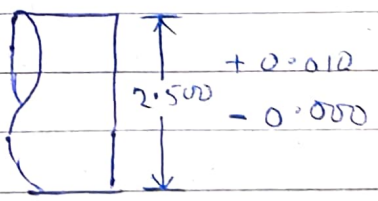
2) Bilateral Tolerances – It allows variation in both directions (+ and –)

– It is indicated by "±"

Ex – 1) 30mm ± 0.1mm (means the actual size can be betⁿ 29.9mm and 30.1mm.



Bilateral



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2. Intro to lathe - Types of lathe - Capstone and turret lathe, Automatic lathe and others - Specification of a center lathe - Cutting fluids Selection of cutting fluids.

Intro

A lathe machine is a versatile tool used in machining to shape and cut materials, typically metals, wood and plastics. It works by rotating the workpiece on its axis while a cutting tool is applied to remove materials, resulting in the desired shape or finish. lathe machines are used for tasks such as turning, drilling, threading and facing, allowing for the production of parts with high precision. also known as Centre lathe because it has two centres which rotates & holds the during various operation main Components of a lathe machine.

- Main Components

1) Bed - The bed is the base of the lathe machine providing support for all other Components. made of CI or Steel.

2) Head Stock - It is located at the left end of the bed and houses the spindle, bearings and drive mechanism.

3) Spindle - It is a rotating shaft that holds the workpiece. It is supported by bearings and is driven

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by the headstock.

4) Tailstock – It is located at the right end of the bed and provides support for the workpiece during turning operation.

5) Carriage : It is a movable Component that however the Cutting tool. It can be moved along the bed to perform various operation.

6) Cross-Slide : It is a Component of the Carriage that allows the Cutting tool to move ⊥ to the workpiece.

7) Compound rest : It is a Component of the Carriage that allows the Cutting tool to move at an ∠ to the workpiece.

8) Tool post :
It is a Component of the Carriage that holds the Cutting tool in place.

- Additional Components.

1) chuck : It is a device that holds the workpiece in place on the spindle.

2) Drive System : It includes the motor, gear box, and belts that transmit power to the spindle.

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3. Feed Mechanism : It allows that Carriage to move along the bed, feeding the Cutting tool into the workpiece.

4. Safety Guards : They are installed to protect the operations from moving parts and flying chips

• Control Mechanism

1) Hand wheel : It is used to manually Control the movement of the Carriage and Cross-Slide.

2) Feed rod : It is used to Control the feed rate of the Carriage.

3) Spindle Speed Control : It allows the operator to adjust the speed of the Spindle.

A lathe machine is veriatile and Can perform various operations, which are essential for shaping and machining metals into desired form (metal or wood)

Operations

1) Turning

- The most Common operation, where the workpiece is rotated, and the cutting tools is moved in a linear direction to remove material.

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- It creates cylindrical shapes, such as shafts and rods.

2) facing
- A cutting tools is moved ⊥ to the workpieces axis to create a flate surface.

- used to smooth the ends of the workpiece or create a square face.

3) Boring
- Enlarging an existing hole in the workpiece using a single-point cutting or a boring tool.

- used for high precision when the hole's die needs to be accurate.

4) Drilling
- The operation of creating a hole in the workpiece using a rotating drill bit.

- It is often done using the tailstock, which holds

- Cross Drilling used to create cross holes the drill bit.

5) Threading — Cutting helical grooves threads on the workpiece — The cutting tool moves along the workpiece surface in a helical path to create threads used for bolts, screw, etc.

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6. knurling – A process of Creating a textured pattern (usually a diamond or straight pattern) on the surface of the workpiece – provides better grip on parts like handles or knobs.

7. Parting – Cutting off a part of the workpiece to seprate it from the rest – A parting tool is used a thin tool that cuts into the material to make a clean cut.

8. Grooving : Cutting a groove (a narrow recess) along the workpiece, typically used for Creating a seating for a ring or similar Component.

– The grooving tool is used to cut these groove which can be wide or narrow.

9. chucking : The workpiece is held and clamped using a chuck, which allows it is rotate and undergo turning or drilling operation.

– This operation involves positioning and securing the workpiece in the lathe.

10. Taper Turning – A technique for creating conical or tapered shapes. This can be done by either tilting the tailstock or using a taper turning tool for the desired taper angle.

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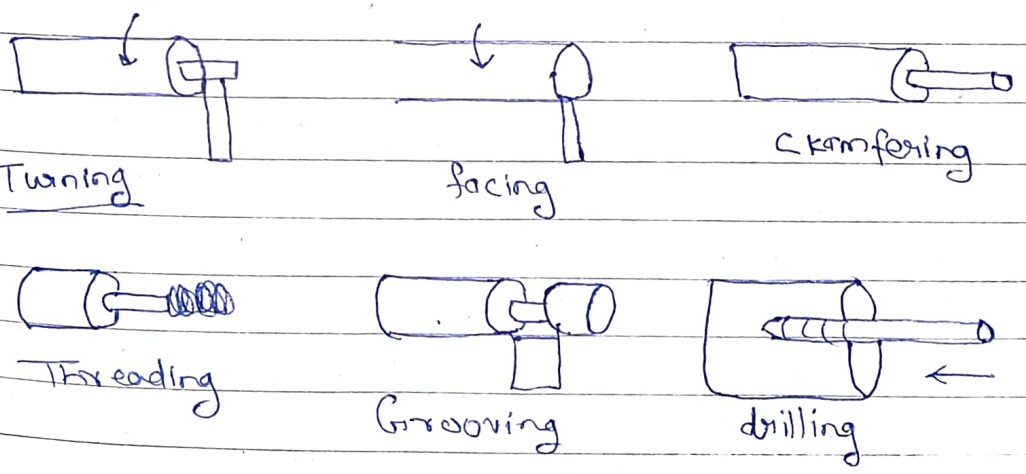
11. Sandpapering/Polishing – used for smoothing or polishing the surface of the workpiece after machining. It removes minor tool marks or imperfections and provides a smooth finish.

12. Centering – Creating a small hole at the center of the workpiece end, typically to guide the tailstock live center or other tools for further operations.

13. Cutting of threads (External / Interal)

- External T.C (Thread cutting) = Creating threads on the outer surface of a workpiece.
- Internal T.C = Cutting threads inside a hole using a suitable tool and method.

14. Reaming – Smooths the internal surface of oxiding hole.



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Types of Lathe

1. Capstone lathe

- Description: It is a type of lathe that uses a rotating capstan (a cylinderical bar) to hold and move the cutting tool.

- features: The capston lathe has a rotating headstock, a tailstock, and a capston that can be moved along the bed.

- Advantage: High precision, versatility and ability to perform complex operation.

- Application – used for precision turning, facing and drilling of small to medium-sized workpiece.

2. Turret lathe

- Description: It is a type of lathe that uses a rotating turret (a hexagonal or octagonal block) to hold multiple cutting tools.

- features: has a rotating headstock, a tailstock and a turret that can be indexed to present different cutting tools to the workpiece.

- Advantage: High productivity, reduced setup time, and ability to perform multiple operation in a single setup.

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- Application : used for high-vol. production of medium-sized workpiece, such as engine components, gears and shafts.

3. Automatic lathe :

- Description : An automatic lathe is a type of lathe that uses computer numerical control (CNC) or other automatic technologies to perform turning operations without human intervention.

- features : Has a CNC control system, a rotating headstock, and a tailstock, as well as automated tool changing and workpiece handling.

- Advantage : High precision, high productivity, and reduced labor costs.

- Application : used for high-volume production of complex workpieces, such as medical devices, aerospace components, and precision machinery parts.

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Difference bet^n Capstan lathe and Turret lathe.

- Capstan lathe.

→ It is light duty machine
→ Turret head is mounted on a ram and ram is mounted on the saddle.
→ lengthwise movement of turret is less.
→ short workpiece only can be machined.
→ Turret head can be moved manually.
→ As the construction of lathe is not rigid, heavy cut cannot be given.
→ Capable of turning only 80mm dia bar.
→ Turret mounted over the ram can be easily moved manually.

- Turret lathe

→ heavy duty machine.
→ Turret head is directly mounted on the saddle and saddle is slides over bed aways.
→ more
→ long workpiece
→ Cannot
→ As the construction of lathe is rigid, heavy cut can be given.
→ 200mm dia bar.
→ Turret mounted on saddle become very difficult to move manually.

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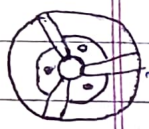
Work holding Devices:

They are tools or mechanisms used to securely hold and position a workpiece during various manufacturing operations, such as machining, grinding, or assembly. These devices ensure that the workpiece is accurately located, securely held, and protected from damage.

Types:

i) Chucks: It is a device that holds a workpiece by gripping its outer dia.

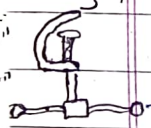


Types - 3-Jaw, 4-Jaw, 6-Jaw, Collect chucks.

2. Vices: Device that holds a workpiece by gripping its edges or surfaces.

Types - Bench, machine, and Toolmaker's Vice.

3. Clamps: Device that hold a workpiece by applying pressure to its surfaces.



Types - Bar, C-, F-, Toggle. clamps.

4. fixtures: They are Custom-made devices that hold a workpiece in a specific position and orientation used for repetitive operations or for holding complex workpieces.

5. Jigs - devices that hold a workpiece and guide the cutting tool or other machining operation. used for drilling, milling or other operation that require precise location and orientation.

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- functions
1. stability: Prevents movement of the workpiece during machining.

2. Accuracy: Ensure ~~precise~~ precise positioning or accurate cuts.

3. Safety: Reduce the risk of accidents and part damage.

4. Repeatability: Allows consistent resultant in mass production.

5. Accessibility: Provides tool ~~area~~ access to required area of the workpiece.

6. flexibility: Accomodates different sizes, shaps and orientations.

Tool Holding devices:
They are used to securely hold cutting tools during machining operations to ensure accuracy and safety.

1. Tool holders: Hold tools like end mills, drills, or boring bars on machines like lathes and mills.

2. Morse Taper
A self-locking system used for drills and removes in machining like lathes and drill presses.

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3. Quick change Tool Holder : Allow fast tool changes in CNC machining or lathes for efficient production.

4. chucks : clamps tools (e.g, drill chucks) Securely often used in CNC lathes and grinders.

5. Vise lamps : used to hold tools Securely in milling or CNC machines.

6. CNC Tool Holders : Precision holders like CAT or HSK for CNC machines, ensuring Stability and repeatability.

7. Magnetic Tool Holders : use magnets to hold tools often in automated Systems.

8. Tapping chucks : Designed for holding taps during threading operations.

9. Grinding Tool Holders : Hold grinding wheels or abrasive in place on grinding machines.

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