Week – 01

CO-01: List relevant work place Occupational health and safety standards and explain the importance of the need to comply with them.

Machine Shop Safety Tips & Safety Guidelines:

GENERAL SAFETY TIPS:

1. Safety glasses with side shields must be worn at all times.
2. Do not wear loose clothing, loose neckwear or exposed jewellery while operating machinery.
3. Pull back and secure long hair.
4. Do not wear thin fabric shoes, sandals, open-toed shoes, and high-heeled shoes.
5. A machinist's apron tied in a quick release manner should be worn ideally.
6. Always keep hands and other body parts a safe distance away from moving machine parts, work pieces, and cutters.
7. Use hand tools for their designed purposes only.
8. Report defective machinery, equipment or hand tools to the lab in-charge.

SAFETY GUIDELINES:

1. If guards or safety mechanisms are present do not remove or disable them.
2. Do not attempt to oil, clean, adjust, or repair any machine while it is running. Stop the machine and lock the power switch in the "OFF" position.
3. Do not operate any machine unless authorized to do so.
4. Do not set up or operate machinery if you are not trained and familiar with that setup.
5. Even after the power is off, do not leave the machine until it has stopped running. Someone else may not notice that it is still in motion and be injured. Do not leave a machine until it has come to a complete stop.
6. Do not try to stop the machine with your hands or body.
7. Check tools and machines before use to assure they are safe to use.
8. Always see that work and cutting tools on any machine are clamped securely before starting to work.
9. Projecting setscrews are very dangerous because they may catch on sleeves or clothing. The same goes for chuck jaws on a lathe, they are very dangerous especially when extended near the outer limits.
10. Only one person should operate a given machine and its switches.
11. Do not lean against a machine.
12. Concentrate on the work and do not talk unnecessarily while operating the machine.
13. Do not talk to others when they are operating a machine. A distraction may lead to an injury.
14. Do not walk behind people operating a machine; you may bump them by accident or startle them and cause an accident.
15. Always remove gloves before turning on or operating any machine. If material is rough or sharp and gloves must be worn, place or handle material with the machine turned off.
16. Do not leave tools or work on the table of a machine even if the machine is not running. Tools or work may fall off and cause toe or foot injury.
17. Use a brush to remove short, discontinuous types of chips--not hands, fingers, or rags.
18. Use a pair of pliers to remove chips, especially the long, stringy type.
19. Never handle chips with your bare hands or fingers. Chips are extremely sharp and can easily cause cuts.
20. Never use compressed air to clean any machine.

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21. Stop the machine tool to make speed and feed changes that require the shifting of a gear lever.
22. Always use correct speeds and feeds. A broken tool becomes a hazard and can cause great personal injury.

Principles of First Aid

1] Preserve Life

- The first aim of first aid is to preserve life, which involves the key emergency practices to ensure that the casualty isn't in any mortal danger.
- Remember though, this includes preserving your own life as you shouldn't put yourself in danger in order to apply first aid.
- It's at this stage where you should do a quick risk assessment to check for dangers to the injured person, yourself or bystanders which could cause the situation to escalate.
- If in doubt, do not attempt to apply first aid and immediately call for a medical professional.

2] Prevent Deterioration

- Once you've followed all the steps associated with the first principle, your next priority is to prevent deterioration of the injured person's condition.
- Keeping a casualty still to avoid aggravating their injury, or from complicating any unseen issues, is crucial.
- This helps prevent to further injuries, and clearing the area of any immediate dangers will help you to do so.

3] Promote Recovery

- Finally, there are steps you should follow which will help lessen the amount of time taken for a casualty to recover from an accident and aid in minimising lasting damage and scarring.
- The prime example of this is applying cold water to a burn as soon as possible to lower the chance of long-term scarring and helps speed up the healing process.

Preventive measures to be taken during Fire and Electrical emergency:

1. Provide adequate means of escape
2. Prevent Accidental Electrical Contact
3. Use Approved Equipment Only
4. Wear the Right Protective Gear
5. Temporary Electrical Service Safety
6. Outline clear pathways to exit doors
7. Install smoke detection systems
8. Maintain smoke suppression systems
9. Conduct regular fire drills
10. Use flame-retardant materials in interiors
11. Make your workplace/office accessible to fire-fighters
12. Keep the building plans handy.
13. Ask the local fire brigade to assess safety
14. Comply with National Building Code

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Knowledge about Safety and Environment Regulations:

It means all laws relating to pollution, the release or other discharge, handling, disposition or treatment of Hazardous Materials and other substances or the protection of the environment or of employee health and safety, Hazardous Materials Transportation etc.

These are the strict rules, regulations, permits, licenses, approvals etc. to the industry from the courts or government to protect human health and safety or environment.

Personal Protective Devices for prevention of accident

1. Goggles: To protect eyes from welding and such processes
2. Helmets: As a head protection in construction sites and where objects are likely to fall
3. Gloves: For handling chemicals and hot objects
4. Safety shoes: For protection of feet
5. Apron: For protection of body
6. Safety belts: Used in moving vehicles or while hanging around
7. Mask: To protect against inhaling tiny particles
8. Ear plugs: To protect against excessive noise

5-'S' Principle:

- 5-'S' is the name of work place organization that uses 5 Japanese words.
- It is the step towards quality improvement by the work place organization
- 5-'S' can be classified as:

1] Sorting (Seiri):

- To avoid unnecessary materials, tools, machineries, documents etc. in a work place.
- Keep only required items and keeping them at easily accessible place.

2] Straightening (Seiton):

- Everything should be in its place and there should be place for everything.

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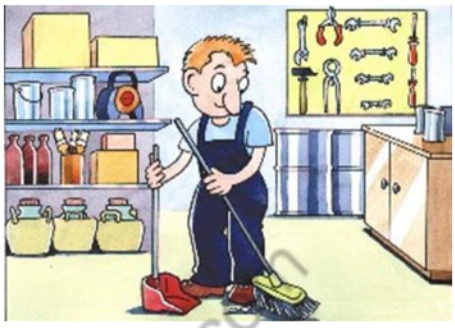
- The place of each items should be labelled clearly. Tools are kept close to workplace.

3] Shine(Seiso):



- Keep the workplace tidy, clean and organized.
- At the end of work everything is restored to its place and ensured that everything is where it belongs.

4] Standardizing (Seiketso):

- It is the standardizing of work practice.
- All employees doing same job should be able to work in any station.
- They should be able to use same tools that are in the same location in every work station.
- Everyone should know their responsibility and should follow first 3-'S'

5] Sustain (Skitsuke):

- Every workers and managers has to follow rules and procedure in the work place. Once previous 4-'S' have established maintain the focus.
- When issue arise, suggestion for improvement is done, new ways of working tools and new changes as required are carried out.

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Industrial Accident:

- ⇨ An accident is an unwanted event that is never planned.
- ⇨ It is an unexpected event or a sudden miss-happening resulting in temporary or permanent disablement of employees
- ⇨ Accident involves heavy losses resulting from wasted machine hours, man hours, compensation amount, training etc.
- ⇨ Accident can be prevented by taking the proper safety measures.

Safety:

- ➢ The condition of being protected from unlikely events or danger or injury or risk or miss happening is called safety.
- ➢ Safety can also be referred as controlling hazards.

Causes of accidents:

1] Accident due to dangerous machines: Dangerous machines such as pressure vessels, heat exchangers, turbines, electrical machinery, hoists, lifts, cranes etc are sometimes the causes of accident.

2] Unsafe physical conditions: This includes reasons such as absence of guards, improper illumination and ventilation, improper clothing, uncomfortable temperature, bad design of machinery, absence of proper seating, excessive noise, hard and tedious work, rapidity of production, bad layout, improper working conditions etc.

3] Moving or falling objects: Moving objects are sometimes causes of accidents in industries.

4] Personal factors: Personal factors such as lack of knowledge, over confidence, lack of confidence, long working hours without rest, lack of training, lack of sleep, low morale, boredom, inexperience, lack of good health etc can lead to accident.

5] Unsafe acts: These are acts such as working at unsafe speed, loading machines beyond capacity, not using safety devices, not following safety procedures etc can lead to accidents.

6] Electrical causes: Some of the important electrical causes are:

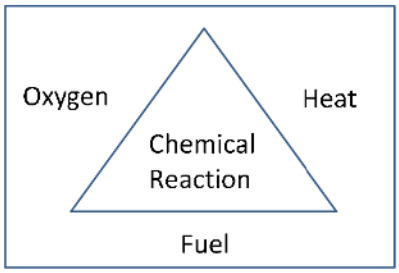
i. Not providing proper protecting devices
ii. Not obeying proper instructions and not following safety precautions
iii. Failure to use insulated pliers, screw drivers, rubber gloves etc.

7] Exposure to harmful substances: These includes exposure to toxic gases, fumes, dust, vapours, mist and other harmful chemical effects

Fire Triangle:

Fire is a chemical reaction that requires three elements:

1. Heat
2. Fuel
3. Oxygen



These three elements typically are referred to as the “Fire Triangle”.

- *If any one of the element is removed, there will not have fire or the fire will be extinguished. This is the principle used in fire extinguishers.*

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Classification of Fire:

Fires are classified as A,B,C,D and K, based on the type of substance that is the fuel for the fire, as follows:

1. Class A - Fires due to combustion of paper, trash, plastic, wood and cloth. It leaves an ash behind
2. Class B – Fire due to flammable gases or liquids, such as propane, oil and gasoline
3. Class C – Fires due to electrical components
4. Class D – Fires due to metals such as, aluminium, magnesium, sodium etc.
5. Class K – Fires due to vegetable or animal cooking oils or fats

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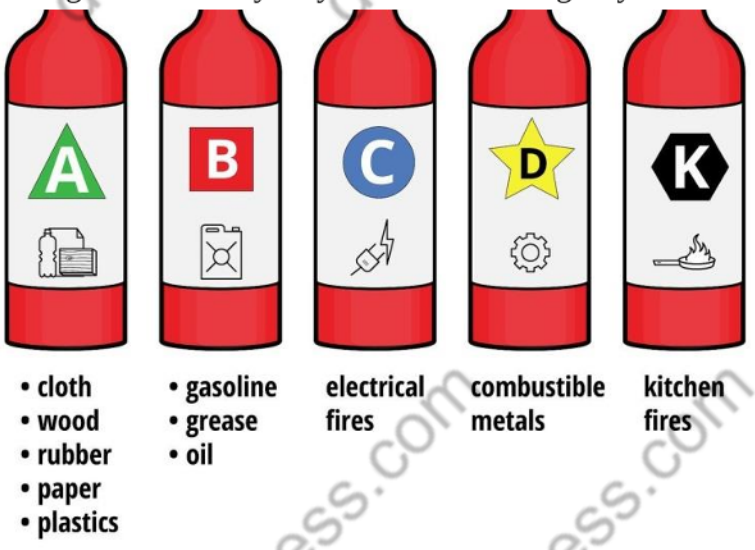
Fire Extinguishers:

- There are different types of fire extinguisher designed to put out the different classes of fire.
- Selecting the appropriate fire extinguisher is an important consideration
- The wrong extinguisher actually may make a fire emergency worse



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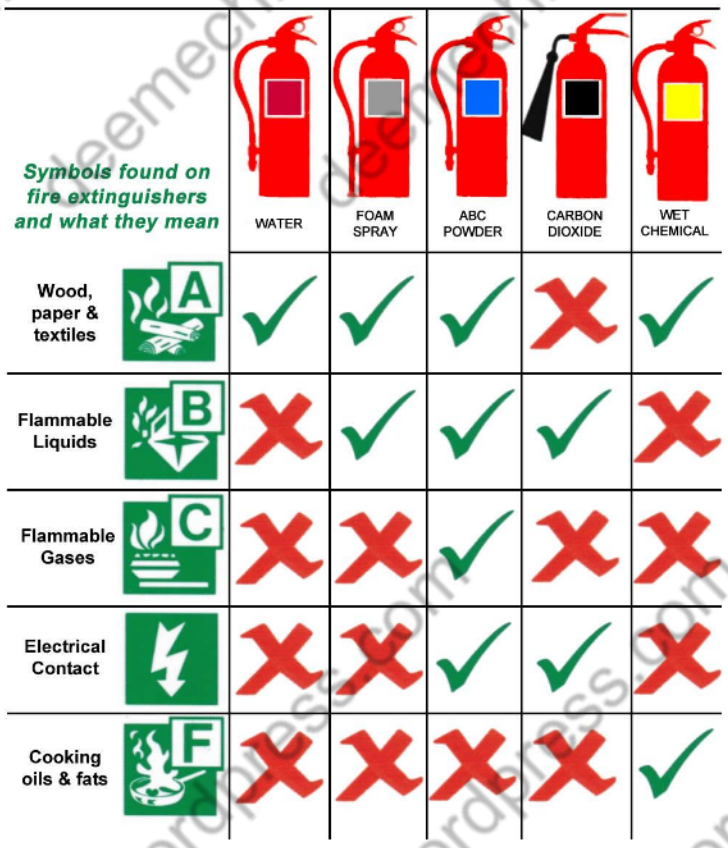
Know your Fire Extinguisher



The following table shows the types of extinguishers, fire classes for each is used and the limitations of each extinguisher:

Sl no.	Fire Extinguisher Type	Class of fire it Extinguishes	Extinguisher Limitations / Comments
1	Dry chemical (multipurpose)	A,B,C	Generally good for use in roofing industry
2	Foam-alcohol resistant and aqueous film forming foam (AFFF) types	B	Expensive, effective on class B only, limited life.
3	Water	A	Good only for class A fires
4	Metal X	D,B,C	Expensive; must be kept dry
5	Carbon Dioxide	B,C	If used in confined areas, will create oxygen deficiency
6	Halon	B,C	Expensive; not effective in windy conditions; toxic gases may be released in extremely hot fires because of decomposition
7	Potassium Acetate	K	Expensive, wet chemical extinguisher.

Safety and Environment Regulations:

- Environment (E), health (H) and safety (S), EHS is an acronym for the set that studies and implements the practical aspects of protecting the environment and maintaining health and safety at occupation.
- In simple terms it is what organizations must do to make sure that their activities do not cause harm to anyone. Commonly, quality - quality assurance and quality control - is adjoined to form the company division known as HSQE.
- From a safety standpoint, it involves creating organized efforts and procedures for identifying workplace hazards and reducing accidents and exposure to harmful situations and substances.
- It also includes training of personnel in accident prevention, accident response, emergency preparedness, and use of protective clothing and equipment.
- Better health at its heart, should have the development of safe, high quality, and environmentally friendly processes, working practices and systemic activities that prevent or reduce the risk of harm to people in general, operators, or patients.
- From an environmental standpoint, it involves creating a systematic approach to complying with environmental regulations, such as managing waste or air emissions all the way to helping site's reduce the company's carbon footprint.
- Regulatory requirements play an important role in EHS discipline and EHS managers must identify and understand relevant EHS regulations, the implications of which must be communicated to executive management so the company can implement suitable measures.

Other abbreviations:

Acronym	Name	Group
OHS	Occupational health and safety	Occupational health and safety
WHS	Work health and safety	Work health and safety
HSE	Health, safety and environment	Health, safety and environment
EHS	Environment, health and safety	
SHE	Safety, health and environment	
QHSE	Quality, health, safety, and environment	Quality, health, safety, and environment
HSEQ	Health, safety, environment and quality	
HSSE	Health, safety, security and environment	Health, safety, security and environment
QHSSE	Quality, health, safety, security, and environment	Quality, health, safety, security, and environment

EHS guidelines cover categories specific to each industry as well as those that are general to most industry sectors. Examples of general categories and subcategories are:

1] Environmental

a) Air emissions and ambient air quality
b) Energy conservation
c) Wastewater and ambient water quality
d) Water conservation
e) Hazardous materials management
f) Waste management
g) Noise
h) Contaminated land

2] Occupational health and safety

a) General facility design and operation
b) Communication and training
c) Physical hazards
d) Chemical hazards
e) Biological hazards
f) Radiological hazards BG
g) Personal protective equipment (PPE)
h) Special hazard environments
i) Monitoring

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3] Community health and safety

a) Water quality and availability
b) Structural safety of project infrastructure
c) Life and fire safety (LFS)
d) Traffic safety
e) Transport of hazardous materials
f) Disease prevention
g) Emergency preparedness and response

4] Construction and decommissioning

a) Environment
b) Occupational health and safety
c) Community health and safety

Week – 02

CO-02: Explain the importance of Cutting tool Geometry, list various Cutting Parameters, the role and use of the right Coolants and Lubricants for the given machining processes.

Lubrication and Metal removal:

- Lubrication is the control of friction and wear by the introduction of a friction-reducing film between moving surfaces in contact.
- The lubricant used can be a fluid, solid, or plastic substance.

Need of Lubrication:

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The primary functions of a lubricant are to:

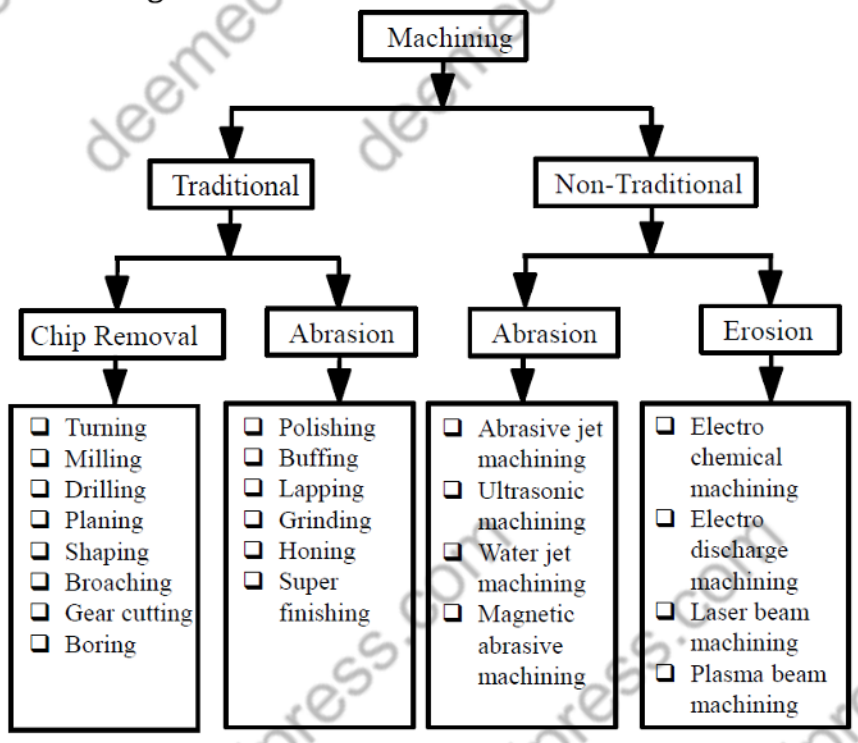
- Reduce friction
- Prevent wear
- Protect the equipment from corrosion
- Control temperature (dissipate heat)
- Control contamination (carry contaminants to a filter or sump)
- Transmit power (hydraulics)
- Provide a fluid seal

Selection of Lubricant as per ISO standard:

Six key areas are considered when selecting lubricants for equipment.

1. Function: what does the lubricant do?
2. Ingredients: what's in the lubricant?
3. Terminology: grade etc.
4. Ease of use
5. Longevity: Long life
6. Cost: must be cost effective

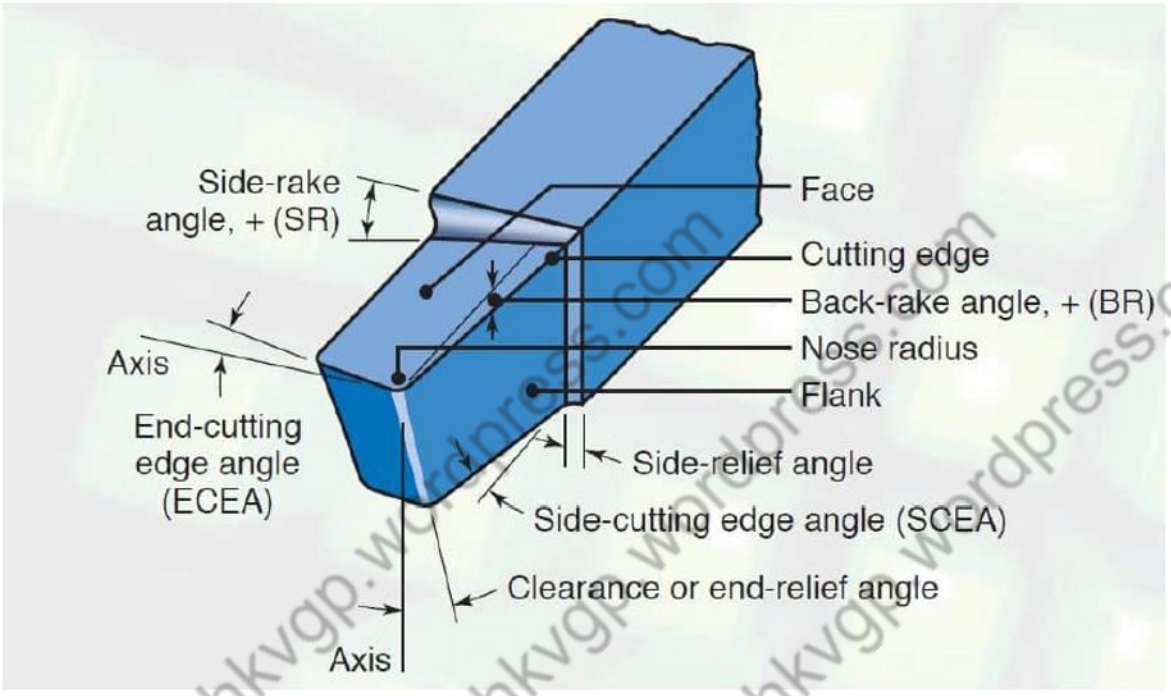
Classification of Machining Process:



Cutting Tools:

Single Point Cutting Tool:

- This tool consists of a sharpened cutting part called its point and the shank.
- The point of the tool is bounded by the face (along which the chips slides as they are cut by the tool), the side flank or major flank the end flank or minor flank and the base.
- As we know we perform several operations on the lathe (like turning, facing) from the single-point cutting tool.
- Design and fabrication are very easy for this tool.
- This tool can be made at a very cheaper rate as compared to others.



Single point cutting tool

There are only two types of tool: Single and Multi-Point cutting tool.

1. **Single Point cutting tool:** One cutting point or tip is available. Example: Lathe Machine tool, Planning Machine tool.

2. **Multi-Point cutting tool:** More than One cutting point or tip is available. Example: Milling cutter, Grinding wheel, drill tool, etc.

Single point cutting tool:

This tool can be made from several materials like:

1. High carbon steel
2. High-speed steel
3. Ceramics
4. Cerements
5. Diamonds
6. Ucon
7. Cemented carbide
8. CBN (Cubic boron nitrite)

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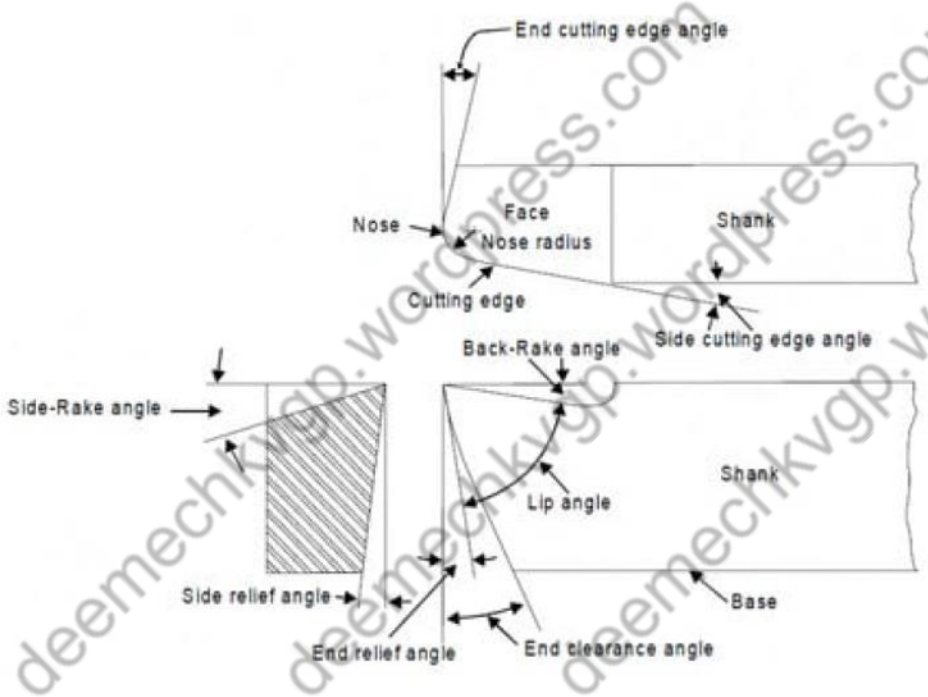
Single Point Cutting Tool Geometry / Nomenclature:

1) *Shank*
2) *Flank*
3) *Face*
4) *Heel*
5) *Nose*
6) *Nose radius*
7) *Cutting Edges*

Angle:

1. *Side Cutting edge angle*
2. *End cutting edge angle*
3. *Side relief angle*
4. *End relief angle*
5. *Back Rack angle*
6. *Side rack angle*



single-point cutting tool

1. Shank:

- This is the main body of the tool. The shank is used to hold the tool (i.e tool holder).

2. Flank:

- The surface or surface below and adjacent to the cutting edge is called flank of the tool.

3. Face:

- The surface on which the chips slide is called the face of the tool.

4. Heel:

- It is the intersection of the flan and the base of the tool. It is a curved portion at the bottom of the tool.

5. Nose:

- It is the point where the side cutting edge and end cutting edge intersects.

6. Noise radius:

- The nose radius will provide long life and also good surface finish with it a sharp point on the nose.

7. Cutting edge:

- It is the edge on the face of the tool which removes the material from the workpiece.
- The tool cutting edge consists of side cutting edge (major cutting edge), end cutting edge (minor cutting edge and the nose).

Angle:

1. Side cutting edge angle:

- This angle also is known as the lead angle. This is the angle between the side cutting edge and side of the tool shank.

2. End cutting edge angle:

- This is the angle between the end cutting edge and a line normal to the tool shank.

3. Side relief angle:

- It is the angle between the portion of the side flank immediately below the side cutting edge and a line perpendicular to the base of the tool and measured at the right angle to the end flank.

4. End relief angle:

- It is the angle between the portion of the end flank immediately below the end cutting edge and a line perpendicular to the base of the tool and measured at the right angle to the end flank.

5. Back rack angle :

- It is the angle between the tool face and a line parallel to the base of the tool and measured in a plane perpendicular through the side cutting edge.
- The back rack angle is positive if the side cutting edge slopes downwards from the point towards the shank and the back rack angle is negative if the slope is side cutting edge is reversed.

6. Side rack angle:

- It is the angle between the tool face and a line parallel to the base of the tool and measured in a plane perpendicular to the base and the side cutting edge.
- This angle gives the slope of the face of the tool from the cutting edge.
- The side rack angle is negative if the slope is toward the cutting edge.
- And the side rack angle is positive if the slope is away from the cutting edge.

Single Point Cutting Tool Advantages:

The main advantages are:

1. Design and fabrication are easy.
2. This tool is a little cheaper in price.

Single Point Cutting Tool Disadvantages:
The main disadvantages are:

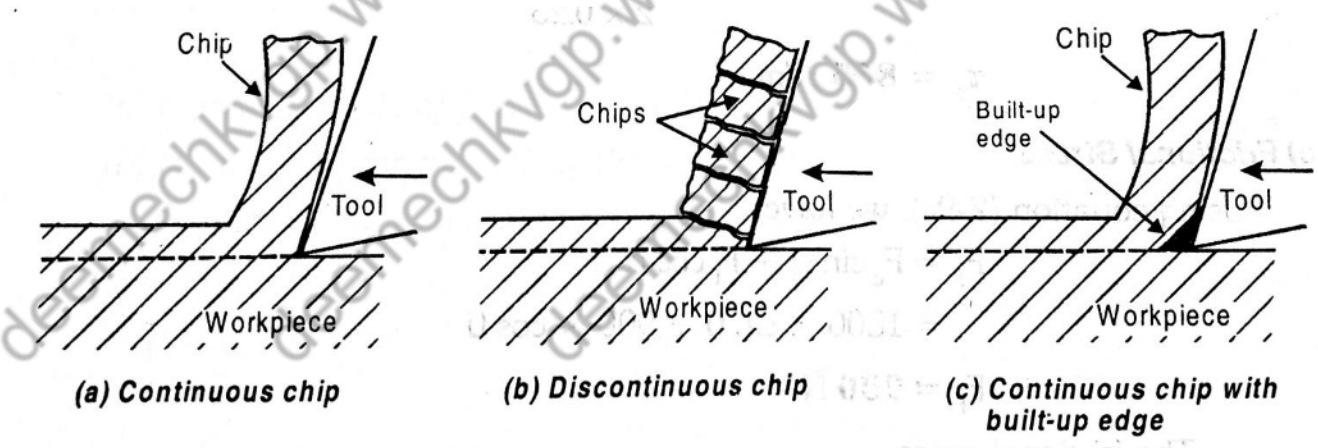
1. *There is having little high tool wear rate.*
2. *Shorter tool life.*
3. *Low metal removal rate.*
4. *Low productive.*

Single Point Cutting Tool Application:

This tool is used in several machines for producing a flat surface like:
Lathe machine
Shaper Machine *and more*

Types of chips formed during machining:

- Different types of chips are formed in machining depending upon the type of metal being cut and machining conditions
- Types of chips formed are broadly classified into three groups:
  a) Continuous chips
  b) Discontinuous chips
  c) Continuous chips with built up edge



(a) Continuous chip ***(b) Discontinuous chip*** ***(c) Continuous chip with built-up edge***

a) **Continuous chips:** If the metal chips formed during machining is without segments i.e. without breakage, then it is called as continuous types of chips.

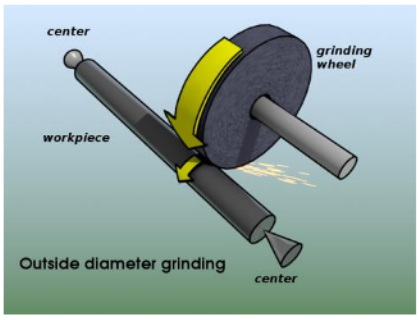
b) **Discontinuous chips:** If the chips formed during machining process are not continuous i.e. formed with breakage is called discontinuous chips.

c) **Continuous chips with built up edge:** Continuous chips with built up edge is formed by machining ductile material with high friction at the chip-tool interface. It is similar to the continuous types of chips but it is of less smoothness due to the built up edge.

Week - 03

Grinding

- Grinding is abrasive machining process in which a rotating abrasive wheel removes metal from the workpiece.
- Grinding cab be used to finish surfaces.
- Grinding operation can be classified as follows:
    1. Cylindrical grinding (External and internal)
    2. Surface grinding
    3. Form grinding



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Grain size or grit number:

- It indicates the number of meshes per inch of the screen through which the grain pass.
- The abrasive have four general grain size based on hardness of the metal to be ground, amount of material to be removed and the finish required.

Group	Grain Size
Coarse	10 to 24
Medium	30 to 60
Fine	80 to 180
Very fine	220 to 600

Grade:

- Grade refers to the hardness with which a bond hols the abrasive grains together.
- The grades are denoted from A to Z, where A being the softest and Z being the hardest grade.
- The grade of the grinding wheel selected based upon hardness of the material to be ground, work speed and conditions of the grinding machines.
- Grades are grouped as follows:

Group	Grade
Soft	ABCDE FGH
Medium	I J K LMNOP
Hard	QTST UVWXYZ

Structure:

- It is the representation of how closely the abrasive grains are packed with their bond coatings.
- Depending upon their closeness of the grains, the structure can be classified as open and dense.
- The structure is represented as numbers and is classified as follows:

Group	Structure Number
Dense	1 2 3 4 5 6 7 8
Open	9 10 11 12 13 14 15 and higher

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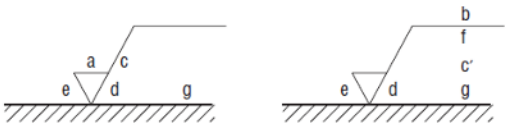
Week – 04

CO-03: Demonstrate turning operation for a given component drawing and object, prepare a process chart and estimate the cost of its production as per drawing.

1. Positions of Auxiliary Symbols for Surface Symbol

A surface roughness value, cut-off value or reference length, processing method, grain direction, surface undulation, etc. are indicated around the surface symbol as shown in Fig. 1 below.

Fig. 1. Positions of Auxiliary Symbols



a ：Ra Value
b ：Machining Method
c′ ：Cut-off Value, Evaluation Length
c ：Reference Length, Evaluation Length
d ：Grain Direction
f ：Parameter other than Ra（tp：Parameter/Cut-Off Level）
g ：Surface Undulation（according to JIS B 0610）

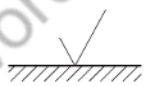
Remark： These symbols except a and f are provided when they are needed.

Remark： Under ISO 1302, a finish range should be indicated as e in Fig. 1.

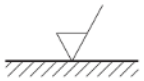
Symbol	Meaning	Illustration
=	The trace left by a cutting instrument is parallel to the projection plane in the drawing. Ex. Shaped Surface	Trace Left by a Cutting Instrument
⊥	The trace left by a cutting instrument is perpendicular to the projection plane in the drawing. Ex. Shaped Surface （Side View） Circular Cut, Cylindrical Cut	Trace Left by a Cutting Instrument
X	The pattern left by a cutting instrument diagonally crosses the projection plane in the drawing. Ex. Honed Surface	Trace Left by a Cutting Instrument

■Examples

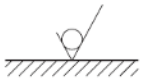
Surface Symbol



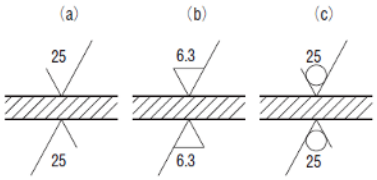
Removal of Material by Machining is Required

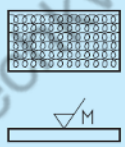


Removal of Material is Prohibited

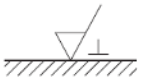


Upper Limit of Ra



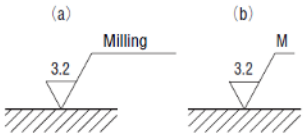
M	The pattern left by a cutting instrument crosses in various directions or has no grain direction. Ex. Lapped Surface, Superfinished Surface and Surface Finished with a Front Mill or End Mill	
C	The pattern left by a cutting instrument is virtually concentric around the center of the plane in the drawing. Ex. Faced Surface	 
R	The pattern left by a cutting instrument is virtually radial around the center of the plane in the drawing.	 

Grain Direction

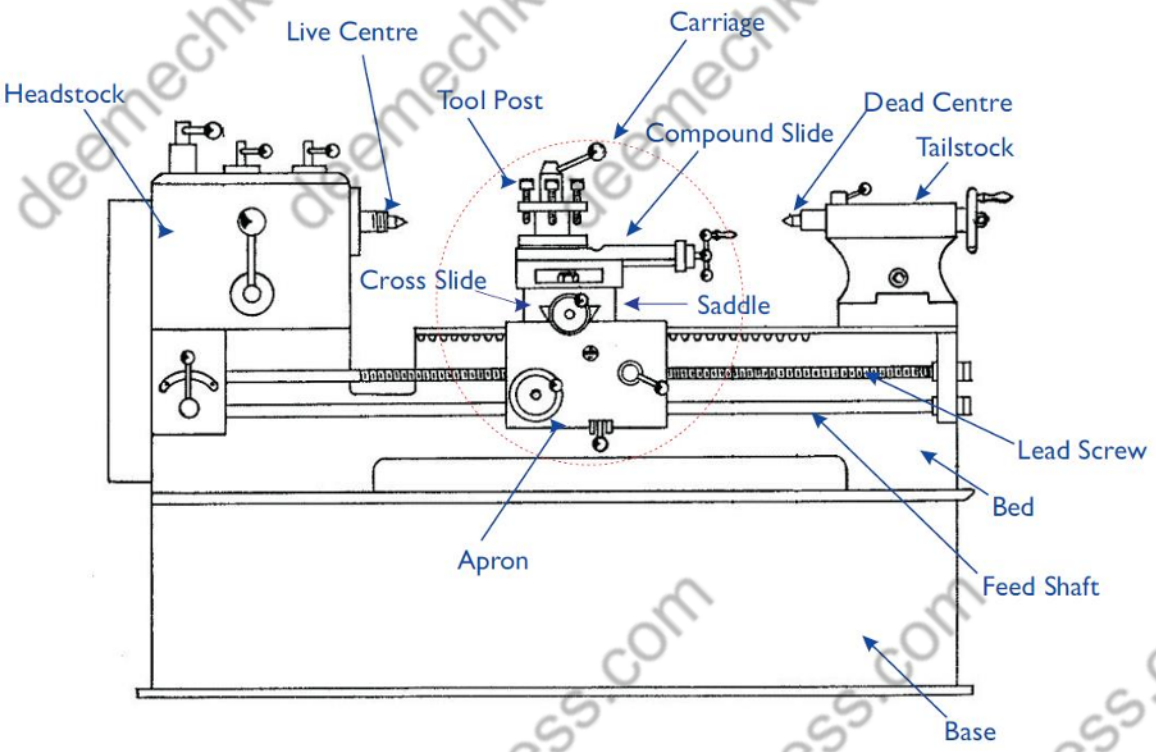


Upper and Lower Limits of Ra

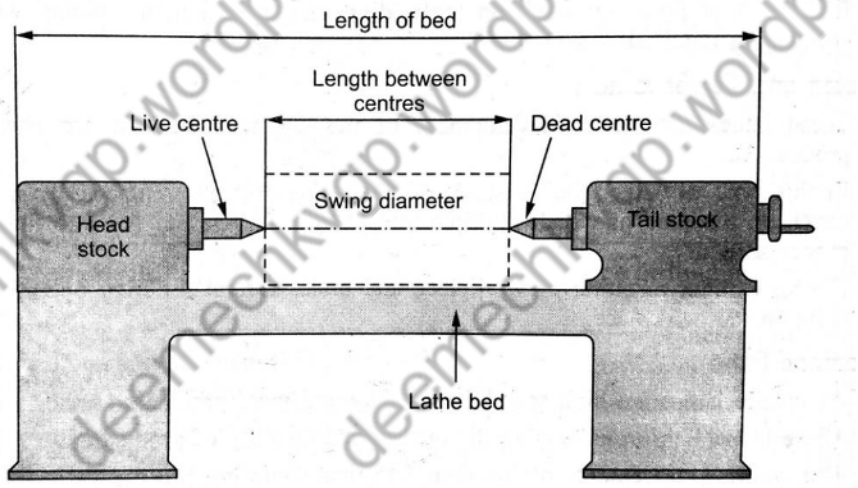
Machining Method



Lathe Machine:



Specification of Lathe Machine:



In order to specify the size of the lathe, following specifications should be included:

a) **Height of the centres:** It is measured from the lathe bed
b) **The length between centres:** It is the maximum length of the work piece that can be mounted between centres.
c) **The length of bed:** It includes length of headstock and tailstock.
d) **The swing diameter over bed:** It is the largest diameter of the work piece that revolves without touching the bed.
e) **Swing diameter over carriage:** It is the largest diameter of the work piece that can revolve over the lathe saddle. It is always less than swing diameter over the bed.
f) **Maximum bar diameter:** It is the maximum diameter of bar stock that passes through the hole of the headstock spindle.
g) **Spindle speed**

h) Spindle nose diameter
i) Lead screw pitch
j) Motor horse power and R.P.M

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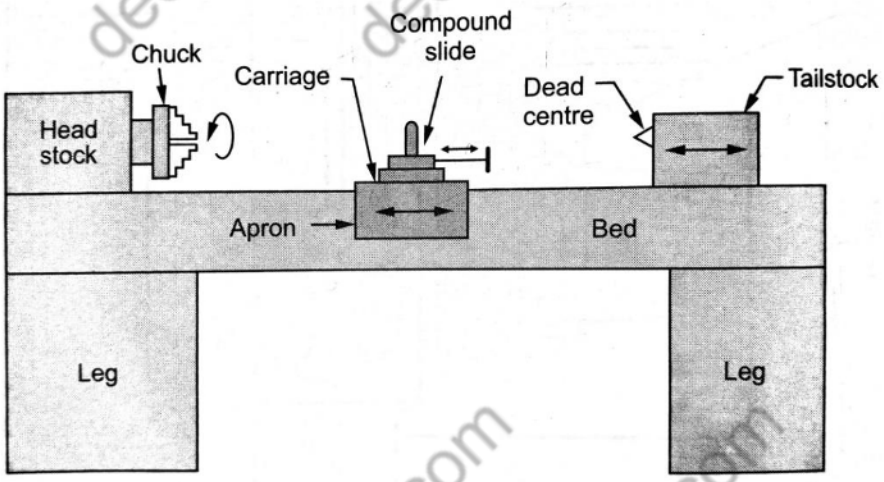
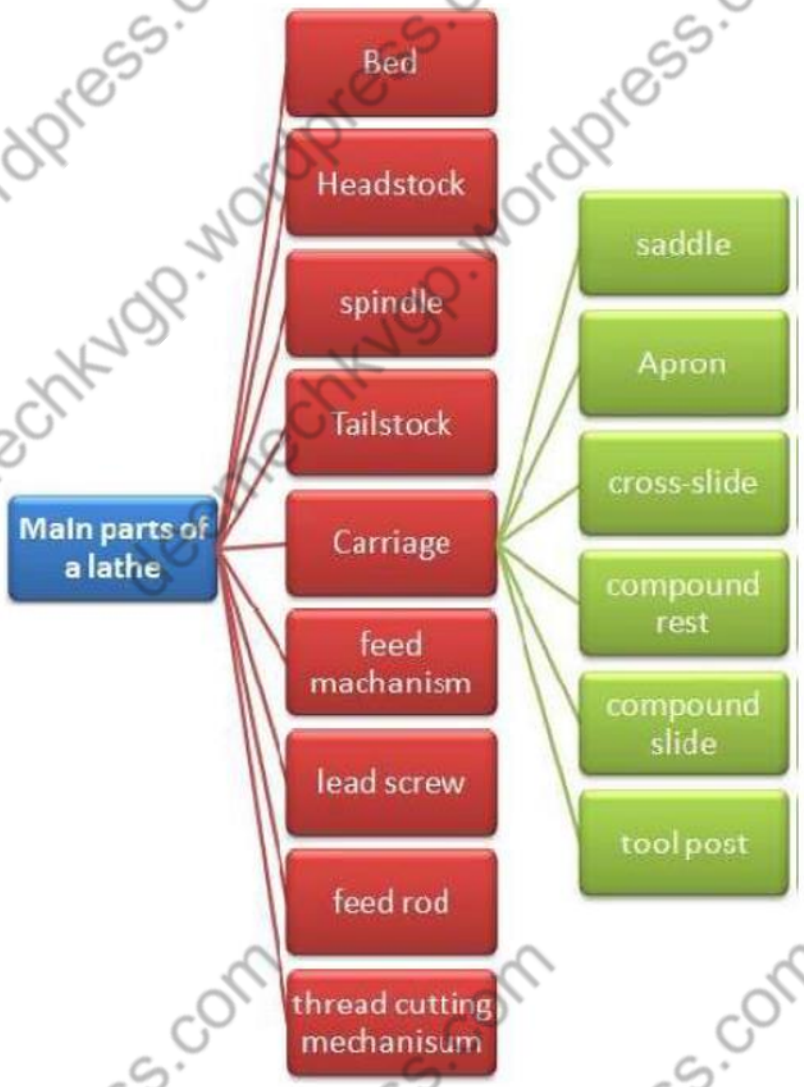
Block Diagram of a Lathe Machine:



Main parts of a lathe

Every individual part performs an important task in a lathe. Some important parts of a lathe are listed below.

- Bed
- Headstock
- Spindle
- Tailstock
- Carriage
  - ❖ Saddle
  - ❖ Apron
  - ❖ Cross-slide
  - ❖ Compound rest
  - ❖ Compound slide
  - ❖ Tool post
- Feed mechanism
- Lead screw
- Thread cutting mechanism
- Feed rod



Types of lathe machine

Various designs and constructions of lathe have been developed to suit different machining conditions and usage. The following are the different types of lathe

- Speed lathe
  - Woodworking lathe
  - Centering lathe
  - Polishing lathe
  - Metal spinning lathe
- Engine lathe
  - Belt driven lathe
  - Individual motor driven lathe
  - Gear head lathe
- Bench lathe
- Tool room lathe
- Semi automatic lathe
  - Capstan lathe
  - Turret lathe
- Automatic lathe
- CNC Lathe
- Special purpose lathe
  - Wheel lathe
  - Gap bed lathe
  - T lathe
  - Duplicating lathe

Speed lathe

Spindle of a speed lathe operates at very high speeds (approximately at a range of 1200 to 3600 rpm) and so it is named so. It consists of a headstock, a tailstock, a bed and a tool slide only. Parts like lead screw, feed rod and apron are not found in this type of lathe.

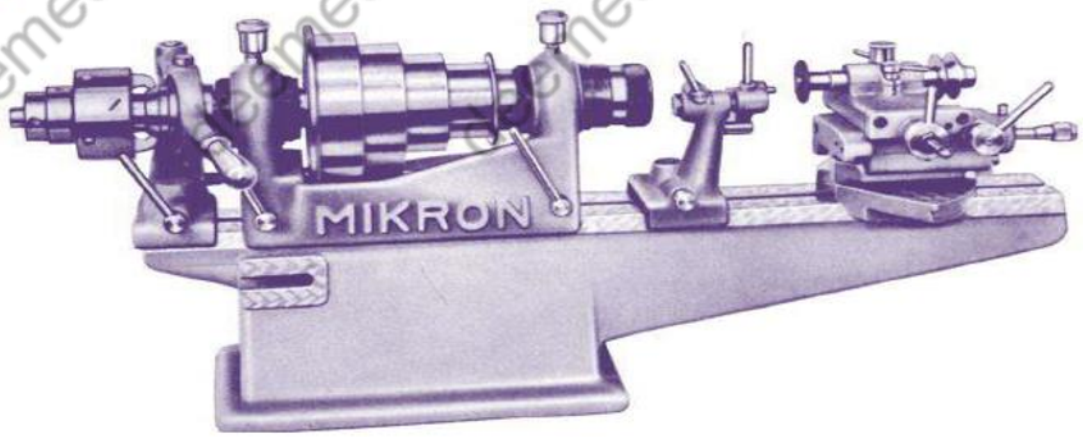
1. Centering lathes are used for drilling center holes.
2. The woodworking lathes are meant for working on wooden planks.
3. Metal spinning lathes are useful in making tumblers and vessels from sheet metal.

Woodworking lathe: Complex forms made on a wood lathe develop from surprisingly few types of cuts: parting, planning, bead, cove, and hollowing. Parting separates the wood from the holding device, or establishes depth cuts. Planning is done with a tool in which the bevel below the cutting edge supports wood fibers, just as in a typical wood planer. Beads are a convex shape relative to the cylinder, and coves are a concave shape. Hollowing techniques are a combination of drilling and scooping out materials. The wood turner is at liberty to choose from a variety of tools for all of these techniques,

Most woodworking lathes are designed to be operated at a speed of between 200 and 1,400 revolutions per minute, with slightly over 1,000 rpm considered optimal for most such work, and with larger work pieces requiring lower speeds.

Polishing lathe

polishing lathes have features preferred by dentists, dental lab technicians, jewelers, lapidary, and others requiring precise trouble free polishing. The ball bearings in all lathes are lubricated for life and sealed to prevent entry of dust and debris.

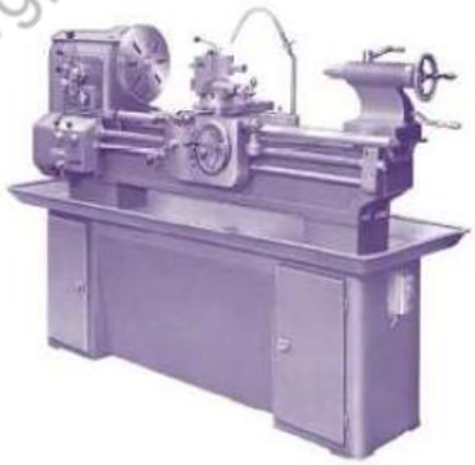


Metal spinning lathe

Metal spinning, also known as spin forming or spinning or metal turning most commonly, is a metalworking process by which a disc or tube of metal is rotated at high speed and formed into an axially symmetric part. Spinning can be performed by hand or by a CNC lathe.

Engine lathe or center lathe

Engine lathes are named so because the early lathes were driven by steam engines. As the turning operations are performed by holding the work piece between two centers, it is also known as center lathe. Engine lathes are widely used in industries. It consists of parts like headstock, tailstock and carriage. Parts like lead screw and feed rod which are useful in providing automatic feed are also found in this type of lathe.



Bench lathe

Bench lathe is a small lathe generally mounted on a bench. It consists of all the parts of an engine lathe. It is used for small works like machining tiny and precise parts and parts of measuring instruments.

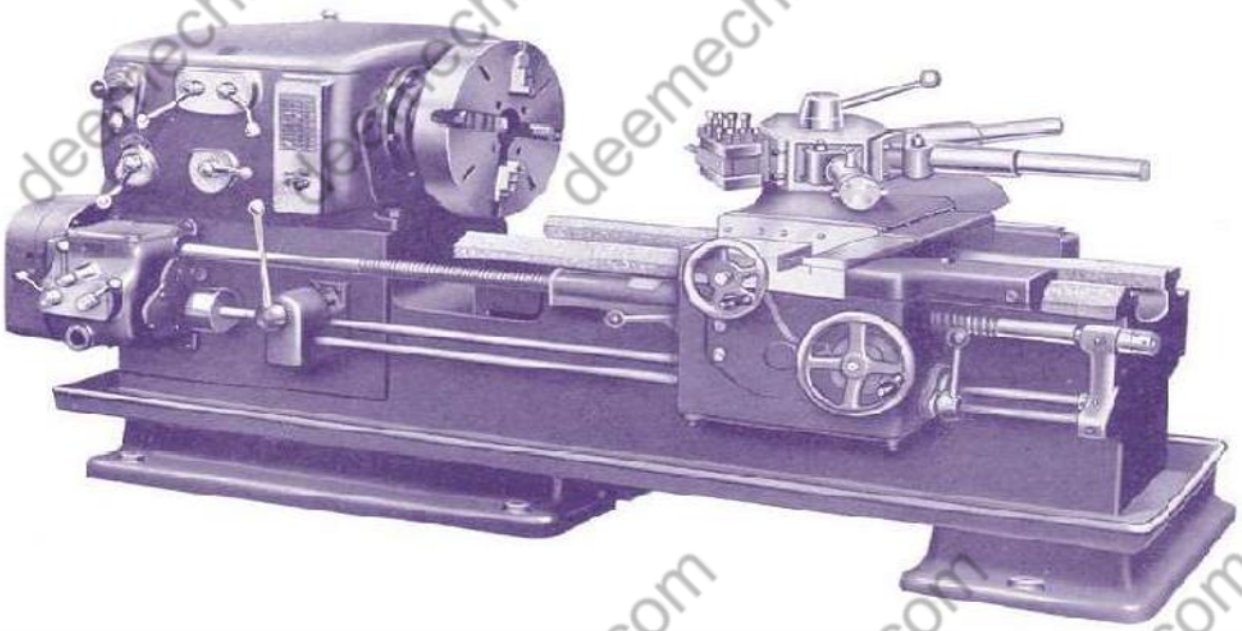
Tool room lathe

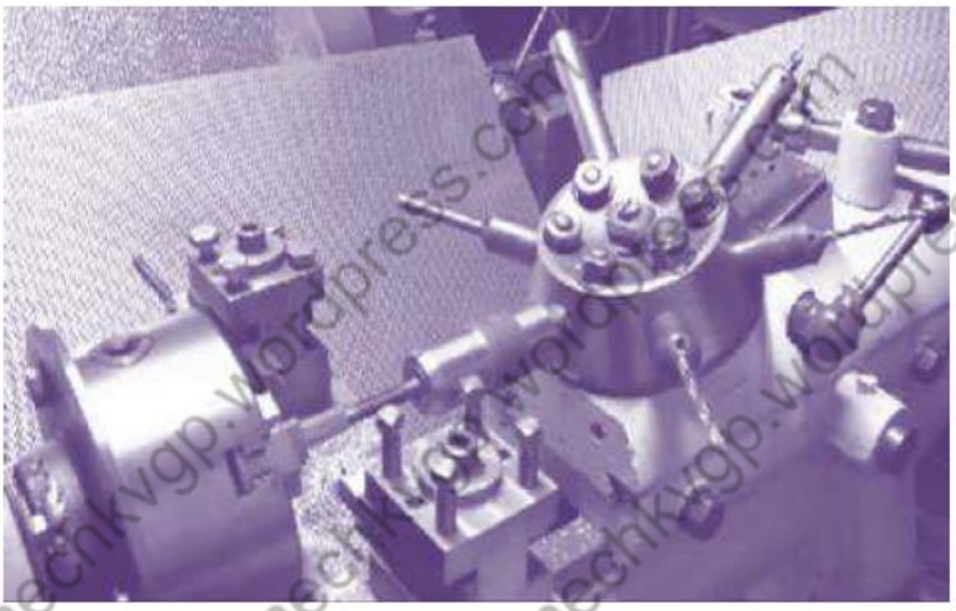
A tool room lathe has similar features of an engine lathe but is accurately built and has wide range of spindle speeds to perform precise operations and different feeds. It is costlier than a center lathe. This is mainly used for precision works like manufacturing tools, dies, jigs, fixtures and gauges.

Semi-automatic lathe

Turret and Capstan lathes are known as semi-automatic lathes. These lathes are used for production work where large quantities of identical work pieces are manufactured. They are called semi-automatic lathes as some of the tasks are performed by the operators and the rest by the machines themselves.

A semi-skilled operator can do this at low cost and at shorter time. So, the cost of production is reduced. There are two tool posts in the machine namely four-way tool post and rear tool post. Four tools can be mounted on the four-way tool post and parting tool is mounted on the rear tool post. The tailstock of an engine lathe is replaced by a hexagonal turret. As many tools may be fitted on the six sides of the turret, different types of operations can be performed on a work piece without resetting of tools. The tool heads of a turret lathe and a capstan lathe are illustrated in Fig





Automatic Lathe Machines

An automatic lathe is a lathe (usually a metalworking lathe) whose actions are controlled automatically. Although all electronically controlled (CNC) lathes are automatic but they are usually not called by that name. The mechanically controlled lathes are called automatic lathe.

Automatic lathes are operated with complete automatic control. They are high speed, mass production lathes. An operator can look after more than one automatic lathe at a time. A lathe in which the work piece is automatically fed and removed without use of an operator. It requires very less attention after the setup has been made and the machine loaded.

- Once tools are set and the machine is started it performs automatically all the operations to finish the job.
- After the job is complete, the machine will continue to repeat the cycles producing identical parts.

- An operator can maintain five or six such a types of lathes at a time simply look after the general maintenance of the machine and cutting tools.
- It has heavier construction and provides wider range of speeds.
- The saddle carrying the turret head moves along the whole length of the bed. Much longer jobs can be machined.
- Turret head directly mounted on the saddle. The front tool post can carry 4 tools and rear tool post may have 1 or 2 tools. Turret may have4 to 6 tools.
- More than one tool may be set to operate simultaneously. There is no lead screw.

In this machine technology has been designed to make industrial tasks easier, faster and error free. Automatic Lathe Machines are extremely versatile machines that give big returns on small investment. Up to 80% of all turning jobs can be profitably handled by these automats with accuracy and precision. These automatic machines have proved economical for mass production of simple and complex turned parts for various engineering products. The simple design of these automats greatly reduces the time for changeover of tooling setup from one component to another.

Computer Numerical Controlled (CNC):

Computer numerical controlled (CNC) lathes are rapidly replacing the older production lathes (multi spindle, etc.) due to their ease of setting, operation, repeatability and accuracy. They are designed to use modern carbide tooling and fully use modern processes. The part may be designed and the tool paths programmed by the CAD/CAM process or manually by the programmer, and the resulting file uploaded to the machine, and once set and trialed the machine will continue to turn out parts under the occasional supervision of an operator.

The machine is controlled electronically via a computer menu style interface, the program may be modified and displayed at the machine, along with a simulated view of the process. The setter/operator needs a high level of skill to perform the process, however the knowledge base is broader compared to the older production machines where intimate knowledge of each machine was considered essential. These machines are often set and operated by the same person, where the operator will supervise a small number of machines (cell).

The design of a CNC lathe varies with different manufacturers, but they all have some common elements. The turret holds the tool holders and indexes them as needed, the spindle holds the work piece and there are slides that let the turret move in multiple axis simultaneously.

Special purpose lathe:

Special purpose lathes are used for special purposes and for jobs, which cannot be accommodated and conveniently machined on a standard lathe. Wheel lathe, "T" lathe, duplicating lathe are some examples of special purpose lathe.

Wheel lathe:

A wheel lathe is a machine tool used in the manufacturing and reconditioning of wheels for railway cars. Wheel lathes are used to re-cut the profile of the wheel in cases where the wheel has been worn down or compromised because of excessive use. Like other lathes, the wheel lathe works by gripping the work object in this case, the wheel in a piece called a chuck and rotating the object across a single fixed cutting point. As the wheel

rotates across the axis of the cutting tool, strips of metal are shaved off its surface. The machine operator controls the lathe and shapes the wheel in a process known as turning.

"T" lathe

These lathes are used for production work where large quantities of identical work pieces are manufactured. These lathes are used for larger diameter facing of the work piece.

Duplicating lathe

One type of specialized lathe is duplicating or copying lathe also known as Blanchard lathe after its inventor Thomas Blanchard. This type of lathe was able to create shapes identical to a standard pattern and it revolutionized the process of gun stock making in 1820's when it was invented.

Differences between a Engine lathe and turret lathe & capstan lathe

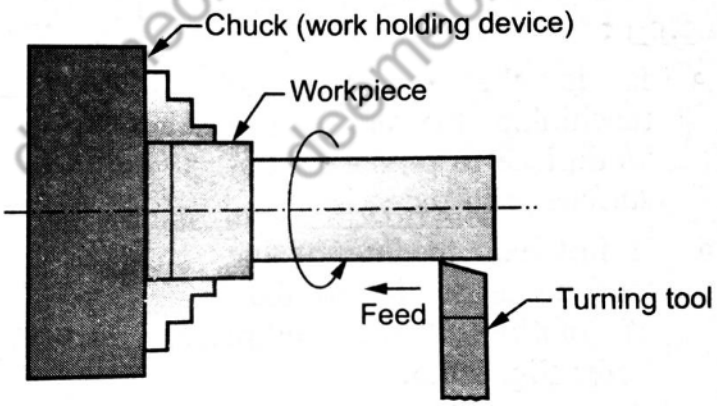
Engine lathe	Turret & Capstan lathe
1. There is only one tool post	1. There are two tool posts – four-way tool post and rear tool post
2. Tailstock is located at the right side of the bed	2. Tailstock is replaced by a hexagonal tool head called turret
3. Only one cutting tool can be held in the tailstock	3. A minimum of six tools can be held in the turret
4. No provision to control the tool movement (feed) automatically	4. Turret movement can be controlled automatically
5. Only one tool can be put into machining at a time. Tools have to be set every time according to the operation to be performed	5. More tools can be set on the turret and each of them can be set at the work one by one automatically
6. Setting of tools will take more time	6. Setting of cutting tool is easy
7. A skilled operator is necessary to work on the machine	7. After the initial settings are made, a semi-skilled operator can operate the machine
8. The machine has to be stopped to change the tool	8. Tools can be indexed even when the machine is on
9. The production cost is high	9. Production cost is reduced as the rate of production is more
10. Motors with 3 to 5 HP are used	10. Motors with 15 HP are used

Differences between a turret lathe and a capstan lathe

Turret lathe	Capstan lathe
1. Turret tool head is directly fitted on the saddle and both of them appear like one unit.	1. Turret head is mounted on a slide called ram which is mounted on the saddle
2. Saddle is moved to provide feed to the tool	2. To provide feed to the tool, saddle is locked at a particular point and the ram is moved
3. It is difficult to move the saddle for feed	3. It is easy to move the ram for feed
4. As the saddle can be moved along the entire length of the bed, it is suitable for longer work pieces	4. As the movement of the ram is limited, it is suitable for machining shorter work pieces only
5. To index the turret tool head, a clamping lever is released and the turret is rotated manually	5. When the hand wheel for the ram is reversed, the turret tool head is indexed automatically
6. Limit dogs are used to control the distance of tool movement	6. To control the distance of tool movement, feed stop screws are provided at the rear side of the turret
7. Some turret lathes have the facility of moving the turret at right angles to the lathe axis	7. No such facility
8. Heavy and sturdy	8. Lighter in construction
9. Suitable for machining heavy and large work pieces	9. Only small and light work pieces are machined
10. Machining can be done by providing more depth of cut and feed	10. Only limited amount of feed and depth of cut are provided for machining

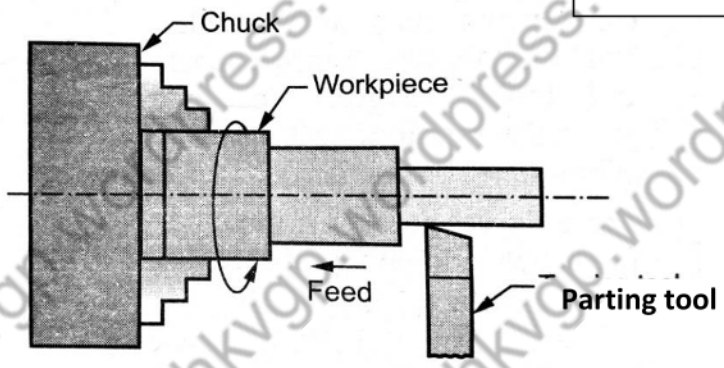
Lathe Operations:

1] Straight turning:



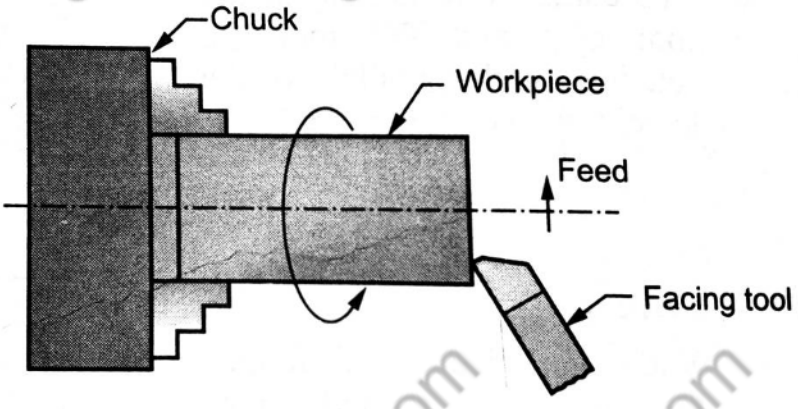
- Excess material is removed from the work piece to produce a cylindrical surface.
- The cutting tool is held in the tool post and fed into the rotating work parallel to the lathe axis.

2] Step turning:



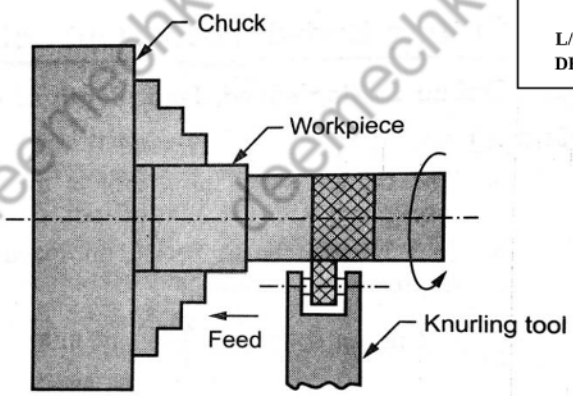
- Here excess materials from the workpiece is removed non uniformly i.e. in various steps with different diameter.

3] Facing:



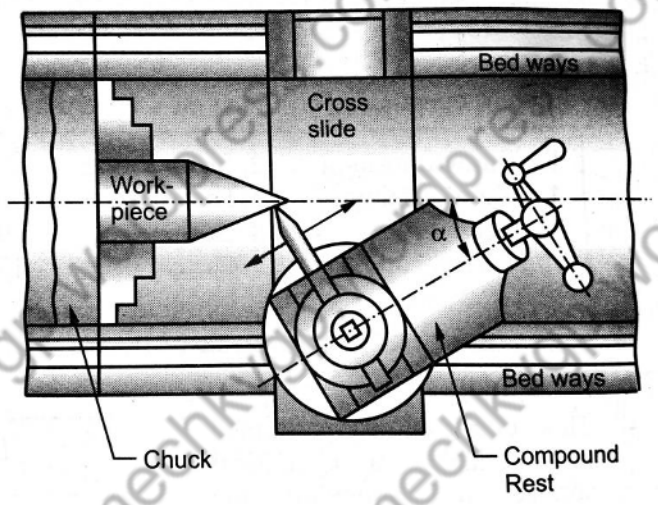
- It is the operation of machining the ends of a workpiece to produce a flat surface with the axis.

4] Knurling:



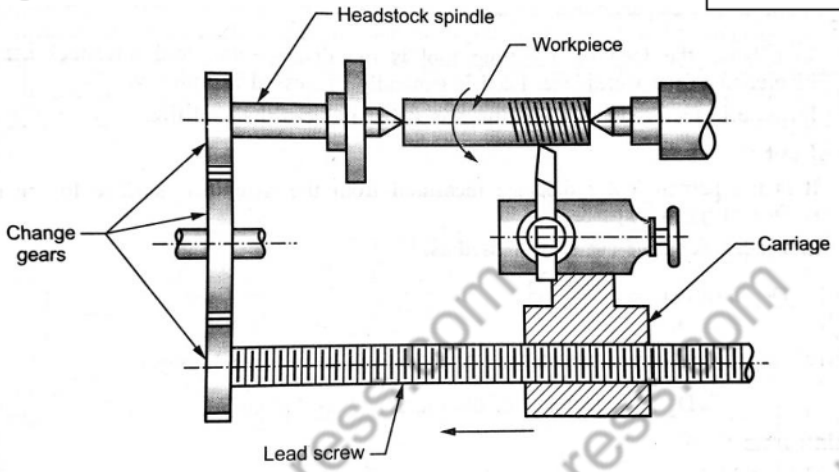
- It is a finishing process used to create any combination of horizontal, vertical or crossing lines on the surface of a workpiece.
- Knurling provides a better grip as compared to smooth surface.

5] Taper turning:



- Taper turning is a machinings operation, which means that the diameter of cylindrical workpieces gradually decreases from one part to another. The taper can be external or internal.

6] Thread cutting:



- In thread cutting, helical grooves are produced on a cylindrical or conical surface by feeding the tool longitudinally when the workpiece is revolved between the centres (live centre and dead centre).

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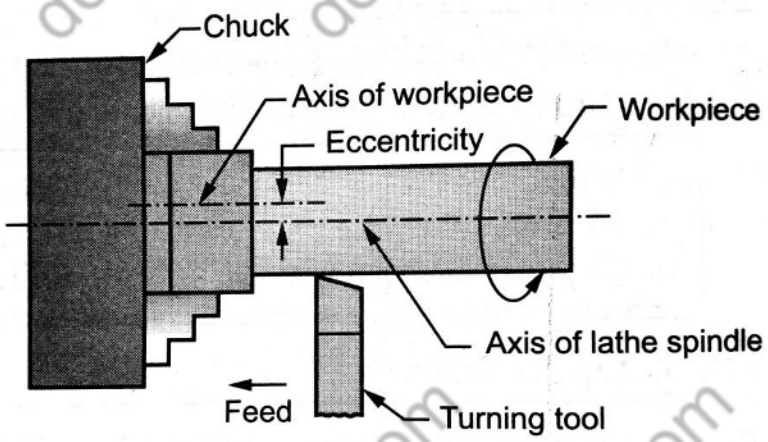
7] Eccentric turning:



- If a cylindrical work piece has two separate axis of rotation, one being out of center at the other, the work piece is termed as eccentric and turning of different surfaces of the work piece is known as “Eccentric Turning”.