LECTURE NOTES

ON

MANUFACTURING TECHNOLOGY

4^{th} SEMESTER MECHANICAL

BY

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Date - 12 / 12 / 2019

Manufacturing :- It is the production of products for use ore sale using labour and Machines, tools, chemical and biological processing ore formulation, and is the essence of secondary industry.

Technology :- It is the sum of techniques, skills, Methods and processes used in the accomplishment of objectives such as scientific investigation.

Manufacturing technology :-

It is defined as the field of study focused on process techniques ore equipments, cost reeduction, increase efficiency, enhanced reliability, security, safety and pollution free object.

*) Reliability :- It is the probability that a system ore component will perform fore a prescribed time under environment Condition.

Chapter-1 Tool Materials

Tool Materials Characteristics :-

(i) Hot hardness :-

→ Material must remain harder than the common work At higher operating temperature.

(ii) Weare Resistance :-

→ The Material must resist relative hardness of workpiece or Any changes.

(iii) Toughness :-

→ It is a common/combination of strength and ductility. It must have sufficient toughness to prevent vabireation and breakage.

(iv) Cost & fabrication :-

→ It should have reasonable (Low).

→ It should have low cost within limits.

Ductility :- It is the physical propercty of a Material associated with the ability to be rammered thin or stretched into wire Without breaking. A ductile substance can be drawing into a wire.

Malleability :- It is the physical propercty of

Metals that defined their ability to be hammered, pressed, or rolled into thin sheet without breaking.

Date - 14/12/2019

Composition of Tool Material :-

Tool Material types are cutting tool :-

(i) Carbon Steel :-

Composition : The carbon amount reange from 0.008 - 1.5%

(ii) Medium Alloy Steel :-

Composition :- It have a carbon contain same as plain carbon steel or mild steel in addition 5% Alloy of tungsten (W), Molybedicum (Mo), Chromicum (Cr), Vanadium (V).

(iii) High Speed Steel (H.S.S) :-

High tungsten :- (18-4-1) (T-series)

Tungsten - 18%

Chromium - 4%

Vanadium - 1%

High Molybedium (6-6-4-2) (M-series)

Molybedium - 6%

Tungsten - 6%

Chromium - 4%

Vanadium - 2%

High Cobalt :- (C-series)

It is called as "super High Speed Steel".

Cobalt added 2-15%

Tungsten - 20%

Chromium - 4%

Vanadium - 2%

(iv) Satelites :-

It is a non-ferrous Alloy

Cobalt = 40-48%

Chromium = 30-35%

Tungsten = 12-19%

(v) Cemented carbite :-

82% Tungsten carbite

10% Titanium Carbite

8 % Cobalt

vi) Ceramics :-

→ Generally use aluminium oxide

→ It is made by composing AlO_2 powder in a mold about 260 kg/cm^2

vii) ~~Ceram~~ Diamond :-

→ These are Naturally occuring diamond or Carbon Compounds.

→ Composition of Abrasive.

→ It is mainly used for grinding harden material where superior finishing required.

Task :

*) What is duplex steel ?

→ Duplex stainless steels are family of stainless steels. These are called duplex grades because their Metallurgical structure Consist of two phases, austenitic and ferrite in roughly equal proportion.

*) What are ceramics and abrasive ?

Ceramics :- A ceramic is an inorganic non-Metalic Solid made up of either

Metal ore non-metal compounds that have been shaped and then hardened by heating to high temperature.

Abrasive :- An Abrasive is a material, often a Mineral, i.e. used to shape ore finish a workpiece through rubbing which leads to parts of the workpiece being worn may away by friction.

Ex:- wood, sandpaper, sand

(iii) Hydraulic Energy to mechanical Energy

Water turbines :- Convert hydraulic Energy to Mechanical Energy is used to drive generators that develop electricity water turbines are generally designed and Manufatured to each power stations own conditions of water head, discharge, water and power demands.

(iv) A.c to D.c

A rectifier is an electrical device that converts A.c to D.c.

(v) Electrical Energy to Mechanical Energy

A Motore generates ore converts Electrical to Mechanical Energy.

Mechanical to Energy to Electrical Energy

A generatore converts Mechanical to Electrical Energy.

(viii) (C.B.N) Cubic Boran nitride

→ It contains atoms of boran and nitride.

→ It is the hardest tool material.

*) Physical properties and uses of different type of tool material.

The various type of tool materials Are

(i) Carbon steel

(ii) medium alloy steel

(iii) high Speed steel

(iv) cast alloy stelites

(v) Cemented Carbide tool material

(vi) Oxide ore Ceramic tool material

(vii) Diamonds

(viii) Abrasives

(ix) Cubic boran nitride (CBN)

1. Carbon steel :-

Properties

→ Low hot hardness

→ poor hardenability

→ Can be with stand cutting temperature 200°C

→ Carbon tool steel are harder than many hss.

Uses :-

It can be used most economically under the condition.

→ The carbon steel are used for making certain taps and drills.

→ For making wood working tools.

2. Medium Alloy steel :-

Properties :-

→ Better hardenability

→ higher wear resistance

→ higherc hardness

Uses :-

→ used forc making drills.

→ used forc making taps, etc.

→ It can out effectively up to temperature 250° to 300°c

3. High speed steel :- (H.S.S.)

Properties :-

→ High hot hardness

→ cutting tool retain the cutting abilily up to 600°c

→ High weare resistance

→ The hardenability is good.

Uses :-

→ Drills.

→ Broaches

→ Milling cutters

→ Lathe cutting tools.

→ Taps, etc.

4. Cast alloy Satelite :-

Properties :-

(i) Material is not so hard of at room temperature.

(ii) hardness above 1000°f is greater than H.S.S.

(iii) Hot hardness is higher than H.S.S at higher temperature.

(iv) This Material is very brittle.

uses :-

These materials are used Extensively in some non metal cutting application such as rubber, plastic.

(v) Cemented Carbite :-

properties :-

→ High hardness

→ high heat resistance

→ high wear resistance

→ high hot hardness up to a temperature of 900°C.

→ Low specific heat

Uses :-
These tool materials are used for Machining Cast iron, alloy steels.

(6) Oxides Ceramic tool Material :-

Properties :-

(i) The ceramic has Extremely high Compressive Strength. It is Quietly brittle.

(ii) Heat Conductivity is very low. So generally no coolant is required while Machining.

(iii) The ceramic tools can retain strength and hardness up to 1200°C

Uses :-
These tool materials are used for turening boaring, etc operations at high Speed.

(7) Diamonds :-

Properties :-

(i) It has low co-efficient of friction.

(ii) hardness of the diamond is incompressible.

Uses :- Diamonds are suitable cutting very hard material such as glass, Plas...

Ceramics.

Abrasive :-

Uses :-

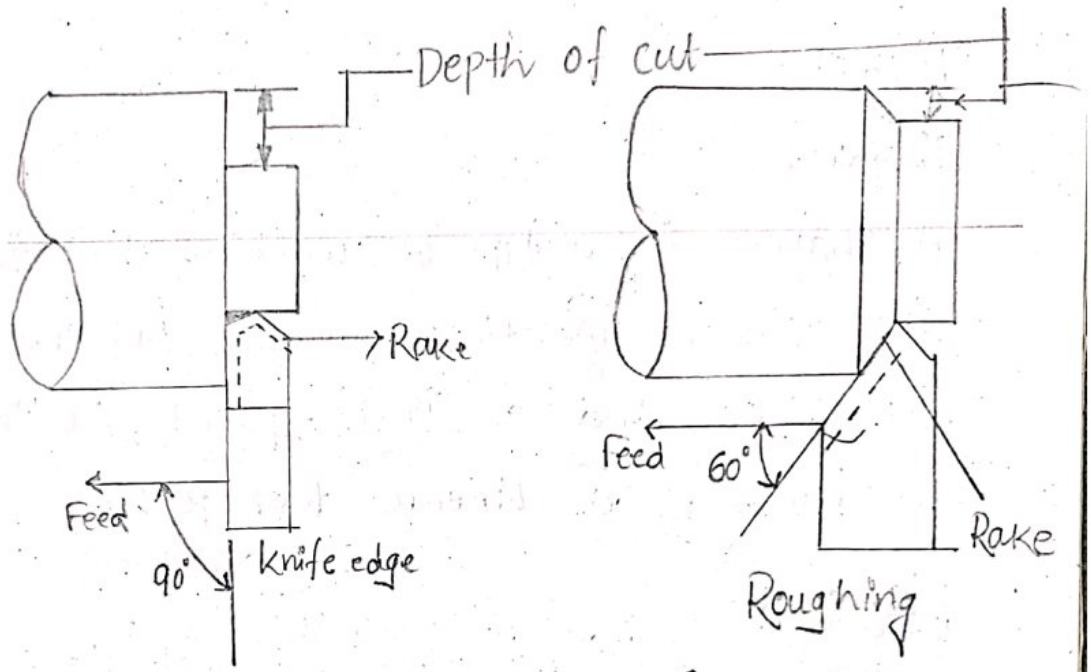
For most grinding opereations there are two kind of abreasives in genereal use namely aluminium oxide and silicon carbite. The aluminium oxide abreasive are used for grinding all high tensile materials, where as silicon carbite abreasive are moree stable for low tensile materials.

Chapter - 2 Cutting tool Dt - 21/12/19

Cutting tool :-

(i) Any tool which can be used to remove material from workpiece.

(ii) Tool must be harder than the work piece and it must contain specific geometry and clearance angle.



(Orthogonal) (Oblique)

(Picture of orthogonal and oblique cutting)

Single point cutting tool :-

Rake angle :- It is the angle between front of cutting face to perpendicular line to workpiece.

Single point cutting edge :-

These have only one cutting edge used in length, shapper planer, boaring machine.

multi point cutting edge :-

These have more than one cutting edge or multiple cutting edge (ex - drill).

Task :-

Shaper :-

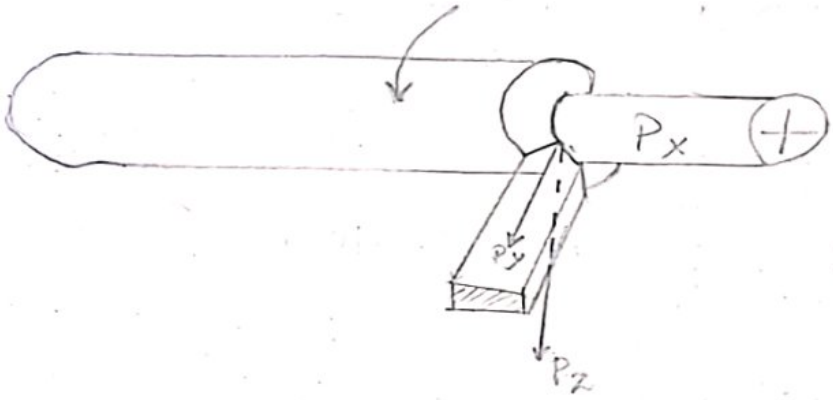
A shaper is a type of machine tool that uses linear relative motion between the workpiece and a single-point cutting tool to machine a linear tool path.

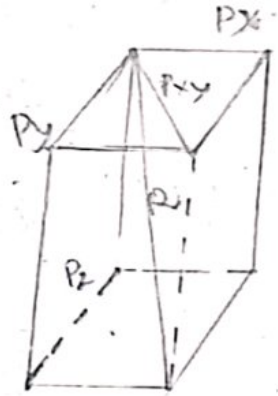
Planer :-

A planer is a type of metal working machine tool that uses linear relative motion between the work piece and a single-point cutting tool to cut the workpiece.

Slifer :-

I move smoothly over a surface with a twisting or oscillating motion.





Picture of cutting forces in conventional turning process.

Cutting Action of hand tool :- Dt - 04/01/2a

Chisel :-

(i) It is a cutting tool and a attached blade on its end. It is used for carving cutting hared materials like wood, stone, metal.

(ii) It is forced in material linear to relative motion.

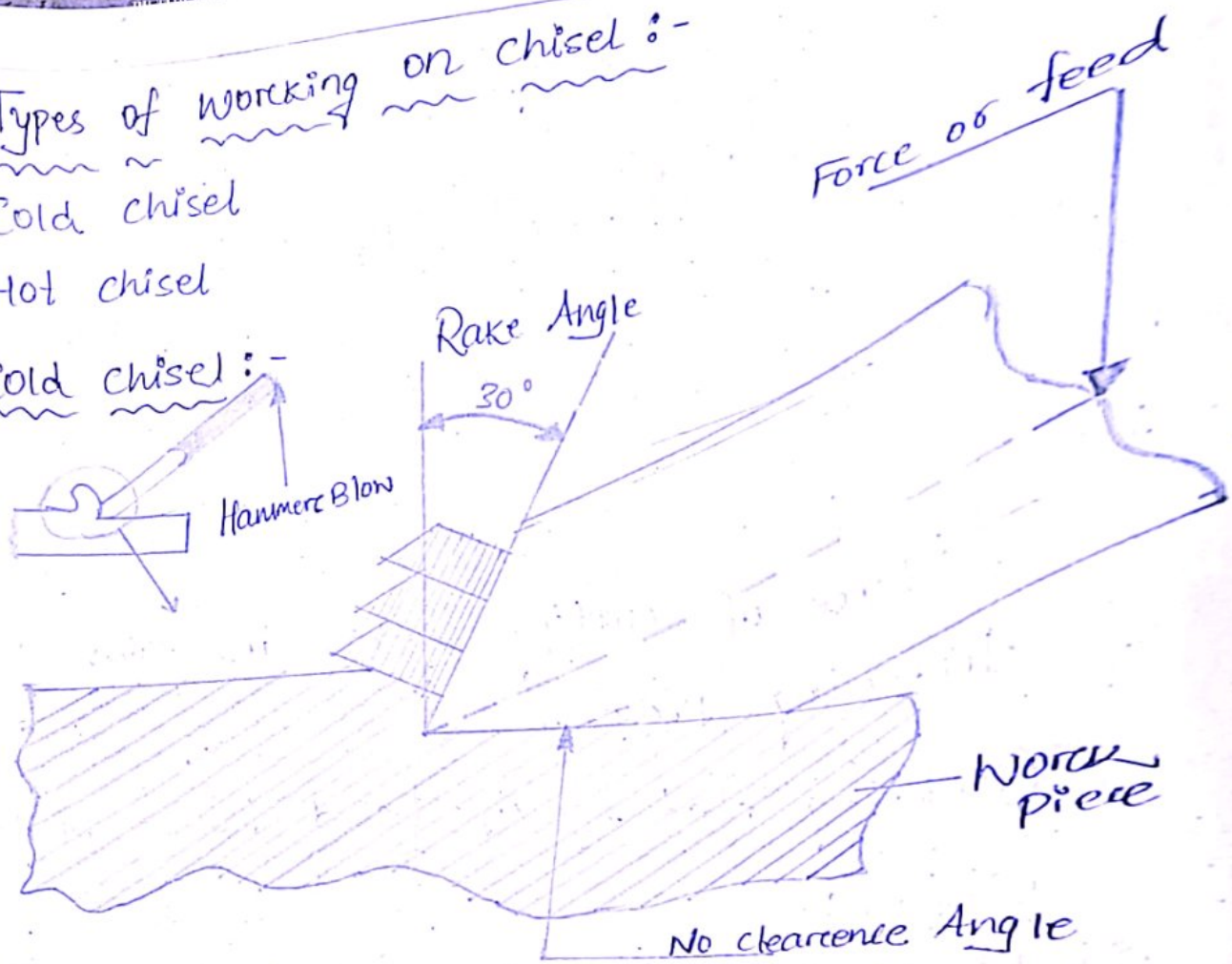
(iii) The driving force manually applied using hammer.

(iv) It is used in wood working and metal working operations like carving, cutting, shaving, shaping trimming.

Types of working on chisel :-

(i) Cold chisel
(ii) Hot chisel

Cold chisel :-

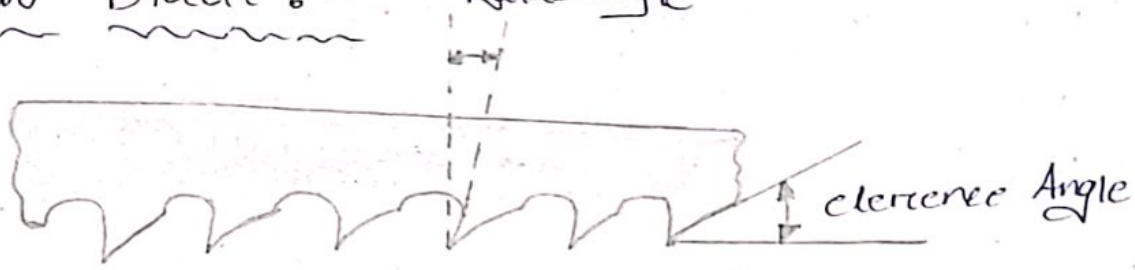


(i) It is made from tempered steel.
(ii) used to cut cold material.
(iii) used for rough finishing.

Hot chisel :-

(i) It is used to cut materials at high temperature (heated metal)
(ii) used for smooth finishing

Hacksaw Blade :-



(i) It is a fine tooth saw. It can cut plastic, wood, and others non-metals.

(ii) It is attached to 'C' shaped frame which holds blade under tension.

(iii) The frame can be adjustable.

(iv) Blades are available in standaredised length of 10" or 12" for standard Hack saw.

(v) The pitch of the teeth 14-32 per inch.

(vi) It is set in a wave. It is made of carbon steel or mild steel.

Die :-

(i) It is used for low strength material such as Rubber, cloth, plastic, sheet metal etc.

(ii) It can be done on flat bed or rotary process.

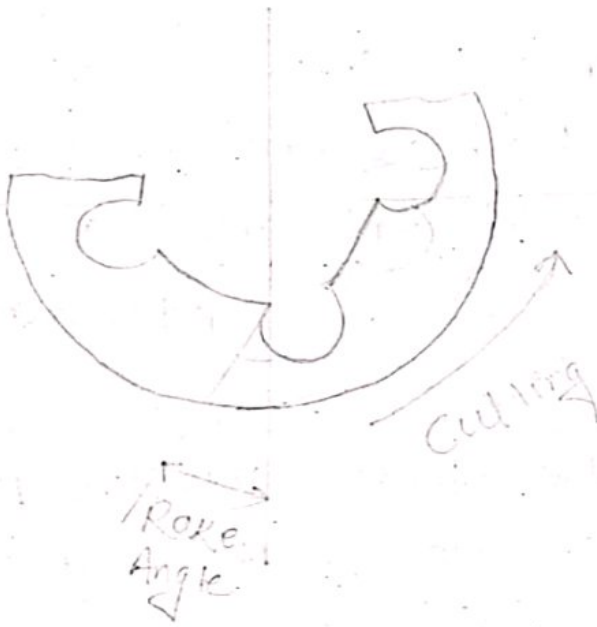
(iii) For rotary dry cutting used cylindrical die.

(iv) It is used to cut External thread on rod or Pipe.

(v) It is made up of H.S.S (High Speed Steel)

(vi) This process is called dieing.

(vii) This process can be controlled by electric, hydraulic and pressurised.



(Rake Angle on a die)

Reamer :-

i) It is a multiple edge cutting tool the proces of enlarging hole is called reamming.

ii) It consists of helical cutting edge.

iii) It is used to remove small amount of material and it is made of high carbon or plain carbon steel.

Machining process parameter :-

Factors affecting tool life :-

*) Cutting speed :-

It can be defined as relative surface speed between tool at the job or amount of length that will pass the cutting edge of tool per. unit time.

*) Feed :-

It is defined as relation by small movement per cycle of cutting tool relative to the workpiece usually, along the cutting speed direction.

*) Depth of cut :- (D.O.C)

→ It is the thickness of the layer of metal removed in one cut or pass.

→ Initial - final.

vii) colourless and orderless

viii) harmless to bearing

ix) harmless to skin

x) non - corrosive

xi) Transperancy

xii) low viscosity

xiii) low price.

Choice of cutting fluids :-

1) Type of opercation

2) The reate of material removed

3) material of the workpiece

4) material of the tool

5) Surface finish requirements.

6) Cost of cutting fluids.

*) TIME of cutting fluids :-

Water :-

Pure water is the best cutting fluid available because of heighest heat carrying capacity but, water Choeats corrosion.

*) Coolants & lubricants :-

These are the liquid or gases applied to tool and workpiece to assist cutting operations (friction, heat, and gases flying chips).

*) Purpose of lubricants :-

(i) To cool the tool
ii) To cool the work piece
iii) To lubricate and reduce friction.
iv) To improve surface finish.
v) Protect from corrosion.
vi) Break chips into small parcts.
vii) To wash the chips away from the tool.

*) Properties of cutting fluids :-

i) High High absorption
ii) Good lubrication
iii) Low co-efficient of friction
iv) High flash point.
v) Stability not to oxide
vi) Neutral in nature (chemically not creating)

vii) colourless and orderless

viii) harmless to bearing

ix) harmless to skin

x) non - corrosive

xi) Transperancy

xii) low viscosity

xiii) low price.

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Water:-

Pure water is the best cutting fluid available because of heighest heat carrying capacity but, water chreats corrosion.

Soluble Oil :-

→ These are made of 80% of water, soap and mineral oil.

→ The soap break oil into minor particle to dispose through water.

→ Water increase cooling, and oil provide lubrication.

*) Straight oils :- (fatty oils)

The straight oils may be

i) Straight mineral oils, Kirosine, Petrol.

ii) It consist of animal, vegetable or synthetic equivalent, lard oil etc.

iii) It has both cooling and lubricating properety.

*) Mixed oils :-

i) It is a combination of mineral fatty oil.

*) Cutting tool Geometry :-

SHANK :- It is main body of the tool.

FLANK :- Surface below and adjecent to the edge

Heel :-

It is the intersection of flank and base of the tool

Nose :-

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

Cutting edge :-

It is the face of the tool which remove the material from workpiece it consists of measure, Minor and nose.

Face :- The face surface against which the chisels slides upwards.

Base :- It is the undercise of the SHANK

Rake :-

It is the scope away from the cutting edge Largerc then rake angle more the cutting surface.

(ii) Negative it sloop is reversed.

Side reake Angle :-

It is the Angle between tool face & line parallel to base Measure perpendicular.

(i) Negative is sloope is towards cutting tools.

(ii) positive is type away from the cutting edge.

Designation of cutting tool :-

ASA :- American standard assosiation
ANSI :- American National standard Institute
ORS :- Orthogonal Rake System

Tool Angles :- (CS - Side cutting edge Angle)

The Angle between the side cutting edge and side of the tool shanks.

End cutting edge Angle :- (CE)

It is the Angle between and cutting edge and a line Normal to the tools shanks.

Side relief Angle :-

It is the Angle between side flank and below the edge and perpendicular top to the base of tool Measured arce right Angle.

End relief Angle :-

It is the Angle between the [illegible] prees on a the end flank and blow the side cutting edge and a perpendicular line to the base Measured at right Angle.

Back Rake Angle :-

It is the Angle between the face of the tool & line parallel to base of the tool measured

Perpendicular.

(i) The Angle is positive in cutting edge shape downward.

(ii) Negative it sloop is reversed.

Side reake Angle :-

It is the Angle between tool face & line parallel to base Measure perpendicular.

(i) Negative is sloope is towards cutting tools.

(ii) positive is type away from the cutting edge.

CH-3 LATHE MACHINE

Lathe machine :-

It one of oldest machine used for rotating & machining pitch of work. its function is to move metal form work piece of required shape & size.

Type of lathe :-

1. Speed Lathe :-
   Wood working, Sintering, polishing, & spinning.
2. Engine Lathe :-
   Belt drive, motor drive, geare head lathe.
3. Bench Lathe :-
   Tool room Lathe, Capstan & turrent Lathe
4. Special propose Lathe :-
   Wheel Lathe, Bed Lathe

Parts of Lathe :-

Bed :-

(i) The bed is the base and foundation of the lathe.
(ii) It is made of cast iron.
(iii) It is massive and rigid casting mode in piece to resist deflection & vibration.

Its Support head stock, tail stock carriage.

Head Stocks :-

(i) It is an assemebly permanately fastened to the left end of the lathe.

(ii) It provides Rotation of work are multiple Speed.

(iii) It is mode of carbon or Nickel Chroome steel.

(iv) It Contain Gear box, Chuck, face plate Spindle.

(v) Spindle is follow through out the length through which long bare can be feed.

Tail Stocks :-

(i) Located in owner way in right side of head.

(ii) It is a non-rotating part with slide and Clamt.

(iii) It accommondate or allow different length work pieces.

Uses :- Support other end of work when machined between do centred.

(iv) Hold the tool for drilling reaming & rapping.

Carriage :-

It is placed in between Head stock & tail Stocks.

→ It is movable & hold cutting tool to impact longitudinal cross speed.

Parts of carriage :-

① Saddle :-

It is an shape casting that feeds overe hed & it carriage cross slide & tool post.

② Cross Slide :-

It is mounted an saddle it provides cutting tool motion can be moved by feed screw controlled by wheel or by power feed.

③ Compound Rest :-

It is mounted top of cross-slide & support tool post it can be moved by screw and hand wheel not by power feed.

④ Tool post :-

It is mounted top of Compound rest and it can be moved and clamped in any position. it can rotate and hold the cutters at any desired Angle.

⑤ Apron :-

The percson of a the carriage which extend in front of the lathe which contain gears,

clutch leaver it also contain friction clutch.

(6) Feed Mechanism :-

Longitudinal feed Cross feed & Angular feed.

(7) Lathe opercations :-

Turning, chamfering, threading, cutting, facing, knurling, parting, grooving.

Facing :- it generate flat surface perpendicular to rotational exit. The tool feed into workpiece spindle speed selected and the tool feed by hand and feed given by cross-slide.

Turning :- it remove excess material from workpiece.

(i) Straight turning :-

It produce cylindrical shape.

(ii) Rough turning :- Remove of excess material by applying High rate of feed & depth (2-2-5 mm) and feed rate 0.30 - 1.05 mm.

(iii) Tapper turning :-

(i) Uniformly increase or decrease in diameter.

(ii) It produce Conical Surface.

(4) Knurling :-

(i) It is the process of marking a diamond shape pattern or a zigzag pattern on surface workpiece.

(ii) It help to provide groups and prevent from sliping it uses special knurling tool set up steel rollers with a holder.

Parting OFF :-

It is the operation of cutting workpiece after machine to required shape & size.

$$\boxed{\text{Tan } \theta = \frac{D-d}{2L}}$$

Threading Cutting :-

→ It is similar to cutting operation where boring tool with cutting edge used to create thread.

→ The tool is fixed on tool post and Angle feed through lathe.

→ The components as per Given data of lathe.

Internal Machining :-

① Drilling :-

(i) Production of cylindrical hole by rotating cutting edge called drill.

(ii) Work piece revolve is check or Face plate and drill head in tail stock.

(iii) Feed affected by movement of tailstock.

② Boring :-

→ It is the operation of enlarging of hole by drilling, punching and forging.

→ The work clamped in carriage & the boring bar hold the tool.

→ The work clamped is carriage & the boring bar holds the tools.

→ Longitudinal moment Gives feed.

Safety measure during Machining :-

(i) before operating one should fuel orgfarid how to reun and stop.

(ii) Safety gogyles perdferced.

(iii) Above rainp bercs let clutch.

(iv) Sarck distance menting tools and instru-

Capstan & Turrent

(1) The head stock posses is wider range of speeds and the in construction it require 15 HP power to drive the spindle.

(2) The tool post mounted on the cross slide is four ways & a rear tool post is mounted on the rear slide which holds 4 tools.

(3) In turrent lathe, the tail stock is replaced by a turrent by a turrent which is hexagonal block which contain is 6 tools on each face.

(4) The feed movement of each tool set on square of hexagonal turrent is Regularity by stops & feed strips.

(5) Combination cuts can be taken by mountly two or more tools on the sides on the same face of turrent.

(6) The labour cost is less

(7) The threads are cuts by die heads & taps

(8) Turreent lathe are suitable for producing large no of identical pieces.

Engine Lathe

(i) It requires 3 hp drive the spindle.

(ii) In Engine lathe one tool can be mounted at one time for different operations.

(iii) It can accommodate one tool of limited size.

(iv) The feed movement is given by head.

(v) Combination cuts can not be done.

(vi) Labour cost is more.

(vii) The threads are cut by lead screws

Centre lathe is suitable for odd jobs having different shaps & sizes.

(viii) The threads are not cut by lead screws.

	Capstan Lathe	Turrent lathe
(i)	Its turrent head is mounted in slide which mores on the Guidle ways produced on the saddle.	(i) It is turrent to head is mounted directly on the saddle.
(ii)	For feeding the tool to the work the saddle is fixed at convenient distance from the work.	(ii) FOR feeding the tool to the work, the entire saddle is unit is moved.
(iii)	It is suitable for smaller size & lighter jobs it is not suitable for heavy cutting condition.	(iii) It is suitable for long and heavy work and Severe cutting Conditions.
(iv)	It is suitable to work the smaller bare up to 60mm dia.	(iv) It used to work for large size bare up to 200mm dia.
(v)	The turrent head may hexagonal ore circular.	(v) Turrent head is hexagonal.
(vi)	It is smaller in size compound to turrent lathe.	(vi) It is large in size as Compared to capstan lathe.
(vii)	The tool traverse is faster and offers less faigure to the hands of the of the operator.	(vii) The tool feeding is reacting slower and provide more fatigue to operation hands.

Production of Hexagonal Bolts :-

Operation No	Description of operation	Tool Position	Tools
01	Hold in Collect	1st Turrent position	- Bare stock
02	Turn to 16 mm dia	2nd Turrent position	- Roller steady bar turning tools.
03	Form end of Bolt	3rd Turrent position	- Roller steady bar Ending tool.
04	Screw 16 mm	4th turrent position	- slef opening diahead with chaser
05	Chamfer	front cross slide tool post	- 16 mm Chamfering tools
06	Parting off	Rear tool post	- parting off tool.

1. Chuck
2. Tool post
3. Chamfering tool
4. Reamer
5. Second drill
6. First drill
7. drill & Counter sink
8. Work stock
9. Four Station turrent

(a) Setting of Bare stock :-

It is said at a distance 70mm from the collect by using slipe gauge extra Length of 10mm bolt length allowed 4mm parting of 6mm if clearence.

(b) Setting of Rollers Steady turning tools :-

(i) The turning tool set turrent face for diameter 16mm. the stop tool is 20mm

(ii) The rollers are set behind cutting edge at 1.5 mm

C) Setting Roller bend ending tools :-

The ending set on turrient face burright operation afterc turning Proces.

D) Setting self opening dia head :-

It is mounted turrient face and diasure fitted to cut thread 16mm diameter.

E) Setting chamfering tools :-

It is mounted 4 station turrient on cross slide and extreme longitude position of the saddle Adjusted.

5) Setting of parting off tools :-

This set on really tool post and the longitudinal position parting off at distance 4mm of from furrcent faie.

Internal Machining :-

Tapper turening :-

D = large diameter of tapper

d = small diameter of tapper

L = Length of work

l = Length of the tapper

α = half tapper Angle

S = Set over.

CH-4 SHAPER MACHINE DT-10/02/2020

Shaper Machine :-

→ It is Reciprocating dia of Machine tool used to produce.

→ Flat surfaces the surface may be horizontal, Vertically or inclide.

Working Principle :-

① The job are fixed rigidly in vise clamped to machine table and the tool held in tool post mounted the Ram.

② The Ram Nores and four motion and max the tool to cut material in fourds stocks.

③ No cutting task places running return ideal stock stocks the job is given feed in a direction normal to the cutting tool actions.

Types of Shaper :-

① According to Machanism 3 types
- @ Crank types
- ⑤ gear types
- © hordlic types

② According position and travel of Ram
- @ horizontal type

b) verctical types
c) head travelling types

③ According desing of table
ⓐ stand shaperc
ⓑ inversal shaperc

④ According cutting stoe:-
ⓐ push types
ⓑ drean types

Specification of Shaperc Machine:-

① maximum length strock - 175mm to 900mm.
② maximum Horizontal treavel
③ maximum verctical travel
④ maximum distance from table to Ram.
⑤ tool box with verctical aregesment:
⑥ Length on wrcite table
⑦ Differcent Range of speed and avaiable
⑧ Differcent Range of feed available

Parts of shaper Machine :-

Base :-

The Base provided Setability as it support equipments of shaper and observe force and vibration it is made cast iron.

Column :-

→ Column is hole casting and mounted on base it provided.

→ Ram doiring Mechanism nescessary gud ways provided way linear Moment of the Ram.

Cross Rail :-

(i) It is mounted on front vertical guide ways to of column.

(ii) It has two parallel guide on its top vertical plane perpendicular to Ram axis.

Saddle :-

(i) It is Mounted on cross rail which hold the table.

(ii) The cross wise Mounted of the table control by feed screw.

Table :-

→ The table fastened into column and provided 'T' salt for Mounting work piece.

② The table can moved open down and cross wise.

Ram :-

① It is Reciprocating member and semic cylindrical Shapere.

② It is full rigid inside and a single point cutting tool attach tool.

Tool head :-

Single point cutting tool used. the tool head hold the tool provide Verctical and Angular feed and provided automatic relief during return stroke.

Shapere -Mechanism :-

① Crank and slotted Mechanism :-

① PMM & PMR Toangen to the crank pin circle.

② When the link is PM

③ $\overset{\frown}{CEB}$ = Cutting Stroke

$\overset{\frown}{BDC}$ = Return Stroke

$\frac{CEB}{BDC} = \frac{\alpha}{B} = \frac{\alpha}{360° - 1}$

1. Knob
2. Pin
3. Helical Spring
4. Pawl
5. Wheel
6. Arm fulcum
7. Connecting Pin
8. Driving disc
9. Crank Pin

1. The Arm Swing about screw around Connecting Rod and Carrya Spring loaded pawl.
2. It helps in power feed to operated forward and reciver directions.
3. Direction can be provided by varying the distance between Centre and disc
4. Large the side greater the feed and v.
5. The Amount feed depend on type of finish the discarry a spear gear driven bull gear. it cause the Connecting rod to Resiprocated and it moves the pawl overe one or more teeth.

Applications Of Shaperr Machine :-

(1) To generented straight and that flat Surface.
(2) Smooth rete surface.
(3) To marcke make gear teeth
(4) Machining dies. Poines and Slotes.

CH-5 PLANNER MACHINE

Planner Machine :-

It is a Machine which produce plane flat surface by single point cutting tool.

Shaper Machine	Planner Machine
(i) It used for small workings	(i) It used for large workings.
(ii) Single point cutting tool used	(ii) To Extra cutting used for Machining.
(iii) Cutting tool Moves open. down in horizontal directions.	(iii) Cutting tool remain motionless.
(iv) Stroke length is small	(iv) Stroke length is bigger
(v) Cutting Rate and Cutting Stroke differ	(v) It has stable cutting Speed.
(vi) Work piece held tightly on Bed.	(vi) Work piece held firmly on a horizontal moving table.

*) Parts of a Planner :-

BED :-

→ The bed of a planner is a box like casting cross ribs.

→ It is a very large in size and heavy in weight and it supports the column and all other moving parts of the Machine.

→ The Guided ways provided on the bed for the movement of the table.

The hollow space within the box like structure of the bed home the driving Mechanism for the table.

Table :-

The table supports the job and reciprocates along the ways of the bed.

The planner table is heavy rectangular casting and is made of Cast iron.

The top face of the table is accurately finished in order to hold the job correctly.

The top face of the table is "T" slotted for clamping the job and job holding devices.

At each end of the table or Hollow space is left for Collecting chips.

A groove is cut on the side of the table for clamping planner revising dugs at different position.

Column :-

→ It is a rigid vertical box like structure.

→ The front face of each housing is accurately Machines to provide Guide ways on which the Coosier may be Slipped up and down for accommodating the different Suitable

Heights job.

The housing is enclosed with vertical elevating screw and cross feed screws for tool heads and counter balanced the weight of the cross rail.

Cross Rail :-

→ It is a rigid box like casting connecting the two housings.

→ The cross rail can be raised or lowered on the face of the housing and can be clamped at any desired position.

→ The cross rail when clamped showed remain parallel to the top surface of the table.

→ The two elevating screws in two the housing are rotated by an equal horizontal any in position.

→ The two tool heads are mounted upon the cross Rail.

→ The cross Rail has screws for vertical and cross flew of the tool heads and a screw for Elevating the rail.

Tool head :-

→ The tool head of the planers is similar to that of a Shaper in Construction and Operation.

Clamping of job :-

→ There are three important points to be noted while clamping the job on the planner table.

→ proper clamping should be done all around the job

→ The job should be held that the surface planned should remain in proper position. With other surface.

→ The job may be located on the planning Machine table by the following methods.

→ By standard clamping devices.

→ By Special fixtures.

→ The Standard clamping devices are T-bolts, Stops, planer jacks, heavy duty vises, Angle plates & Planner Centres etc.

*) PLANNER TOOLS :-

→ The cutting tools which are uses in planer are Single point cutting tool which are used in lathe and shaper.

→ Planer tool may be solid forged type or bit type.

→ The bit may be brazed, welded or mechanically fed on a M.S. bar.

→ As a planer tool has to take up heavy cuts, the tools are made heavier and largers in cross-section.

6th lesson

Milling Machine :-

→ A Milling Machine is a type of metal cutting device which remove metal with a fast rotating multi-touch cutter.

→ This Machine yield high production of differs varities of jobs; in choice for production Machine.

→ Smaller jobs arce employed for machining in Milling M/c.

→ Using Multi tooth cutters & various forms of cutter, A Milling Machine can be economically empolyed for generating varcites of surface Quite Speedily.

Types of Milling Machine :-

(a) Column and Knee type :-
- Hand Milling
- plane Milling
- universal
- Vertical

(b) fixed belt type Milling

(c) planner type Milling

iv) Special type Milling M/c.

Rotary table M/c

Drop Milling Machine

Milling attachment :-

→ It is a rotary table types work holding device bolted on the table.

→ It provides a rotary motion to the work-piece in addition to longitudinal, cross & vertical Motions.

Work Holding devices :-

→ Angle Plates.

→ V-blocks

→ Special fixtures.

Dividing head :-

They are 3 types

① Plane or simply indexing head (imp)

② universal dividing head (V.I.m.P)

③ Optical dividing head.

Plane indexing head :-

→ It has a Spindle which carrcy job holding

device such as jaw, chuck, hace blade and centre carries.

→ A worm rigidly fixed on spindle which crank is mounted on warm shaft such that the rotation result in rotation of spindle.

→ In a plane dividing head spindle rotates only on horizontal axis.

→ The index plate remain constant as fixed.

→ The Amount of spindle relative to work depend on ratio between worm and worm wheel.

→ The most common ratio is 40 : 1
i.e. = 40 revolution of index crank as worm wheel move the spindle one revolution.

universal dividing head :-

→ It is most commonly used type of attachment in milling machine.

→ It is used for setting the workpiece in horizontal vertical and inclined position relative to milling Machine table.

→ Turning the work periodically form indexing
→ A continouse rotary motion creates helical gelbov in milling operation.
→ The dividing head connected to table feed screw through a gear train to impact a continous rotary motion.
→ It working mechanism is the crank rigidly fixed at one end while the vevil runs feed.
→ The index plate is bolted with gear and can be locked against rotation of lock pin.

Optical Dividing head :-

→ It is use forc high precision Angulcar indencing with respective milling cutter the reading build into dividing head forc optical system.

Work Holding Attachments :-

Special Attachments use on milling Machine

→ Vertical Milling attachments
It is use forc horizontal spindle to do facing on horizontal surface

→ Universal milling attachment :-

Similar to vertical attachment with Acoivelling the Spindle about two mutual perpendicular axis.

Direct Index :-

It has an Index placed fitted directly on Spindle.

The intermediate use of work while is avoided.

The index plated has 24 holes and use index fixture

Compound

It uses two different circles of one plate.

It rotate the crank or the handle by

Differential index :-

A set of gears placed at extra in between plates.

It is connected to geare train, which recieve motion from worm wheel.

$$\frac{\text{Drivers}}{\text{Drivers}} = \frac{(n - N)\ 14}{11}$$

N is the no. of Division
(n-N) if positive the index plate rotate has with crank.
If (n-N) is negative it rotates opposite of crank. If negative

Chapter-7 Slotter MACHINE

:Slotter Machine :-

→ It is use fore cutting grooves, key ways and slots of
→ It Make Regular, irregular surface both by internal and External Machining.
→ The ram reciprocates in vertical axis.

Machine parts :-

Base/Bed :- It is rigidly build to with stand all cutting forces and entire load of the Machine.

Column :- It is vertical member and can't integral with the base.

→ Driving Mechanism & feeding Mechanism inside the Column.
→ The front vertical face accurately finished for providing ways to ram.

Saddle :-

→ It is mounted on Guideways and reciprocate from the Column by power or manual control it provide longitudinal feed.
→ The top surface of the saddle is accurately finished to provide ways to the Cross-Slide.

Cross-Slide :-

It is mounted upon the Guideway and move parallel to the column. It is controlled by power feed etc.

Rotating table :-

It is a circular table mounted on cross slide. The table rotate in degrees by rotating ~~indexing~~ Indexing.

T-Slots are cut top face of the table for holding different Clamp Device.

Ram :-

It is Reciprocating members of the Machine mounted on the column.

It Supports the tool at it's bottom end on toolhead.

Ram drive Mechanism :-

A slotter removes metal during Downward cutting Stroke and the upward is ideal stroke.

It reduce the ideal time and quick return Mechanism applied in the Machine.

Feed Mechanism :-

The feed is Given by table.

It has 3 types of moment.

(i) Longitudinal :-

It is the table feed is perpendicular to the column toward or away from face. it is called longitudinal.

(ii) Cross-feed :-

If the table feed is parallel to the face of column it is called cross-feed.

(iii) Circular feed :- It is the table rotated in vertical axis the feed moment is circular feed.

Slotter Tools :-

α = Top Rake Angle

β = Clearence Angle

→ In slotter the Angles are provided for better cutting and its acts along the length of the tool.

→ The nose of the tool slightly behind the shank.

→ The slotly tools are forged type.

→ Bit type tools fitted in heavy duty tool holdings.

Keyway cutting tools are thinner cutting edges.

→ round nose tools use fore machining circular surface.

→ Square nose tools are use fore machining flat surface.

Chapter - 8 Grinding

→ It is the process of removing material from work piece.

→ It brings the diameter very closed tolerance (0.02 mm) limits or Give a fine finish.

→ The grinding machine support and rotates Grinding wheel for smooth operations.

→ It remove very small amount chips.

Methods of Grinding :-

According to type surface to be grounded Main kinds of grinding method are

(i) External cylindrical grinding

(ii) Internal cylindrical grinding

External cylindrical grinding :-

→ It produce a straight or tappere surface on a workpiece.

→ It is a rotate a about its own axis between centres.

Internal cylindrical grinding :-

(i) It produce internal cylindrical holes & tapers
(ii) The work is chocked and rotated on its axis, and the grinding wheel rotate against the wheel.

Types of grinding :-

(1) Surface Grinding :-

It produce flat surface and work may be grounded by Grinding wheel.

(2) Face grinding :-

It is a Method of grinding vertical flat surface and the spindal wheel may be horizontal or vertical.

(3) Form grinding :-

It is done by speeially shaped grinding wheels to make Gearc teeth, thread, shaft, etc.

(4) Set Wheel Grinding :-

It is a Method of grinding short workpiece without changing Grinding wheel.

(5) Centre less Grinding :-

It is a Method of grinding External

Chapter - 8 Grinding

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(5) Centre less Grinding :-

It is a Method of grinding External

& internal cylindrical surface in which the work is supported among a regulating wheel, a grinding wheel.

(6) OFF hand Grinding :-

It is a rough grinding Method in which work is held in hand pressed against the rotating wheel.

Types of Grinding Machine :-

→ Surface Grinders
→ Cylindrical Grinders
→ Centre less Grinders
→ Portable Grinders
→ Pedestal Grinders
→ Cutters & tool Grinders
→ Internal Grinders
→ Flexible shaft Grinders

Chapter - 9 Internal Machining Operations

Introduction of drilling Machine :-

→ In a drilling Machine holes may be drilled Quickly and at a cost.

→ The hole is generated by the rotating edge of a cutting tool known as "drill bit" which exerets large force on the work clamped on the table.

Classification of drilling Machines :-

→ Bench drilling Machine

→ Pillare drilling Machine

→ Radial drilling Machine

Bench drilling Machine :-

→ The Bench drilling Machine is a small Machine for drilling a small holes at High Speed in light jobs. it is also called as "Sensitive drilling Machine".

→ The drill is fed into the work by purely hand Control.

→ This Machines are Capable of rotating drills of diameter from 1.5 to 15.5 mm.

Working of Bench drilling Machine :-

→ Workpiece with the exact location marked on it with the centre punch & clamped rigidly on the worktable.

→ Spindle axis and centere punch indentation are in same line.

→ Machine is started and drill bit is lowered by rotating feed handle.

→ Drill bit touches the work and starts removing material.

Pillare driling Machine :-

→ Pillare driling Machine is free standing and is of a fare heavierc Construction able to take laregerc drills.

→ It has a heavy frame to Support a Widerc rangc of Wark.

→ The table height is adjustable and power Speed and feeds arce available.

→ The laregerc drills normally have a taperc Shank located within taperc borve in the Spindle end.

These taperes arce standardized as morse taperes.

Radial Drilling Machine :-

→ These are heavy duty and versatile ~~drilling~~ ~~Adjustable~~ drilling Machine used to perform drilling operate on large and heavy work piece.

→ Holes up to 7.5 cm.

Working of Radial drilling Machine :-

→ Workpiece is marked for Exact location and mounted on the work table.

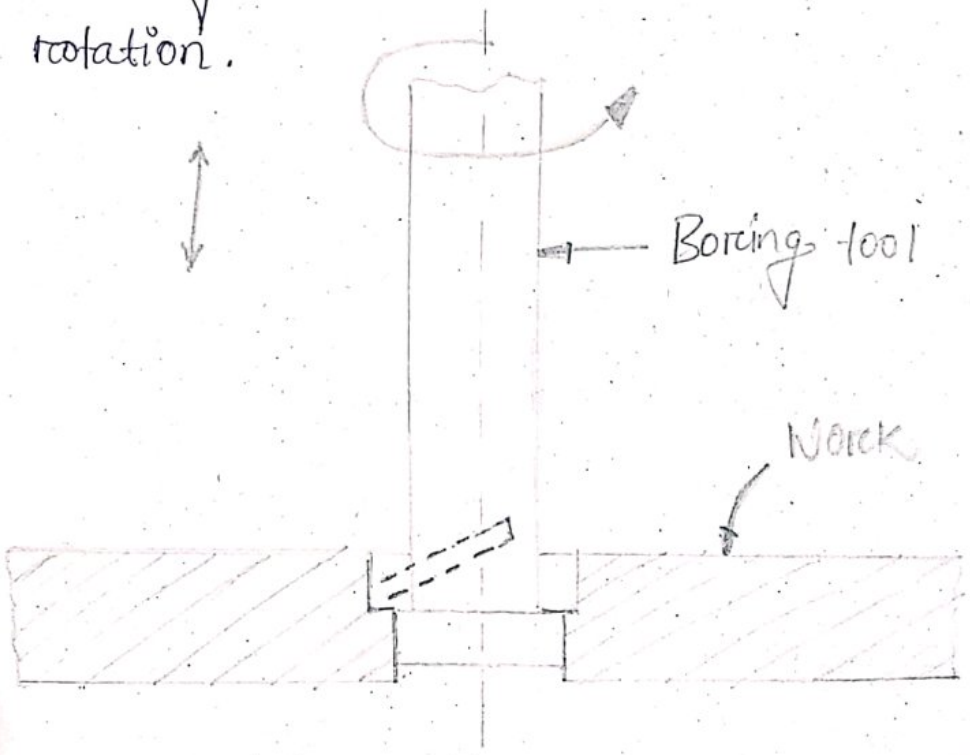
→ Drill bit is located by moving the radial arm and drill to the marked location.

→ By starting drill spindle motor holes are drilled.

*) Boring :-

→ Lathe boring is a cutting operation that uses a single-point cutting tool or a boring head to produce or cylindrical surfaces by enlarging an existing opening in a workpiece.

→ The cutting tool moves parallel to the axis of rotation.

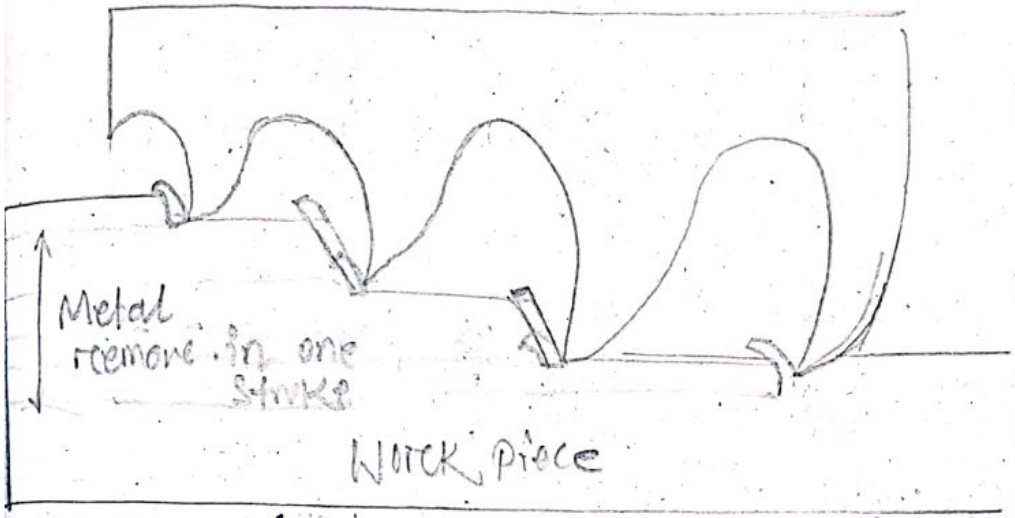


(Boring)

*) Broaching :-

→ Broaching is a machining process that uses a toothed tool, called a broach, to remove material.

→ Broaching is a similare technique to shaping with a long multiple-tooth cutterc.



(Broaching Operation)

Types of Broaching :-

Broaching's are two types :-

(1) Pull type
(2) Push type

Pull broaching :-

Workpiece is clamped to the broaching machine in stationary position and the broach is pulled through the work.

Broaches are usually long and are held in a special head. Pull broaching is mostly used for internal broaching.

(2) Push broaching :-

→ Workpiece is held in the broaching Machine in stationary position and broach is pushed through the portion of workpiece to the Machined.

→ Push broaching is done by hand and arbor Presses (hydraulic press).

→ This method is also use for internal broaching like for sizing and finishing the holes, Cavities, and key ways.

Applications of broaching :-

(i) High production reate.

(ii) Job is prepared in one stroke.

(iii) High tool life

(iv) Internal & External Machining can be done

(v) 0.8 micron finishing can be obtained.

(vi) Interchangeability of Components can be done due to tolerances obtained in reange.

(vii) Roughing & finishing can be done in single stroke.

*) Applications of broaching :-

→ Automotive
→ Agriculture
→ Industrial Manufacturing
→ Oil & gas
→ heavy equipment
→ fasteners & gears

Drilling

→ Drilling is performed to originate a hole.

→ Cutting tool used for drilling is known as drill.

→ Drill is a double point cutting tool.

→ Drilling is the first phase of hole fabrication. It doesn't require any special feature prior to operation.

→ Drilling can increase the length of the hole.

→ Surface quality of drilled hole is not very good.

→ Material removal rate (MRR) in drilling operation is higher.

Boring

→ Boring is performed to enlarge the diameter of an existing hole.

→ Cutting tool used for boring is known as boring bar.

→ Boring bar is a single point cutting.

→ A pre-drilled hole is mandatory for performing boring.

→ boring can increase diameter of an existing hole.

→ Surface Quality is better than drilling.

→ MRR is lower than drilling but higher than reaming.

Reaming

→ Reaming is performed to finish hole surfaces and to improve tolerance.

→ Cutting tool used for reaming is called reamer.

→ Reamer is a multi-point cutting tool.

→ Similar to boring, reaming can be performed only if a hollow part or hole exists.

→ Neither diameter nor length can be increased substantial by reaming.

→ Reaming produces high finished surface.

→ MRR is poor, MRR is n an issue in reaming.

chapter - 10 Surface finishing, Lapping :-

Definition of Surface finish :-

→ Surface finishing is the process of altering the surface on an object like Plating, polishing, anodizing, Coating fore the purpose of enhancing its appereance or functional properties.

→ The outermost boundary of a body adjacent to the aire is called Surface.
When sharp cutting edge, the terem Surface finish describe the boundary.

→ A Good Surface is affected by many variables in single ore multiple point machining.

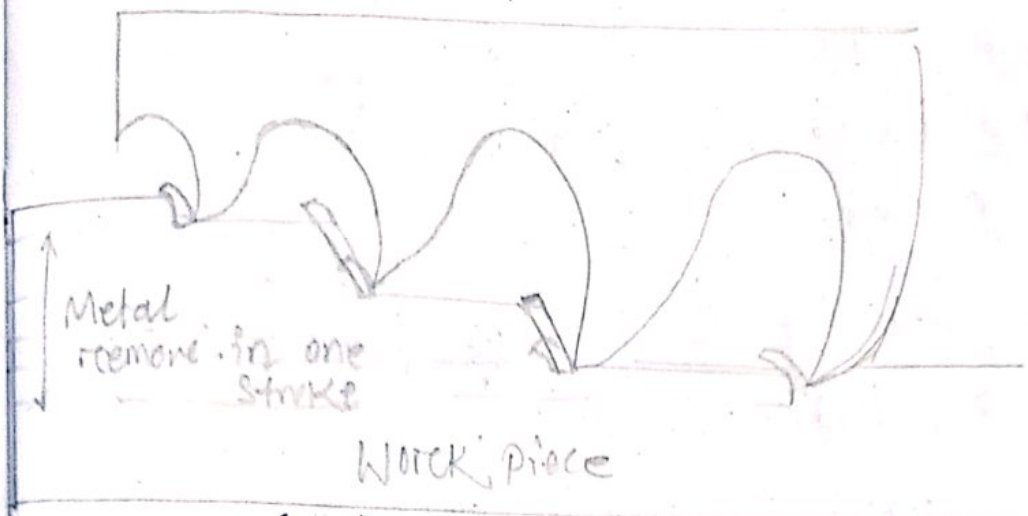
Surface finish is defined in terems of 4 factors:-

Roughness :- Closely Spaced Surface irregularities resulting from the manufatering process or tools.

Lay :- The overall direction of the roughness patteren which can be affected by the Machine and Setup.

Waviness :- longere Spaced irregularities Caused

→ Broaching is a similare technique to shaping with a long multiple-tooth cutter.



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