Production Process 2

Q.P CODE: 50533

Sem 4/Mechanical/ Choice based/ May-18

Q.1]a] Explain types of chips produce during machining process ? [5]

Ans : Types of chips

1. Discontinuous or segmental chips
2. Continuous chips without built up edge
3. Continuous chips with built up edge

Discontinuous of segmental chips

This container ships consists of independent plastically deformed segments which fall of a separate unconnected pieces are in some cases may loosely adhere to each other. These chips are produced by actual fracture of the metal head of the cutting edge. Conditions favoring the formation of discontinuous sheets are use of brittle workpiece cutting ductile materials at very low speed, large depth of cut and small rake angles.

Advantage

When associated with brittle materials discontinuous chips mean low power consumption, reasonable tool life and fair surface finish.

Disadvantage

For ductile material such its are not desirable because they indicate excessive tool wear and poor surface finish. Discontinuous ships also produce variation in cutting force coinciding with fracture cycle of the chips.

Continuous chips without built up edge.

Continuous chips without a built up edge are formed when the material ahead of the cutting is continuously be formed without fracture followed by a smooth flow of the chip of the tool face.conditions which lead to formation of such chips are cutting ductile materials at normal cutting speeds small depths of cut large rake angles,reduce friction on tool face and existence of suitable cutting temperature.the friction at the tool face may be reduced by using a polished tool,employing and efficient cutting fluid or by using tool materials with low coefficient of friction.

Advantage

This type of chips are removed desirable.They are associated with lower tool forces, better tool life and good surface finish.

Disadvantage

Sometimes such chips pose problems of chip disposal.

Continuous chips with built up edge

This type of chips are similar to the continuous cheap except that a built of age is form on the tool in this case. These built up edge is a stagnant mass of metal which sticks on to the face of the tool while the cheap shares past it.the built up edge is formed by welding of a section of chief material to the tool because of the high pressure and temperature.the built up edge grows by addition of more layers of metal till it becomes unstable and portion of it shears off going party with the cheap and partly with the workpiece. This process of forming and breaking of of the builder page is repeated add very fast rate.

Advantage

Machining with builder page maybe beneficial during the of machining in increasing the tool life because the cutting take place over the built up edge and not over the actual tooltip.

Disadvantages

The conditions which are conducive to the formation of built up is our cutting ductile material with high speed steel tools at low speed, affinity between tool and workpiece materials, high friction at tool face an absence or insufficient supply of cutting fluid.

Q.1]b] Explain machinability ? [5]

Ans: Machinability the property of the material to be machined and may be defined as the ease with which the material can be cut. Like tool life machinability also does not lend itself to any single definition acceptable to all authority. The ease with which a material can be machined varies with machine variables like cutting speed dimension of cut tool material and geometry, rigidity of the machine and type of cutting fluid used.

Similarly for a given set of machine conditions the ease of machining is influenced by work material variables like hardness, strength, microstructure, degree of cold work strain hardenability,size and shape of workpiece and the rigidity of workpiece.

Machinability is generally measured in terms of following

1. Tool life.
2. Magnitude of tool forces, machining work, energy or power consumption.
3. Rate of metal removal possible
4. Quality of surface produce

Other criteria that may be used for machinability include dimensional stability of finished work, is generated during cutting, ease of chip disposal, share angle or chip thickness ratio, drilling thrust, weight of drill penetrations and so on.

The important of these criteria as for as machining cost are concerned is the tool life.machinability ratings of different materials based on true life are given in terms of the machinability index which is defined as machinability index

If machinability for free cutting steel for 20 minute tool life is considered as 100,the machinability index for different material is as follows:

Stainless steel 25

Low Carbon steel 60

Copper 70

Brass 180

Aluminum alloys 300-1500

Magnesium alloys 600-2000

Q.1]c] Distinguish between additive manufacturing and CNC machining ? [5]

Ans:

Sr. No	Additive manufacturing	CNC machining
1.	AM stand for additive manufacturing techniques.	CNC stands for computer numerical controlled techniques.
2.	It is additive process.	It is a subtractive process.
3.	I am generally uses for making materials.	CNC machine in can process Machin able materials.
4.	Speed is much lower in CNC machining.	Speed of CNC machine is faster than AM.
5.	Setup time required is less.	Considerable amount of time is required to set machine.
6.	AM can manufacture complex intricate shaped products in less time.	Certain complex shaped products cannot be manufactured on CNC unless they are broken into smaller section and reassembled at later stage.
7.	Accuracy of obtained by AM process is higher than date of CNC machining as the machine operates with a resolution of a few tens of microns.	Because of tool wear problem, vibration, material defect issues, accuracy of CNC machined product is less.
8.	Incorrect programming results into incorrect built of product.	Incorrect programming results in several damages and safety risks.

Q.1]d] Compare milling fixture and drilling fixtures. [5]

Ans:

Sr.No.	Features	Milling fixtures	Drilling fixtures

1.	Type of machine operations	Surface slots segment or form off machine	Drilling counterboring, countersinking, tapping and reaming.
2.	Nature of cut.	Intermittent more serious when using multiple machine	Continuous. Generally one job is machine at a time
3.	Forces involved	Heavy forces and torque acting intermittently	Much lighter forces and torque continuous in nature.
4.	Vibrations	High possibility of vibrations due to intermittent cutting	Much less chance of vibration.
5.	Clamping requirement	Combination of strength and mass is required to counter considerable forces and vibration.	The thrust is usually taken by the machine table. Only light torque to be balanced
6.	Mounting of the fixture	The fixture is family clamped the machine table	No clamping is necessary
7.	Weight	Milling fixtures are heavy and robust	Generally lightness is a main consideration to facilitate
8.	Tool fixing alignment fixtures	The fixture is provided with a tool setting gauge and tension piece for alignment	No such features are necessary.

Q.1]e] Explain strip layout. **[5]**

Ans: Any important requirement in planning sheet metal operations is to prepare a proper layout design.a proper stock layout is essential in order to decide how the blanks will be cut from the sheet stock in the best way.

While planning a blanking operation, for example, business to provide suitable clearance between adjacent blanks and edge of the last blank and the age of the strip to prevent the metal being drawn between the punch and die.

Figure 1 show some of the terms that are used in relation to strip layout. The following terms and normal used.

t= stock thickness

a= distance between edge of the strip and the blank called front and back scrap

b=distance between the nearest points of the blacks and also the distance between the edge of the blank and edge of the strip, called scrap

c= die advanced or the lead of the die. It is the distance from a point on one blank to the corresponding point on next blank

h= height of the blank or diameter in case of circular blank

W= width of the strip = h+2a

L= length of the strip for a given number of blanks

The distance a is generally given by the equation

$a = t + 0.015\ h$

Distance b must be large enough to prevent the scrap from twisting and wedging between the punch and die. A rule of thumb is to make it at least equal to 1.5t. other factors that permit it to be thinner are strip thickness, hardness of the material, type of operation, shape of the blank etc.the commonly used values of b are given in table below

Material thickness 1 mm	B mm
< 0.8	0.8
0.8 to 3.2	t
>3.2	3.2

Q.2]a] Define tool life and factors affecting the tool life **[10]**

Ans: Tool life may be defined as the effective time interval between resharpening of a tool.

- **Cutting speed**
  Cutting speed is the most important variable affecting to life. It has been shown that to life decreases with cutting speed according to the relation known as Taylor tool life equation.

  V = cutting speed m/s
  T= tool life min
  n = exponent whose value many depends on the tool for the very slightly with other machine variables
  C = a constant whose value depends upon the work material and other variables.
  Numerically c is equal to the cutting speed in m/s which will give way to life of 1 minute.
- The value of exponent and can be e obtained by plotting equation 1 on a log plot as shown in the figure.

$$n = \tan \emptyset = \frac{p}{q} = \frac{(\log v_1 - \log v_2)}{(\log t_2 - \log t_1)}$$

- The average value of n four common tool material is high speed steel 0.1 to 0.15 carbides 0.2 to 0.5 and ceramics 0.6 to 1.0

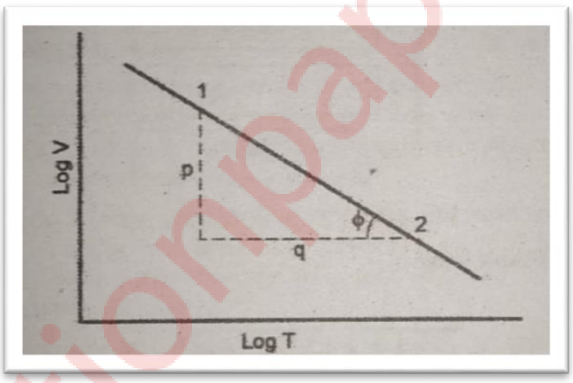


Fig 1 Tool life as a function of cutting speed

1. **Feed and depth of cut**
   - Another tool life equation that has been suggested involves feed and depth of cut in addition to cutting speed V.

$$VT^N F^{N_1} d^{N_2} = k$$

   - The values of coefficient n four feed and n for depth of cut very from 0.06 to 0.34 and 0.10 to 0.12 respectively.

2. **Tool material**
   - Tool material that can withstand high cutting temperature without losing their mechanical properties and geometry will have life.
   - High hardness give good wear resistance to the tool but reduces its toughness for shock resistance.
   - Material having higher thermal shock resistance, high thermal conductivity and low coefficient of thermal expansion need to higher tool life.

3. **Tool geometry**
    - Tool life is influenced by the geometry of the tool in following ways
    - Increase in positive rake angle reduces cutting forces and heat generation leading to increase tool life.
    - But increasing the rectangle inversely of its strength of the tool and uses the area of heat conduction leading to possibility of early tool failure.
    - Relief or clearance angle prevent rubbing of the tool flank against the work and hence help increases tool life. Again larger angles mechanical weakens the tool.
    - Tool life is also similarly affected by cutting edge angle
4. **Work material**
    - Hard work materials lead to higher power consumption and tool wear and hence shorter tool life.
    - Impurities or hard constitutes in the work material increases tool wear.
    - Scales and oxide layers present on the work material are highly abrasive and have adverse effect on tool life.
5. **Nature of cut**
    - Intermediate cutting leads to reduced tool life compared to continuous cutting.
    - Shock loading due to continuous work surface or hard spots leads to reduction in tool life.

Q.2]b] Write in detail about indexing device. [6]

Ans :

Use: indexing jigs and fixtures are used when workpiece with relationship location holes or slits are to be machined. According to the machine tool used for producing the holes or slots there are two ways in which workpiece may be indexed:

(i) By rotation of the workpiece for drilling, milling, and surface grinding operations.

(ii) By sliding of the workpiece for lathe and external grinding.

Drilling jigs with indexing

Indexing jigs for drilling are the jigs that are used to drill a series of holes on a circle on the face of a workpiece. Every time jig the is indexed, it brings a hole position under the drill. The design and manipulation of jigs for performing a given operation may vary. This is illustrated through three dimensions for drilling 6 equip spaced holes on the periphery of a circular blank.

Drilling is performed by using each of the six brushes successively with the workpiece clamped in the position. In the design after drilling each hole the workpiece is index through 60 degrees by using the previously drilled hole for location with help of a spring loaded pin. the use of an index plate for drilling 6 equispaced holes in a flange mounted on a plate.

The index plate has six equispaced . The slots in the indexing plate have one face radial to the centre and and other face inclined at 30 degree to the first face. Working surfaces are hardened and ground. A spring is provided to exert positive force on the plunger.

The workpiece is indexed and each hole is drilled in turn. The plunger fits by turn in each slot of the index plate. For indexing the plunger is pulled out of the slot and the index slot is moved till next slots come in line of the indexing plunger.

Indexing with a sliding device

An indexing arrangement using a sliding device. The sliding member consist of slots at suitable spacing and the fix member consisting of a spring loaded lever that fits in the slides. For indexing the lever is lifted off a slot and the sliding member is moved until the next slot comes under the lever.

Q.2]c] Explain in detail about powder bed fusion. [4]

Ans : The Powder Bed Fusion process includes the following commonly used printing techniques: Direct metal laser sintering (DMLS), Electron beam melting (EBM), Selective heat sintering (SHS), Selective laser melting (SLM) and Selective laser sintering (SLS).

Powder bed fusion (PBF) methods use either a laser or electron beam to melt and fuse material powder together. Electron beam melting (EBM), methods require a vacuum but can be used with metals and alloys in the creation of functional parts.

All PBF processes involve the spreading of the powder material over previous layers. There are different mechanisms to enable this, including a roller or a blade.

A hopper or a reservoir below of aside the bed provides fresh material supply. Direct metal laser sintering (DMLS) is the same as SLS, but with the use of metals and not plastics.

The process sinters the powder, layer by layer. Selective Heat Sintering differs from other processes by way of using a heated thermal print head to fuse powder material together. As before, layers are added with a roller in between fusion of layers. A platform lowers the model accordingly.

Q.3] State the classification of additive manufacturing (AM)/rapid prototyping system and explain one in detail. [10]

Ans : Acording to the type of raw material used in the process, AM/RP can be classified as :

1. **Liquid polymer system**

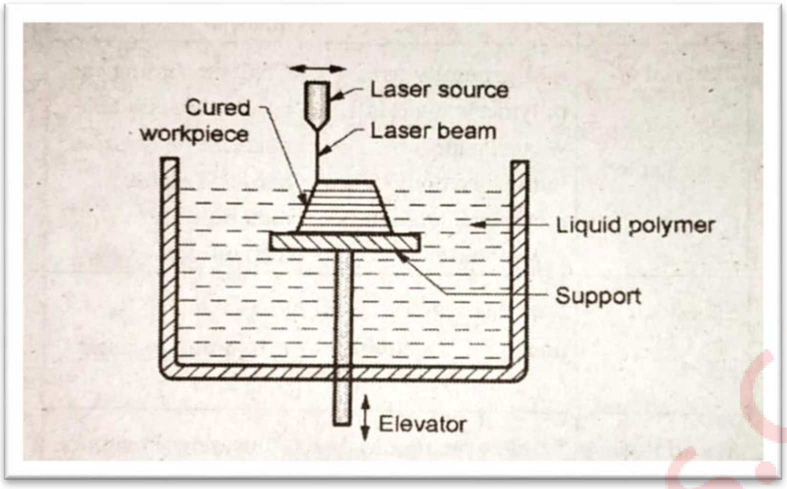


fig 1

Liquid polymers are the most popular material used in a m stereolithography apparatus and solid ground curing processes used liquid polymers.

Hindi system liquid state polymers are used as raw material. Today we love the path from the liquid,layers of liquid polymers are converted into solid forms by using a heat source such as UV laser. The process in which liquid is converted into solid state is called as **curing.**

2. **Discrete particle system**

Discrete particles are nothing but the Powder particles of uniform shape and size. Final powder particles gives better results.generally polymer powder who exhibits thermoplastic behaviour are used as it can be melted and again remelted to permit joining of layers on to one another, selective laser sintering and direct laser deposition are two main discrete particle system. In this system a heat source like UV laser is used to melt or software the Powder.

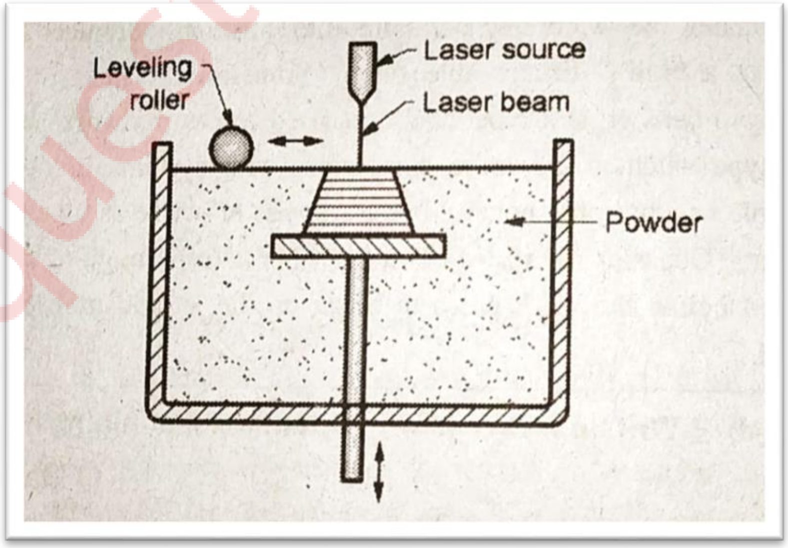


fig 2

3. Molten material system

this system uses of preheating chamber which increases the temperature of material to the melting point so that it can flow through a delivery system.

Fused deposition modelling is the most well-known method comes under the system. FDM process was originally developed by advanced ceramics research ACR situated in tuscon.

Arizona and it was significant advanced by stratasys, inc of Minneapolis, Minnesota.this process used extrusion method to deposit molten materials on to one another.

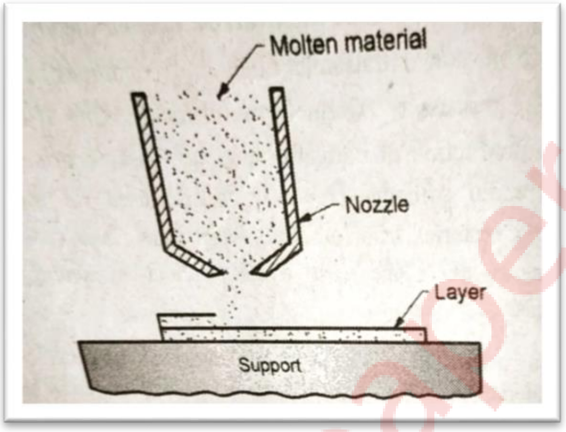


Fig 3

4. **Solid sheet system**

In this system players of solid sheet material such as paper plastic metals for composites are attached to form stack and laser is used to cut away unused portions.

This layer are bonded together by means of heat activated resins.

One of the earliest a.m. technology which uses this system is laminated object manufacturing l o m process

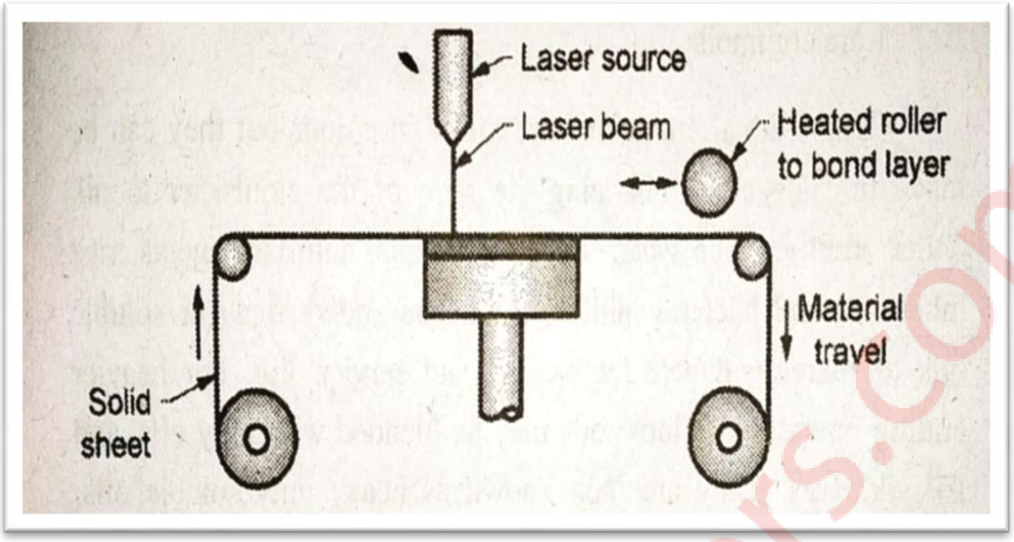


fig 4

Q.3]b]List different types of dynamometer and Explain strain gauge dynamometer [6]

Ans:

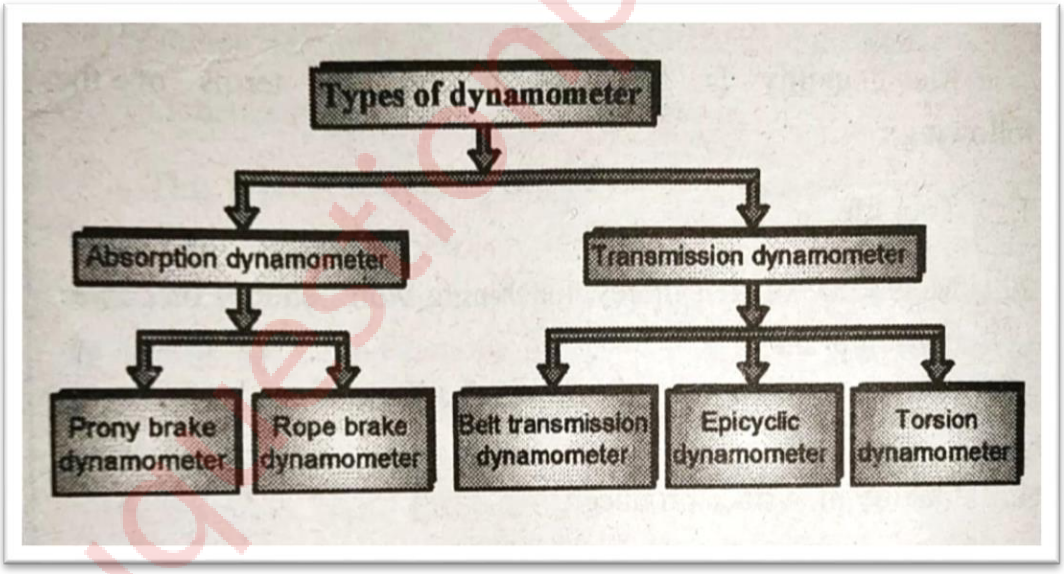


Fig 1

Strain gauge type dynamometer

It uses too sensitive dial indicators contacting two mutually perpendicular surfaces of the tool to measure deflection of the tool due to cutting and thrust forces on the tool.

A lever system can be utilized to magnify the deflection for increasing the sensitivity of the dynamometer.

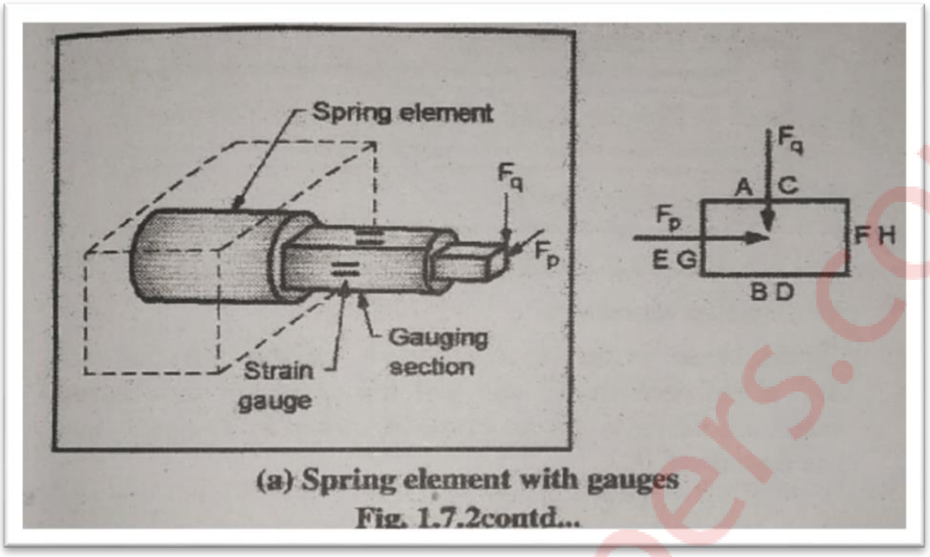


fig 1

The basic principle of the Strain gauge type dynamometer is shown in Fig. The spring element in this case is a circular rod which carries the tool. Strain gauges are mounted on two flat surfaces machined on the rod. This strain gauges give an output emf corresponding to the tool forces. The gauges are connected in four arms of a whetstone Bridge as shown in Fig

The emf from the bridge can be measured with the help of an oscilloscope or a record and calibrated to directly give the value of the force in corresponding direction. Strain gauge type of dynamometers are more sensitive. They can give a continuous record of forces. As such this dynamometers are more widely used.

Q.3]c] Explain end milling cutters [4]

Ans : End mills

An **end mill** is a type of milling cutter a cutting tool used in industrial milling applications. It is distinguished from the drill bit in its application, geometry, and manufacture. While a drill bit can only cut in the axial direction, a milling bit can generally cut in all directions, though some cannot cut axially

Types : Square **end mills** are used for general **milling** applications including slotting, profiling and plunge cutting.

Keyway **end mills** are manufactured with undersized cutting diameters to produce a tight fit between the keyway slot they cut and the woodruff key or keystock.

Use. : They are used for cutting slots, producing recess, squaring ends or surfacing

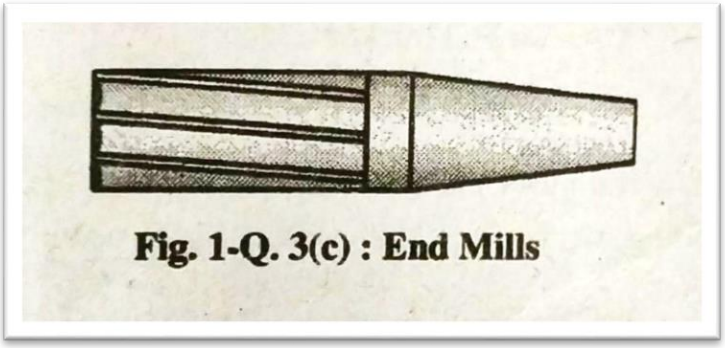


Fig 1

Q.4]a] Describe the mechanism of chip formation in detail **[10]**

Ans : Irrespective of the shape of chips produce the basic mechanism for the formation of chips is same in all cutting operations. When the force is applied to the cutting the material of the workpiece head of the cutting edge is deformed by a process of shear. If the thickness t and l of a chip (Fig. 1) are measured and compared with the corresponding and uncut dimensions t and l it is found that t t and l l establishing thereby that the metal cutting process is different from the type of cutting process in wood in which the work pieceis split with no change in thickness and length of the cut section.

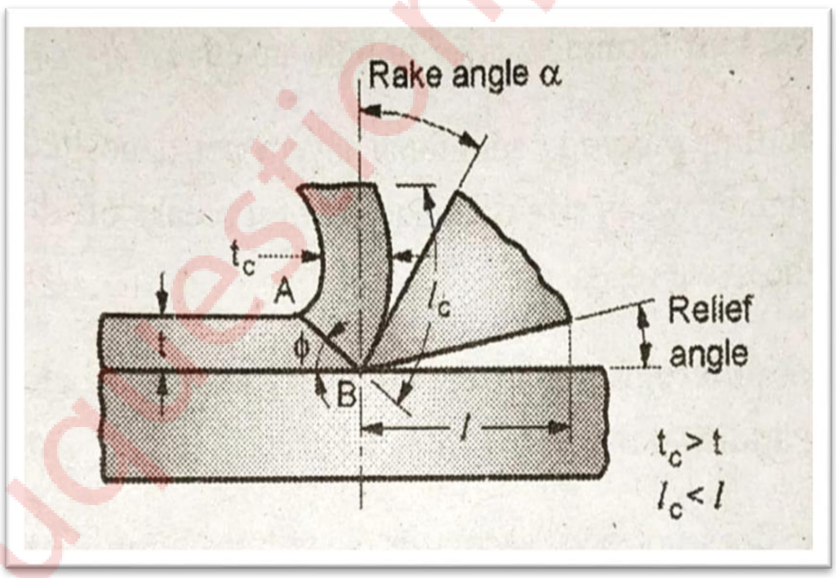


fig 1

Line AB projected perpendicular to the paper and parallel to itself describes what is known as the shear plane. Angle theta which the shear plane makes with the direction of tool travel is termed as the shear angle and has significant effect on the machining process. Obviously if this angle is low, the shear plane is larger and higher forces are required for shearing the workpiece.

what happens when the metal is cut is clearly shown by an idealized model due to Piispanen (1937) shown in Fig. 2

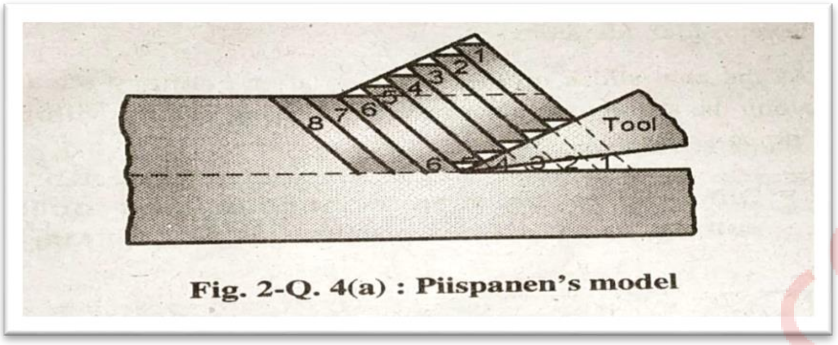


fig 2

In this model the metal to be cut is assumed to be divided into number of parallel segments stack like a Deck of cards in front of the tool. The segments in the chip number 1 to 5 original occupied the corresponding positions in the work piece shown dotted. As the tool advances the segment closest to the tool slips the finite distance relative to the uncut metal. when the tool advances to the next segment the previously cut segment moves up the tool face as a part of the chip. Pisspanen's model is oversimplified but it illustrates the block wise slip occurring in the metal cutting process. The evidence of such a block wise slip is found on the flow lines on the surface of the chip.

In the case of continuous chips, cashiering occurs without a fracture of the metal. If the metal is not able to undergo all the required amount of shear without fracture , fracture occurs intermittently along the shear plane breaking the chip into segments and producing discontinuous chips. In the case of continuous shapes with build-up edge the metal shears without fracture but the resistance the sliding of the chip up the tool face causes welding between the shape and tool face and hence a portion of chip shears of forming a layer of buildup edge.

As cutting proceed additional layer that deposited and the build-up edge grows in size proportion of its breaks off due to chip flow and cycle repeats.

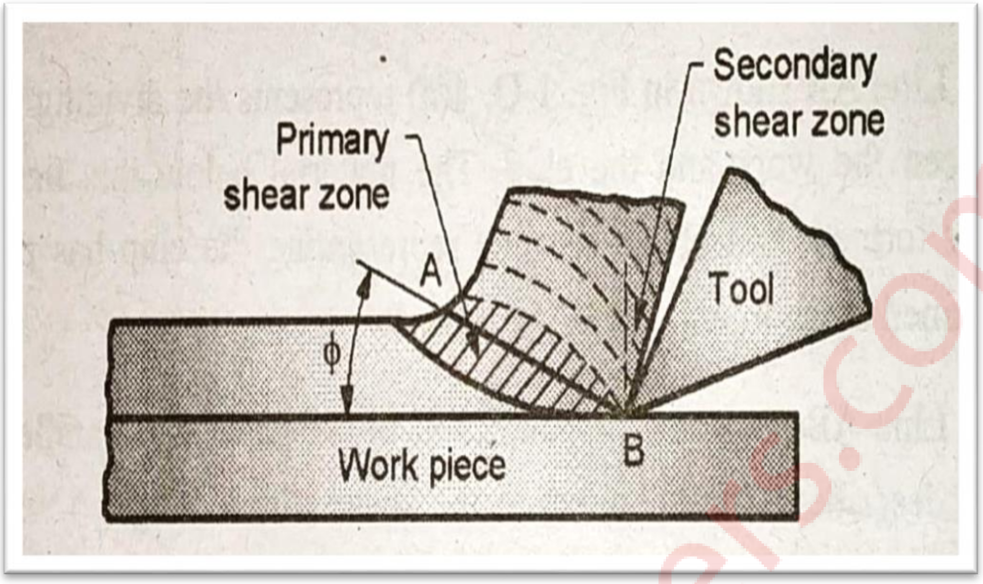


fig 3

If the photomicrographs of the chips are examined closely, the following additional points can be noticed :

1. Share does not occur across a plane but within a shear zone shown in Fig.

2. The thickness of the shear zone decreases as a cutting increases so that for higher speeds of the order of those normally used for cutting, this zone may be approximated by a plane. Both thin and thick zone models have been developed in literature.

3. As a chip slides up the tool face after primary shearing along the shear zone secondary shearing occurs within the chip as shown.

Q.4]b] Explain the steps in designing Bending dies. [6]

Ans : Design of bending dies

- **Bend radius**
  Bend radius is the radius of curvature on the inside of concave surface of the bend. The bend radius must not be very small is cracking of the material on the outside is to be awarded.
  Very ductile materials can have zero bend radius i.e.they can be folded over themselves but in general this radius should not be less than 0.8 mm.
  For hard materials bending is normally less than 180 degree and bend radius may be up to or higher than 5t. When bending to an angle of 90 degree, the minimum bend radius varies with material as follows :

Material	Minimum bend radius
Carbon steel	2 to 5t

Stainless steel	1t
Ti alloys	2 to 3.5t
Brass	0.3 to 0.5t
Aluminium	0.35 t

- **Bend allowance**
  Bend allowance for the length of the sheet required for bending is given by
  B = a (R +kt)
  Where, a = bend radius radians
  R = inside radius of the band, mm
  Kt = location of neutral axis from bottom surface, mm
  = 0.33 t when R< 2t
  = 0.5 t when R > 2t
- **Spring back**
  The spring back in low carbon steels can be upto 1 to 2 degree while for medium carbon steel it is 3 to 4 degree.
  For phosphor bronze and spring steel Spring that can be from 10 to 15 degree.
  To compensate for springback wedge shaped punches and the matching dice must be made with included angle less than that required in the party by the estimated value of spring back.
- **Width of die opening**
  The width of the opening is generally taken as 8t but for materials of high tensile strength and thickness greater than 25 mm it is taken as 12t.
- **Bending pressure**

For u bending aur channel bending the pressure is twice that of V bending while for edge bending it is about half that for V bending.

Q.4]c] Explain the design principles for turning fixture **[5]**

Ans : Turning and boring operations are performed on center lathe, automats, vertical boring mills and horizontal boring machines. Fixtures are used on all these is machines for location and holding of special and complex shaped work pieces. The general features of location, support and clamping are similar to dose jigs and milling fixtures. The spindles of center lathes and capstan and turret lathes are provided with flanged end and the fixtures are aligned with the flange bye means of a spigot and clamped by means of bolts as shown in Fig. 1

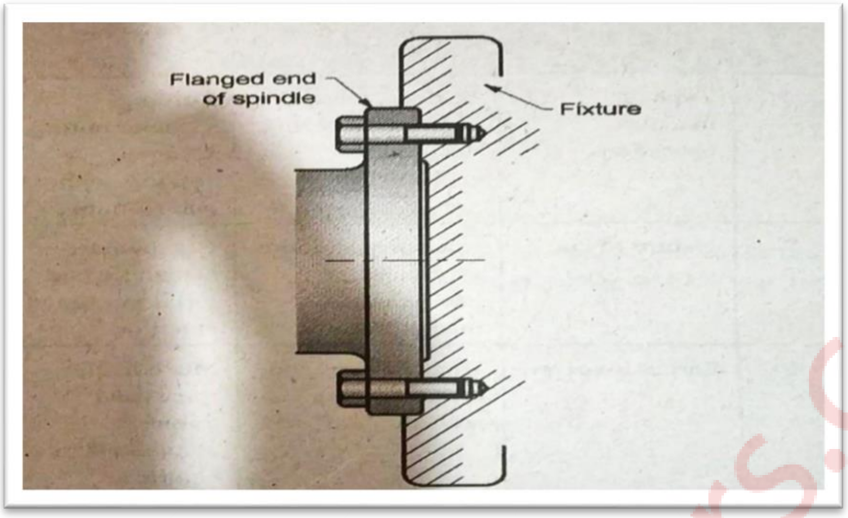


fig 1

One of the important requirements when dealing with turning fixtures is the need for balancing. If the workpiece has irregular shape there is always a possibility of unsymmetrical disposal of metal which was the balanced either by introducing compensating metal in the design of the fixture base or by attaching extra weight to it. Lack of balance will introduce dangerous centrifugal forces which will be detrimental to the spindle bearings parts of the fixture and the safety of the operator.

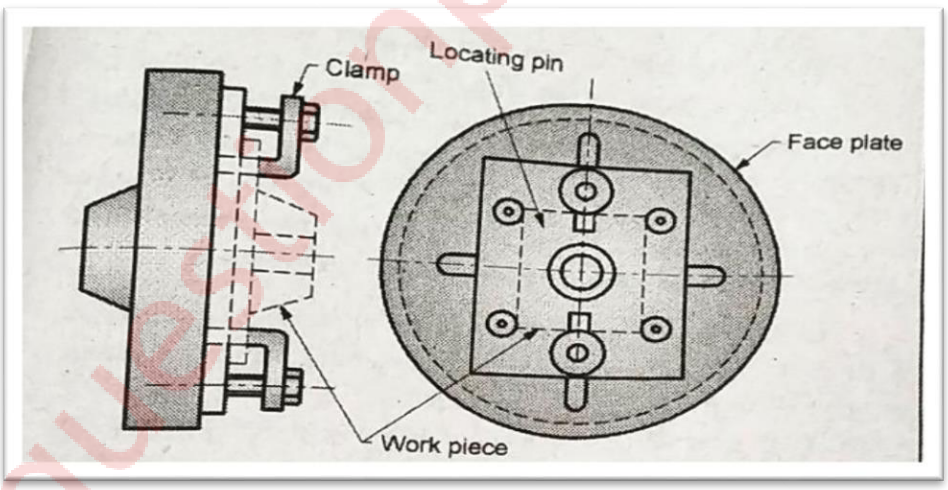


Fig 2

A typical turning fixture is shown in Fig. 2. The workpiece is located and clamped to a platform that projects out of the fixture base. The fixture illustrated is provided with a balance weight, a pilot bush to guide the boring bar. setting phase machined relative to the location system and a typical hardened setting piece.

Another type of lathe fixture mounted on the face plate is shown in Fig. 2

This fixture has a rectangular flat base plate which is bolted to the face place. The locating and the clamping arrangements are similar to the previous type but no counterweight is necessary because of the symmetry of the mass distribution around the centre line of the fixture. In both cases the face plate itself is either screwed on the spindle nose or bolted to the spindle flange.

Q.5]a] Give the classification of non traditional machining process and explain water jet machining in detail. [10]

Ans : The non-traditional machining process can be classified into various groups on the following basis.

1. **Types of energy required :** mechanical, chemical, electrochemical and thermoelectric.
2. **Mechanism involved in material removal :** abrasion erosion, ionic dissolution, vaporization, fusion etc or a combination of these.
3. **Source of immediate energy required for the process:** ultrasonic vibration, hydrostatic pressure,high electric current density, high voltage and amplified light.
4. **Medium of transfer of energy :** abrasive particles, electrolyte, electrons, hot gases, radiation etc.

Water jet machining

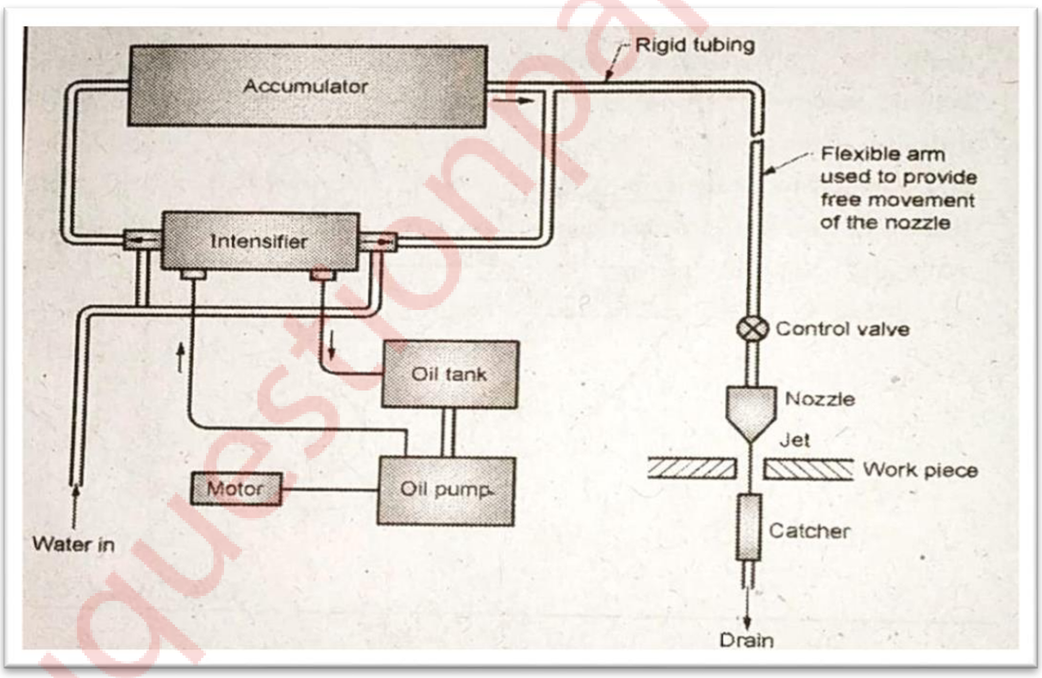


Fig 1

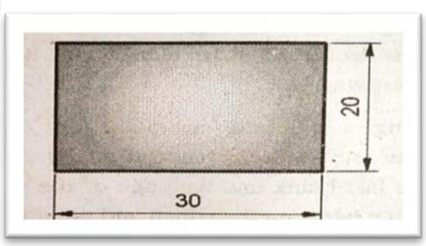
- The figure shows a typical wjm setup. It uses a motor driven oil pump to pump oil from an oil storage tank to an intensifier unit. The intensifier uses the low-pressure oil from the oil pump to generate the very high pressure water needed for the jet.
- Oil is applied on one side of a large piston in a double acting intensifier causing displacement of a small piston used for generating high pressure in the water.

- The movement of the large oil piston causes high pressure in water on one side of the intensifier while on other side it causes suction of water. When the piston reaches end of its stroke a four way valve reverses the direction of the flow of the oil thereby allowing pumping action in both directions.
- The output water pressure generated by the intensifier depends on the ratio of the area of the oil piston and water piston given by the relationship
- And maybe as high as 40 times the pressure of the oil supplied to the intensifier. By regulating the pressure of the input oil to the intensifier the pressure of the water can be easily regulated.
- High pressure accumulator is provided in the system to avoid off the water flow at the beginning of each stroke caused by compression of water at very high pressure.
- The accumulator serve as surge tank ok and ensure a smooth and uniform flow of water with pressure fluctuations within 5%. The high pressure water from the accumulator is taken to the water jet nozzle through rigid tubing because flexible tubing available in the market cannot which stand the high pressure involved.
- Swivel connection may be provided at the suitable intervals to provide some flexibility to the nozzle. The control value shown in the line is used for providing on off control for the jet.
- the nozzles used in the water jet machining process are made up of sapphire and have hole diameter of 0.07 to 0.5 mm.large nozzle boss of more than 1 mm diameter are not preferred because of the very large size of pump motor required to maintain water flow.
- Water softener, deionization units and filtration units are sometimes used within the WJM setups to remove mineral deposits, sediments orders particles from water which make cause keeping or blocking of the nozzle

Q.5]b] estimate blanking force to cut a blank of 20 mm wide and 30 mm long from A 1.2 mm thick metal strip. If the ultimate shearing strength of the material is 450 N/mm, also find the work done in the percentage penetration is 30% of thickness [6]

Ans : Blank size = 20 × 30 mm ,t = 1.2 mm p=;0.3

F = 450 L= 2(30+20) =100 mm



Blanking force F= L t F = 100×1.2×450

= **54 kN**

Work done = F p t

= 5.4× 0.3× 1.2× 1000/1000

= **19.44 J**

Q.5]c] Differentiate between orthogonal and oblique cutting. [4]

Ans :

Sr.No	Orthogonal cutting	Oblique cutting
1.	The cutting edge is perpendicular to the direction of the cutting velocity.	The cutting edge is inclined at an acute angle with the normal to the cutting was direction.
2.	The direction of the chief floor on the tool face is normal to the cutting edge.	The chips flow on the double face making an angle with the normal to the cutting edge.
3.	The cutting edge is larger than the width of the work piece. Example, there is no side flow	The cutting edge may or may not clear the width of the work piece.
4.	Maximum chip thickness occurs at middle.	The maximum chip thickness may not occur at the middle.
5.	The tool is perfectly sharp and contacts the chip on the rake face only.	More than one cutting edges maybe action frequently.
6.	Only two components of the cutting forces act on the tool (mutually perpendicular to each other).	The cutting force system is generally three dimensional.
7.	To life is higher	To life is lower

Q.6 write short note on. [20]

a) Factors affecting surface finish. [5]

Ans: The nature of surface produced by different manufacturing process like turning ,shaping ,milling , grinding various considerably when compared with each other. The factors affecting surface produced by process of primary related to:

Factors affecting surface finish

1. Type and condition of the workpiece

2. Type of operation

3. Shape, geometry and condition of the tool

4. Cutting parameters speed, feed, depth of cut

5. Rigidity of the machine- tool -work -system

6. Cutting fluids used

7. Deflection of the tool or workpiece.

The nature of surface produce effects its friction, wear, lubrication and load carrying characteristics. It is therefore often necessary to define surface characteristics and get an idea of the finish produced. Visual inspection of surfaces produced by different operations does not produce any comparative insight into the amount of surface irregularities present, hence it is often necessary to carry out a quantitative evaluation using various types of surface roughness meters.

b) 3D system stereo lithography apparatus. **[5]**

Ans : In 1960, first photopolymer but developed and it was mostly used for casting and printing industries. In 1980, Charles Hull discovered that solid polymer patterns can be produced by exposing UV curable materials to a scanning laser, this was the beginning of stereolithographic process. In 1986, 3D systems was found by inventor Charles Hull and Raymond freed. The company has grown significantly and now it has more than 400 patents. 3D systems Inc is is headquartered in a circle Rock Hill, USA.

Process

Fig. 1 shows basic SLA process. This process uses vat consisting of liquid photopolymer, a laser source and elevator. liquid photopolymers are sensitive to UV light so the resin is photo chemically solidified with the help of laser beam and first layer of desire object is formed.

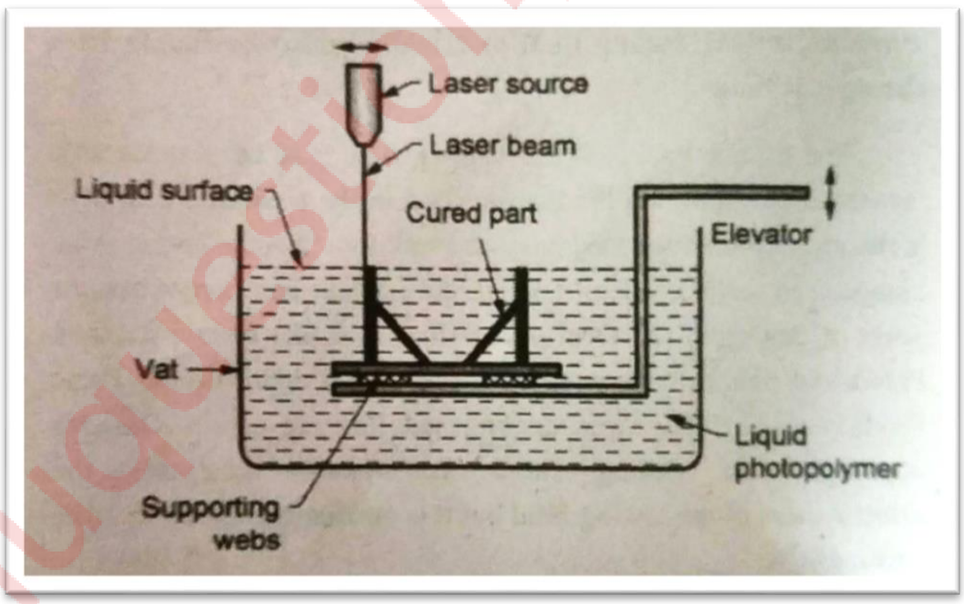


Fig 1

After the formation of one layer, elevator is lowered from the top of resin by the distance of layer thickness. Another layer of the material is is formed onto the previous layer by exposing new liquid surface to laser beam. This process is repeated until the last layer of the desired object. After completion vat is drained and object is removed.

Materials

Various types of photopolymers available which can be solved by exposing it to electromagnetic radiation including gamma rays, X-rays, UV and visible range. SLA materials are curable in UV range. These UV curable photopolymers are resins which was formulated from reactive liquid monomers and photo initiators. Some of the resins may contain chemical modifiers and fillers to meet specified chemical and mechanical requirements.

Advantages of SLA

The main advantages of SLA are

1. SLA can be used continuously without the need of human interference.

2. It has good accuracy and can be used for many applications.

Disadvantages of SLA

1. In SLA, special structure requires support structures that must be design and fabricated together with the main structure.

2. After completion of part, processing is required, which is Tedious and time consuming.

Applications of SLA

Main applications of SLA include:

1. Manufacturing of prototypes for design, analysis ,verification and functional testing

2. Creation of model for conceptualization, presentation and packaging

c) Types of coolants. [5]

Ans:

1. Neat oils:

The term straight or neat oils when applied to coolants and lubricants means non diluted oils. Meet oils are mineral oils ,fatty oils or combination of these two with or without other additives. Mineral oils are composed of hydrocarbons of different structure and molecular weights. some of the common examples of straight mineral oils are petroleum oils kerosene and paraffin, low viscosity petroleum fractions such as mineral seal.

Fatty oils or fixed oils: diesel consists of animal, fish and vegetable oils. Common example are lard oil ,oleic acid ,sperm oil whale oil ,cottonseed oil and linseed oil. Straight mineral oils without any additives are suitable only for light load and hands are used for machining nonferrous metals like aluminum and magnesium. For heavier machining of non ferrous alloys mineral oils are blended with fatty oils.

These blended oils are called compounded oils and have excellent boundary lubrication properties. They are commonly used on automatic machines. For still heavier load mineral oils are blended with EP additives like Sulphur, chlorine and phosphorus. Presence of this EP additives in the oil imparts anti welding properties to the oil and help prevent formation of build up edge on the tool. Neat oils have a good service life are not prone to any bacterial contamination and the not very significantly affected by any leakage of hydraulic or other lubricating oils into these oils. But the soils are prone to fuming sometimes cause skin trouble and a generally costlier than water soluble oils.

2. Water soluble oils

Water soluble oils are blend of mineral oils, emulsifying agents and coupling agents. For use these oils are mixed with water to form a water emulsion. Water provides the cooling effect and the oil is used for lubricating properties. The ratio of water soil may vary from 10: 1 to 40 : 1 for general machining but for high speed operations like grinding ratio is of the order of 80 : 1 to 100 : 1 are common.

Conventional emulsions our milky in color birthday can be made translate ine by changing the ratio of the emulsifier to oil. Other additives like water softener agents antifoaming agents rust inhibitors and bacteria in meters may be added to water soluble oils to increase their effectiveness and service life. for heavier cutting operations soluble oil to be blended with fatty oils and EP additives.

They are known as heavy duty soluble oils. Heavy duty soluble oils have concentrations of 10 : 1 to 5 : 1 depending upon the requirements. Compared to the neat oils soluble oils are less stable ,require periodic checking of concentration, are more prone to degeneration due to bacteria and fungus action and the most seriously affected is mixed with any tramp oil from hydraulic or machine lubrication systems.

3. Synthetic coolants:

Synthetic coolants are non- petroleum products which are blended with water in the ratio 52 to 250 parts of water for each part of the chemical.

They have pulling property is better than soluble oils and used chiefly for grinding. they also have a better life than soluble oils are not affected by grandpa oil and do not require too much monitoring of their composition. But these oils are chemically very active and may damage pumps, other metal parts, lubricants seals etc. They may also be toxic.

4. Gaseous fluids:

one of the major problems in cutting fluid application is the difficulty for the cutting fluid actually reach the cutting zone during machining.

The effectiveness of the cutting fluid can be considerable be increased by supplying the cutting fluid in the form of a gas. Mist is the most commonly used gaseous fluid. In a mist cooling system, compressed air is used to atomize the coolant and carry it to the point of cutting in the form of a mist. Gases like carbon dioxide, freon and helium have been used for special applications. This fluid for form lubricating cooling and flushing action. Gaseous application of cutting fluids considerable increases the effectiveness of the cutting fluid but it is costlier compared to the other method**s.**

d) Chemical machining [5]

Ans: Chemical machining or chemical milling (CHM) is the process of using reactive chemicals etchants to selectively dissolve and remove material from the workpiece. The material can be removed from selected areas of the workpiece or from the entire surface of the workpiece as per requirement. the removal of material occurs because of the conversion of the metal into soluble metallic solids by the etchants.

Areas from where metal is not to be removed or covered by etchants resisting maskants or resists as shown schematically in Fig. 1-Q. 6(d). The metal removable rate is controlled by varying the composition, concentration and operating conditions of the reagent used. The process is extremely useful for blanking of thin sheets and for production of intricate stampings, gaskets, printed circuit boards, radio components, etc. It is also used for selectively removing materials from aircraft wing panels and spacecraft components to reduce their weight without weakening them structurally.

The process is ideal for producing complex configurations in thin materials and delicate parts which would be damaged by tool forces in conventional machining) balancing of grinding wheels

e) Balancing of grinding wheels [5]

Ans : Because of the very high speeds at which they operate grinding wheels must be balance for proper operations.

balance tools result in poor finish, vibrations of the machine and difficulty in maintaining size.the wheels are balance at the time of manufacture and must be tested periodically for balance.

The wheels are generally made from a composite materials consisting of coarse-particle aggregate pressed and bonded together by a cementing matrix (called the bond in grinding wheel terminology) to form a solid, circular shape.

Various profiles and cross sections are available depending on the intended usage for the wheel. They may also be made from a solid steel or aluminum disc with particles bonded to the surface.

Types : Straight wheel, Cylinder or wheel ring tapered wheel and diamond wheel.