

SCHEME OF VALUATION(Scoring Indicators')

Revision: 2015

Course code: 6021

Course Title: Advanced Production Processes

QnNo.	Scoring indicator
Total	

I.

PART A

1. Collets, Four jaw chucks, Three jaw Chucks, Fixtures
2. FMS is a production system in which machines are capable of manufacturing different products without any changeover such as tools etc
3. EDM, ECM, Ultrasonic machining [any two]
4. A jig is a work holding device which also locates or guides the cutting tool with respect to the work piece.
5. Blanking is the process of cutting out desired shape from the strip or sheet by a single blow of the punch. Punching is the process of making hole by using a punch and die.

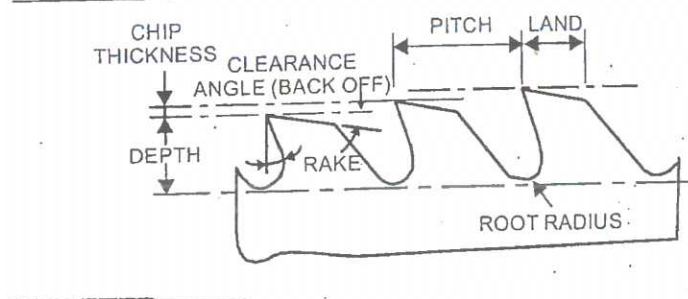
II.

PART B

1. Differences between a turret lathe and engine lathe.
 - In turret lathe, the tailstock of an engine lathe is replaced by turret that holds six or more tools. In addition, a four way tool post on cross-slide and a rear tool post on carriage holds additional tools whereas in engine lathe only one tool is normally held in standard tool post, and for different operations tool must be changed,
 - In turret lathes two or more cutting tools are used simultaneously whereas in engine lathe only one tool is used as once.
 - In turret lathes, each tool station is provided with feed stop (or feed strip) so that each cut of a tool is the same as previous cut.

- In turret lathe rapid machining of any quantity of identical parts is possible with initial tool setup.
- Turret lathes are not usually fitted with lead screw and threads are normally cut by using dieheads and taps. However, a short length of screw (chasing screw) is sometimes provided for cutting threads by a chaser.
- . In case of turret lathes, an extreme rigidity for holding or work and tools is. built into permit multiple and combined cuts.
- Turret lathes are suitable for mass production whereas engine lathes are not economical for mass production.

2.



Pitch: is the linear distance between the cutting edge of the tooth and the corresponding edge of the next tooth.

Land: It is the top portion of the tool and is ground to provide a slight clearance.

Back off: corresponds to clearance angle of single point cutting tool and its value vary from 0.5° to 20°

Hook or face angle: is equivalent to rake angle of a single point tool.

Tooth gullet or chip space: Chips may curl up in the gullet or chip space

3. Natural abrasives, and Artificial abrasives.

Natural abrasives include sand stone (solid quartz), emery, diamond. Natural abrasives lack uniformity and contain a high percentage of impurities they have been almost totally replaced by artificial abrasives.

Artificial abrasives are used extensively because, their characteristic can be easily controlled. They include silicon carbide (SiC), aluminium oxide, boron carbide, cubic boron nitride etc. Hard materials up to HSS can be ground by aluminium oxide. But very hard materials like carbides are ground by (SiC) or boron carbide.

4. Advantages of CNC system:

CNC are more flexible, and possess storage (memory) facilities. CNC machines are faster than NC machines, and errors due to damaged tape are eliminated. The other advantages of CNC system are :

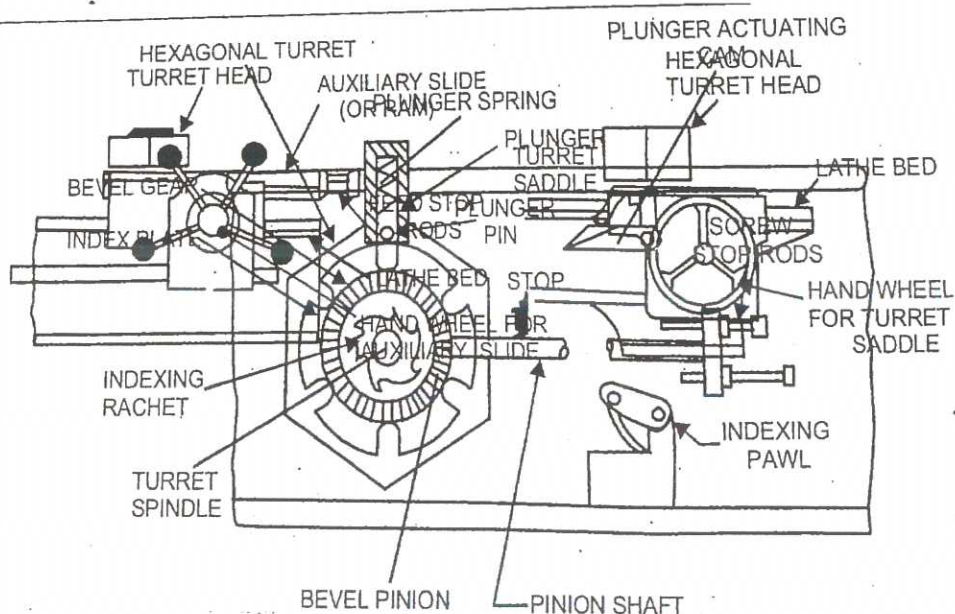
Suitable for small batch quantities as well as for complex jobs with multiple operations. Reduction in time for launching new products by reducing jigs, fixtures and special toolings.

Requires less inspection and production of better quality products. Editing of programs at floor level is very conveniently done

5.

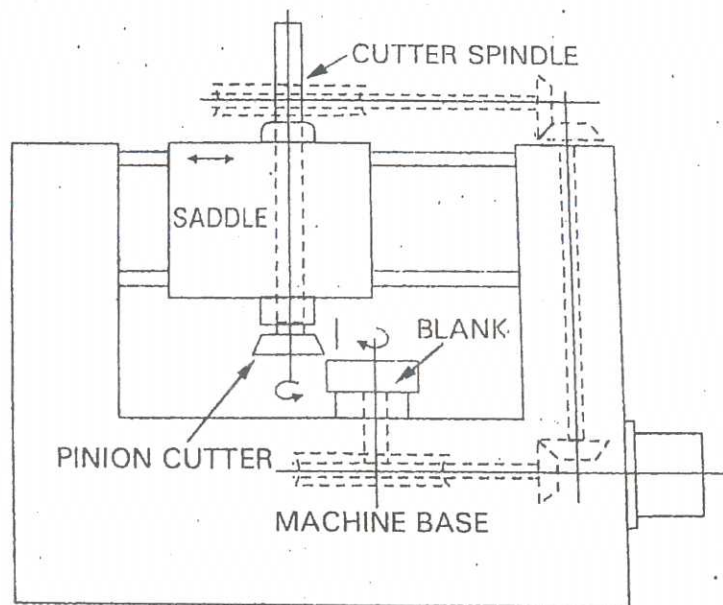
The turret can be indexed long with its to and fro motion. Mechanism for automatic indexing of turret is shown in Fig.

The plunger locks the index plate by spring pressure and prevents rotary movement when the turret is moving forward. During this advancement the tool held in the



turret performs its operation. Now indexing of turret is done during backward motion of the turret. At backward position of turret, the actuating cam lifts the plunger out of the groove and unlocks index plate. This is due to riding of the pin on the bevel surface of the cam. By this time, the spring loaded pawl engages with a groove of the ratchet plate causes the ratchet to rotate as the turret moves backward.

6.



The blank is mounted up on a vertical arbor and a pinion cutter fixed to the cutter spindle which is carried by saddle. A guide controls the action of the cutter spindle. The saddle can be fed along the side ways. The cutter spindle and work spindle are connected to each other through gearing, and desired gear ratio between pinion cutter and blank depends on the number of teeth on the cutter and number of teeth required on the blank.

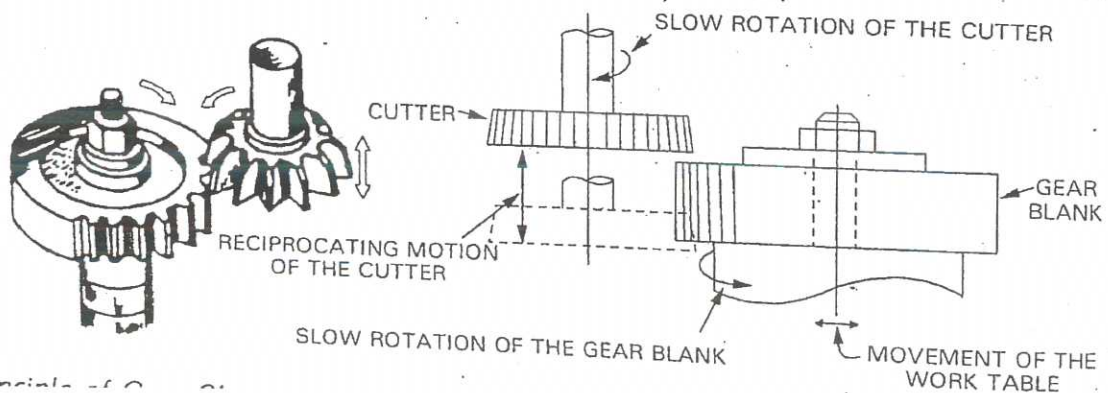
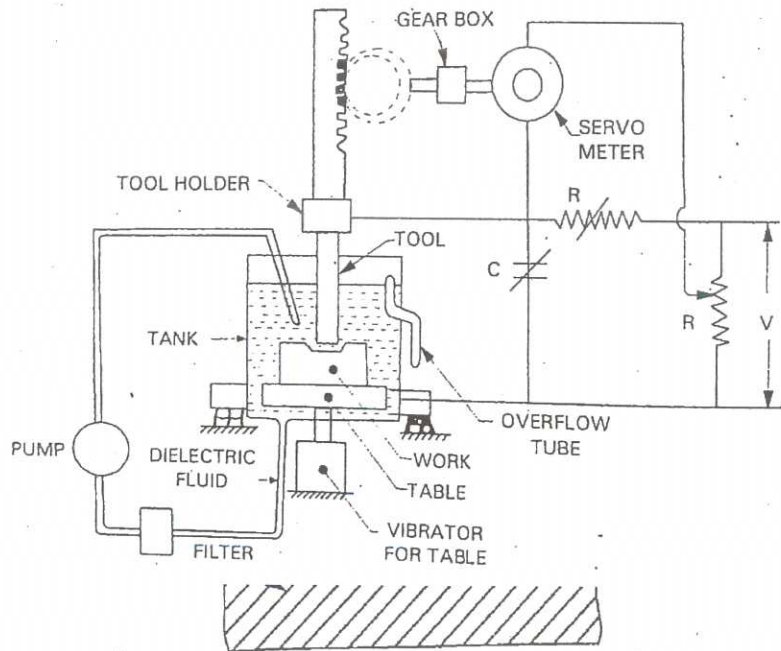
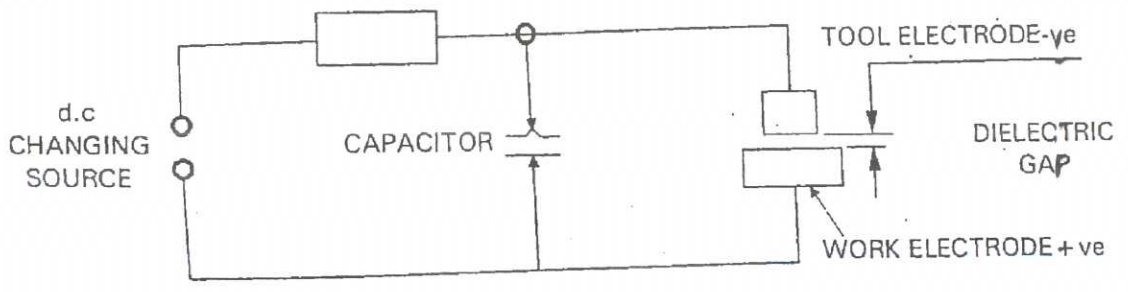


Fig. 5.8 Principle of Gear Hobbing

F.



(a) Principle



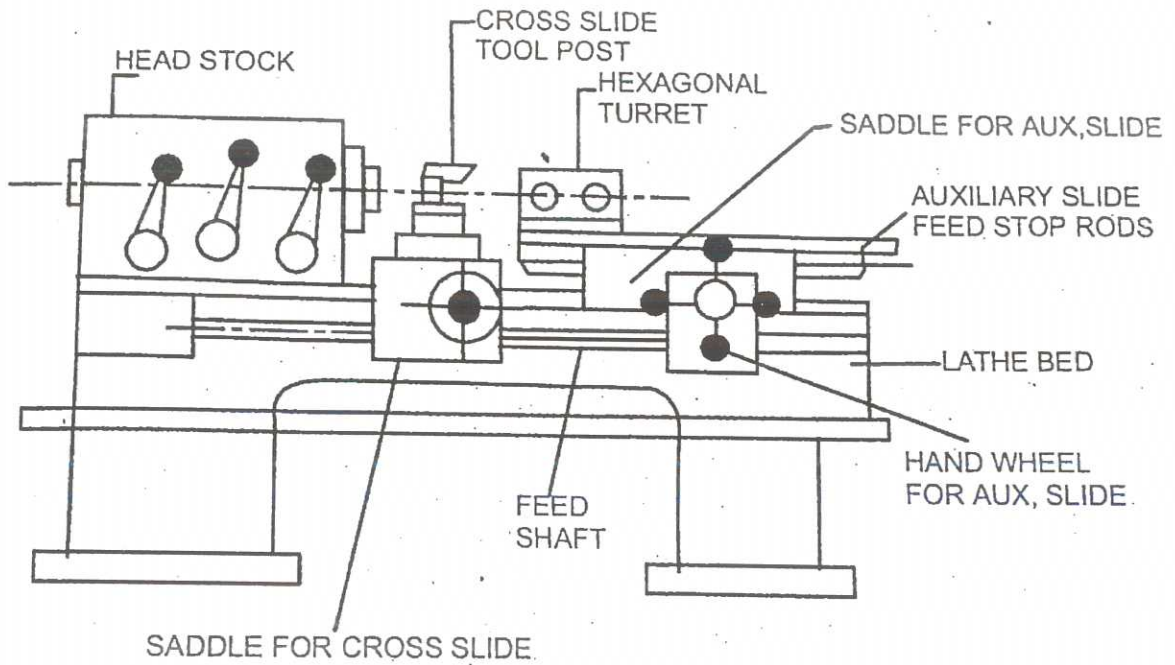
(b) Circuit Diagram

3 Principle of Electrical-Discharge Machining (EDM)

In this process the metal is removed by intense heat of electric spark. The tool and work piece are submerged in dielectric fluid. The spark discharges are maintained by sufficient potential difference between tool and work piece separated by a dielectric in a very small gap. A large number of electrons emitted from tool(Cathode) impinges on the work material(Anode) and thus develop a very high temperature. This temperature is sufficient to melt and vapourise the portion of metal to be removed

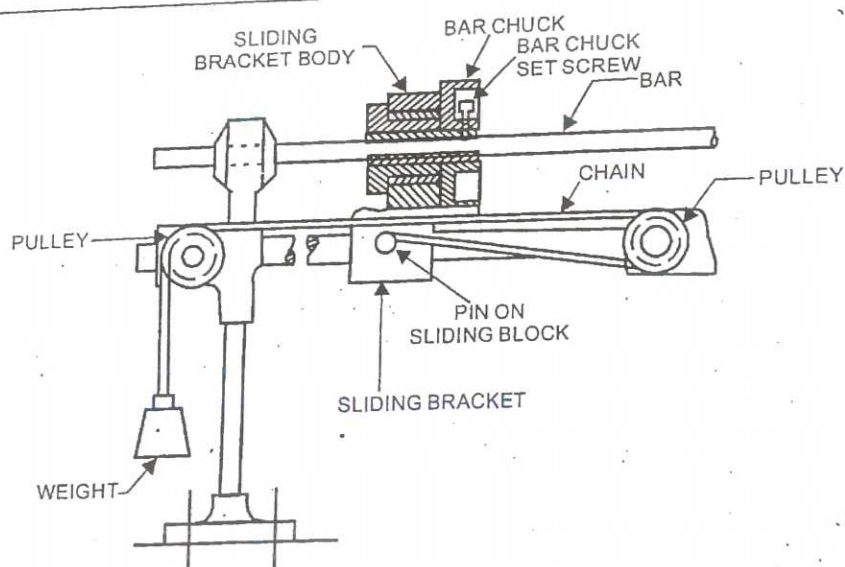
Part C.

- III (a) The capstan lathe is a ram type turret lathe in which hexagonal turret is mounted on a ram slide. The saddle, which supports the ram, is clamped to the desired position. This lathe is of light construction and has a short turret



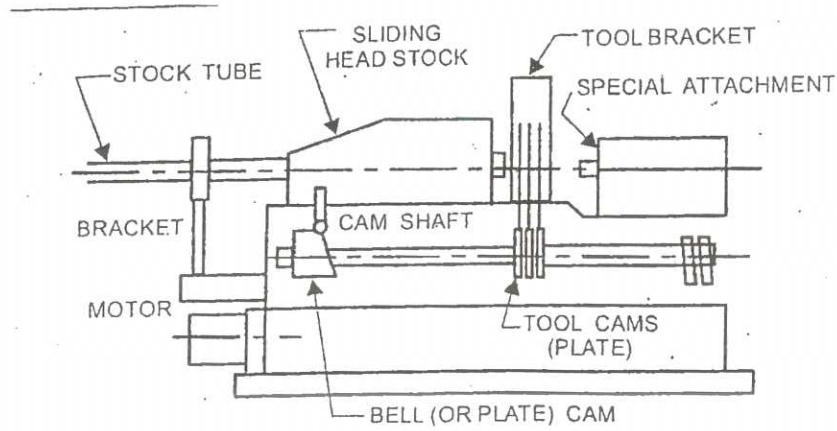
- b) Figure shows bar fed mechanism. mechanism facilitate to feed the bar without stopping the machine.

Various types of bar feeding mechanism have been designed to feed the bar immediately when the collet opens without stopping the machine. The bar is passed through the bar chuck, lathe spindle and then through the collet chuck. The bar chuck rotates in a sliding bracket which is mounted on long sliding bar. The weight attached to chain exerts thrust all the time on bar chuck which is holding the bar by means of two set screws and forces the bar through the spindle when the collet chuck is released. Thus bar feeding mechanisms facilitate to feed the bar without stopping the machine.



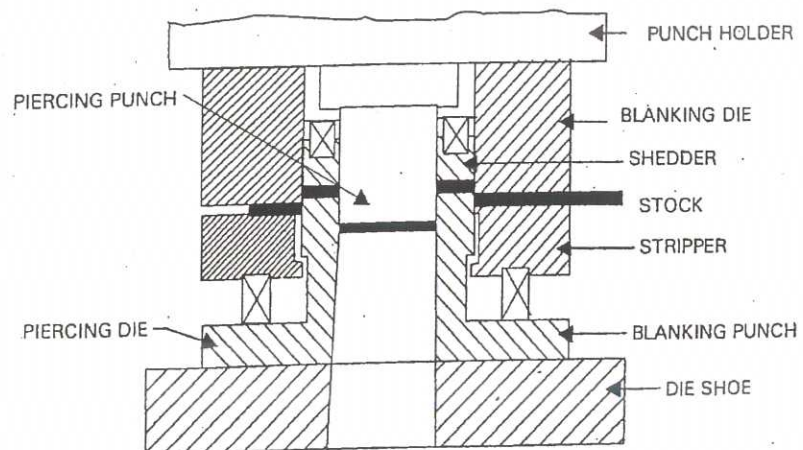
IV (a) In swiss-type automatic screw machine head stock is movable and the tools are fixed in the slides. These machines are employed for mass production of long and accurate parts of small diameter bars.

The stock is held by a rotating collet in the head stock and is fed through a hard bushing in the center of the tool head. Five single point tools are placed radially on the tool head around the bushing. These tools are controlled by cams that bring the tool as per requirement.



(b) The term 'machining centre' describes almost any CNC milling and drilling machine that includes an automatic tool changer and a table that clamps the work piece in place. On a machining centre, the tool rotates, but the work does not. The orientation of the spindle is the most fundamental defining characteristic of a machining centre. Vertical machining centres generally favour precision while horizontal machining centres generally favour production. Another common machining centre type is the five-axis machining centre, which is able to pivot the tool and/or the part in order to mill and drill at various orientations.

V (a) In compound die two or more cutting operations are performed at single station in a single stroke of the ram. When the ram descends, the blanking and piercing operations are performed simultaneously. For blanking operation, the punch used for piercing becomes a die. i.e. blanking is done in opposite direction to that of piercing as in Fig. This die is very economical. It leads to savings in floor space and power, and the accuracy of the parts produced is higher



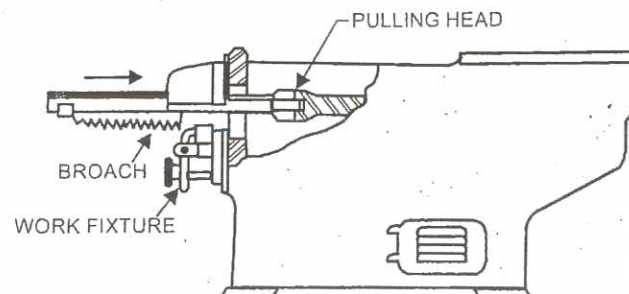
b7

<i>Jigs</i>	<i>Fixtures</i>
1. Hold the work piece in position and guide the cutting tool.	1. Hold the work piece in position, but not guide the cutting tool.
2. Usually movable on machine table.	2. Clamped in a fixed position on machine table.
3. Used for drilling, reaming tapping and counter boring.	3. Used for milling, turning, grinding, welding etc.
4. Lighter in construction.	4. Heavy in construction.

VL
(a)

Horizontal Broaching Machine :

The horizontal broaching machine is used for surface broaching or internal broaching, the latter being most common. The work is held in fixture. In the surface broaching the tool (broach) is pulled over the surface while for internal broaching the broach is pulled through the work (i.e. through the hole). These machines are mostly pull type and can be operated at a cutting speed of 3 to 15 m/min. The speed of return stroke (non - cutting stroke) may be about 30 m/min. Hydraulic horizontal machine has an infinitely variable range of cutting speed with return speed much greater than the cutting speed. Horizontal surface broaching machine is shown in Fig. 4.5. The broach is pulled over the top surface of the work piece held in a fixture. The hydraulic cylinder which pulls the broach is housed in the right end of the machine.



Horizontal Surface Broaching Machine

b)

TYPES OF DRILL JIGS :

A drill, jig may be designed for drilling one or more holes. The following types of jigs are widely used in industry.

1. Template jig
2. Plate jig
3. Channel jig
4. Box jig
5. Leaf (latch) jig
6. Indexing jig
7. Universal jig

Template jig :

Template is a simple drill jig and may be used when making plain holes. It consists holes to guides the tool and is used directly over the component.

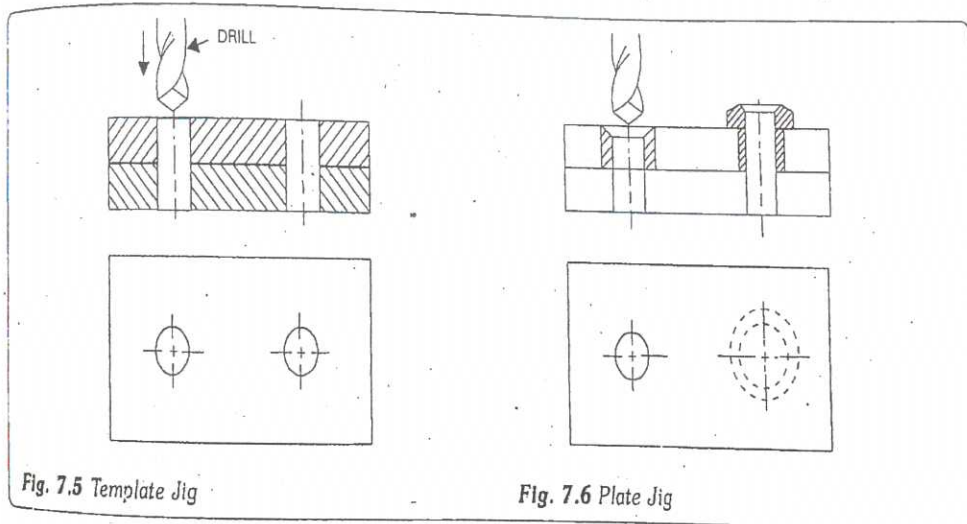


Fig. 7.5 Template Jig

Fig. 7.6 Plate Jig

Plate jig :

Template jig in which drill bushes are provided is called plate jig. It is used for accurate drilling on large parts.

VII (a) In cylindrical grinders the work is mounted between the centres and rotated against the grinding

wheel. The work may also be held in a chuck for certain operations.

The various movements involved in a cylindrical grinding are shown in Fig. 9.14. They are :

1. The work must revolve
 2. The wheel must revolve
 3. The work must pass the wheel or the wheel must pass the work.
 4. The movement of wheel into the work or work into wheel,
- In cylindrical grinding machines the following operations are performed.

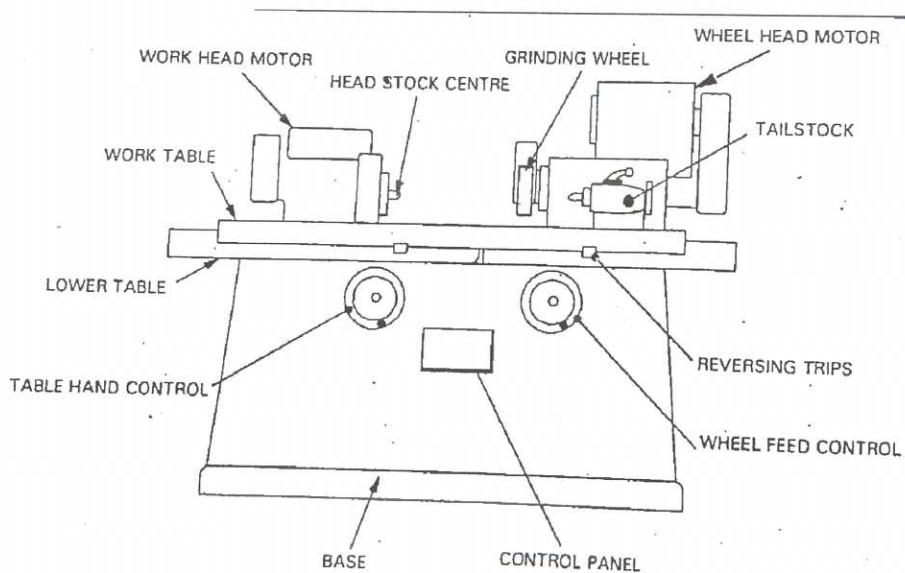
1. Traverse grinding, and
2. Plunge cut grinding

For traverse grinding, the work reciprocates as the wheel feeds into the work. This operation produces cylindrical shapes longer than the width of wheel.

In plunge cut grinding, the work rotates in a fixed position and the wheel is fed into the work piece until the required diameter is obtained. In this case the length of cylindrical shape produced is equal to the width of grinding wheel.

The plain cylindrical grinding machine has the following parts :

1. Bed or Base
2. Table
3. Headstock
4. Tailstock or Footstock
5. Wheelhead



Cylindrical Grinding Machine

(b)

The bonding materials are used for holding the abrasive grains together. The following bonds are commonly used in grinding wheels. ^

1. Vitrified bond,
2. Silicate bond,
3. Shellac bond,
4. Resinoid bond, "
5. Rubber bond, and 6. Oxichloride bond.

1 Vitrified bond : Vitrified bond is made of clay or feldspar. The clay and water is mixed with abrasive grains, and the mixture is moulded to form the wheel is then baked in a kiln upto a temperature of about 1250 °C to develop true strength. As the burning proceeds clay fuses and forms porcelain that holds the grains together.

2. Silicate bond : Silicate bond is made of abrasive grains.

Silicate bond is less sensitive to shock. Therefore release the abrasive grains more easily . It is affected by moisture and alkaline solution. It is suitable for the grinding where the heat generation is minimum, and mainly used for making large wheels.

Shellac bond : In shellac bond, also called as elastic bond, shellac is mixed with abrasive in a heated container and is shaped in a heated mould. The shaped wheels are then baked at 150°C for several hours.

3. Shellac bond. wheels are comparatively easy to manufacture and are capable of producing high finishes on cam shaft and mill rolls. They produce less temperature (120 - 150°C) than vitrified bond. Shellac wheels possess high elasticity and considerable strength. They also possess a high degree of safety which makes them valuable for operations (cutting off hardened steel) requiring thin wheel. The other applications of shellac wheels includes sharpening of saws, knives and fettling of castings.

Shellac wheels are not suitable for heavy duty, and wheels of bigger diameter cannot be produced.

4. Resinoid bond : Resinoid wheels -are made from synthetic resins (Bakelite) mixed with abrasive grains. The mixture is heated in a mould at about 200°C. At this temperature resin sets and holds the abrasive grains together. A resinoid bonded wheel is designated as B.

Resinoid wheels are more flexible and can run at high speeds (2900 m/min) than vitrified bond wheels. They cut cool, and removes stock rapidly. They are used for cutting off metal bars and tubes and for the work needing a very high surface finish. .

Resinoid wheels are likely to be softened prolonged exposure to water or water based cutting fluids.

5. Rubber bond : Rubber bonded wheels are made from pure rubber and abrasive. In this bond abrasive grains are mixed with pure rubber and sulphur (added as a vulcaniser). The mixture is deformed into sheets. The wheels are cut out of the sheet and then heated in a mould to vulcanise the rubber. A rubber bonded wheel is designated by R. *

Rubber bonded wheels are strongest of all and is also tough. It is suitable for making extremely thin wheels for cutting off operations. They produce high surface finish and can be used for finishing ball bearing races. Rubber bonded wheels can also be used as regulating wheels in centreless grinding.

They generate more heat and are affected by alkaline solutions and dampness. The strength of bond decreases with time. When subjected to heat, the bond softens and release the grains.

Therefore, cutting fluids are normally be used with this bond.

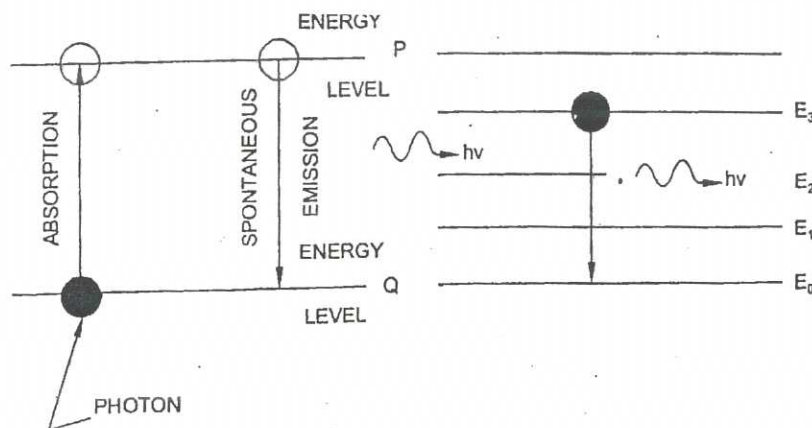
VIII

(a) LASER BEAM MACHINING (LBM) PROCESS :

Principle :

The word laser stands for Light amplification by Stimulated Emission of Radiation. When an electron of atom absorbed energy from an external source, the electron which are in its original energy level, jump to a higher energy level

S

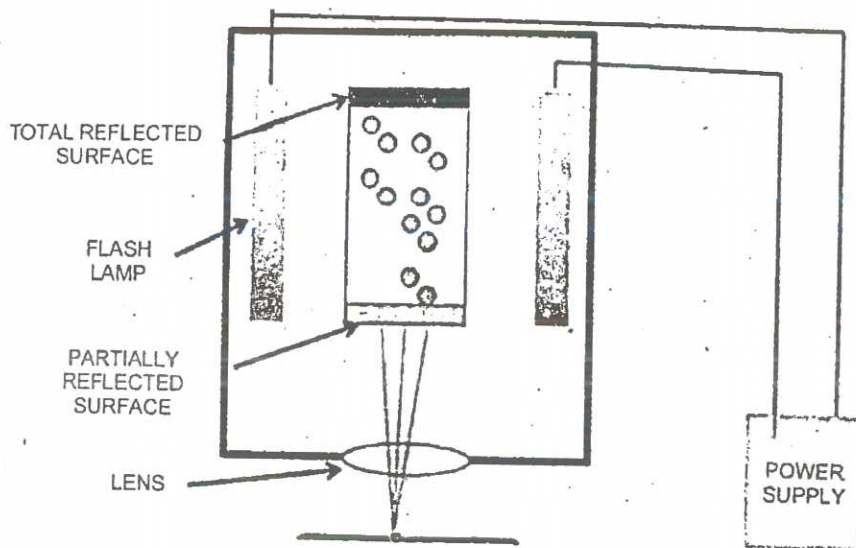


This is not a stable condition of atom so this electron emits the absorbed energy in form of photons and come back to its original state. If an atom which is already at higher energy level absorbs

energy, it will emit double energy to return at its original state. The energy emitted by the atom has same frequency and wavelength as the stimulating energy. ~~This is fundamental of laser.~~ When the laser material placed in presence of some other energy source, it absorb energy at some extant and release it when reaches its absorbing limit. This high amplified light beam is called laser. '

This machining process works on basic property of laser. It uses a laser beam, which is a narrow, monochromatic high intense light which can cut or machine any metal and non-metal. It can use to cut any material irrespective to hardness of work piece. It can also use to cut diamond which is hardest known material on earth.

Equipment's



Laser Beam Machining^

- Power Supply :

It provides the energy for excitation of electron from lower energy level to higher energy level. This gives power to xenon flash lamps, which produce light energy. The laser material is exposed in light energy to keep storing energy.

(b)

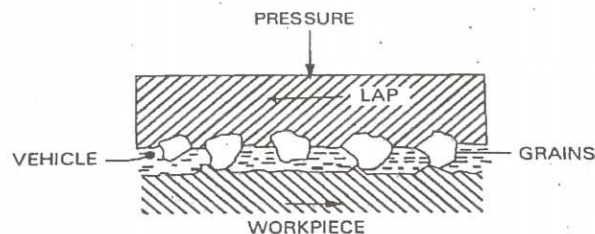
Lapping is an abrasive process used to improve the surface finish and to obtain small changes in dimensions or to obtain almost perfect contact between two mating surfaces.

The process is extensively used for the finishing of gauge blocks and flats.

Lapping consists of rubbing work surface with lap surface which is charged with fine abrasive particles. The lap material is generally softer than the work material. Cast iron is mostly used for lap materials. Graphite in the cast iron serves to hold the abrasive particles and provides lubricating effect. Besides cast

iron, copper alloys, lead, plastic and wool are also used as lap materials. Hard material for lap is generally selected for soft abrasives.

The narrow grooves are cut on lap surface and is then charged by spreading and pressing the abrasive particles (aluminium oxide or silicon carbides) over the surface of lap. Silicon carbide is used for rapid stock removal and aluminium oxide for improved surface finish. The work piece is then held against the lap and moved in unrepeated paths. A suitable cutting fluid (lapping vehicle) is used for lapping. The principle of lapping is shown in Fig. 9.34.



Lapping Process

The lapping can be done by hand or by machine. In hand lapping either lap or the work is held by hand and a relative motion is produced between them. The rubbing of contacting surfaces in the presence of abrasive medium produces the smooth surfaces finish. This method is employed for finishing surface plate, engine valves and valve seats.

In Machine lapping either lap or the work is held in machine holder and a relative motion is produced between them. Machine lapping is performed for obtaining highly finished surfaces in mass production. Many components like races of ball bearings, worm and worm gears and various automobile parts are finished by machine lapping.

IX (a) Elements of CIM Systems:

Computer integrated system consists of different elements whose integration is must for successful implementation of these systems. These systems are designed, developed and applied in such a manner that output of one system serves as the input of other system. These elements/subsystems are;

- a) Part and product design : There are four phases that are crucial in part and product design. They include preliminary design, refinement, analysis, and implementation. The design department of the company is responsible for these tasks.

- b) Tool and fixture design: Tooling engineers using computer-aided design (CAD) tools to develop the systems or fixtures that produce the parts.
- c) Process planning: The process planner design a plan that outlines the routes, operation, machines, and tools required and attempts to minimize cost, manufacturing time, and machine idle time while maximizing productivity and quality.
- d) Production planning: There are two concepts used that include materials requirement planning (MRP) and machine loading and scheduling.
- e) Purchasing : After preparing all the plans, the purchasing department take care of the purchasing orders and follow up these orders. The department is responsible to receive the right material, inspect the material and send it to the appropriate places.
- h) Automation: This is the integrated part of the manufacturing process. It consists of computer controlled machinery such as CNC, DNC, flexible manufacturing system, robots, automated material handling systems and computer aided quality control.
- i) Storage and retrieval: These tasks involve the storage and retrieval of raw materials, works-in-process inventory, finished goods, and equipment.
- j) Information Management: It is very important element of the computer integrated system. It involves the master production scheduling, database management, communication, manufacturing system integrated and management information systems. Finance: Money is very important to any industry. It involves the proper investment, working capital, cash flow control, accounting and allocation of funds.

b) ADVANTAGES AND LIMITATIONS OF FMS :

All parts with specified size can be manufactured

Production rate can be adjusted to market demand without additional power

Set-up time is virtually eliminated, and complete group of parts will go to assembly at one time.

High flexibility, and capable of making a different products without retooling.

The system is adoptable to CAD/CAM (Computer Aided Design and Computer Aided Manufacture)

Better predictability, and easy control of operations and scheduling

Limitations

High degree of planning is required

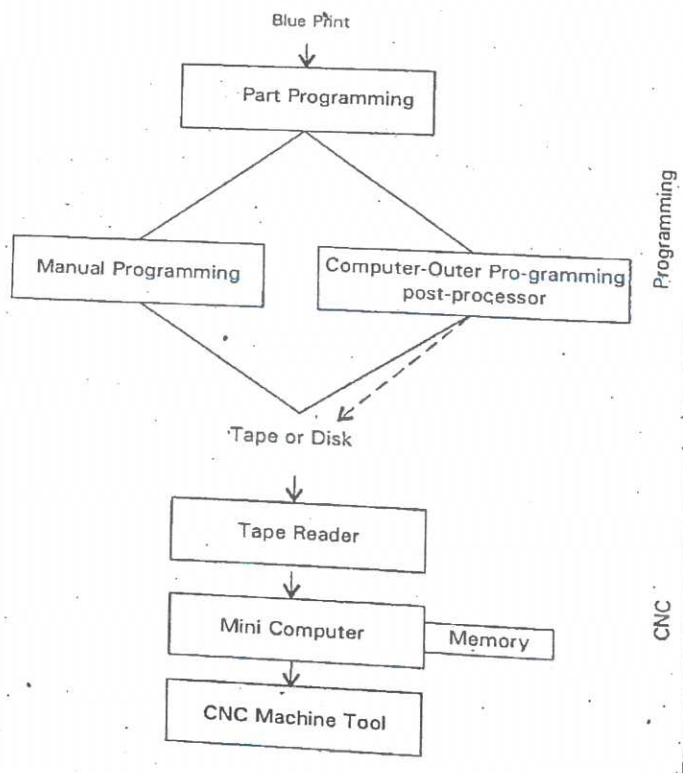
Longer time is required to reach peak production

Consistency of raw material becomes important.

7 e) CNC system:

NC is an early form of machine control using number and letters in the form of punched tape. CNC (Computer Numerical Control) stores and processes machining information directly in a machine built in computer i.e. NC machine provided with a dedicated mini-computer is called CNC machine. If there is a computer failure only one machine is affected.

CNC machine tools do not necessarily need the programme in the form of punched tape. Input data may be dialed straight into the memory by means of keyboard which is similar to that of a typewriter.



(b) Robots are employed where working conditions are hazardous or uncomfortable and are likely to affect the health of the workers. The field of applications of robots include

- 1- Material handling.
- 2- Robot moves the work pieces from one location to another.
2. Machine loading applications.
3. Robot loads the machine with work piece and unloads the finished part. .

4. Spray painting applications.
5. Welding applications, mainly spot welding and arc welding.
6. Machining operations such as drilling, grinding, polishing etc.
7. Assembly of parts.

8. Inspection purposes.

9. Automotive and Air space Industry.