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SIXTH SEMESTER DIPLOMA EXAMINATION IN MECHANICAL

ENGINEERING—OCTOBER,2013

ADVANCED PRODUCTION PROCESS

(Maximum marks : 100) [*Time : 3 hours*]

PART—A

I. Answer all qustions in one or two sentences. Each qustion carries two marks.

1. List any four tool holding devicesused in turret or capstan lathe.

Ans:

1) Stright cutter holder.
2) Multiple cutter holder.
3) Knee tool holder.
4) Flange tool holder.
5) Knurling tool holder.
6) Form tool holder.
7) Die holder.

2. Define spring back in bending.

Ans:

The deformation which has been accompanied by bending is partly plastic and partlyelastic. When bending force is removed, there is some elasticrecovery, resulting in a slight decreese in bent angle. This is known as spring back.

3. Differentiate piercing and blanking.

Ans: Blanking:

Blanking is the process of cutting out desired shape from the strip or sheet by a single blow of the punch.

Piercing:

Pearsing is the process of making a desired hole by using a punch and die.

4. Name two artificial Abrasives.

1) Silicon carbide – SiC
2) Aluminium oxide – Al2O3

5. What is numerical control.

Numerical control is system of controlling a machine or process by instructions in the form of numbers and letters.

PART—B

(Maximum marks : 30)

II. Answer Any five qustions. Each qustion carries 6 marks.

I. Compare capstan lathe and turret lathe.

Ans:

S.NO	Capstan lathe	Turret lathe
1.	Turret head is mounted on a ram which slides over the saddle.	Turret head is directly mounted on saddle. But it slides on bed.
2.	The turret movement is limitted.	The turret moves on entire length of the bed without any restriction.
3.	Hence, shorter workpiece can be machined.	Longer work piece can be machined.
4	.No cross wise movement to turret.	Facing and turning are usually done by cross-wise movement of turret.

II. List the different types of gear generation process.

Ans:

1) Casting
    a) Sand casting
    b) Permanent casting
    c) Die casting
2) Powder metallurgy.
3) Plastic moulding.
4) Stamping.
5) Extruding.
6) Coining.
7) Rolling.
8) Machining.
    a) Form cutting
    b) Template method.
    c) Generating

III. Explain the principle of location of a rectangular block in a jig.

Ans:

<u>Six Points Location of a Rectangular Block</u>

Any rectangular body many have three axis along *x*-axis, *y*-axis and *z*-axis. It can more along any of these axes or any of its movement can be released to these three axes. At the same time the body can also rotate about these axes too. So total degree of freedom of the body along which it can move is six. For processing the body it is required to restrain all

the degree of freedom (DOF) by arranging suitable locating points and then clamping it in a fixed and required position.

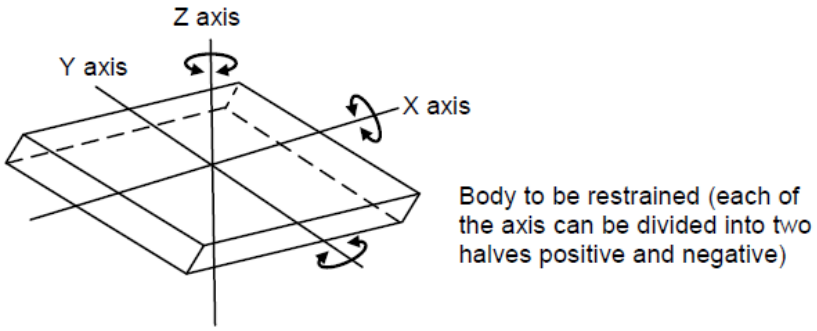

Figure : Available Degree of Freedom of Rectangular Block

Considering the six degree of freedom of a rectangular block as shown in Figure. It is made to rest on several points on the jig body. Provide a rest to workpiece on three points on the bottom *x*-*y* surface. This will stop the movement along *z*-axis, rotation with respect to *x*-axis and *y*-axis. Supporting it on the three points is considered as better support then one point or two points. Rest the workpiece on two points of side surface (*x*-*z*), this will fix the movement of workpiece along *y*-axis and rotation with respect to *z*-axis. Provide a support at one point of the adjacent surface (*y*-*z*) that will fix other remaining free movements. This principle of location of fixing points on the workpiece is also named as 3-2-1 principle of fixture design as number of points selected at different faces of the workpiece are 3, 2 and 1 respectively.

IV. Summarise the steps involved in the manufacture of a grinding wheel.

Ans:

The abrasive grains are chief ingredients of grinding wheel. They are reduced tosize by rolling, milling or crushing. The reduced grains are screened through a fine wire mesh to seperate the fine grains, and impurities such as iron oxide are eliminated by passing the grains through a magnetic seperators. The abrasive grains are then washed to eliminate all the remining impurities. The pure abrasive grains are mixed with a suitable bonding material and moulded to desired shape, and then baked in a furnace in a manner suitable for bonding material used. The baked wheels are cooled, cleaned and inspected.

V. Discus any two methods of preparing metal powder.

Ans:

There are various methods available for the production of powders.

<u>Atomization:</u>

In this process molten metal is forced through a a small orifice and is disinegrated by a powerful jet of compressed air, inert gas or water jet. These small particles are then allowedto solidify. These are generally spherical in shape. Atomization is used mostly for low melting point metals/alloys such as brass, bronze, zinc, tin, lead and aluminium powders.

<u>Machining:</u>

In this method first chips are produced by filing, turning etc. And subsequently pulvarised by crushing and milling. The powders produced by this method are coarse in size and irregular in shape. Hence, this method is used for special cases such as production of magnesium powder.

VI. Discuss about positioning machines and contouring machines.

Ans:

positioning machines

The positioning accuracy of computer numerical control (CNC) machine tools is mainly limited by the manufacturing accuracy of their linear and circular motion axes and by the long-term dimensional stability of their structures. Maximizing this accuracy can prove to be a particularly challenging task, especially for large-sized systems. . In fact, heat-induced deformations, long-period deformation of foundations and the Manu- factoring process itself, these all cause time-dependent
Structural deformations of the machine body, which are difficult to model and to predict. The usual approach is a model-based prediction of structural deformations, which is followed by a compensation of positioning errors at CNC level.

contouring machines.

Several specific attempts have been similarly made in the elimination of contour. To provide a direct and effective elimination of deviation, orientation and tracking-lag that are main concerns in five-axis tool-path tracking control, a new tool-path control scheme was presented by Lo. The control system, consisted of a real-time transformation between the drive-coordinate and the work piece-coordinate bases, an model for calculation of the deviation, etc. and control laws to eliminate them. The proposed control system constructs a 'global and coupled' loop to achieve an effective control of the overall performance in terms of the deviation, the orientation, and the tracking lag. The deviation, etc. are components defined in the work piece coordinate basis. In contrast, the fed back position signals (Pd) and the control signals (Ud) sent to the axial drives are both defined in the drive-coordinate basis. Coordinate transformations were introduced to the proposed control system.

VII. State the advantages of NC and CNC machines over conventional machine tools.

Ans:

S.NO	Conventional system	NC system	CNC system
1	It requires more manual works.	It requires less manual works.	It requires less manual works.
2	Skilled labour is needed.	Less skill is enough.	Less skill is enough.
3	Less accuracy is obtained	More accuracy is obtained	More accuracy is obtained
4	The system is less flexible.	The system is medium flexible.	The system is more flexible.

PART—C

(Maximum marks : 60)

Answer one full qustion from each unit . Each qustion carries 15marks.

UNIT – 1

III. (a) Show the lay out of swiss type automatic screw machine and explain the working.

Ans:

Swiss type Automatic screw machine

In automatic screw machine the head stock is movable and the tool are fixed in the slides. These machines are employed for mass production of long accurate parts of small diameter bar stock. These machines are chiefly used in the precision industries for manufacture of watches, instruments, radio parts etc.

The swiss type automatic screw machine as shown in figure.

The stock held by a rotating collet in the head stock and is fed through a hard bushing in the centre of the tool head. Five single point tools are placed radialy on the tool head around the bushing. Tools on horizontal slide performs plane turning while other tools on three slides are used for knurling, chamfering, recessing and cutting-off operations. These tools are controlled by cams that brings the tools in as required for different operations. The special operations such as centering, drilling, and reaming are performed by auxiliary slide.

(b) Explain the bar feeding mechanism in a turret or capstan lathe.

Ans:

Bar feeding mechanism in a turret or capstan lathe.

Bar work in capstan and turret lathes can be processed conveniently by incorporating bar-feed mechanism. The purpose of this mechanism is to fed the bar forward through spindle into yhe bar stop when the collet chuck open after completing the first piece. Bar may be fed by hand, but one has to stop the machine for feeding the bar and it also wastes a lot of time. Various types of bar feeding mechanism have been designedto fed the bar immediately when the collet opens without stoping the machine.

Figure shows the barv feeding mechanism. The bar is passed through the bar 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 mechanism fecilitate to feed the bar without stopping the machine.

OR

IV. Illustrate the construction and working of capstan lathe.

Ans:

Capstan lathe.

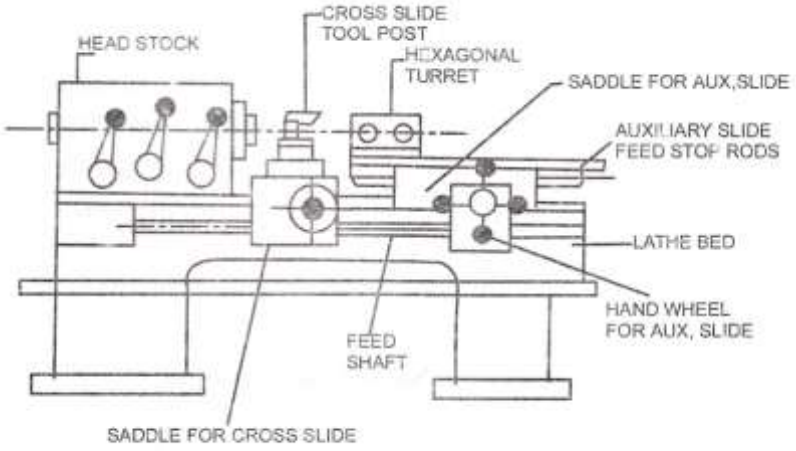

Fig. 1.1 PARTS OF CAPSTAN LATHE

The capstan is a ram type turret lathe in which hexagonalturret is mounted on a ram slide. The saddle, which supports the ram, is clamped to the bed at desired posiyion. This lathe is of light construction and has a short turret stroke and an automatic index on the turret.

The turret stroke depends on the length of the ram that varies from 100mm to 375mm. Capstan lathes are used for mass production of small to medium size components from bar and rod stock.

The main parts of capstan lathe are given below.

1) Bed :

The bed is a long casting fitted with guide ways. It supports headstock, turret saddle and cross-slide saddle.

2) Headstock :

The function of head stock is to control the spindle speeds. All geard head stock is most common and it provides a wide range of speeds are allows heaviour cuts. It is located on the left end of the bed.

3) Turret :

It is tool holding device shaped in the form of hexagonal and is mounted on a ram. The specialy designed tools are attached to six faces of hexagonal turret and are brought into position for different operations. The tools used in turret are drills, reamers, boring bats and cutting tools. For each set of tools a stop screw is provided to control the tool movement.

4) Turret saddle :

Turret saddle supports ram on which hazagonal turret is mounted. The turret saddle can be moved over the bed and clamped in any desired positions.

5) Cross-slide and Carriage :

The cross-slide mounted on the carriage. It is equiped with four station type tool post at the front, and one rear tool post at the back of the cross-slide.

Carriage mounted across the entire bed. It moves parallel to the lathe bed. Cutting tools are fed to the work by movement of carrege along the bed; and cross-slide across the bed.

(b) Identify the size and specification of a turret lathe.

Ans:

The size of a turret lathe is designed by the following items,

- The maximum diameter of bar that can be accomodated in headstock spindle, and
- Swing diameter of the work that can be rotated over the lathe bedways.

The specification of these lines should also include range of spindle speeds, feeds, power and floor space required.

UNIT – 11

V. V(a) Explain continues broaching with help of neat sketch.

Ans:

Continues broaching machine

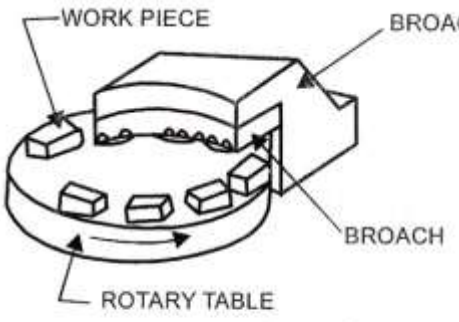

Fig. 4.8 ROTARY-TABLE CONTINUOUS BROACHING MACHINE

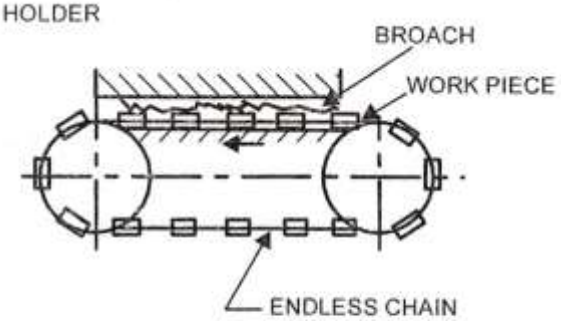

Fig. 4.9 HORIZONTAL CONTINUOUS BROACHING MACHINE

In continues broaching machines the broach is held stationary, while the work piece are continuesly passed under them. In these machines, the work piece are loaded and unloaded without stopping the machine. This fecilities continues operations. These machines are used for mass production of small components.Continues broaching machine are classified into two types.

1) Rotary – table continues broaching machine :

In rotary broaching machine, the work piece in a fixture is supported on revolving table which move past the stationary broaches. These broaches can be easily sdjusted and sharpened.

2) Horizontal continues broaching machine :

In horizontal continues broaching machine, the work is held in the fixture which are mounted on an endless chain. The chain carries the work in a stright path under the stationary broaches.

(b) Explain the construction and working of power press.

Ans:

Power press.

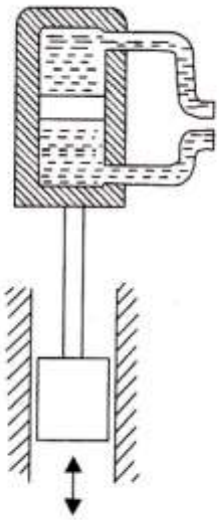

Fig. 6.2 Hydraulic Press

Power press or Hydraulic press consists of a rigid frame with one or more hydraulic cylinders and pistons. The piston is secured through strong connecting link to the press ram. Hydraulic presses are widely used for forgings, heavy blanking and drawing.

Speed of ram may be varied easily and ram travel is under direct control of the operator. Ram pressure may be maintained constant throughout the work strok. Ram can be stopped at any point along its path of travel. Are the advantages of power presses.

OR

VI. (a) Explain the working of jig boring machine.

Ans:

Jig boring machine

Jig boring machine resemblesin appearence to a vertical milling machine, but the machining accuracy of jig boring machine is very high, within a range of 0.0025mm. Jig boring machine are used in precision tool room applications for locating and boring holes in jigs, fixtures, gauge and other precision parts.

Jig boring machine consist of a work table having a flat vertical spindle and appropriate measuring instruments. All movements and measurements of the table are made in relation to the verticle axis of the spindle. The main distinguishing features of this machines are that the spindle and other parts are rigid to prevent deflection. For boring, the work piece are clamped on the table by T-bolts and straps, and an existing hole is

enlarged by using a single point tool. The single point tool produce better surface finish and locates holes with maximum accuracy.

(b) What are the essential characterstics in the proper design of jigs and fixtures.

Ans:

1. Location :
- Ensure that the workpiece is given the desired constraints.
- Position the locators in such a way that swarf will not cause misalignment.
2. Clamping :
- Position the clamps to give the best resistance to the cutting force.
- Clamping should be such that no deformation of work piece is caused.
3. Clearance :
- Provide sufficient clearance to allow for variation of work piece size.
4. Stability and rigidity :
- Make the equipment stable so as to prevent displacement from its position during operation.
5. Handling :
- Make the equipment light and easy to handle
- Avoid sharp corner.
6. Cost and safety :
- Adopt simple design to minimise cost.
- Location and clamping methods should minimise the idle time.
- Use of standard parts is recommended.

UNIT – 111

VII. Expalin the function and working of a cylindrical centre type grinder with the help of neat sketch.

Ans:

Cylindrical grinding machine

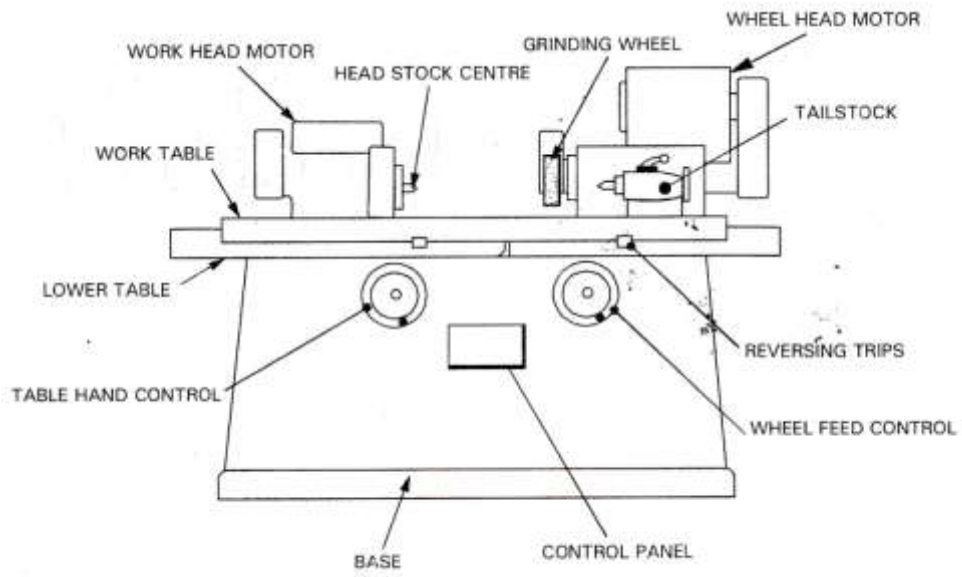

Fig. 10.17 CYLINDRICAL GRINDING MACHINE

In cylindrical grinders the work is mounted between the centers 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 given below,

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 the wheel.

In cylindrical grinding machine following operations are performed.

- Traverse grinding : The work reciprocates as the wheel feeds into the work.
- Plug cut grinder : The work rotates in a fixed position and the wheel is fed into the work piece until the required diameter is obtained.

(b) Explain the electric discharge machining with the help of a neat sketch.

Ans:

Electrical discharge machining

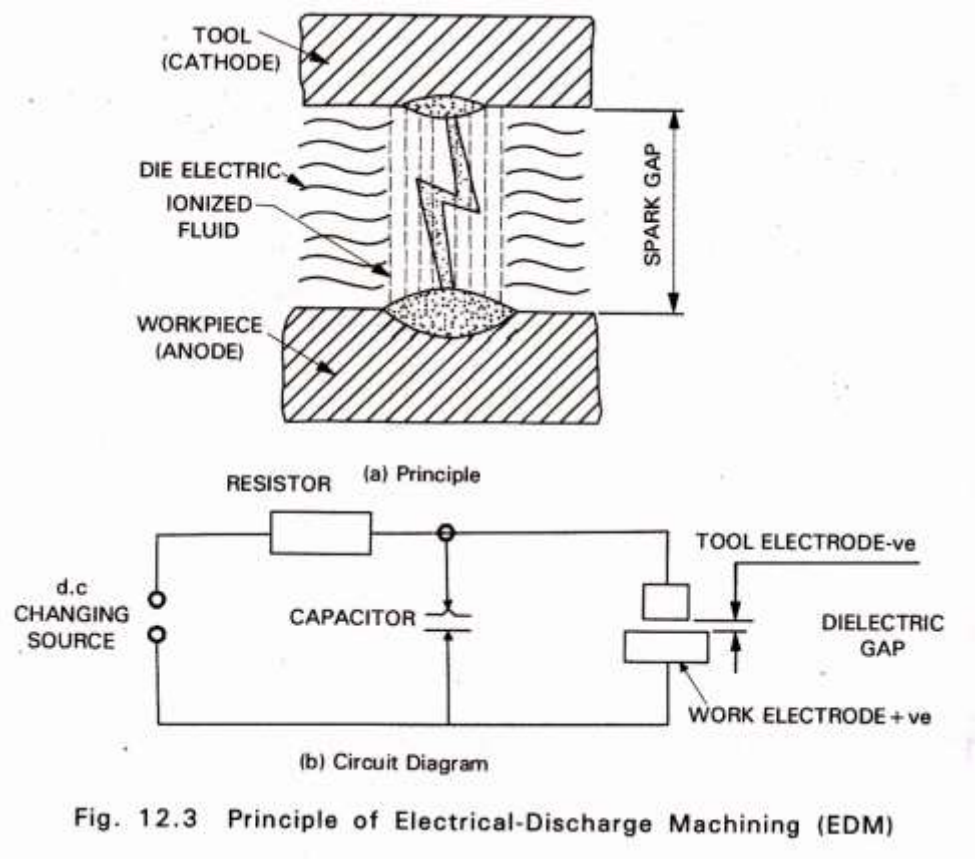

Fig. 12.3 Principle of Electrical-Discharge Machining (EDM)

Electrical discharge machining is also known as spark erosion. With this process soft or extremely hard workpieces such as tungsten carbides can be machined. The working principle described below.

Principle :

In this process the metal is removed by intense heat of electric spark. The tool and the work piece are submerged in dielectric fluid. The spark discharges are created by maintaining sufficient potential difference between tool and work piece, seperated by a dielectric in a very small gap. A large nomber of electrons emitted from tool impinges on work material and thus develop a very high temperature. This temperature is sufficient to melt and even vaporise a part of the metal. In this way metal is removed from the workpiece.

OR

VIII. (a) Discus about lapping, honing and super finishing.

Ans:

Lapping :

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

Lapping cosist of rubbing work surface with lap surface which is charged with fine abrasive particles. The lap material is generally softer than the work material. The lapping pressure is generally kept in the range of 0.01 – 0.2/mm2. 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. Machine lapping is performed for obtaining highly finished surfaces in mass production.

Honing :

Honing is a finishing process in which honing tool rotates and reciprocates in the stationary hole being honed. It is used on holes and bores, which require a fine surface finish and a high degree of accuracy.

For honing, the hone is inserted into the hole and adjusted to bear against the walls. Work is kept stationary, and the metal is removed as a result of rotary as well as reciprocating motion of the hone in the hole. A cutting fluid is used to remove chips and to keep temperature iow. It is important to see that the hone should not leave the work surface and stroke length must cover the entire worklength. Honing can be performed on lathe or drilling machine, but better results can be obtained on honing machines for production work.

Super finishing :

Superfinishing is a special technique for producing fine quality surface finish by using abrasive stick. In superfinishing, tool reciprocates with short strokes across the surface of the rotating work piece. Acontrolled amounts of pressure is applied to the abrasive stick to effect the surface cutting.

Superfinishing is applied for externalor internal surfaces which have been previously ground or precision turned. Parts made from cast iron, steel or non-ferrous metals can be successfully superfinished.

(b) Discuss the process involved in preparing powder component.

Ans:

Manufacturing of metal powders:

There are various mathods available for the production of powders, depending upon the type and nature of metal. Some of the important processes are :

1. Atomization.
2. Machining.
3. Crushing and milling.
4. Reduction.
5. Electrolyte deposition.
6. Shotting.
7. Condensation.

Atomization:

In atomization process molten metal is forced through a small orifice and is disintegrated by a power ful jet of compressed air, inert gas or water jet. These small particles are then allowed to solidfy. These are generally spherical in shape.

Machining:

In machining method first chips are produced by filing, turning etc. And subsequently pulvarised by crushing and milling. The powders produced by this method are coarse in size and irregular in shape.

Crushing and milling:

Crushing and milling methods are used for brittle materials. Jaw crushers, stamping mills, ball mills are used to breakdown the material by crushing and impact.

Reduction:

In reduction process the pure metal is obtained by reducing its oxide with suitable reducing gas at an elevated temperature in a controlled furnace.The reduced product is then crushed and milled to a powder.

Electrolyte deposition:

Electrolytic deposition method is commonly used for producing iron and copper powders. This process is similar to electroplating. For making copper powder, copper plates are placed as anodes in the tank of electrolyte, where as the aluminium plates are placed into electrolyte to act as anode. When DC current is passed through electrolyte, the copper gets deposited on cathode. The cathode plates are taken out from electrlyte tank and the deposited powder is scrapped off. The powder is washed, dried and pulvarised to produce powder of the desired grain size. The powder is further subjected to heat treatment to remove work hardness effect.

Shotting:

In this method, the molten metal is poured through a siever or orifice and is cooled by dropping into water. This produces spherical particles of large size. This method is commonly used for metals of low melting points.

Condensation:

In this method, metals are boiled to produce metal vapours and then condenced to obtain metal powders ; this process is applied to volatile metals such as zinc, magnesium and cadmium.

UNIT – 1V

IX. (a) Differentiate closed loop system and open loop system of control.

Ans:

S. NO	Open loop system	Closed loop system
1.	No feed back about the result produsedue to open loop.	Instantaneous feedback about the result produced.
2.	No referance for the result.	Definite referance for the result.
3.	There is no checking of the out put with the desired goal.	There is a checking of the out put with the desired goal.
4.	It is relatively cheap.	It is costlier.
5.	This system is used where the	This system is used where the accuracy is

	accuracy is least cosidered.	more important.

(b) Enumarate the advantages and disadvantages of flexible manufacturing system.

Ans:

Advantages:

- All parts with specified size can be manufactured.
- Production rate can be adjusted to market demand without additional man power.
- Set up time is vrtually 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 adoptable to CAD/CAM.

Disadvantages :

- Design is complicated and costly to build.
- High degree of planning is required.
- Longer time is required to reach peak production.
- Consistency of raw material becomes important.
- Tool perfomance and condition monitoring is also expencive.
- Fixtures can sometimes cost more with FMS.

OR

X. (a) Interpret the role of AGVs in increasing flexibility in flexible manufacturing system.

Automated guided vehicle systems offers a viable solution when the conventional systems are inadequate to satisfy the requirements of plants. They are employed where the product is carried out through interconnected work calls and where flexibility and rapid change over times are of primary importance.

AGVS possess intrinsic flexibility and capability to integrate with other automatic devices such as robots, CNC, automatic storage system. These system find application for distribution, assembly and manufacturing.

(b) Enumarate the factors influencing the selection of robots.

Ans:

Factors that influence the selection of robots in manufacturing plant are :

1. Load – carrying capacity.
2. Speed movement.
3. Reliability.
4. Repeatability.
5. Arm configuration.
6. Degree of freedom.
7. Control system.
8. Program memory.
9. Work envelop.