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SIXTH SEMESTER DIPLOMA EXAMINATION IN MECHANICAL

ENGINEERING—MARCH,2012

ADVANCED PRODUCTION PROCESS

(Maximum marks : 75) [*Time : 3 hours*]

PART—A

(Maximum marks : 15)

I. Answer the following questions in one or two sentences :

1. What is meant by Robotics ?

ANS : Robort is a programmable work handling device." An industrial robort is a reprogrammable, multifunctional manipulator designed to move material, parts, tools or specialised devices through variable programmed motions to accomblish a variety of tasks".

2. Write short notes on Knee tool holder.

ANS : Knee tool holder is bolted directly to the turret face. Additional support is given by the over head pilot which is located in the brush. It is useful for simultaneousturning and boring or drilling. For boring (or drilling) a boring bar may be set in the central bore whose exis coincides with the lathe axis.

3. Briefly explain Lacquers.

ANS : Lacquer is a clear or coloured wood finish that dries by solvent evaporation or a curing process that produces a hard, durable finish. This finish can be of any sheen level from ultra matte to high gloss, and it can be further polished as required. It is also used for "lacquer paint", which is a paint that typically dries better on a hard and smooth surface.

4. Write down the Applications of CAD/CAM.

ANS :

- Programming for NC, CNC and industrial robots.
- Design of tool and fixtures.
- Quality control and process planning.
- Inspection and scheduling.
- Plant layout.

5. List out the important bonding materials used in grinding.

ANS :

- Vitrified bond.
- Silicate bond.
- Shellac bond.
- Resinoid bond.
- Rubber bond. And
- Oxychloride bond.

6. Explain Embossing and Coining.

ANS :

Embossing: Embossing is a shallow forming operation which uses a matched punch and die. The thickness of work piece is uniform, and is intended for duplicating of the pattern on either side of the sheet metal.It is used for decorative sheet work and to obtain the impressions of desired form.

COINING: Coining is squeezing operation in which the metal flows into the cavity between the punch and die. It is employed for making coins, medals and similar articles.

7. Write down the advantages and limitations of Gear Hobbing operation.

ANS : Advantages

- Continuous cutting action makes it fastest generatingprocess.
- Does not require reciprocating or indexing movements.
- Rate of production is high.
- Produces accurate gears.

Limitations

- Cannot cut internal gears, bevel gears and gears with adjacent shoulders.
- Hob is complicated and expensive tool and require careful re-grinding.

8. State the applications of Broaching.

ANS : The operation of Broaching was orginally developed for machining small, internal surface such as key way in a small diameter which is relatively dificulty for slotter.

Internal Broaching is used for machining and sizing of round holes, square, hexagonal and many other shapes of holes. Internal key way, splines and gears are easily produced by broaching.

9. State the applications of Numerical control.

ANS : Major Applications of NC machines.

- For making complex parts which is not possible to manufacture them accurately on conventional machine.
- For reprtative parts which are to be produced in low and medium batch production.

- For manufacturing of parts which are frequently subjected to design change.
- To manufacture the parts whose cost is high if they are made on conventional machine tool.

10. List the basic components of FMS.

ANS : The basic components of flexible manufacturing system include

1. Machine tools and related equipment.
2. Material handling equipment.
3. Computer control system.

PART—B

(Maximum marks : 60)

(Answe one full qustion frome each unit)

UNIT – 1

II. (a) Draw a Capstan lathe and name the parts.

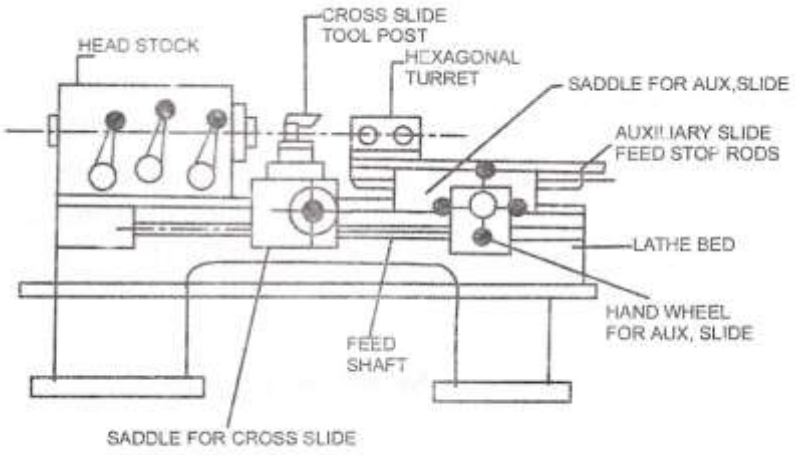


Fig. 1.1 PARTS OF CAPSTAN LATHE

(b) Explain the principle of pantograph machine.

ANS :

The working of mechanical type copying machine is based upon the principle of the pantograph and is used to copy the form of an involute gear tooth space on to the grinding wheel of a gear tooth grinding machine. It will be noted that the follower, fulcrum and tracer must all lie on a stright line. Also the type of pantograph shown produces a reverse image of the template form on the wheel and hence template must be arranged accordingly. The pantograph ratio L1/L2 varies usually 5:1 to 10:1.

OR

III. (a) Explain with neat sketch operation of automatic screw cutting machine.

ANS : Automatic screw cutting machine

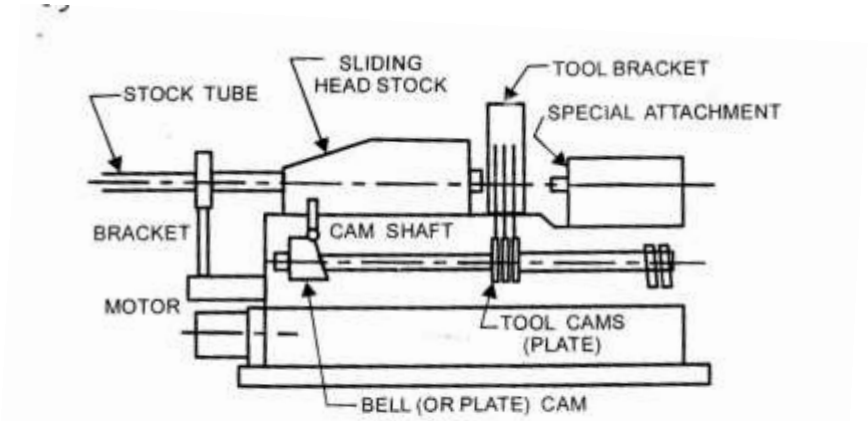


Fig. 2.3.2 LAYOUT OF SWISS TYPE AUTOMATIC SCREW MACHINE

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) List the important advantages and limitation of hydraulic controls in machine tool.

ANS : Many of the machine tools are provided with hydraulic systems. The motion of the Ram, table or tool is controlled by very effectively by hydraulic pressure.The hydraulic system offer the following advantages.

- Provide infinitely variable speed over a wide range.
- Quick and smooth reversal of machine members without any damage.
- Automatic overload protection.
- Easy lubrication.
- Simple mechanism.

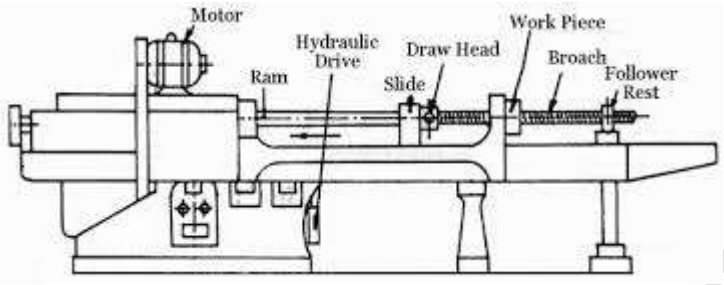
Limitations

- Leakage of hydraulic fluid through seals and gaps.
- Ingress of air into fluid makes the movement of table or ram non-uniform.
- Temperature affects the fluid properties.
- Overall efficiency is low.
- Hydraulic system is not very rigid.

IV. (a) **Draw a horizontal pull broaching machine and explain.**

ANS :

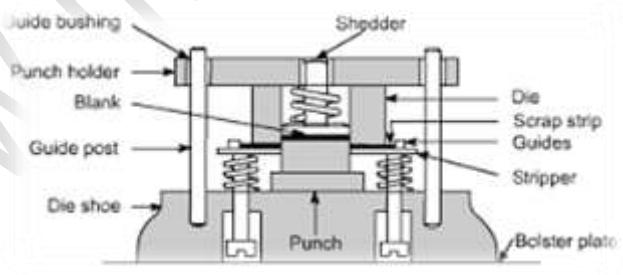
Horizontal Broaching machine



The horizontal broaching machine is used for surface broaching or internal broaching, the later being most common. The work is held in fixture. In the surface broaching the tool is pulled over the surface while for internal broaching the broach is pulled through the work. These machines are mostly pull type and can be operated at a cutting speed of 3 to 15 m/min. Hydraulic horizontal machine hasan infinitly variable range of cutting speed with return speed much greater.The broach is pulled over the top surface of the work piece held in fixture. The hydraulic cylinder which pulls the broach is housedin the right end of the machine.

(b) **Explain with neat sketch the operation of inverted Die.**

ANS : Inverted die



In inverted dies, the die is attached to punch holder and the punch is carried on the die shoe attached to the bolster. As the ram descends, the blank is cut off from the strip. On the upward stroke of the ram, the shedder pushes the blank out of the die opening and the stripper forces the scrap strip off the punch. Design of inverted dies is complicated and its cost is high. However, there is little possibility of thin blanks being bent, and the cutting edges need less regrinding.

OR

V. (a) Explain advantages and limitation of Broaching.

ANS :

Advantages

- Fast and simple process.
- High degree of accuracyand finishis possible.
- Any shape of profile can be easily machined.
- Machining process is completed with one stroke of broach.
- Life of broach tool is high.
- Cutting temperature and tool wear is low.
- Does not require a highly skilled operator.
- Cutting force acts in the clamping direction. It does not tends to lift the workpiece from fixture.
- Cutting fluids can be applied more easily and effectively.
- Most economical for mass production of components.

Limitations

- Not economical for small quantity productions.
- Cost of broach is high.
- Tool grinding is difficult and expensive.
- Not suitable to machine a surface having obstruction.
- The work must be strong enough to withstand cutting forcess.
- Very high and delicate jobs cannot broached easily.
- The cost of broaching machine is high. It has to be very rigid to control vibrations.
- Large amount of metal cannot be removed by broaching.

(b) Explain gear shapping operation using pinion gear.

ANS :

Gear shaping using pinion cutter

The gear shaping process is carried on a vertical type shaper. The parts of gear shaper shown in figure.

The blank is mounted upon a vertical arbor, and a pinion cutter fix to the cutter spindle which is carried by the saddle. A guide controls the action of the cutter spindle. The saddle can be fed along slide ways.

The cutter spindle and the work spindle are connected to each other through gearing, and the desired gear ratio between the pinion cutter and blank depends upon the nomber of teeth on the cutter, and the nomber of teeth required on the blank.

The pinion cutter is essentially a gear with cutting edges. The cutter is mounted on machine spindle and rotate in mesh with gear blank. To provide the cutting action, the cutter is reciprocated along its own axis across the width of the blank. This reciprocating motion is obtained by some form of crank and lever mechanism. The path followed by the cutter is guided by the suitable arrangement. The guiding unit can be changed depending upon the type of gear production. For cutting helical gears special helical guide ways are provided for the cutting spindle.

The gear blank is mounted on the vertical arbor of the work table. The setting of cenre distance and infeed to the tooth depth is effected by travel of the work table with the blank. The cutter and gear blank are connected by gears so that they will roll togather as if they are two gears in mesh.

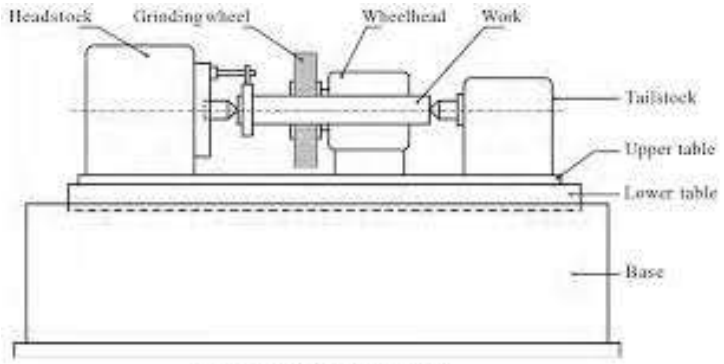
To provide the cutting action, the cutter is reciprocated across the width of the blank, and at the same timefeed is applied to gear blank. Cutter and blank slowly rotate at proper speed bratio until all the teeth are generated on the gear blank.

UNIT – 111

VI. (a) Explain plain cylindrical grinding machine with a neat sketch.

ANS :

Plain cylindrical grinding machine



Cylindrical Grinding Machine

The plain cylindrical grinding machine shown in figure. It has the following parts,

1. Bed or Base
2. Table
3. Headstock
4. Tailstock or Foot stock
5. Wheel head

In cylindrical grinders the work is mounted between the centers and rotated against the grinding wheel.

Base:

The base or bed rests on the floor. The top of the base is machined accurately to form ways for the table. It also houses the table drive mechanism.

Table:

The lower table mounted on the ways of the bed. It provides traverse motion to the work past the grinding wheel. It can be operated manualy.

Upper table:

It is mounted on lower table and can be swivelled for grinding tapers and alignment purposes. The head stock and tail stock are mounted on this table.

Head stock:

Head stock supports and drive the work piece with the help of centre and dog or chuck

Tailstock:

Tailstock or foot stock is mounted on the right end of the table. It can be adjusted along the length of the bed to support the right end of the work.

Wheel head:

Wheel head is mounted on a cross-slide at right angle to the table, providing the in-feed movement of the wheel to the work.

Acylindrical centre type grinding machine is specified by the maximum diameter and the length of the workpiece that can be accomodated between the centers.

(b) **List different types of drill jigs. Explain channel jig and template jig with sketch.**

ANS : Adrill 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 jig.
6. Indexing jig.
7. Universal jig.

Template jig:

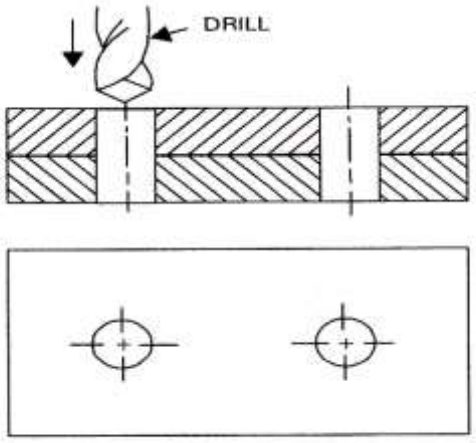


Fig. 8.5 TEMPLATE JIG

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

Channel jig:

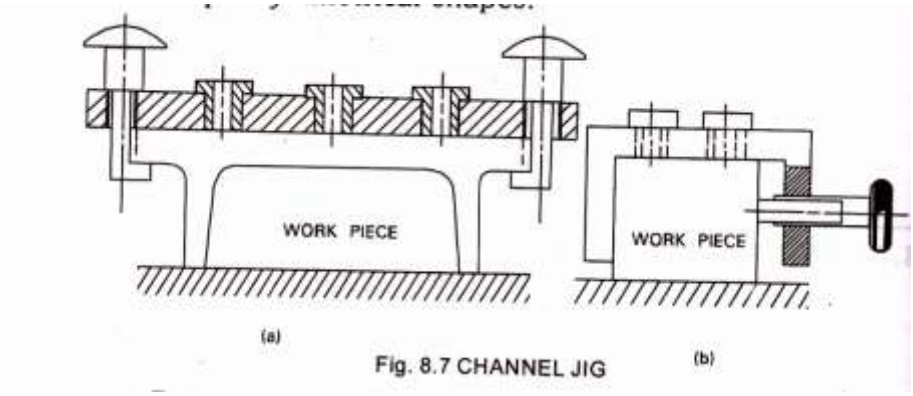


Fig. 8.7 CHANNEL JIG

The body of channel jig is in the form of standard channel. The component is located in a channel and is clamped by screw. It is used for drilling simple symmetrical shapes.

OR

VII. (a) Explain the advantages and limitations of centerless grinding.

ANS :

Advantages and limitations

- No axial thrust on work, long parts are easily ground.
- Work centre Holes are not necessory.
- The process is relatively fast, and ideal for production process.
- Plain, short pieces can be continuosly ground using through feed grinding.
- Size of the work is easily controlled.
- The process is relatively simple, and iow order of skill is needed to operate the machine.

Disadvantages

- Work having obstructions is not easily handled.
- Work with flats and key ways cannot be ground.

(b) **Explain milling fixture with neat sketch.**

ANS : Milling fixture

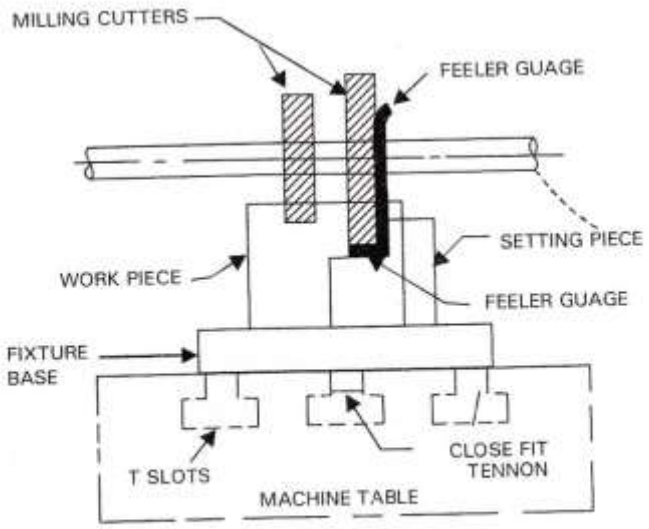


Fig. 8.10 (b) MILLING FIXTURE

The cutting force induced in milling is heavy and therefore, the fixture is rigidly attached to the table. Cast iron fixture are more efficient than steel and is recomended for accurate work. The milling fixture essentialy consists of base, tenon strips, setting blocks, T-bolts, clamps and locating pin. The work piece is located on fixture base which is bolted in position on the machine table. The cutter is set in a correct position by mounting a feeler gauge.

UNIT – 1V

VIII. (a) **Explain the principle of Electroplating with neat sketch.**

ANS : Electro-plating

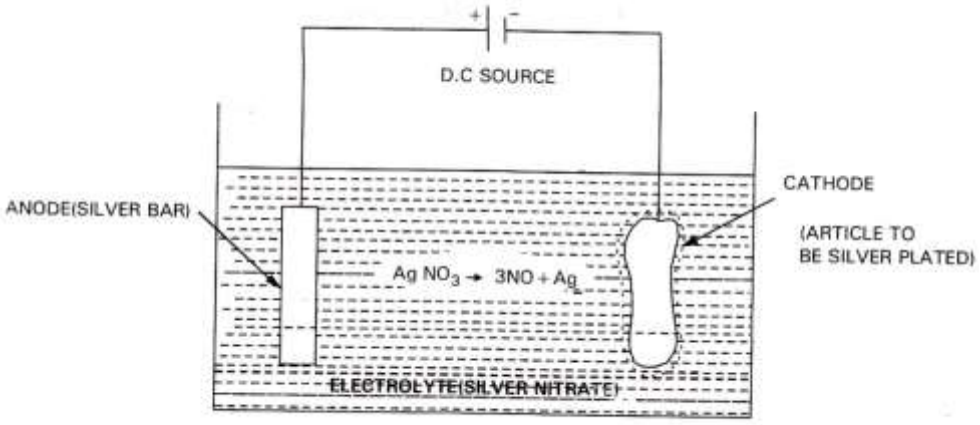


Fig. 11.1 PRINCIPLE OF ELECTRO - PLATING (SILVER-PLATING)

Electro-plating is the most popular means of applaying metallic coatings. In all electro plating processes, a protective coating is applied by the electrolysis action. Typical coatings include copper, nickel, chromium, cadmium, gold, silver, tin, and sink. A high accuracy of coating thickness can be radily obtained by controlling the voltage, current dencity, time of deposition, composition and temperature of electrolyte.

The theory of electro plating is based on the Faraday's Laws of electrolyte. The principle of electro-plating is that when DC is passed through the electrolyte causes the metalic elements to seperate from the solution and are migrated to the cathode, forming a deposit of pure metal. The particles from the anode pass into the solution to maintain the concentration of electrolyte.

(b) **Explain the following surface finishing mathords.**
(i) Galvanising **(ii) Anodising**

ANS :

(i) Galvanising:

Galvanising is the process of produsing the zink coating on iron or steel by hot-dipping by immersion of iron or steel articles in molten bath of sinc.

For galvanising, the work surface must be cleaned by picking and fluxed by immersing the material in a solution zinc cloride. The flux prevents the oxidation of surface and assit the formation of good bond between the coating and base metal. After cleaning, the articles are dipped in a bath of molten zinc maintained at about 450°c. In galvanising the zinc coating results due to the tendency of the molten zinc to diffuse into the base metal. The time and temperature of dipping controls the charactor and thickness of coating layer. The usual coating thickness of galvanised sheets varies from 0.025 to 0.3 mm. At higher temperature diffusion rate is high; and long time in molten zinc increases the hardness and brittleness of coating layer and cause subsequent difficulty in bending and forming of the final product.

Galvanising is the popular method of protecting steel sheets and formed products from atmospheric corrosion. The parts with galvanised coating of 0.01 mm will give a life of over 15 years.

Galvanising is used for out door hard ware, pipe, fence wire, nails, roofing, and a wide variety of sheet metal products.

(ii) Anodising:

Anodising is the process of produsing oxide film on aluminium bars. It is used on aluminium both for decorration and for protection of the base metal. The articles to be anodised are first cleaned properly. The film is produced by Electro-chemical reaction. The aluminium work work piece is made anode, and cathode is made of either lead or graphite. For anodising, sulphuric acid is mostly used as electrolyte and the process may be carried with AC or DC. DC is generally employed as it generates a coating that has deeper penetration. As current is passed through electrolyte, oxygen is liberated at the surface of the work piece and immediately combines with it to form the oxide film. The thickness of the oxide film increases with the current density and with lowering of the temperature of the solution.

At an optimum temperature of 3°c, a very hard film of about 0.15mm thickness is produsedd. Above, 30°c no anodising will take place because sulphuric acid will dissolve the oxide as soon as it is produced. At 20°c, an oxide film of 0.01 mm thickness is produced.

OR

IX. (a) **Explain the advantages and limitation of USM.**

ANS :

Advantages:

- No heat is generated during machining.
- It has an ebility to machine very hard material with little distortion.
- It is a burrless and distortionless process.
- Good surface finish and high accuracy may be easily obtained.
- Complex shapes can be machined on the materials which are not suitable for conventional machining.
- Conducting as well as non-conducting materials can be machined.

Limitation:

- Cannot remove large amount of materials.
- The maximum metal removal rate is 3mm^3/s.
- Dificult to machine very deep holes, as slurry movement is restricted. The depth of cylindrical holes is limited to 2.5 times the diameter of tool
- The power consumption is high.
- Equipment and tooling cost is high as it requires special tooling for each job.
- Abrasive slurry need to be replaced periodically.
- Suitable only for the materials having hardness more than 45RC.

(b) Explain open front jig boring machine with diagram.

ANS :

Open front jig boring machine

It is similar in construction to vertical milling machine. It consists of a single vertical column with guide ways to support the spindle head, and a horizontal bed in front of the column. The spindle rotates on vertical columns, and a position of work on the table may be obtained with a table, mounted on the machine base. The table moved perpendicular and parallal to the columns face to provide coordinate positioning of the work piece.

UNIT – V

X. (a) Explane job flexibility and machine flexibility.

ANS : The flexibility in the system can be achieved through job-flexibility and machine-flexibility.

Job-flexibility:

Job flexibility is the ability of the system to cope with the changes in the specification of jobs to be proceed by the system. It can be achieved by increasing the capabilities of machine by providing with more sophisticated controls. It can also be achieved at system level by distributing the required tasks among the work station which are specialised to perform such operations.

Machine-flexibility:

It is the ability of the system to cope with changes and disturbances at the machine and work centers. It is achieved by providing in-process inventories so that break down of one machine does not keep the other machine idle.

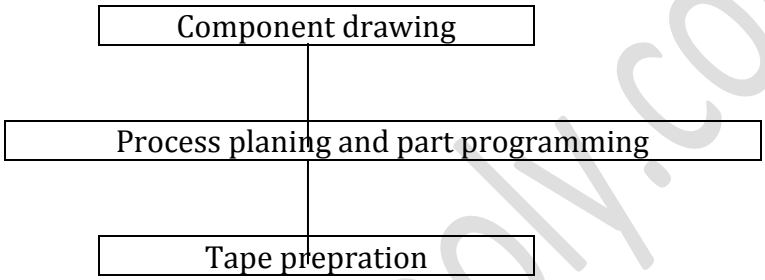
(b) Explain the basic procedure for part program and preparation of tape.

Ans:

The basic procedure for part programme and preparation of tape summarised below,

- Study the drawing and prepare the most economical sequence of operations in a prescribed format.
- Choose the NC machine tool and identify the type of material being processed.
- Decide feed, speed and depth of cut.
- Deside the type of fixtures and cutters to be used.
- Prepare the programmedsheet.
- Prepare the punched tape on the teleprinter.

Basic process for preparing tape.



Programming to get punched tape can be obtained mannually or with a help of computer. Simple point to point programms can be easily developed manually, but more complex ones and all contouring programme are developed with the help of computers.

OR

XI. (a) Explane the basic components of FMS.

ANS : The basic components of Flexible manufacturing system include,

1. Machine tool and related equipment.
2. Material handling equipment.
3. Computer control system.

1.Machine tool and related equipment.

These include CNC and special purpose machine tools along with required tooling system.

2. Material handling equipment.

The functions of material handling system are to move the parts between the machines and to locate these parts for processing at the machines. The work pieces are mounted on the fixtures or pallets and moved through the system by automaticaly guided vehicle or conveyers.

3.Computer control system.

The functions of this system are to contro machine tools, material handling system to monitor the perfomance of the system and to schedule the production.

(b) Explane various mechnical joints used in robots.

Machine tool and related equipment.

ANS :

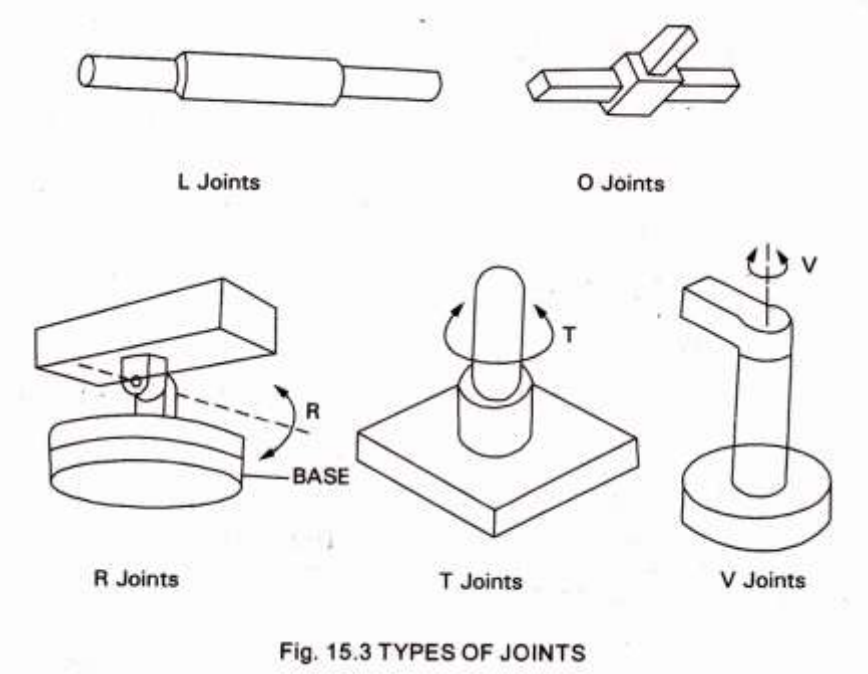


Fig. 15.3 TYPES OF JOINTS

A joint permit the relative motion between two links or arms of robot. Various types of mechanical joints are,

i. Linear joint(L-JOINT) :

Permit linear sliding motion between two links whose arms are parallel.

ii. Orthagonal joint (O-joint) :

Permit linear sliding motion between two links which are perpendicularto each other.

iii. Rotational joint (R-joint) :

Provide rotational relative motion of the joint, with the axis of rotation being parallal to the axis of the two links.

iv. Twisting joint (T-joint) :

Permits rotary motion between two links, the axis of rotation being parallel to the axes of the two links.

v. Revolving jint (V-joint) :

Provides rotary motion; the axis of the input link is parallal to the axis of rotation, and the axis of out put link is perpendicular to the axis of rotation.