



SUMMER – 15 EXAMINATION

Subject Code: 17402 (MFP)

Model Answer

Important Instructions to examiners:

- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more importance (Not applicable for subject English and Communication Skills).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q.1 a)

i) State applications of extrusion process. (Any two 01 mark each)

Rods, Tubes, structural shapes, aircraft parts, Cans, various aluminium brackets, lead covered cables etc.

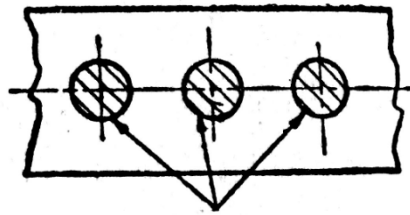
ii) What is Drop forging? Explain (02 marks for explanation)

Drop forging utilizes a closed impression die to obtain shape of the component. The shaping is done by the repeated hammering given to the material in the die cavity. The equipment used for delivering the blows are called drop hammers. The drop forging consists of two halves. The lower half of the die is fixed to the anvil of the machine, while the upper half is fixed to the ram. The heated stock is kept in the lower die while the ram delivers four to five blows on the metal, in quick successions so that the metal spreads and completely fill the die cavity. When the two die halves close the complete cavity is formed.

iii) Explain punching operation with neat sketch. (01 mark explanation, 01 mark for sketch)

Punching operation: (01 Mark description, 01 Mark for figure)

Punching is the operation of production of hole in a sheet metal by the punch and the die. The material punched out to form the hole constitutes the waste. The punch point diameter in the case of piercing is less than or equal to the work material thickness. The punch governs the size of the hole and the clearance provided on the die. The spacing of hole on the plate is actuated by the stop. The stripper plate attached to the die body prevents the sheet metal from being lifted along with the punch after shearing operation.

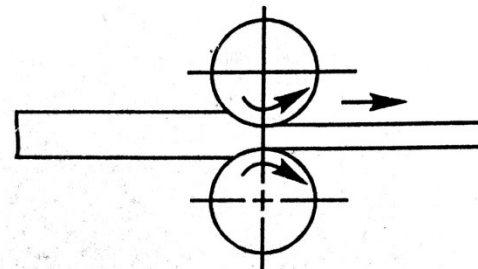


Punches

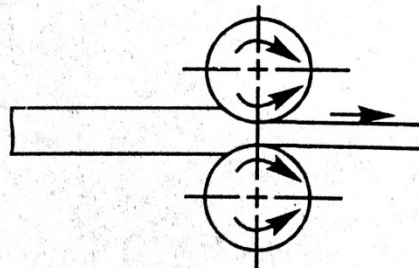
Figure: Punching operation

iv) Explain two high rolling mill with sketch. (01 mark explanation, 01 mark for sketch)

When there are only top and bottom rolls the mill is called two high rolling mill. Fig shows the arrangement for two high mill. In this the arrangement of rolls i.e. direction of rotation of roll can be in i) two high non reversing rolling i.e. only one direction ii) two high reversing rolling i.e. direction of rotation of rolls in forward and reverse direction.



2-High



2-High Reversible

v) Give basic steps in casting processes. (Any four 1/2 mark for each step)

Following are the steps in producing castings:

- 1) Pattern making.
- 2) Moulding and coremaking
- 3) Melting and casting
- 4) Fettling.
- 5) Testing and inspection.

vi) Name any four metals used for making patters. (Any four ½ mark for each)

Cast iron, Brass, Aluminum, white metal, White metal etc.

vii) What is vertical core in moulding

This core placed in a vertical position both in cope and drag halves of the mould. Usually top and bottom of the core are provided with a taper but the amount of taper on the top is greater than that at the bottom.

viii) State any two causes and two remedies of blow holes. (any two each, ½ mark for each causes ½ mark for each remedies)

i) Blow holes:

Causes:-

- i) Excessive moisture in the sand.
- ii) low permeability of sand
- iii) Sand grains are too fine
- iv) Sand is rammed too hard
- v) Venting is insufficient

Remedies:-

- i) Moisture content of the sand must be well.
- ii) Sand of proper grain size should be used.
- iii) Ramming should not be too hard.
- iv) Vent holes should be provided.

Q. 1 b)

i) Differentiate between TIG and MIG welding (any four points 2 marks each)

TIG welding	MIG Welding
This arc welding process uses the intense heat of an electric arc between a tungsten electrode and the material to be welded	this arc welding process uses the high heat of an electric arc between a continuously fed , electrode wire and the material to be welded.
The shielding is obtained from an inert gas such as helium or argon or a mixture of the two.	The shielding is obtained from an gas such as CO ₂ , helium or argon or a mixture of the two.
The electrode used is non consumable	The electrode wire is consumable.
It is easy to weld thin plates and small parts	It is difficult to weld thin plates and small parts
The filler metal may or may not be used.	Very lightly coated or flux cored wire is used.

ii) Explain counter bore and countersink operation of drilling machine.

Counter boring operation: (01 Mark for description, 01 Mark for figure)

Counter boring is the operation of enlarging the end of a hole cylindrically. The enlarged hole forms a square shoulder with the original hole. This is necessary in some cases to accommodate the heads of bolts, studs and pins. The tool used for counter boring is called a counter bore. The counter bores are made with straight or tapered shank to fit in the drill spindle. The cutting edges may have straight or spiral teeth. The tool is guided by a pilot which extends beyond the edge of cutting edge. Counter boring can give an accuracy of about 0.050mm. The cutting speed for counter boring is 25% less than that of drilling operation.

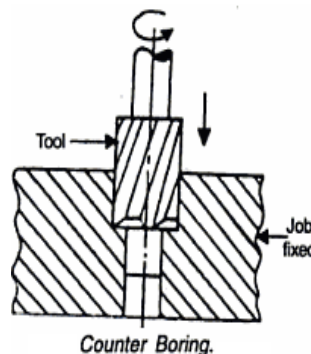


Figure: Counter boring operation

Countersinking: (01 Mark for description, 01 Mark for figure)

Countersinking is the operation of making a cone shaped enlargement of the end of a hole to provide a recess for a flat head or countersink rivet fitted into the hole. The tool used for countersinking is called a countersink. Standard countersinks have 60, 82 or 90 included angle and the cutting edges of the tool are formed at the conical surface.

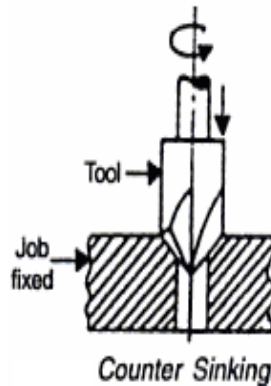


Figure: Countersinking operation

iii) What are the basic types of plastics? Give two applications of each

i) Thermoplastics

Applications:- electrical parts, knobs, toys, bearings, gears, machine slides, rope, bowls, plates, dishpans, flexible tubing, squeeze bottles, bottles, hospital equipments etc.

ii) Thermosetting Plastics

Applications:- aircraft and automobile parts, boat bodies, electrical insulators, furniture, shoe, glass and silver polishes.

Q.2 a) Explain notching and lancing operation with neat sketch

(01 Mark for description, 01 Mark for figure)

Notching:

The notching is the operation of removal of the desired shape from the edge of a plate. The punch and the die set up is similar to the piercing or punching operation.

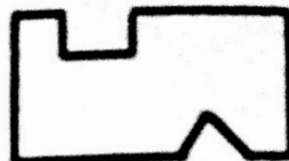


Figure: Notching operation

Lancing operation:

Lancing is the operation of cutting a sheet metal through part of its length and then bending the cut portion. The operation is illustrated in the figure.

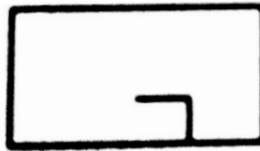


Figure: Lancing operation

b) State various types of dies, Explain any one with neat sketch. (Types 01 mark, explanation 01 mark sketch 02 marks, any one die)

Types of dies:

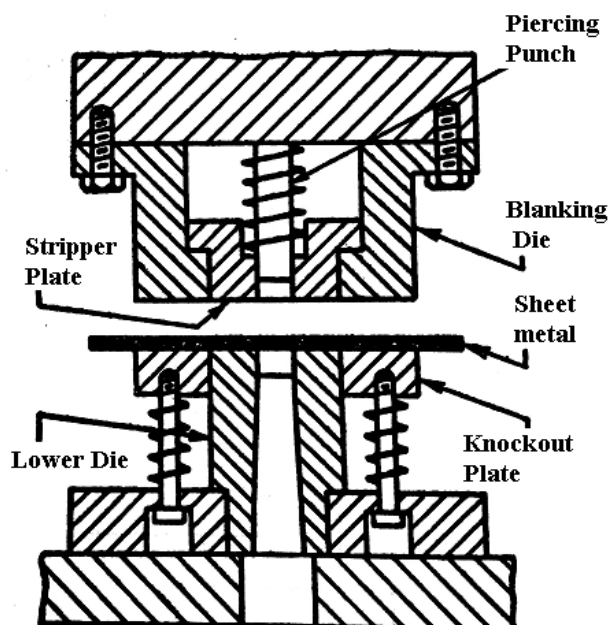
i) According to the type of press operation

- i) Cutting dies: - the common cutting dies are : blanking dies, piercing dies, perforating dies, notching, trimming, shaving and nibbling dies etc.
- ii) Forming dies:- Bending dies, drawing dies, squeezing dies etc.

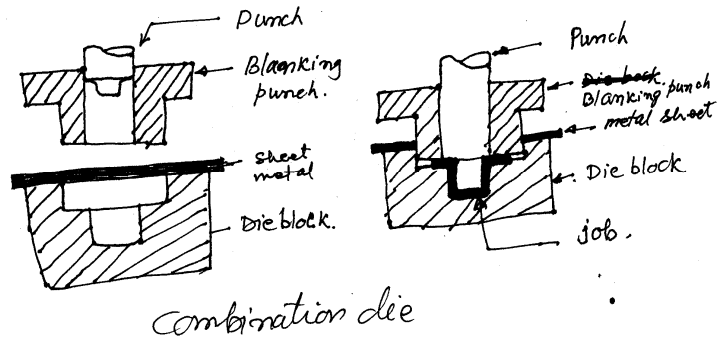
ii) According to the method of operation

- i) Simple die
- ii) Compound die
- iii) Combination die
- iv) Progressive die
- v) Transfer dies.
- vi) Multiple dies

Compound Die: - In these dies, two or more operations may be performed at one station. Such cutting dies are considered as cutting tools since, only cutting operations are carried out. Fig. shows a simple compound die .the blanking die and piercing punch are bolted to the ram. The spring loaded stripper plate is housed within the blanking die. The lower die body has cutting edge both on its outward and inward surfaces. The outside cutting edge serves as a punch for the blanking operation, and the inside cutting edge operates as a die for the piercing punch.



Combination die:-



In a combination die, both cutting and non cutting operations are accomplished at one station of the press in every stroke of ram. The upper die block serves as a blanking punch, and houses a drawing punch at its center. As the punch descends, the metal plate is first sheared and the required size of the blank is obtained. The inner punch now further descends and draws out the metal while the blanking punch serves as a pressure pad. The drawn out cup is ejected at the end of the strike.

Progressive die:

In progressive die, two or more operations are performed simultaneously at a single stroke of the press by mounting separate sets of dies and punches at two or more different stations. The metal is progressed from one station to the other till the complete part is obtained. The sheet metal is fed in to the first die where a hole is pierced by the piercing die set in the first cutting stroke of the ram. Plate is then advanced in the next station and the correct spacing is obtained by the stop. In the second cutting stroke of the ram, pilot enters in to the pierced hole and correctly locates it. While the blanking punch descends and shears the plate to form a washer. By the time the blanking operation is performed, the hole for the next washer is also pierced at the first station. Thus although two strokes are required to complete a washer, each piece of washer is discharged on every strokes of the ram due to the continuity on operation.

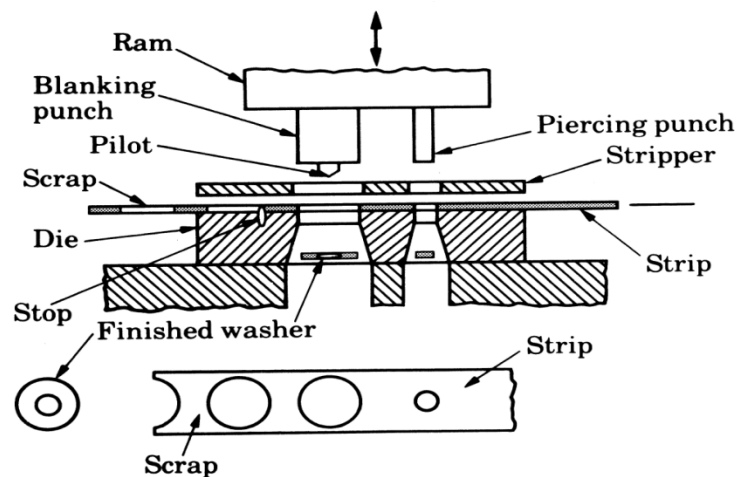


Figure: Progressive die

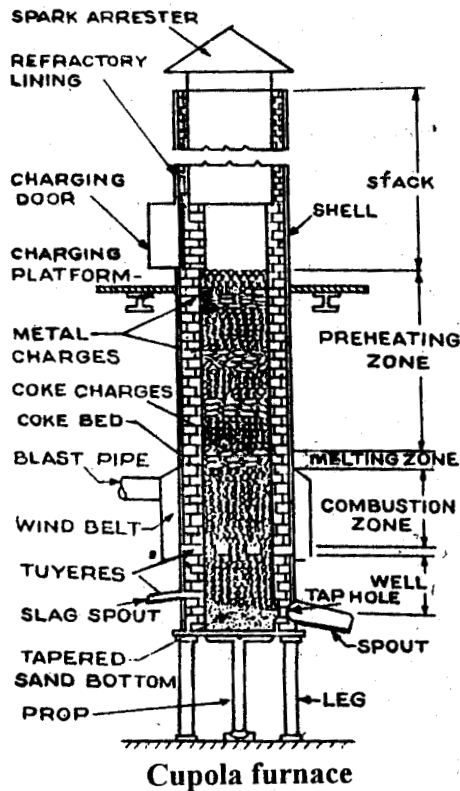
c) State the function of stripper plate and bolster plate. (02 marks each)

Stripper Plate:-It is a plate which is used to strip the metal strip from a cutting or non cutting punch or die.

Bolster Plate: - This is a thick plate secured to the press bed, which is used for locating and supporting the die assembly.

d) Explain the construction and working of cupola furnace with neat sketch.

(02 Mark for description, 02 Mark for figure)



Cupola Furnace:- The cupola furnace consists of a tall vertical cylindrical shell made of steel plates 6 to 12 mm thick, riveted together. It is lined inside with refractory bricks. The shell is mounted either on a brickwork foundation or on steel column. The cupola bottom is hinged so that the furnace may be emptied by dropping the bottom doors. At the front bottom of the cupola a tap hole is provided for molten iron. At the rear and above the tap hole level is a slag hole. A wind box is provided around the shell. The air required for combustion of fuel is supplied to the wind box from the blower by means of a wind pipe. Number of tuyeres (4,6 or 8) are provided in the wind box to supply the air in to the furnace. The tuyeres are situated at a height of between 450 to 500 mm above the bed of the cupola.

A charging door is situated 3 to 6 m above the tuyeres through which metal, coke and flux are fed into the furnace. The shell is usually continued for 4.5 to 6 m above the charging door to form a chimney. A conical spark arrester is provided at the top of the chimney. The spark arrester cools down the sparks and allows only smoke to escape from the chimney.



e) Explain any two types of allowances used in pattern making. (any two , 02 marks each)

Shrinkage Allowance:- as metal solidifies and cools, it shrinks and contracts in size. To compensate for this, a pattern is made larger than the finished casting by means of shrinkage or contraction allowance. In laying measurements for the pattern the patternmakers allows for this by using shrink or contraction rule which is slightly longer than the ordinary rule of the same length. Different metals have different shrinkages, therefore there is a shrink rule for each type of metal used in a casting.

Draft allowance:- When a pattern is drawn from a mould, there is always some possibility of injuring the edges of the mould. This danger is greatly decreased if the vertical surface of a pattern is tapered inward slightly. This slight taper inward on the vertical surface of a pattern is known as draft. Draft may be expressed in millimeter per meter on a side or in degrees.

Machining Allowance:- Rough surfaces of castings that have to be machined are made to dimensions somewhat over those indicated on the finished working drawings. The extra amount of metal provided on the surfaces to be machined is called machine finish allowance and the edges of these surfaces are indicated by a finish mark V or F. the amount that is to be added to the pattern depends upon:- 1) the kind of metal to be used. 2) the size and shape of the casting. 3) method of moulding.

Distortion allowance:- some castings because of their size, shape and type of metal tend to warp or distort during the cooling period. This is a result of uneven shrinkage and is due to uneven metal thickness or to one surface being more exposed than another, causing it to cool more rapidly. The shape of the pattern is thus bent in the opposite direction to overcome this distortion. This feature is called distortion.

Rapping allowance:- when a pattern is rapped in the mould before it is withdrawn, the cavity in the mould is slightly increased. In every cases where casting must be uniform and true to pattern, rapping or shake allowance is provided for by making the pattern slightly smaller than the actual size to compensate for the rapping of the mould

f) Explain any four properties of moulding sand. (01 Mark each)

1. **Porosity:** Molten metal always contain a certain amount of dissolved gases, which are evolved when the metal freezes , Also , the molten metal , coming in contact with the moist sand , generates steam or water vapour. If these gases and water vapour evolved by moulding sand do not find opportunity to escape completely through the mould they will form gas holes and pores in the casting.
The sand must, therefore, be sufficiently porous to allow the gases or moisture present.
2. **strength:** This is the ability of sand particles to stick together. Insufficient strength may lead to a collapse in the mould or its partial destruction during conveying, turning over or closing. The mould may also be damaged during pouring by washing of the walls and core by the molten metal. The strength of moulding sand must, therefore, be sufficient to permit the mould to be formed to the desired shape and to retain this shape even after the hot metal is poured in the mould.
3. **Collapsibility:** After the molten metal in the mould gets solidified, the sand mould must be collapsible so that free contraction of the metal occurs, and this would naturally avoid the tearing or cracking of the contracting metal.
4. **Adhesiveness:** The sand particles must be capable of adhering to another body, i.e. they should cling to the sides of the moulding boxes. It is due to this property that the sand mass can be successfully held in a moulding box and it does not fall out of the box when it is removed.

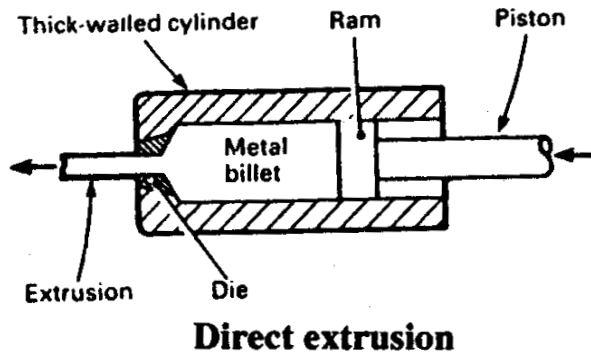
Q.3 Attempt any FOUR of the following:

a) Explain direct extrusion with neat sketch.

(02 marks for sketch, 02 marks for explanation)

Direct or Forward Extrusion:

Direct extrusion illustrated in Figure employs a press-operated ram and a cylinder or container into which the work piece is placed for confinement. A dummy block is used between the ram and hot metal. With application of ram pressure, the metal first plastically fills the shape, and it is then forced out through the die opening until a small amount remains in the container. It is then sawed off next to the die and the butt end removed.



b) Compare hot rolling and cold rolling.

(01 mark for each point any four)

Hot and cold rolling:

Hot Rolling	Cold Rolling
It is carried out above the re-crystallization temperature but below the melting or burning point.	It is carried out below the re crystallization temperature.
The purpose of hot rolling is to convert larger sections such as ingots into smaller sections which can be used either directly in as rolled state or as stock for working through other processes.	Cold working generally employed for providing a smooth and bright surface finish to the previously hot rolled steel. it is also used to finish the hot rolled components to close tolerances
Surface finish of hot rolled parts is relatively poorer due to oxidation and scaling.	Cold rolled parts have better surface finish.
Hot rolling refines metal grains, resulting in improved mechanical properties	Cold rolling processes lead to distortion of grains

c) Explain split pattern with neat sketch.

(02 marks for sketch, 02 marks for explanation)

Split pattern:

Many patterns cannot be made in a single piece because of difficulties encountered in making them. To eliminate this difficulty, and for castings of intricate design or unusual shape, split patterns are employed to form the mould. These patterns are usually made in two parts, as shown in figure, so that one part will produce the lower half of the mould, and the other, the upper half. The two parts, which may or may not be of the same size and shape, are held in their proper relative positions by means of dowel-pins fastened in one piece and fitting holes bored in other. The surface formed at the line of separation of the two parts, usually at the centerline of the pattern, is called the parting surface or parting line. It will be the parting surface of the mould.

It is sometimes necessary to construct a pattern for a complicating casting that requires three or more parts instead of two to make the completed pattern. This type of pattern is known as multi piece pattern. A three part pattern may necessitate the use of a flask having three parts, although it is possible to mould some type of three-part patterns in a two-part flask.

Spindles, cylinders, steam valve bodies, water stop cocks and taps, bearings, small pulleys and wheel are few examples of castings that require the use of split patterns.

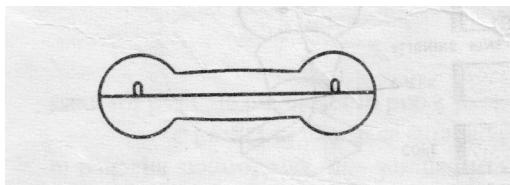


Fig: Two piece split pattern

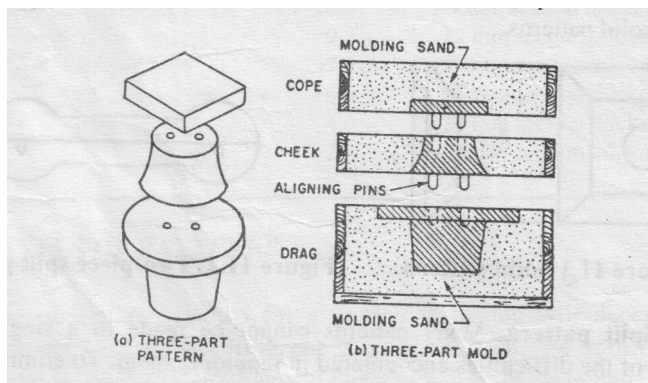


Fig: Three piece split pattern

d) Find the time required to turn a work piece from 70mm diameter to 50mm diameter, having a length of 300mm. The cutting speed is 40 m/min and the feed rate is 0.5 mm/rev. The radial depth of cut should not exceed 2mm.

Given data:

Diameter of work piece before machining = $D=70\text{mm}$

Diameter of work piece after machining = $d=50\text{mm}$

Length of work piece = $L=300\text{mm}$



Cutting speed= $V=40\text{m/min}$

Feed rate= 0.5mm/rev

Max. radial depth of cut= 2mm

Solution:

Let,

RPM of work piece = N

Cutting speed= $V = \pi DN/1000$ m/min.

$$40 = \pi \times 70 \times N / 1000$$

$$N = 40 \times 1000 / \pi \times 70 = 40000 / (3.14 \times 70)$$

$$N = 181.98 \text{ RPM.} \quad \text{Say } 182 \text{ RPM} \quad \text{(02 marks)}$$

Machining time for turning = $L / (S \times N)$ min.

Where,

S = feed of the work piece per revolution mm/rev.

L = length of the work piece in mm.

N = RPM

Machining time for turning = $300 / (0.5 \times 182)$

$$= 3.29 \text{ min}$$

No. of cuts required to reduce dia. From 70 mm to 50mm considering depth of cut 2 mm = 5cuts

Total time required for turning = 3.29×5

$$= 16.45 \text{ minutes} \quad \text{(02 marks)}$$

e) Explain Laser Beam Welding with neat sketch.

(02 marks for sketch, 02 marks for explanation)

Laser Beam Welding:

Lasers are devices which are capable of generating a very intense beam of optical radiation. The word "laser" is an acronym of Light Amplification by the Stimulated Emission of Radiation.

An even more concentrated beam is produced, but at a lower overall efficiency, with the laser beam. A CO₂ laser pumped with 500w emits far-infrared light and develops a peak energy density of 80KW/mm², yet the heat



affected zone is only 0.05 to 0.1mm wide. Oxygen blown on the surface of the metals reduces the heat reflection and increases material removal rates by oxidation; inert gas increases heat transfer for nonmetals.

The laser has the advantage that vacuum is not necessary and it is finding limited but growing application, particularly for thin gauge metals. Lasers using for work such as welding very small wires to electronic devices and similar work is called micro welding. Welding speed of about 2500mm/min is achieved on steel sheet 1.5mm thick. In practice, numerical control is used to move the work piece; and lasers use in heavy production work is still limited.

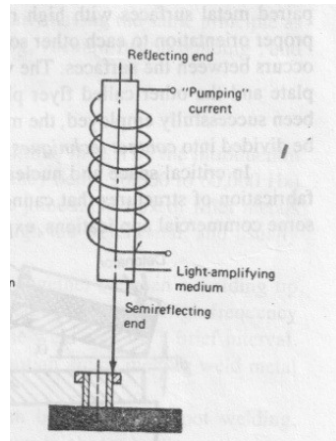


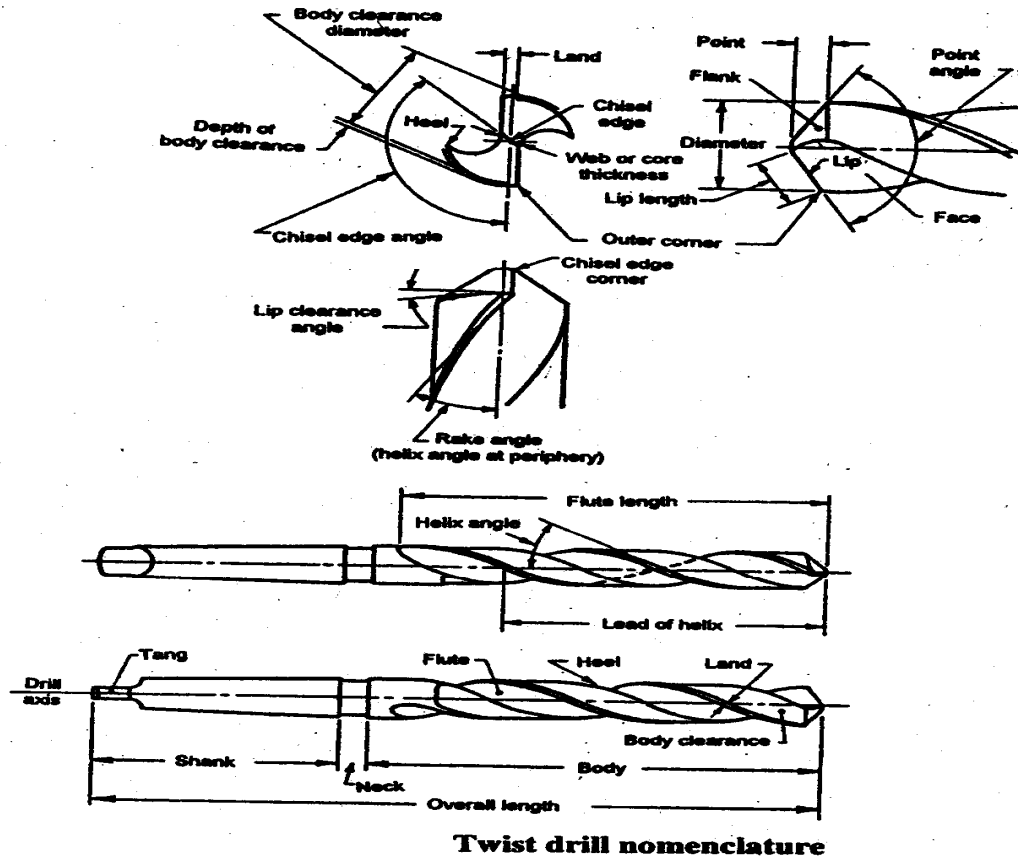
Fig: laser beam welding

f) Draw the neat sketch of twist drill and show the following parts:

i) Flutes ii) Helix angle iii) Lip iv) Point angle

(01 mark for each point)

Figure shows- i) Flutes ii) Helix angle iii) Lip iv) Point angle



Q.4 Attempt any FOUR of the following:

a) Differentiate between open die and closed die forging.

(01 mark for each point any four)

Open die forging	Closed die forging
Metal piece is deformed in a die which do not completely enclose the material	Metal piece is deformed in a die which completely enclose the material
It is also known as smith forging	It is also known as impression die forging.
The metal is altered as the dies as the dies hammer the material through a series of movements until the desired shape is achieved.	In some closed die forging processes, a succession of impression dies are used to modify the shape of the material.
Used for simple shapes	Used for intricate shape.
Work pieces of lesser accuracy are produced	Work pieces of higher accuracy are produced
Relatively inexpensive process.	Relatively expensive process.

b) Explain two rolling mill with neat sketch.

(02 marks for sketch, 02 marks for explanation)

Two Rolling Mill:

It consists of two heavy horizontal rolls, placed exactly one over the other. The rolls are supported on bearings housed in sturdy upright side frames, called stands. The space between the rolls can be adjusted by raising or lowering the upper rolls. The position of the lower roll is fixed. Both the rolls rotate in opposite directions to one another, as shown in figure. Their direction of rotation is fixed and cannot be reversed. Thus the work can be rolled by feeding from one direction only.

There is another type of Two high roll mill which incorporates a drive mechanism that can reverse the direction of rotation of the rolls. This facilitates rolling of the work piece continuously through back- and-forth passes between the rolls. This type of rolling mill is known as a Two high Reversing Mill. They are normally employed for the initial rolling of an ingot.

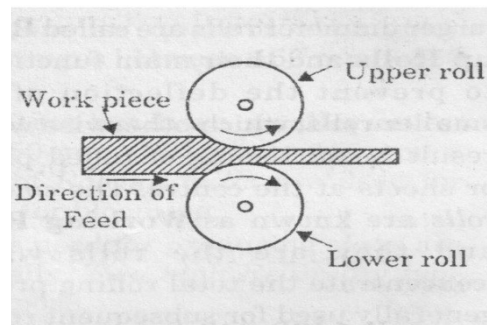


Fig: Two Rolling Mill

c) Explain spot welding with neat sketch.

(02 marks for sketch, 02 marks for explanation)

Spot Welding:

Spot welding is employed to join overlapping strips, sheets or plates of metal at small areas. The pieces are assembled and placed between two electrodes, which must possess high electrical & thermal conductivity and retain the required strength at high temperatures. So they are made of pure copper or tungsten, or copper and chromium for continuous working. When the current is turned on, the pieces are heated at their areas of contact to a welding temperature, and with the aid of mechanical pressure the electrodes are forced against the metal to be welded. The pressure may be developed by a foot lever or by air pressure or by hydraulic cylinders. This may be used to weld steel and other metal parts up to a total thickness of 12 mm.

Practically all combination of ductile metals and alloys can be spot welded. The spot welding method is used for fabricating all types of sheet metal structures where mechanical strength rather than water or air tightness is required. This may be applied to all types of boxes, cans, enclosing cases, etc. Spot welding machines are made in capacities from 10 to 150 k VA.

To obtain good welds, the sheet metal should be free of foreign matter and scale. Films of any type have a tendency to cause variations in surface resistance and also increase the heating effect of the metal in contact with the electrodes.

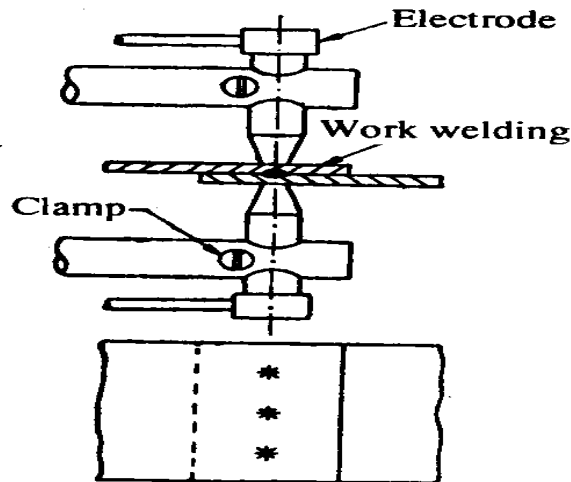


Figure: Spot welding process

d) Explain all three cutting parameters of drilling operations.

(explanation of all three points 4 marks)

1) Cutting Speed :-

Cutting speed in a drilling operation refers to the peripheral speed of a point on the surface of the drill in contact with the work. It is expressed in m/min

So cutting speed (s) is given by,

$$s = \frac{\pi d N}{1000} \text{ rpm}$$

Where, d = drill dia. in mm

N = Spindle speed in rpm.

S = Peripheral speed.

The use of cutting speed of drill depends on several factors such as

- 1) the kind of material being drilled softer the material higher the speed
- 2) The cutting tool material HSS drill can be operated at about twice the speed of high carbon steel drill.



2) Feed :-

It is the distance a drill moves, parallel to axis into the work in each revolution of the spindle. It is expressed in mm per revolution. Also feed can be expressed as feed in mm per minute, if the total distance moved by the drill into work parallel to its axis in one minute is considered.

$$\text{Feed in mm/min} = \text{feed in mm/rev} \times N.$$

The amount of feed as in the cutting speed is dependent upon several machining conditions such as

1. Material being cut e.g. hard, tough, soft etc.
2. Rigidity of the job & machine
3. Depth of hole
4. Type of finish desired
5. Power available
6. Range of feeds available

3) Depth of cut :-

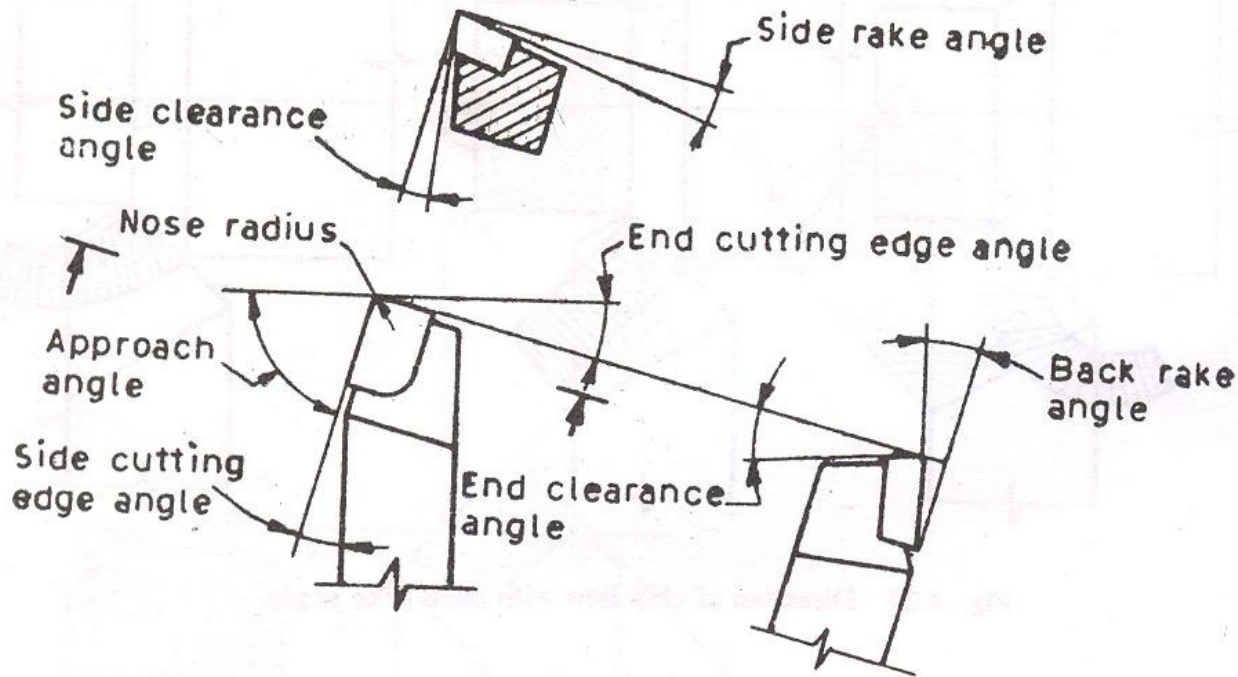
In drilling operation the depth of cut is measured at right angles to the axis of the drill. i.e. the direction of feed. It is generally taken as one half of the drill dia.

$$\text{Depth of cut} = \frac{\text{drill dia}}{2} \text{ mm}$$

e) Explain tool signature with suitable example. Why is it necessary?

(01 marks for sketch, 01 mark for explanation, 02 marks for example)

Tool Signature:



The tool signature or tool designation is used to denote a standardized system of specifying the principal tool angles of a single point cutting tool. Some common systems used for tool designation or tool nomenclature are the following-

1. **American or (ASA) System.** It defines the principle angles like side rake, back rack, nose, etc. without any reference to their location with regard to cutting edge . As such ,this system of nomenclature does not give any indication of the tool behavior with regard to the flow of chip during the cutting operation the three reference planes adopted for designating different tool angles are similar to those used in conventional machine drawing i.e , x-x,y-y and z-z the last one containing the base of tool and the two plane being normal to this plane as well as mutually perpendicular . Thus, this system is a coordinate system of tool nomenclature.
2. **British system:** This system, according to B-S1886-1952, defines the maximum rake. The various tool parameters in this system are indicated if the order of Back rake, Side rake ,End relief angle, Side relief angle, End cutting angle ,Side cutting edge angle and Nose radius.
3. **Continental systems:** This category of tool nomenclature systems includes the German or DIN System (DIN-6581), Russian Systems (OCT-BKC 6897and 6898) and Czechoslovakian System (CSN-1226).The various tool parameters in these systems are specified with reference to the tool reference to the tool reference planes.
4. **International system:** It is an internationally adopted system, developed recently. It incorporates the salient features of tool nomenclature of different systems in it.

Example: A tool with 8, 10, 6, 6, 6, 10, 0.2, signature in A.S.A system is having following specification.

$$\text{Back rake } (\alpha_y) = 8^\circ$$

Side rake (α_x) = 10°

End relief angle (β_y) = 6°

Side relief angle (β_x) = 6°

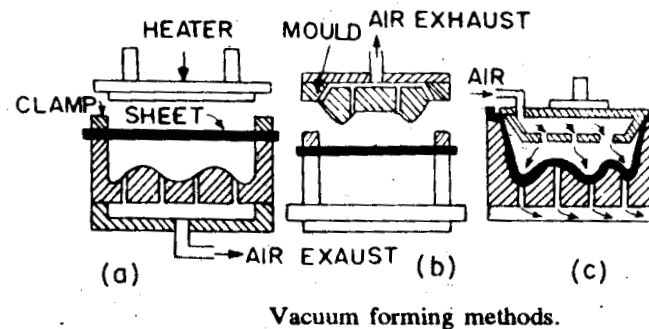
End cutting edge angle (ϕ_e) = 6°

Side cutting edge angle (ϕ_s) = 10°

Nose radius = 0.2mm

f) Explain vacuum forming with neat sketch and give examples.
(02 marks for sketch, 02 marks for explanation)

Vacuum forming:

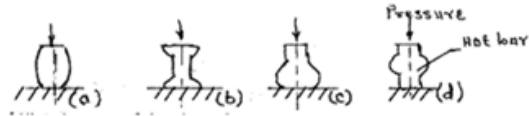


Intricate shapes are easily formed by the application of pressure or vacuum on the plastic sheet draped over the mould. The operation consist of stretching the sheet over the mould cavity to form a seal, heating it by suitable means and then drawing the air out of the space between the sheet and the mould. A few typical vacuum forming examples are illustrated in figure. At (a) only vacuum is used for drawing the heated sheet in the mould .At (b) the formed mould presses down the heated sheet, forming it partially, followed by pulling the vacuum through the mould to complete the forming .At (c) a cored plug is used to push the heated sheet into the mould, followed by applying air pressure through the plug to complete the process.

Q. 5 a) (01 marks for sketch, 01 marks for explanation)

i) **Upsetting:-** it is also known as jumping operation

- In this process the cross section of metal piece is increased with corresponding reduction in length
- Metal is sufficiently heated so that it acquires the plastic stage it become soft
- Then pressure is applied by some means like hammering or dropping from height
- The metal swells or increased its dimensions at right angles to direction of application of force with reduction in length
- After swiveling the desired shape is given the processing operation

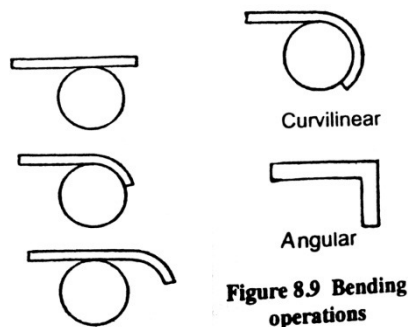


ii) Bending :-

(01 marks for sketch, 01 marks for explanation)

these operation is done in smithy shop the bend with sharp corner angle can be made by hammering the metal over the edge of anvil face or swage block.

- for making a right angle bend that particular portion of the stock which is subjected to bending is heated and jumped on the outer surface.
- this provides an extra material at the the particular place which compensate for elongation for outer surface due to hammering during bending .
- after bending the out sold bulging is finished by means of flatter and inside by means of setsquare
- curved shapes of bends are formed on the horn of anvil or bick iron.



b) Compare direct and indirect extrusion process.(any four points, 01 mark each)

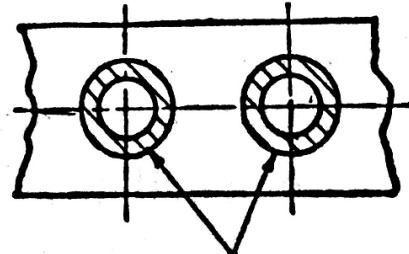
Direct Extrusion	Indirect Extrusion
With the application of the ram pressure the metal is first plastically fills the cylindrical shape and it is then forced out though the die opening.	The extruded part is forced through the hollow ram in backward direction.
It involves great friction between the metal billet and container walls	It involves no friction between the metal billet and container walls
Compared with indirect extrusion more total force is required.	Compared with direct extrusion less total force is required.
Equipment used is simple in design	Equipment used is more complicated .

c) What is Blanking operation in press working?

Blanking:

(02 Mark for description, 02 Mark for figure)

The blanking is the operation of cutting of flat sheet to the desired shape. The metal punched out is the required product and the plate with the whole left on the die goes as waste. While blanking the size of the blank is governed by the size of the die and the clearance is left on the punch.



Blanks

Figure: Blanking operation

d) Draw the block diagram of die set components and label it. (03 marks for sketch, 01 mark for labeling)

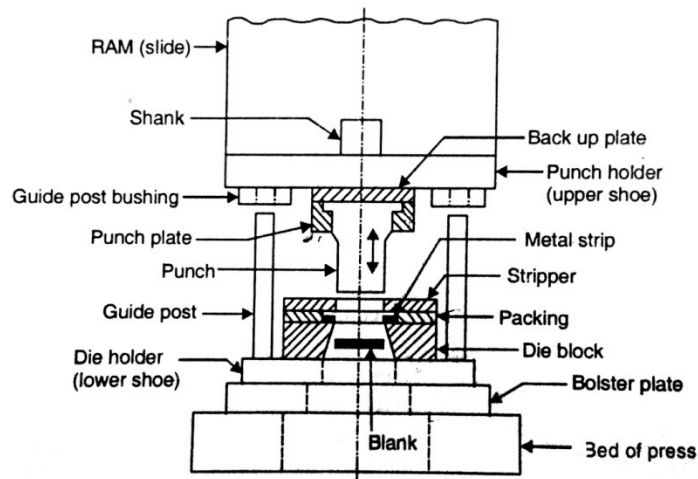


Fig. 2.11. A Simple Cutting Die.

e) Explain centrifugal casting with neat sketch.

Centrifugal casting:

(02 Marks description, 02 Marks for figure)

In the centrifugal casting, molten metal is poured in to moulds while they are rotating. The metal falling in to the centre of the mould at the axis of rotation is thrown out by the centrifugal force under sufficient pressure towards the periphery, and the contaminants or impurities present being lighter in weight are also pushed towards in the centre. This is often machined out any way. Solidification progresses from the outer surface inwards, thus developing an area of weakness in the centre of the wall. This is caused by the meeting of the grain boundaries at final solidification and the entrapment of impurities in the central section. The grain is refined and casting are completely free from any porosity defect by the forced movement of the molten metal, thus making dense sound casting which are less subject to directional variations than static castings. The use of gates, feeders, and cores is eliminated, making the method less expensive and complicated.

Hollow cylindrical bodies such as cast iron water supply and sewerage pipes, steel gun barrels, and other symmetrical objects such as gears, disk wheels, pulleys, are conveniently cast without core by the centrifugal casting.

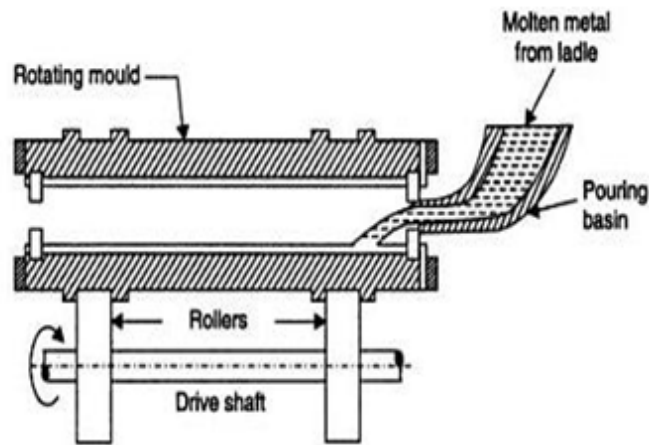


Figure: Centrifugal casting

f) advantages limitations and applications of die casting.

(01 and ½ marks for advantages, 01 and ½ marks for limitations,01 mark for applications)

- most of the nonferrous alloys can be cast.
- close dimensional tolerances can be obtained.
- very thin section can be cast.
- well defined and distinct surface details can be obtained on die cast part.
- high surface finish is obtained .
- intricate shape can be easily cast.
- in intricate if required can be easily cast in desired places.

Limitations :-

- Every metal and alloy can not be die cast.
- The machine and other equipment used are very costly.
- Not used for small batch.
- Complete evacuation of die from die cavity is not same.
- Number of cast can be cast hg.

Applications:-

Housings, hand tool components, shafts, threaded fasteners etc.

Q.NO. 6

a) Describe with neat sketch oxyacetylene gas welding. Give its advantages and disadvantages. (02 marks explanation, 02 marks sketch, 02 marks advantages, 02 marks disadvantages)

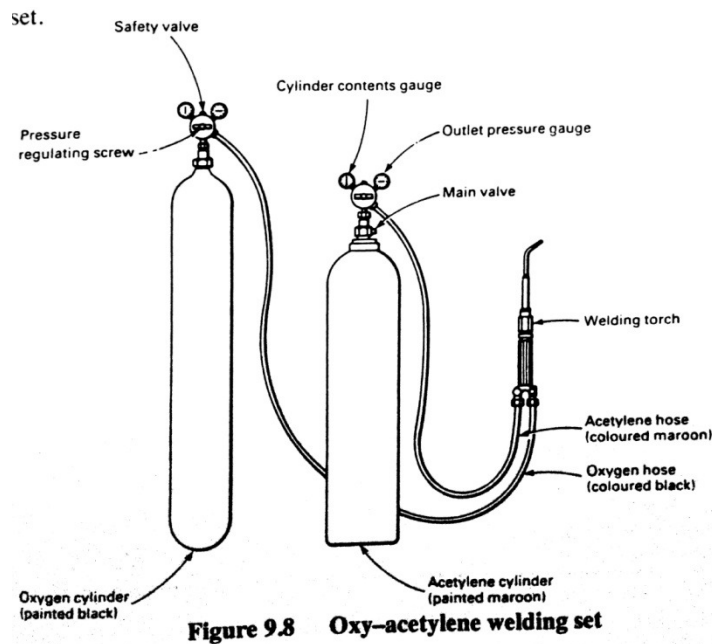
-it is a fusion welding in which metal is heated by gas flame so as to melt it. Molten metal flows along the ends to be joined. Additional metal is added to the flowing molten metal in the form of welding rod to fill up the cavity made during preparation of weld.

-It requires source of heat

-Heat is developed by using gas such as oxygen, hydrogen, oxygen acetylene etc.

- oxyacetylene mixture is most commonly used in industry. In this the temperature of the flame produced is sufficiently high upto 3200°C .

-It requires blow pipe, gas cylinder with pressure regulator, hose with fittings, goggles, gloves, spark lighter, welding rod.



Advantages:-

- This welding process can be used for Almost all metals and alloys used in engineering applications.
- It produces comparatively higher temperature. i.e about $3200-3300^{\circ}\text{C}$.
- Inert gas envelope prevents the weld from oxidation.

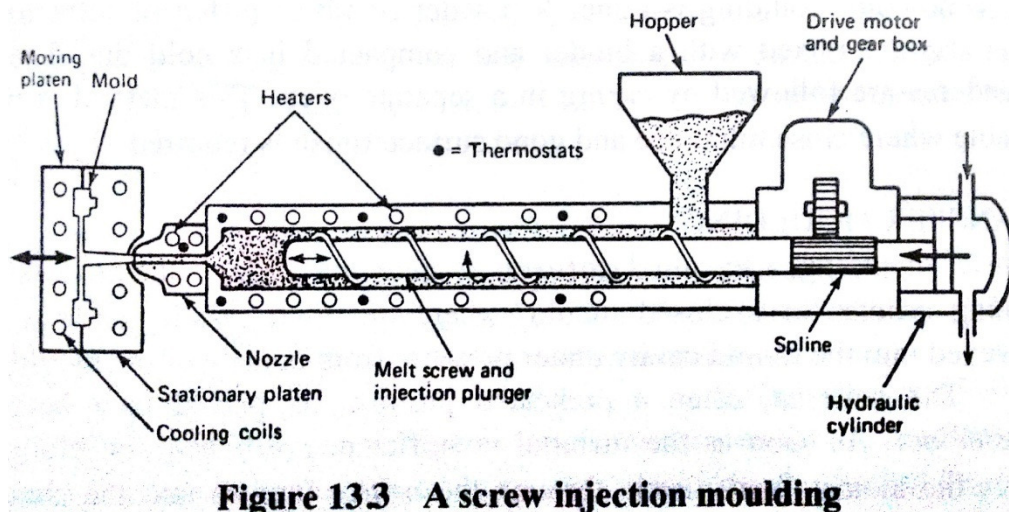
Disadvantages:-

- The oxygen used should be highly pure since even a small proportion of impurities have a considerable effect on the combustion value of oxygen.
- The acetylene cylinder should not handled with enough care.

b) Injection Moulding

(02 marks explanation, 02 marks sketch, 01 and ½ marks for advantages, 01 and ½ marks for limitations, 01 mark for applications)

It is commonly used for thermoplastics. The powder compound is first heated to drive moisture and then feed into the hopper. When the ram is drawn back, some of the powder drops into the chamber. Close the mold and ram is moved forward applying pressure behind the powder. This compresses the material and forces it forward through thin space left around the heated torpedo. The material will come in contact with heated source and solution. The material during heating in the chamber rises the temperature between 175°C to 275°C . this heated material is forced into the mold then the mold is cooled and it is opened. The part is knocked out by knockout pins.



Advantages:-

- It is a faster process and best suitable for mass production.
- Intricate shapes can be produced.
- Good dimensional accuracy can be obtained.

Limitations:-

- machine cost is high.
- Mould design is complicated and costlier

Applications:-

Plastic jugs, knobs, tool handles, electrical equipment components etc.

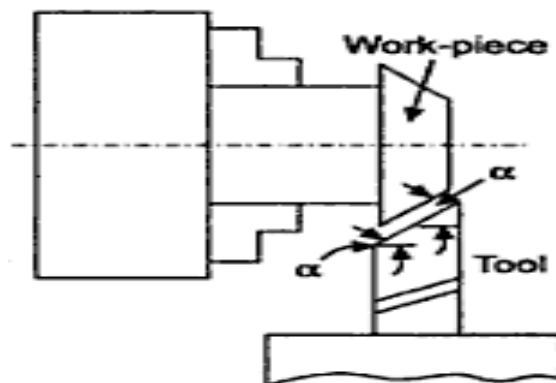
c) Taper Turning Methods

(list 04 marks any four, description 02 marks, sketch 02 marks any one method)

- 1) by broad nose form tool.
- 2) by setting over the tail stock.
- 3) by swiveling the compound rest.
- 4) by taper turning attachment
- 5) by combining longitudinal and cross-feed inspection.

i) Taper turning by form tool:-

- A broad nose tool having straight cutting edge is set on to work at half taper angle.
- the tool is fed straight into revolving workpiece to generate a tapered surface.
- the tool angle should be checked before turning.
- this method is limited to turn short lengths and short taper only.



ii) Taper turning by setting over the tailstock:

- the principle of turning taper by this method is to shift the axis of rotation of the workpiece, at an angle to the lathe axis and feeding the tool parallel to the lathe axis.
- the angle of shift is equal to the half angle of the taper.
- this is done when the body of the tailstock is made to slide on its base towards or away from the operator by a set over screw as shown in fig.

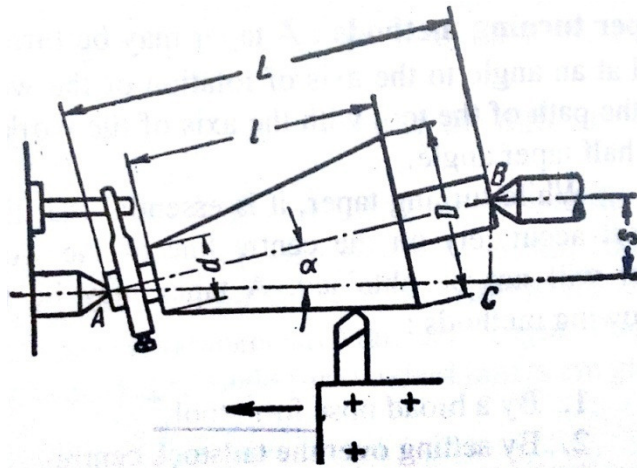


Figure 3.47 Taper angle by setover method

iii) Taper turning by swiveling the compound rest.

- the work piece is rotated on lathe axis and the tool is fed at an angle to the axis of rotation of the work piece.
- the tool mounted on the compound rest is attached to a circular base, graduated in degrees.
- the circular base may be swiveled and clamped at any desired angle.
- this method is limited to turn a short taper .

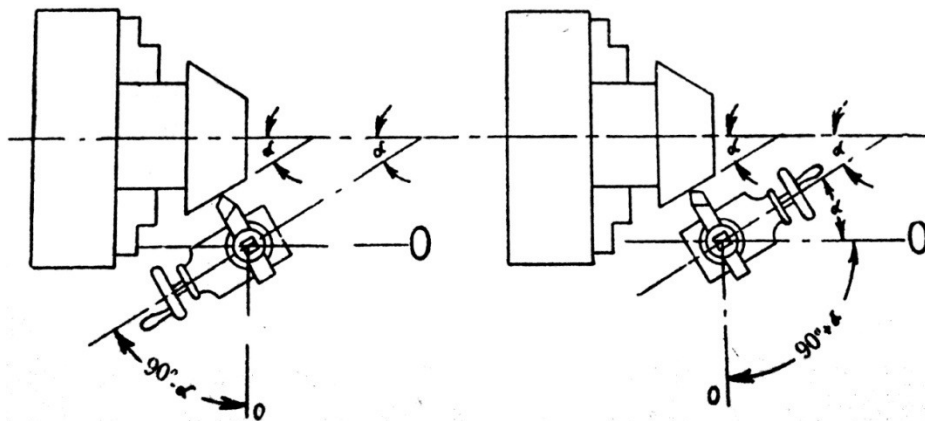


Figure 3.48 Taper turning by swivelling the compound rest.

c)

$$\text{cutting speed} = \pi DN / 1000$$

$$50 = \pi \times 60 \times N / 1000$$

$$5000 \times 7 / 6 \times 22 = N = 265 \text{ rpm. -----(04 marks)}$$

$$T = 400 / 0.5 \times 265 = 3.01 \text{ mins ----- (04 marks)}$$



The solution, weight age is justified. The figures from book are scanned but the hand drawn figures may vary , the marks for correct hand drawn figs. should be given in full credits. nn