WINTER– 17 EXAMINATION

Model Answer Subject Code: 17402

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 judgement 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. No.	Sub Q. N.	Answer	Marking Scheme
1	a	Advantages of Press Forging over Drop Forging – 1.Press forging is quieter than drop forging. 2.Press forging is faster (one operation). 3.Alignment of the two die halves can be easily maintained. 4.Structural quality of the product is superior. 5.More accurate parts are obtained.	**Any Four points 4 marks** **01 mark each**
	b	**Classification Of Rolling Mill:-** Rolling mills may be classified according to the number and arrangement of the rolls. (a): Two high rolling mills (b): Three high rolling mills (c): Four high rolling mills (d): Tandem rolling mills (e): Cluster rolling mills **1: Two high rolling mills** Two high rolling mills may further classified as 1. Reversing mill 2. Non reversing mill A two high rolling mill has two rolls only. **Two high reversing mill:** In two high reversing rolling mills the rolls rotate ist in one direction and then in the other,	**02 classification + 02 explanation and Sketches**

so that rolled metal may pass back and forth through the rolls several times. This type is used in pluming and slabing mills and for roughing work in plate , rail , structural and other mills.

These are more expensive compared to the non reversing rolling mills. Because of the reversible drive needed.

Two high non reversing mill:

In two high non reversing mills as two rolls which revolve continuously in same direction therefore smaller and less costly motive power can be used. However every time material is to be carried back over the top of the mill for again passing in through the rolls. Such an arrangement is used in mills through which the bar passes once and in open train plate mill.

2: Three high rolling mill:

It consists of a roll stand with three parallel rolls one above the other. Adjacent rolls rotates in opposite direction. So that the material may be passed between the top and the middle roll in one direction and the bottom and middle rolls in opposite one.

3: Four high rolling mill:

It has a roll stand with four parallel rolls one above the other. The top and the bottom rolls rotate in opposite direction as do the two middle rolls. The two middle are smaller in size than the top and bottom rolls which are called backup rolls for providing the necessary rigidity to the smaller rolls.

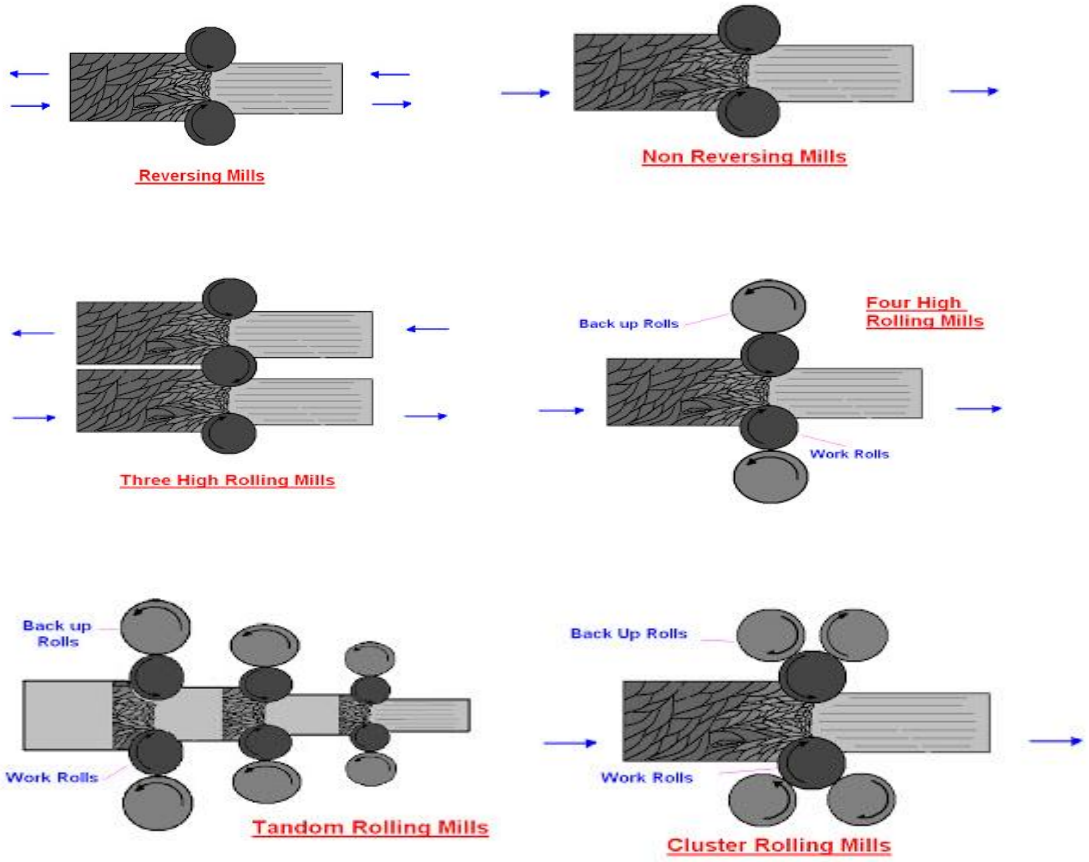
A four high rolling mill is used for the hot rolling of armor and other plates as well as cold rolling of plates, sheets and strips.

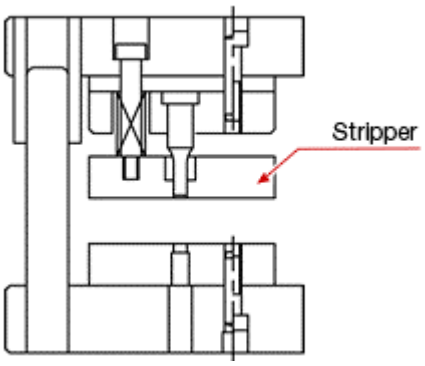
4: Tandem rolling mills:

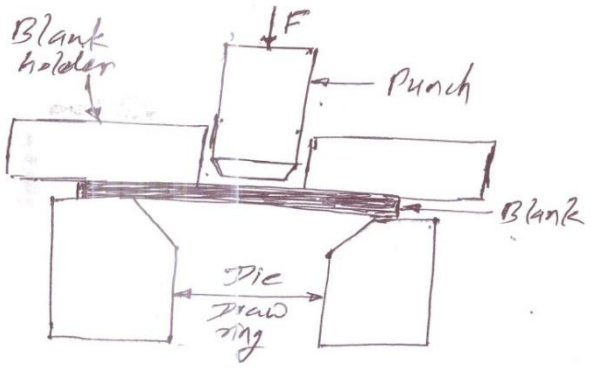
It is a set of two or three stands of roll set in parallel alignment. So that a continuous pass may be made through each one successively with change the direction of material.

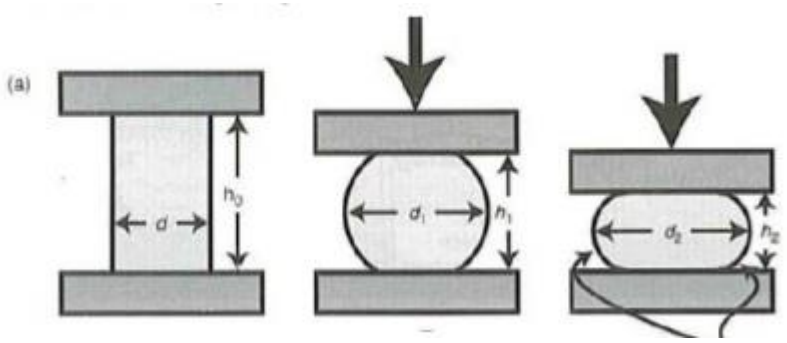
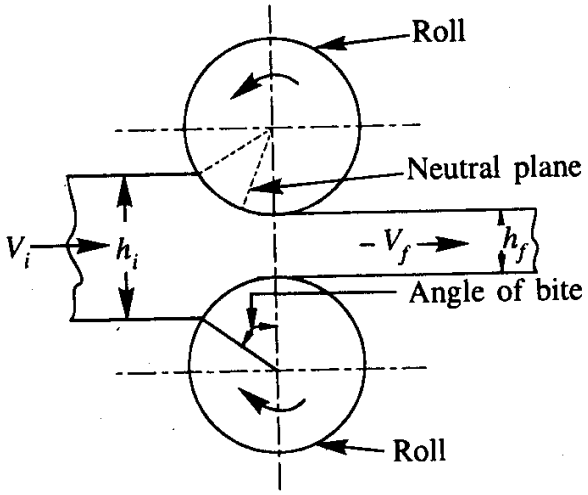
5: Cluster rolling mills:

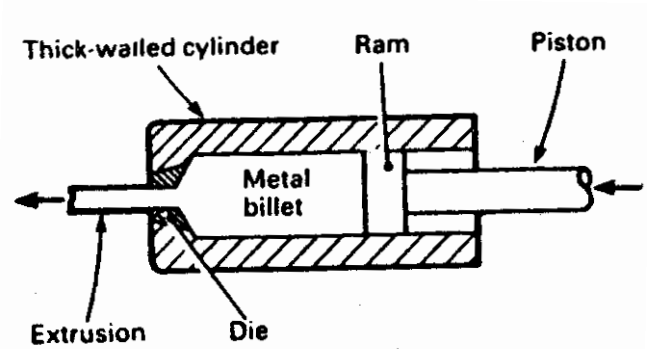
It is a special type of four high rolling mill in which each of the two working rolls is backup by two or more of the larger backup rolls for rolling hard in materials. It may be necessary to employ work rolls of a very small diameter but of considerable length. In such cases adequate of the working rolls can be obtained by using a cluster mill.

			
	c	Advantages Of Extrusion: ▪ High extrusion ratio (It is the ratio of billet cross section area to extruded part cross section area). ▪ It can easily create complex cross section. ▪ This working can be done with both brittle and ductile materials. ▪ High mechanical properties can achieved by cold extrusion.	**Any 4 points 04 marks** **01 mark each**
	d	Classification Of Presses:- **Classification on the basis of source of power.** • Manual Presses. These are either hand or foot operated through levers, screws or gears. A common press of this type is the arbor press used for assembly operations. • Mechanical presses. These presses utilize flywheel energy which is transferred to the work piece by gears, cranks, eccentrics, or levers. • Hydraulic Presses. These presses provide working force through the application of fluid pressure on a piston by means of pumps, valves, intensifiers, and accumulators. These presses have better performance and reliability than	**01 Mark to each point, any four**

		mechanical presses. • Pneumatic Presses. These presses utilize air cylinders to exert the required force. These are generally smaller in size and capacity than hydraulic or mechanical presses, and therefore find use for light duty operations only. OR (i)Manually operated (Fly) press. (ii) Electric Motor driven press. (iii) Pneumatic system driven press. (iv) Hydraulic system driven press.	
	e	Stripper in Press:- In press forming, a stripper is a part used for stripping off the material that has become adhered to the punch. This is also called by other names such as "scrap remover", "brush", etc. The method of using a stripper can be by fixing to the die plate a "fixed stripper", or "semi-fixed stripper" which is movable although it has been fixed to the die plate. Their only purpose is to strip off the material that has become adhered to the punch. Further, there is the "movable stripper" which is attached on the punch side and is movable. This type of stripper is also made to have the action of pressing the material to the die plate. The purpose is to prevent deformation of the material used for forming.  	**02 for explanation and 02 for Fig.**

	f	Drawing operation on press machine :  The drawing operation is very similar to the forming operation except that the drawing operation undergoes severe plastic deformation and the material of the part extends around the sides. A metal cup with a detailed feature at the bottom is an example of the difference between formed and drawn. The bottom of the cup was formed while the sides were drawn.	**02 for explanation and 02 for Fig.**
	g	**Types of pattern:** 1. Single piece pattern 2. Split pattern 3. Match plate pattern 4. Cope and drag pattern 5. Gated pattern 6. Loose piece pattern 7. Sweep pattern 8. Skeleton pattern 9. Segmental pattern 10. Shell pattern 11. Built up pattern 12. Boxed up pattern 13. Lagged up pattern 14. Left and right hand pattern **Explanation of any one with sketch:- (01 Explanation and 01 for Sketch)**	**01 for list 02 marks for explanation, 01 mark for sketch (any one type)**

2	a	**Attempt Any four** **Open Die Forging** Open die forging is the process of deforming a piece of metal between multiple dies that do not completely enclose the material. The metal is altered as the dies "hammer" or "stamp" the material through a series of movements until the desired shape is achieved. Products formed through open forging often need secondary machining and refining to achieve the tolerances required for the finished specifications. Open die forging is often used for short run forgings of parts that are simple, rather than complex, in design, such as discs, rings, sleeves, cylinders and shafts. Custom shapes can also be produced with open die forging. The repeated working of the material through the deformation process increases the strength of the grain structure. Some additional benefits of open die forging include improved fatigue resistance and strength. Open die forging also reduces voids.  	**02 for explanation and 02 for Fig.**
	b	Rolling is a metal forming process in which metal stock is passed through one or more pairs of rolls to reduce the thickness and to make the thickness uniform.  Rolling is a process where metal is compressed between two rotating rolls for reducing its cross section area. The metal is taken into rolls by a friction and subsequently	**02 for explanation and 02 for Fig.**

		compressed to obtain the final shape .The thickness of the metal that can be drawn depends on the roughness of the roll surface. The reduction that could achieve with the set of rolls is designated as the angle of bite is shown in figure. This depends on the type of rolling and the condition of the roll. The volume of the metal that enters the rolling stand should be same as that leaving it except in initial passes when there might be some loss due to filling of voids and cavities in the ingots. Since the area of the cross section gets decreased the metal leaving the rolls would be at the higher velocity than when it entered. The pressure on the rolls gradually builds up from entry to the neutral point where it is the highest and then decreases till it reaches the exit.	
	c	**Direct Extrusion process:-**  **Direct extrusion** Direct extrusion process is shown in fig. The raw material used is a billet. It consists of a press operated ram and a cylinder or container into which the heated billet is placed. A dummy block is used between the ram and the hot metal. With application of ram pressure, the metal first plastically fills the cylindrical shape. And it is then forced out through the die opening until a small amount remains in the container.	**02 for explanation and 02 for Fig.**
	d	**Blanking:** 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.	**02 for explanation and 02 for Fig.**

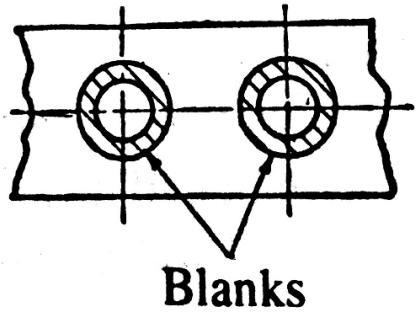
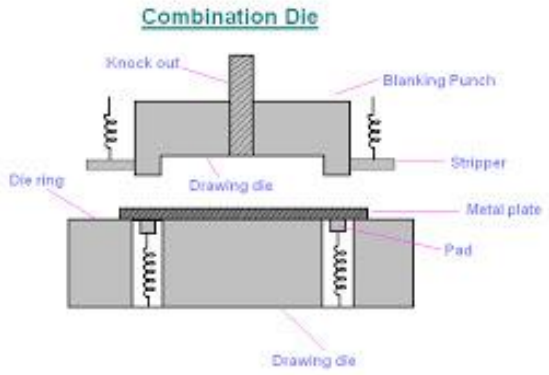


Figure: Blanking operation

e Combination Dies:

In this die more than one operation may be performed at one station. It is difficult from compound die in that in this die, a cutting operation is combined with a bending or drawing operation, due to that it is called combination die. The die may be defined as the female part of a complete tool for producing work in a press. It is also referred to a complete tool consists of a pair of mating members for producing work in a press.

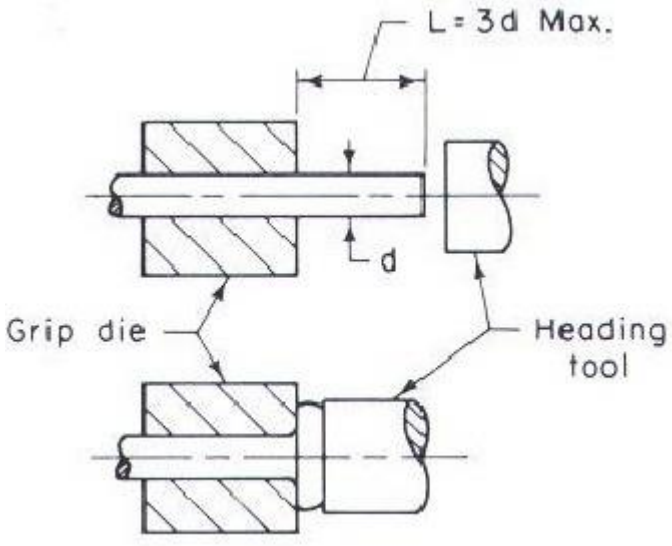


02 for explanation and 02 for Fig.

f Wood as Pattern Material:-

The wood is the most common material used for pattern making. This is because these are easy available and very cheap. The main advantages of wood is that it can be easily shaped and it possess low weight as compared to metal pattern. Wood is optimal for very large casting and small quantity production. One of the disadvantage of the wood pattern is the distortion of dimension due to absorption of moisture. This warpage can reduce some extent by proper seasoning of wood. The wood pattern undergo abrasion in large scale production. In that case it is better to use metal pattern. Most common woods used for pattern are teak, mahogany, pine, walnut, and deodar.

04 marks for expalnation

		Advantages and Disadvantages of Wood pattern: 1. Inexpensive, easy available 2. Low weight - so they are used for large patterns. 3. Easy to shaping, it can fabricated into any form.	
3	a)	**Attempt Any four** **Upset forging :-** Upset forging increases the diameter of the work piece by compressing its length. Based on number of pieces produced, this is the most widely used forging process. A few examples of common parts produced using the upset forging process are engine valves, couplings, bolts, screws, and other fasteners. Upset forging is usually done in special high-speed machines called crank presses. The machines are usually set up to work in the horizontal plane, to facilitate the quick exchange of work pieces from one station to the next, but upsetting can also be done in a vertical crank press or a hydraulic press. The initial work piece is usually wire or rod, but some machines can accept bars up to 25 cm (9.8 in) in diameter and a capacity of over 1000 tons. The standard upsetting machine employs split dies that contain multiple cavities. The dies open enough to allow the work piece to move from one cavity to the next; the dies then close and the heading tool, or ram, then moves longitudinally against the bar, upsetting it into the cavity. If all of the cavities are utilized on every cycle, then a finished part will be produced with every cycle, which makes this process advantageous for mass production.  	**02 marks for explanation, 02 marks for sketch**

	b)	**Important characteristics of foundry sands are as follows:-** **1) Refractoriness:-**It is the property of sand which enables it to withstand high temperatures of molten metal without fusing. Refractoriness is measured by the sinter point of the sand rather than its melting point. **2) Permeability:-** It is also known as Porosity ,which allows gases & steam to escape through the sand mould. If the gases and water vapors evolved by the moulding sand they will form gas holes and pores in the casting. **3) Flowability :-** It is also known as plasticity due to which sand flows during ramming to all portions of mould. Flowability increases as clay and water content increases. High flowability is required to get compacted to a uniform density and to obtain good impression of the pattern in the mould **4) Adhesiveness:-** It is the property due to which sand particles adheres to the surfaces of other materials. i.e sand particles should cling to the sides of the moulding boxes. **5) Cohesiveness:-** It is the property of sand due to which rammed sand particles bind together firmly so that the pattern is withdrawn from mould without damaging the mould surfaces. **6) Collapsibility:-** It is the property of sand due to which it automatically collapses after solidification of the casting to allow a free contraction of metal. This avoids the tearing or cracking of the contracting metal	**01 mark for each explanation, any four**
	c)	**Green sand moulding:-** - Green sand moulds are prepared with natural moulding sand or with mixture of silica sand, bonding clay and water. - Tempered the sand before it can be used. - If the sand is too dry additional water is added if too wet, dry sand is added until it has the proper temper the sand from burning on. - The surface of the moulds which comes in contact with molten metal forms the most important part in green sand moulds. - In order to give the casting clean and bright surface and to prevent the sand from burning on the	**04 marks for explanation**

face of the moulds, a layer of facing sand is given surrounding the pattern.

- facing sand mixture for iron castings generally contains some finely ground bituminous coal known as sea coal, and new sand in addition to used moulding sand.

-The sea coal prevents the sand from fusing to the surface of the casting, and the new sand increases the bond in the facing mixture.

- It is common practice to coat the surface of sand mould with refractory material to produce a smooth skin on the casting.

-the materials ordinarily used for this purpose are graphite, coke, charcoal, gas carbon, plumbago, silica, mica, black lead and talc.

For use these materials in wet sate some adhesive is employed such as clay, gum and other substance being mixed with water are used.

- Blacking or mineral coatings are used dry, are dusted over the mould face.

d **True centrifugal casting:-** **02 marks for explanation, 02 marks for sketch**

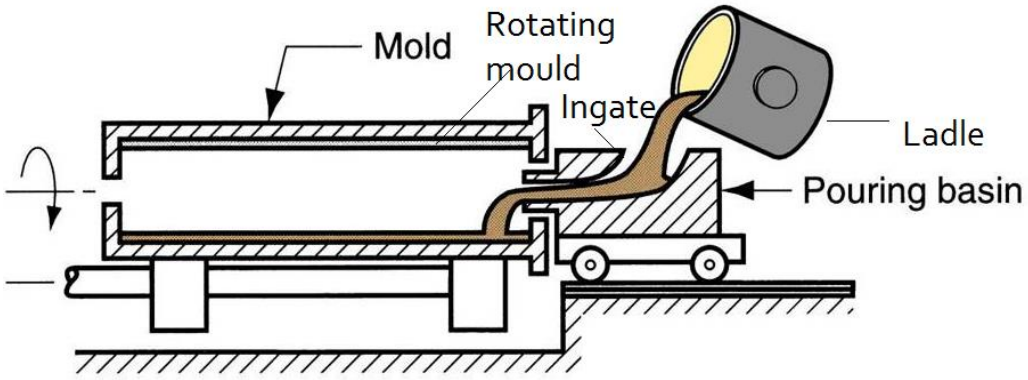
-This employed moulds of rotational symmetry made of steel (with a refractory mould wash or even a green or dry sand lining) or of graphite.

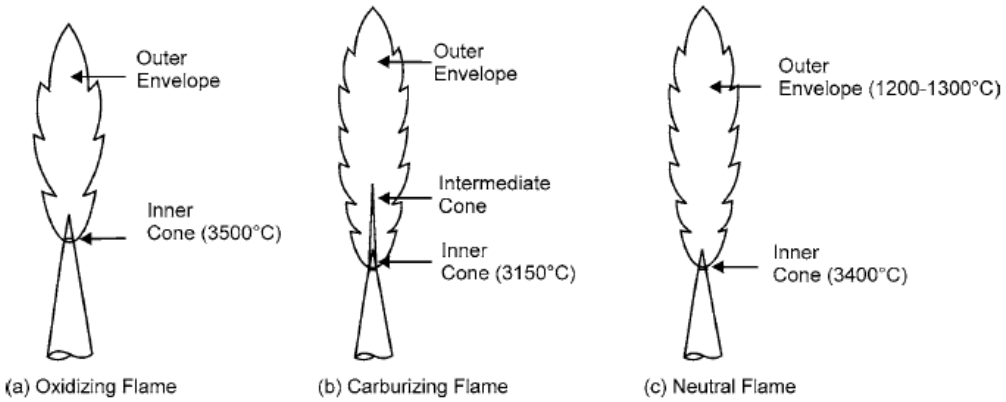
- The melt is poured while the mould rotates at its axis, which may be horizontal, vertical or inclined at any suitable angle between 0 to 90^0 .

-while rotating the molten metal is carried to the walls of the cavity by centrifugal force.

- The metal then solidifies forming a hollow casting without the use of a central force.

- The outside of the mould is water cooled to accelerate solidification.



	e	**Oxy-acetylene gas flames:-** 1) **Neutral Flame :-** neutral flame has two zones, i) a sharp cone extending a short distance from the tip of the torch ii) an outer cone or envelope only faintly luminous and of a bluish colour. ---- The first one develops heat and the second protects the molten metal from oxidation. The neutral flame is widely used for welding steel, stainless steel, cast iron, copper, aluminium etc. **2)Carburizing flame:-** carburizing flame is one in which there is an excess of acetylene. -This flame has three zones: 1) The sharply defined inner cone. 2) an intermediate cone of whitish color. 3) the bluish outer cone. - the length of the length of the intermediate cone is an indication of the proportion of excess acetylene un the flame when welding steel. **3) An oxidizing flame:** in oxidizing flame there is an excess of oxygen. This flame has two zones i) the small inner cone which has purplish tinge ii) the outer cone or envelope. In this case of oxidizing flame the inner cone is not sharply defines as that of neutral or carburizing flame. This flame is necessary for welding brass.  **Fig.** Types of Flames	**02 marks for explanation, 02 marks for sketch**
	f	**Soft soldering :-** Soft soldering is used extensively in sheet metal work for joining parts that are not exposed to the action of high temperature and are not subjected to excessive loads and forces.	**04 marks for explanation**

		- the solder which is composed of lead and tin , has a melting range of 150 to 350 ^{0} c . - a suitable flux is always used in soft soldering. Its function is to prevent oxidation of the surfaces to be soldered. - corrosive, zinc chloride is the most common soldering flux. - A blow torch or soldering iron constitutes the equipment for heating the base metals and melting the solder and the flux. **Hard Soldering:-**it uses solders which melt at higher temperature and are stronger than those used in soft soldering. - The temperature of the various hard solders vary from 600 to 900^0 c. -The fluxes are mostly in paste form and are applied to the joint with a bush before heating	
4	a	**Attempt Any four** **Following are the different types of gates:** 1) **Top gate:-** the molten metal from the pouring basin flows down directly into it. - A strainer made of dry sand or ceramic material is mostly used at the pouring basin to control the metal flow and allow only clean metal to enter. - The advantage of top gating is that all metal enters the casting at the top and the hottest metal therefore comes to rest at the top of the casting. - As a result proper temperature gradients favourable for directional solidification towards the riser located on the top of the casting are maintained. - The gates themselves may be made to serve as the riser. - The disadvantage of top gating is the erosion of the mould by falling metal.	**State 01 mark, explanation 02 marks, 01 mark sketch**

2) **Bottom gate:** The gates which enter into the mould cavity near the bottom of the drag are called bottom drag.

- It is particularly used for to avoid or reduce erosion and gas entrapment and to prevent splashing.
- Metal is allowed to rise gently in the mould and around the cores.
- The disadvantage of bottom gate is the metal is continues to lose its keat as it rises in the mould cavity.
- Directional solidification is thus difficult to achieve.

3) Parting Gate: - in parting line gate the liquid metal enters the mould cavity from the side of the mould at the same level as the mould joint or parting line.

- The arrangement of providing a gate at the parting line in a direction horizontal to the casting allows the use of devices that can effectively trap any slag, dirt, or sand which passé with the metal down the sprue.
- Parting line gates are very simple to construct, and very fast to make.
- The hottest metal reaches the riser , thereby promoting directional solidification.
- The disadvantage is that some turbulence may occur as the liquid metal falls into the mould cavity.

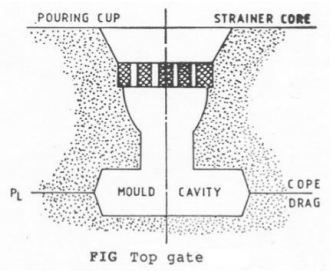
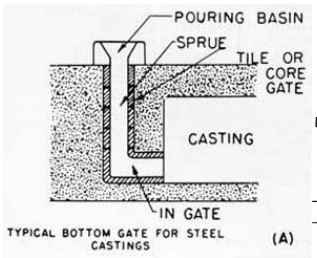
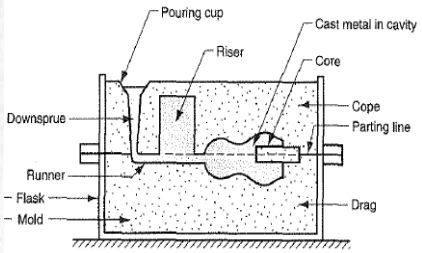
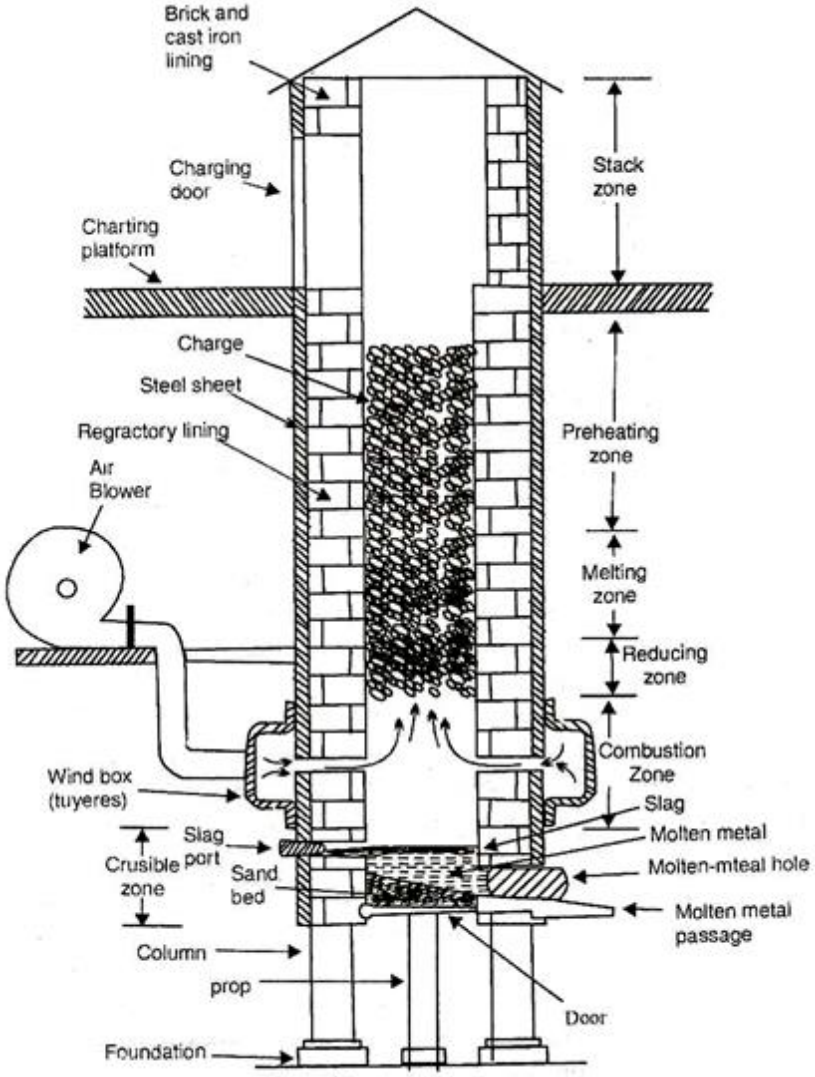


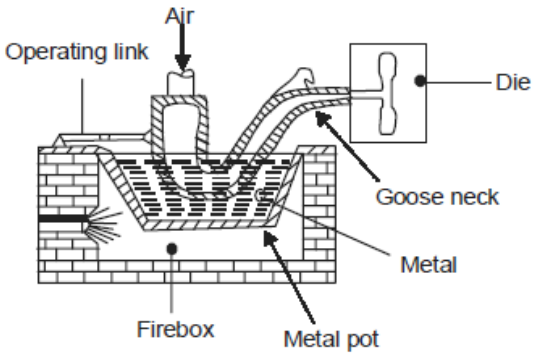
FIG Top gate



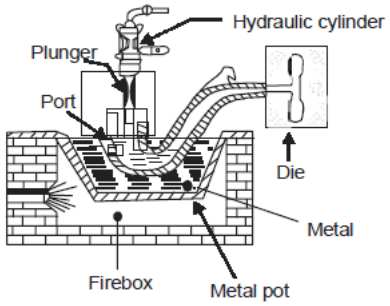


	b	 **Fig. 4.2.** A cupola furnace.	**03 marks for sketch , 01 marks for labeling**
	c	**Hot Chamber Die Casting Machine** - The hot chamber die casting machine of the submerged type is shown in Fig. - The molten metal is forced in the die cavity at pressures from 7 to 14 MPa. - The pressure may be obtained by the application of compressed air as shown in Fig a, or by a hydraulically operated plunger, as shown in Fig (b). - In the first method, the goose neck is lowered into the molten metal for filling it. It is then raised and connected to the die neck. - A suitable mechanism is provided to raise and lower the goose neck.	**02 marks for explanation, 02 marks for sketch**

- The compressed air at a pressure of about 2.5 to 5 MPa is now injected into the goose neck to force the molten metal into the die.
- In the second method, the plunger acts inside a cylinder formed at the end of the goose neck,
- This is immersed in a pot of molten metal.
- A port is provided near the top of the cylinder to allow the entry of the molten metal. The downward stroke of the plunger pushes the molten metal through the goose neck into the die.
- The hot chamber die casting machine is used for casting zinc, tin lead and other low melting alloys.



(a) Operated by Direct Air Pressure



(b) Operated by Hydraulically Operated Plunger.

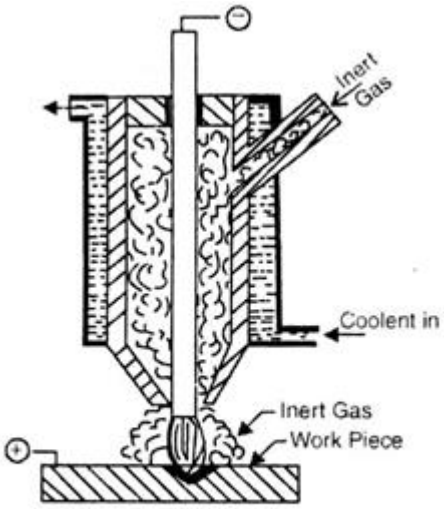
d

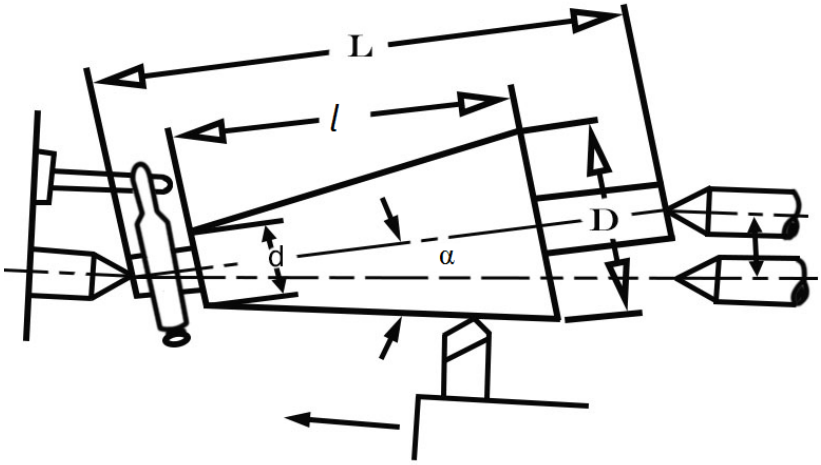
Tungsten Inert Gas (TIG) welding,

It is an arc welding process that uses a non-consumable tungsten electrode to produce the weld. The weld area is protected from atmospheric contamination by an inert shielding gas (argon or helium), and a filler metal is normally used, though some welds, known as autogenously welds, do not require it. A constant-current welding power supply produces electrical energy, which is conducted across the arc through a column of highly ionized gas and metal vapors known as plasma.

TIG is most commonly used to weld thin sections of stainless steel and non-ferrous metals such as aluminum, magnesium, and copper alloys. The process grants the operator greater control over the weld than competing processes such as shielded metal arc welding and gas metal arc welding, allowing for stronger, higher quality welds.

02 marks for explanation, 02 marks for sketch

		However, GTAW is comparatively more complex and difficult to master, and furthermore, it is significantly slower than most other welding techniques. A related process, plasma arc welding, uses a slightly different welding torch to create a more focused welding arc and as a result is often automated.  **Fig.** TIG welding.	
	e	**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 at which the axis of rotation of the workpiece is shifted is equal to 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 setover screw as illustrated in fig. - the amount of setover being limited, this method is suitable for turning small taper on long jobs. Setover= S = L . tanα = L x (D-d) /2l Where, D – large diameter of taper , d - small diameter of taper L- length of the work , l- length of the taper , α = Half taper angle	**02 marks for explanation, 02 marks for sketch**

			
	f	**Types of Thermosetting Plastics** The following are the various types of thermosetting Plastics : **1. Phenolic resins:** The most important of the phenolic resins is phenol formaldehyde. -It is obtained by condensing the phenol with formaldehyde in the presence of a catalyst. - It is popularly known by its trade name of Bakelite. It is a hard, rigid and scratch resistant material. - It is highly resistant to heat, water, non-oxidizing acids, salts and many organic solvents. - It possesses excellent electrical insulating property. - It is one of the cheapest materials of all the thermosetting resins. -It is used in manufacturing handles for cooking pots, knobs, toilet seats, bottle caps, dials, telephone parts, cabinets for radio and television, electrical components like switches, plugs, switch boards etc. -It is also used as a binder in paints and varnishes and as an adhesive for grinding wheel. **2. Amino resins:** The two important amino resins are urea formaldehyde and melamine formaldehyde. -These are condensation products obtained by the reaction of urea or melamine with formaldehyde. -The amino resins can be produced in a wide range of colours and are hard, rigid and durable. ---They possess good electrical properties and are heat and scratch resistant. - The urea formaldehyde is widely used in domestic electrical fittings such as switch covers, plug tops, socket bases and lamp sockets.	**02 marks for state, 02 marks for explanation , any one**

-It is also used for cabinets, toilet seats, buttons and clock cases.

-The melamine formaldehyde, due to good flowability of melamine, is principally used for moulded cups, plates, saucers, bowls etc.

-Both the resins are used as coatings and adhesives.

3. Furane resins: The furane resins are obtained when waste farm products such as cotton seeds, rice hulls, corncobs are processed with certain acids.

-These resins are dark in color, water resistant and have good electrical properties.

- These are used as core sand binders and as hardening additives for gypsum plaster.

4. Silicon resins: The silicon resins differ from most other resins which are based on the carbon atom.

-The silicon resins have silicon and oxygen chains which are linked various organic groups such as methyl side groups.

- The silicon resins may be in the form of liquids, semi-solids (like greases), rubbers and solids.

- The liquid silicones or silicon oils possesses great wetting power for metals, low surface tension and show very small changes in viscosity with temperature.

-These are used as high temperature lubricants, anti-foaming agents, water-repellent finishes for leather and textiles heat transfer media, damping and hydraulic fluids.

-They are also used in cosmetics and polishes.

- The silicones in the semi-solid form (i.e., silicon greases) are modified silicon oils and are obtained by adding fillers like silica, carbon black etc.

-The silicones in the rubber form have high abrasion resistance, stability at high temperatures and remain flexible even at very low temperatures.

-They are mostly used in gaskets, insulations and as additives in other rubbers.

-The solid silicones possesses good electrical insulating properties and outstanding heat resistance.

-They are mostly used in high voltage insulators, high temperature insulating foams and mouldings which require high thermal stability.

5. Epoxy resins: The epoxy resins are obtained from certain special types of organic chemicals, specifically epichlorohydrin and bisphenol (double phenol).

-These are cured or cross-linked by the addition of a hardener.

- The cured epoxy resins have low shrinkage, good flexibility, excellent chemical resistance and electrical insulating properties.

-These are used for surface coatings, adhesives for glass and metals, and laminating materials used in electrical equipments.

-The moulds made from epoxy resins are employed for the production of components for aircrafts and automobiles.

6. Polyester resins: The polyester resins are obtained by the reaction between a dihydric alcohol and a dibasic acid.

-They are divided into the following three groups:

(a) Saturated polyesters,

(b) Unsaturated polyesters, and

(c) Alkyds.

-The saturated polyesters are obtained by reacting glycol with saturated dibasic acid.

-They are a good fibre forming materials and are converted into commercial fibres.

-Such fibres have high scratch resistance, high crease and wrinkle resistance.

-They are mostly used for making synthetic fibres like terylene, dacron etc.

-The unsaturated polyesters are made by reacting glycol with unsaturated dibasic acid (like maleic anhydride).

-They have good flexural strength and can withstand temperatures up to 1450C.

-They are good resistance to water but possess low resistance to acids and alkalis.

-These are generally used in safety helmets, air-craft battery boxes, motor car body components etc.

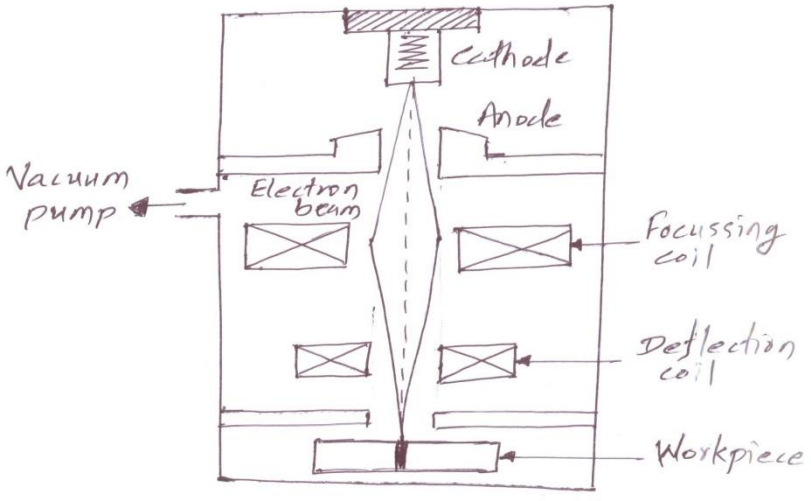
-The alkyds are produced by reacting polyhydric alcohol (like glycerol) with polybasic acid (like phthalic anhydride) in correct proportions in the presence of heat and catalyst (CO_2 gas).

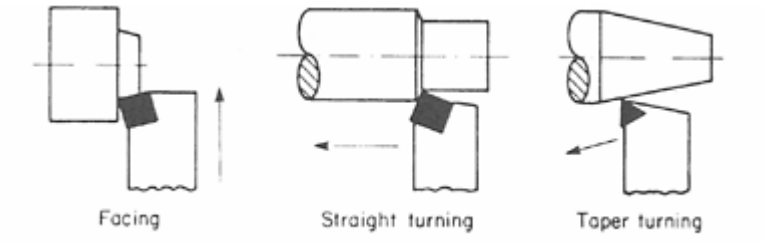
-The alkyd resins are modified either by oil (drying or non-drying) or fatty acids.

-The drying oil-modified alkyds are used as a coating material in numerous formulations.

-The acid or oil modified alkyds are hard, dimensionally stable and resistance to corrosion and acids.

-They are used for making good insulators, aircraft and automobile parts, sheets, rods, tubes, switches, gears, circuit-break insulators etc.

		7. Polyurethanes: The polyurethanes are obtained, commercially, by treating di-isocynate and diol. -They have excellent resistance to abrasion and solvents. - These are used as coatings, films, foams, adhesives and elastomers.	
5	a	**Attempt Any four** **Electron Beam Welding** is a welding process utilizing a heat generated by a beam of high energy electrons. The electrons strike the work piece and their kinetic energy converts into thermal energy heating the metal so that the edges of work piece are fused and joined together forming a weld after Solidification. The process is carried out in a vacuum chamber at a required pressure. Such high vacuum is required in order to prevent loss of the electrons energy in collisions with air molecules. The electrons are emitted by a cathode (electron gun). Due to a high voltage (about 150 kV) applied between the cathode and the anode the electrons are accelerated up to 30% - 60% of the speed of light. Kinetic energy of the electrons becomes sufficient for melting the targeted weld. Some of the electrons energy transforms into X-ray irradiation. Electrons accelerated by electric field are then focused into a thin beam in the focusing coil. Deflection coil moves the electron beam along the weld.  	**2 marks sketch, 2 marks for explanation**
	b	**Various operations performed on lathe:** Turning. 1. Facing. 2. Chamfering 3. Grooving	**2 marks for 8points operation list & 2 marks for explanati**

		4. Forming 5. Knurling 6. Undercutting 7. Eccentric turning 8. Taper turning 9. Thread cutting 10. Drilling 11. Reaming 12. Boring 13. Tapping. **Facing:** Facing is the operation of machining the ends of a piece of work to produce flat surface square with the axis. The operation involves feeding the tool perpendicular to the axis of rotation of the work. **Turning:** Turning in a lathe is to remove excess material from the workpiece to produce a cylindrical surface of required shape and size.  	**on**
	c	Factors considered for selection of cutting speed in lathe machine are as follows: Material of the cutting tool. 1. Hardness and machinability of the metal to be machined. 2. Quality of heat treatment if it is steel tool. 3. Whether machining is to be done with or without the use of coolant	**4 marks for 8 points**

		4. Rigidity of the tool and the work. 5. Shape of the tool. 6. Depth of cut. 7. Feed to be given to the tool.	
	d	**Classification of drilling machine are as follows:** Drilling machines are classified on the basis of: i) Constructional features, ii) the type of work they are required to do. a) Portable drilling machine. b) Bench-type Drilling machine c) Sensitive drilling machine 1. Bench mounting 2. Floor mounting d) Upright drilling machine 1. Round column section 2. Box column section e) Radial drilling machine 1. Plain 2. Semi universal 3. Universal f) Gang drilling machine g) Multiple-spindle Drilling machine. h) Automatic drilling machine i) Deep hole Drilling machine 1. Vertical **2.** Horizontal	**detailed classificati for 4 marks**
	e	**Various types of operations performed on drilling machine.** 1. Drilling 2. Reaming 3. Boring 4. Counter boring 5. Countersinking	4 operation s for 2 marks & any two explanatio n 2 marks

6. Tapping.

1) Drilling:

It is an operation by which holes are produced in solid metal by means of revolving tool called 'Drill'. Fig. shows the various operations on drilling machine.

2) Reaming:

Reaming is accurate way of sizing and finishing the pre-existing hole.
Multi tooth cutting tool. Accuracy of ±0.005mm can be achieved

3) Boring:

Boring is a process of enlarging an existing hole by a single point cutting tool. Boring operation is often preferred because we can correct hole size, or alignment and can produce smooth finish. Boring tool is held in the boring bar which has the shank. Accuracy of ±0.005mm can be achieved.

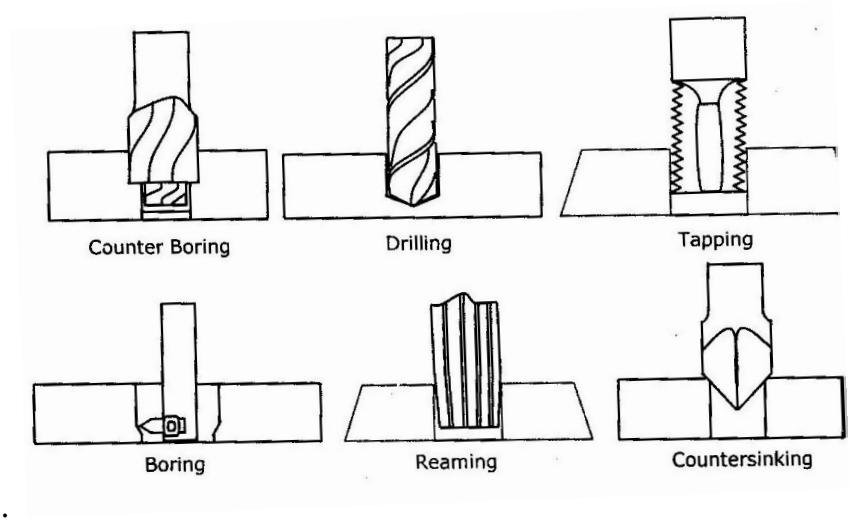


Fig. Various operations on drilling machine

4) Counter Bore:-

This operation uses a pilot to guide the cutting action to accommodate the heads of bolts. Fig. illustrates the counter boring, countersunk and spot facing processes.

5) Countersink:-

Special angled cone shaped enlargement at the end of the hole to accommodate the screws. Cone angles of 60°, 82°, 90°, 100°, 110°, 120°

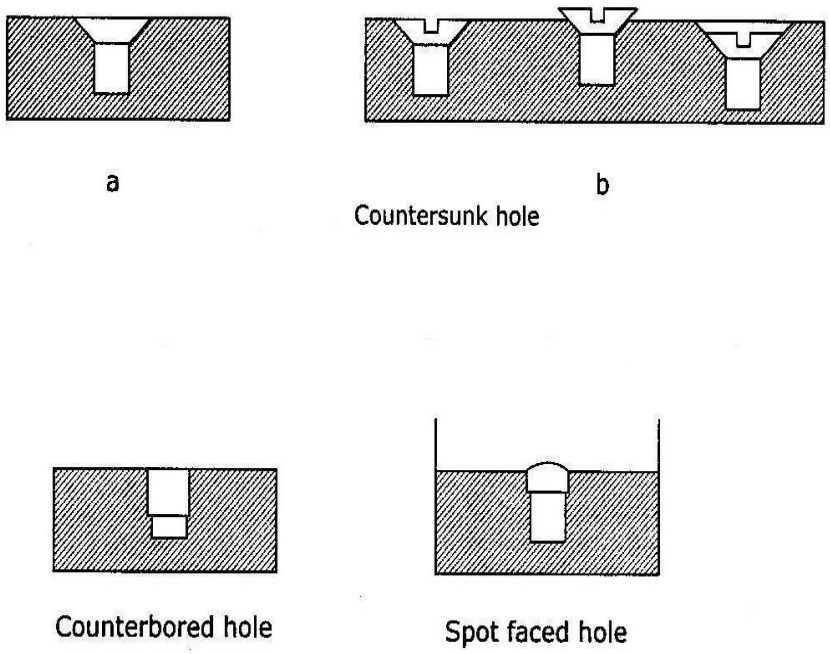
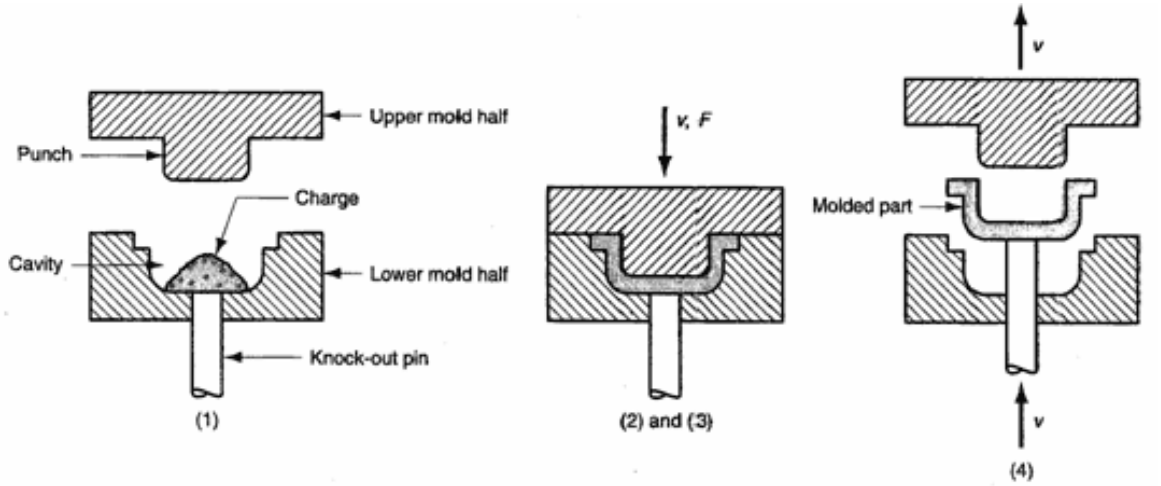


Fig. Counter boring, countersunk and spot facing

6) Tapping:-

Tapping is the process by which internal threads are formed. It is performed either by hand or by machine. Minor diameter of the thread is drilled and then tapping is done.

	f	**Compression Molding:** It is a method of molding in which the molding material, generally preheated, is first placed in an open, heated mould cavity. The mold is closed with a top force or plug member, pressure is applied to force the material into contact with all mold areas, while heat and pressure are maintained until the molding material has cured. The process employs thermosetting resins in a partially cured stage, either in the form of granules, putty-like masses, or performs. Compression molding is a high-volume, high-pressure method suitable for molding complex, high-strength fiber glass reinforcements. Advanced composite thermoplastics can also be compression molded with unidirectional tapes, woven fabrics, randomly oriented fiber mat or chopped strand. The advantage of compression molding is its ability to mold large, fairly intricate parts. Also, it is one of the lowest cost molding methods compared with other methods such as transfer molding and injection molding; moreover it wastes relatively little material, giving it an advantage when working with expensive compounds.	**2 marks sketch, 2 marks for explanation**

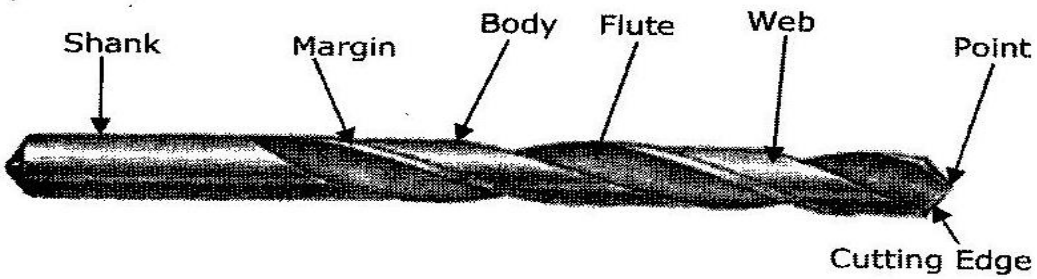
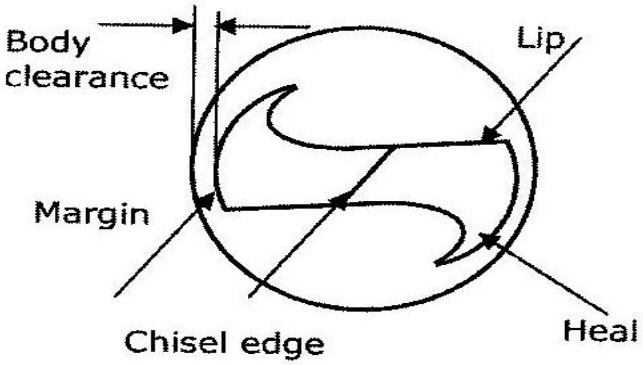


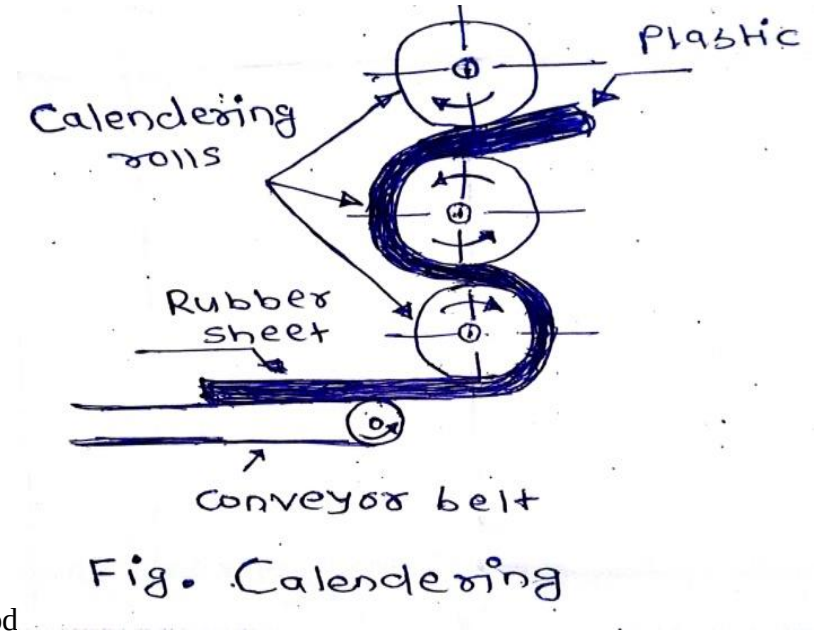
6 a **Attempt Any four**

Welding defects	Explanation and Its reason
Insufficient fusion	It is lack of coalescence between the deposited and the base metal or incomplete penetration of the weld metal into base metal. The usual cause is in ability to raise the temperature of the base metal to its melting point, faulty welding conditions or techniques
Porosity	Blow holes and gas pockets weaken welds and acts as stress raisers. The caused of these defects base metal composition variations, hydrogen embrittlement, shrinkage.
Spatter	To splash with small droplets or to sprinkle around of melted metal is common defect observed during welding It is due to gap between work piece and electrode, velocity of welding, pressure etc
Undercut	An under cut is a groove melted into the base metal adjacent to the toe of the weld. The reasons are non uniform feed of the filler rod, improper position of the electrode or torch

01 mark each, any 4 points with explanation

	b	**Factors influencing rake angle of the single point cutting tool:** 1. **Type of material being cut:** a harder material like cast iron may be machined with smaller rake angle than that required by a soft metal like mild steel or aluminium. 2. **Type of tool material being used:** tool material like cemented carbide permits turning at a very high speed. It has been observed that in machining at a very high cutting speed rake angle has a little influence of cutting pressure. 3. **Depth of cut**: in rough turning, high depth of cut is given to withstand severe cutting pressure. so the rake angle should be decreased to increase the lip angle that provides strength to the cutting edge. 4. **Rigidity of the tool holder and condition of machine:** an improperly supported tool on an old and worn out machine can't take up severe cutting pressure. so machining under such conditions the tool used should have larger rake angle than that at normal condition to reduce the cutting pressure.	**4 marks with explanation**
	c	**Cutting tool signature for single point cutting tools:** The shape of a tool is specified in a special sequence and this special sequence is called tool signature. The tool signature is given below (i) Back rake angle (ii) Side rake angle (iii) Clearance or End Relief angle (iv) Side Relief angle (v) End cutting edge angle (vi) Side cutting edge angle (vii) Nose radius A typical tool signature of single point cutting tool is 0-7-6-8-15-16-0.8. Here this tool signature indicates that the tool has 0, 7, 6, 8, 15, 16 degree back rake, side rake, end relief, side relief, end cutting edge, side cutting edge angle and 0.8 mm nose radius.	**4 marks explanation**

	d	**Twist drill nomenclature:**   **1. Point:** The point is the cone shaped end and it does the cutting. It consists of the following: Dead center: It is the sharp edge at the extreme tip of the drill. This should always be the exact center of the drill. Lips: these are the cutting edges of the drill. Heel: It is the portion of the point back from the cutting edge. **2: Shank:** It is the portion of the drill by which it is clamped in the spindle. The shank may be either straight or tapered. Straight shank drills are used with a chuck. Tapered shank drills have self-holding tapes that fit directly into the drill press spindle. On the taper shank is the another term is used which is called tang. This fits into a slot in the spindles sleeve. **3: Body:** It is the portion between the point and the shank. The body consists of the following parts: **Flutes:** Two or more spiral grooves that run the length of the drill body are called flutes. The flutes do four things. Help from the cutting edge of the drill point. Curl the chip tightly for easier removal. From channels through which chips can escape from the hole being drilled. Allow the coolant and lubricant to get down to the cutting edge. **Margin**	**2 marks sketch & 2 marks explanation**

		It is the narrow strip extending back the entire length of the flute. It is the full diameter of the drill. **Body Clearance:** It is the part of the drill body that has been reduced in order to cut down friction between the drill and the wall of the hole.	
	e	**Calendaring:** It is a process in which heat and pressure are applied to a fabric by passing it between heated rollers, imparting a flat, glossy, smooth surface. During calendaring process rolls of the materials are passed between several pairs of heated rollers, to give shiny surface. Luster (i.e. finishing) increases when the degree of heat and pressure is increased. Calendaring is applied to fabrics in which a smooth, flat surface is desirable, such as most cotton. Many linens and silks and various man made fabrics. Calendaring is also used for polymer materials. Extruded PVC Sheets are produced by this method  Fig. Calendering	**2 marks sketch & 2 marks explanation**
	f	**Various materials for processing plastics:** 1. **Plasticizers:** organic solvents, resin and even water are used as plasticizers. 2. **Fillers:** typical fillers which include wood flour, asbestos fibre, glass fibre, cloth fibre, mica may be added to improve strength, dimensional stability and heat resistance. 3. **Catalyst:** these are usually added to promote faster and more complete polymerization.	**8 points for 4 marks**

		4. **Initiators:** as the name indicates the initiators are used to initiate reaction i.e to allow polymerization to begin. 5. **Dyes and pigments:** pigments and dyes when added give plastics their brilliant colours. The colouring is important as it provides sales appeal. 6. **Blowing agents:** a plastic resin such as polystyrene is foamed by injecting an inert gas before the molten material is forced into the mould. 7. **Modifiers:** The modifiers are added to improve mechanical properties of the base resin. 8. **Antioxidants:** antioxidants added to plastics provide resistance to the ultraviolet rays.	