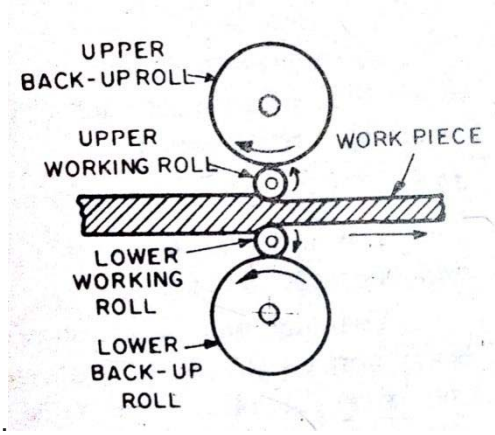
SUMMER– 19 EXAMINATION

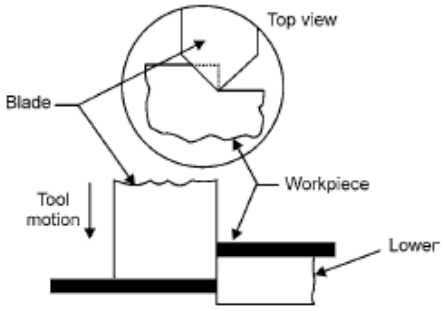
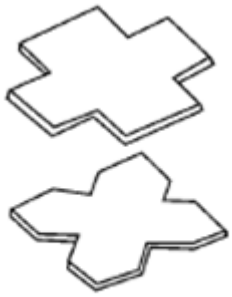
Model Answer Subject Code: 17402

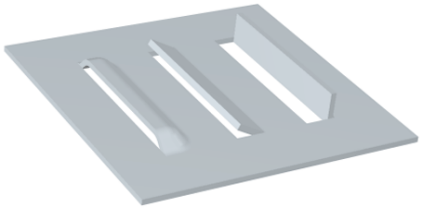
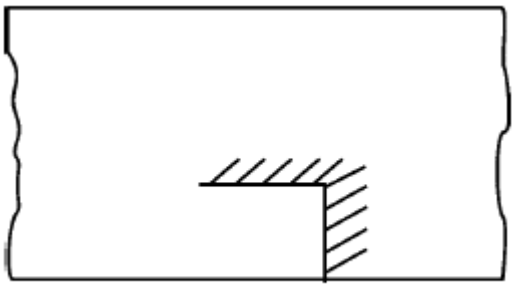
Important Instructions to examiners:

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 i	**Principle of Rolling: (Only Principle 02 Marks)** 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  	**02 Marks for Principle**
	ii	**Extrusion:** Extrusion is a process in which a heated billet of metal is forced by high pressure through an orifice that is shaped to provide the desired form to the finished part. Application: 1. Pipe Manufacturing 2. Wire Manufacturing.	**01 Mark for definition,** **01 mark for any 1 application**
	iii	**Classification of press machine**	**2 mark**

		A) According to source of power: a) Mechanical press b) Hydraulic press B) According to number of slides: a) Single action press b) Double action press c) Triple action press C) According to type of frame: a) Open frame press b) Closed frame press D) According to operation : a) Punching b) Blanking c) Drawing d) Bending	
	iv	**Types of pattern:** 1. Split pattern 2. Match plate pattern 3. Cope and drag pattern 4. Gated pattern 5. Loose piece pattern 6. Sweep pattern 7. Skeleton pattern 8. Segmental pattern 9. Shell pattern 10. Built up pattern 11. Boxed up pattern 12. Lagged up pattern 13. Left and right hand pattern 14. Single piece pattern	**1/2 mark each for any 4 correct types of pattern**
	v	**Various Lathe Operations:** External Turning, Internal Turning, Boring, Parting Off, Threading, Drilling, Reaming, Hole making, Taps and dies for cutting Threads.	**½ Mark each for any 4 operations**
	vi	**There are various applications of Brazing** (a) Brazing is used for fastening of pipe fittings, tanks, carbide tips on tools, radiators, heat	**½ Mark each for any two applications**

		exchangers, electrical parts, axles, etc. (b) It can join cast metals to wrought metals, dissimilar metals and also porous metal components. (c) It is used to join band saws, parts of bicycle such as frame and rims **Applications of Soldering:** Jewelry components, machine tools and some refrigeration and plumbing components, Electronic soldering connects electrical wiring and electronic components to printed circuit boards by utilizing a metallic alloy substance called solder.	**of brazing** **½ Mark each for any two applications of soldering**
	vii	**Shut Height :** The shut height of an upright press is the distance from the top of the bed to the bottom of the slide with stroke down and adjustment up. The shut height must always be defined either from the top of the bed or from the top of the bolster.	**02 marks for definition**
	viii	**Types of forging operations (any Four)** 1. Types according to the temperature of the workpiece (cold, warm and hot forging) 2. Types according to arrangements of dies (Open die forging and closed die forging) 3. Types according to forging equipments (Hammer forging and Press forging)	**Any four ½ mark each**
	b	**Attempt any TWO of the following**	**08**
	i	**Notching:** It is a shearing process during which a metal scrap piece is removed from the outside edge of a metal workpiece. Notching is typically a manually operated, low-production process. During a notching operation, the metal workpiece has an outside edge removed by the use of multiple shear blades that are set at right angles to each other.  Fig. Notching  Fig workpiece after the notching **Lancing:** It is a cutting operation in which a hole is partially cut and then one side is bent down to form a shape such as tab, vent or louver.	***01 Marks For each explanation & 01 Marks For each Sketch***

		  Fig. Lancing	
	ii	**MOULD MAKING TECHNIQUE** for a two piece pattern. Sufficient care should also be taken in such that sense that the molding box must adjust mold cavity, riser and the gating system (sprue, runner and gates etc.). 2. Next, place the drag portion of the pattern with the parting surface down on the bottom (ram-up) board as shown in Fig.(a). 3. The facing sand is then sprinkled carefully all around the pattern so that the pattern does not stick with molding sand during withdrawn of the pattern. 4. The drag is then filled with loose prepared molding sand and ramming of the molding sand is done uniformly in the molding box around the pattern. Fill the molding sand once again and then perform ramming. Repeat the process three four times, 5. The excess amount of sand is then removed using strike off bar to bring molding sand at the same level of the molding flask height to completes the drag. 6. The drag is then rolled over and the parting sand is sprinkled over on the top of the drag Fig.(b). 7. Now the cope pattern is placed on the drag pattern and alignment is done using dowel pins. 8. Then cope (flask) is placed over the rammed drag and the parting sand is sprinkled all around the cope pattern. 9. Sprue and riser pins are placed in vertically position at suitable locations using support of molding sand. It will help to form suitable sized cavities for pouring molten metal etc. Fig. (c). 10. The gaggers in the cope are set at suitable locations if necessary. They should not be located too close to the pattern or mold cavity otherwise they may chill the casting and fill the cope with molding sand and ram uniformly. 11. Strike off the excess sand from the top of the cope. 12. Remove sprue and riser pins and create vent holes in the cope with a vent wire. The basic purpose of vent creating vent holes in cope is to permit the escape of gases generated during pouring and solidification of the casting. 13. Sprinkle parting sand over the top of the cope surface and roll over the cope on the bottom board. 14. Rap and remove both the cope and drag patterns and repair the mold suitably if needed and dressing is applied 15. The gate is then cut connecting the lower base of sprue basin with runner and then the mold cavity. 16. Apply mold coating with a swab and bake the mold in case of a dry sand mold. 17. Set the cores in the mold, if needed and close the mold by inverting cope over drag. 18. The cope is then clamped with drag and the mold is ready for pouring.	***02 Marks For explanation & 02 Marks For Sketch***

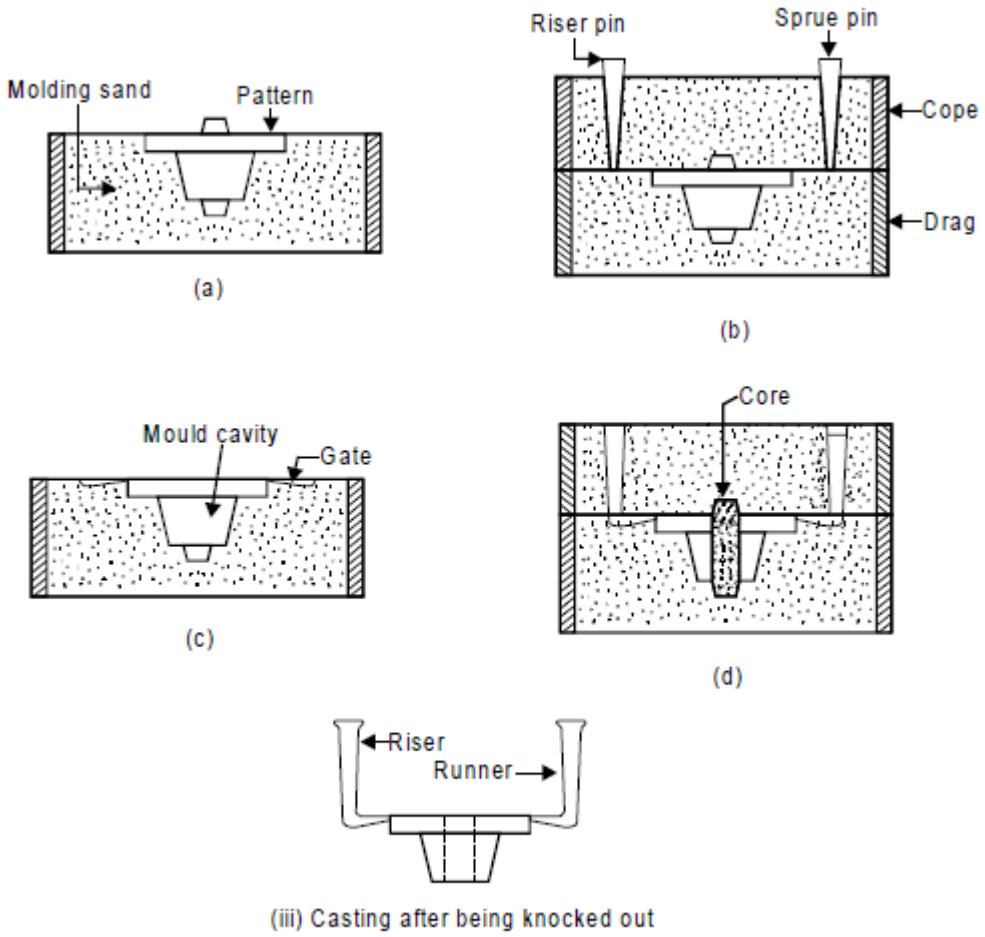


Fig. making a mold

iii **Electron Beam Welding Process**

In EBW process, the heat is generated when the electron beam impinges on work piece. As the high velocity electron beam strikes the surfaces to be welded, their kinetic energy changes to thermal energy and hence causes the workpiece metal to melt and fuse.

A schematic setup of the electron beam welding is shown in Fig. This process employs an electron gun in which the cathode in form of hot filament of tungsten or tantalum is the source of a stream of electrons. The electrons emitted from filament by thermionic emission are accelerated to a high velocity to the anode because of the large potential difference that exists between them. The potential differences that are used are of the order of 30 kV to 175 kV. The higher the potential difference, higher would be the acceleration. The current levels are low ranging between 50 mA to 1000 mA. The electron beam is focused by a magnetic lens system on the work pieces to be welded. The depth of penetration of the weld depends on the electron speed which in turn is dependent upon the accelerating voltage. When the high velocity electron beam strikes the work-piece all the kinetic energy is converted to heat. As these electrons penetrate the metal, the material that is directly in the path is melted which when solidifies form the joint.

02 Marks For explanation & 02 Marks For Sketch

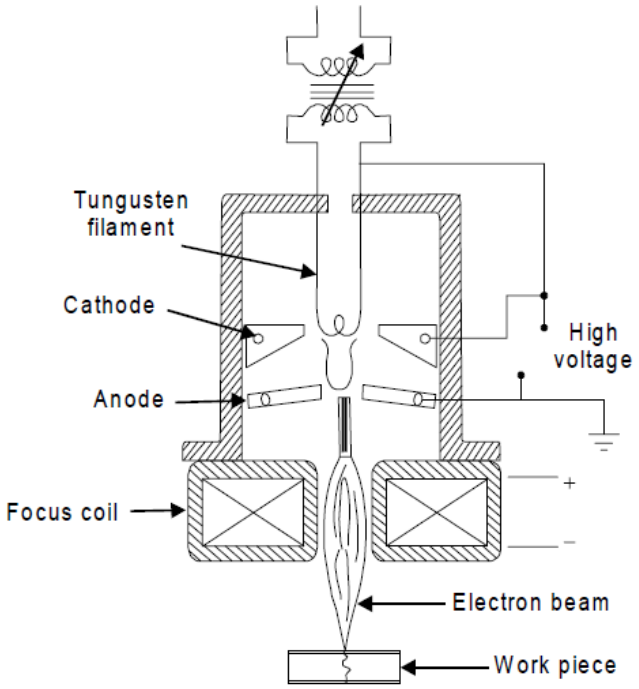


Fig. Electron beam welding set up

2 **Attempt any FOUR of the following:** **16**

a

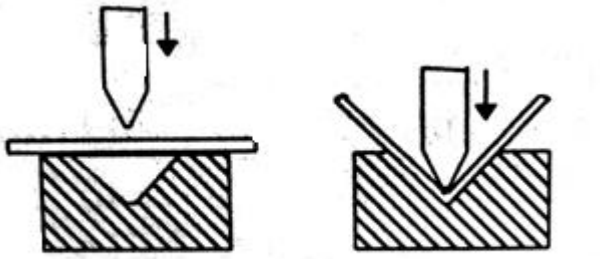
Sr. No.	Hot Rolling	Cold Rolling
1	It is carried out above the recrystalization temperature	It is carried out below the recrystalization temperature
2	No internal or residual stresses are set up	Residual or internal stresses are setup in th metal
3	No cracks and blow holes are develops in the workpiece.	Existing cracks propagates and new cracks may developed
4	Dimensional accuracy is less	Dimensional accuracy is more
5	It requires less power/force	It requires more power/force.
6	It is used for structural, sections, channels production etc	It is used for rods, sheets, plates, bars etc.

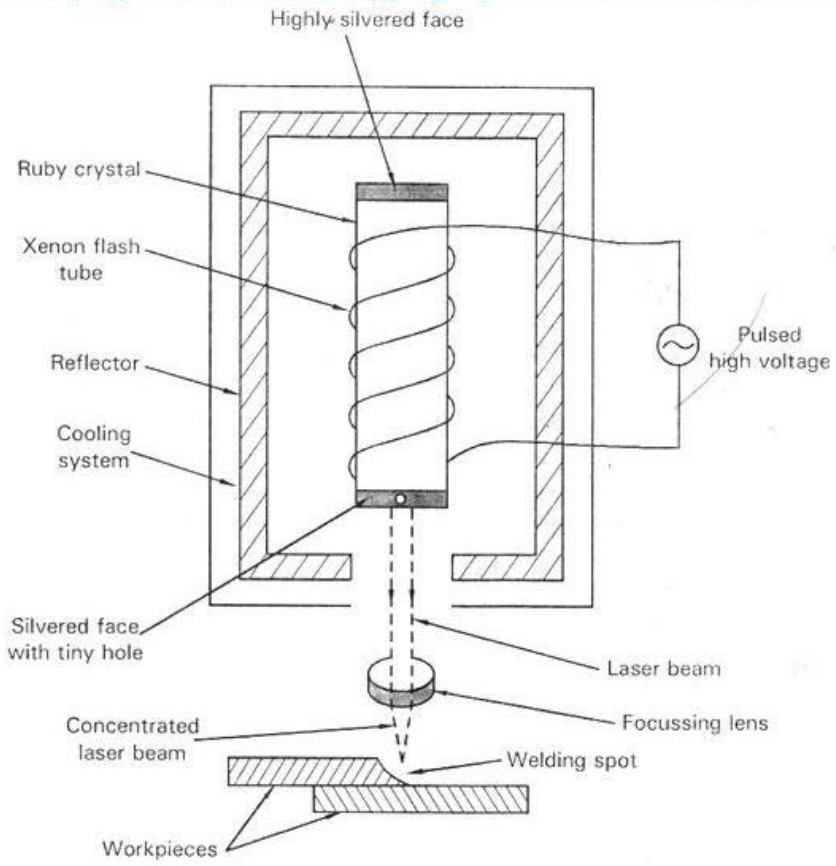
Any 4 points, 01 mark each

b **Tool signature:** **02 marks for definition, 02 marks for example**

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.	
	c	In bending the metal is stressed in both tension and compression at the two sides of the neutral axis beyond the elastic limit but below the ultimate strength of the material. As the metal is loaded beyond the elastic limit, some amount of plastic deformation takes place and when load is removed the metal retains the bent shape given by the die. Some amount of elastic recovery of the metal when the load is removed, resulting in a slight decrease in the bent angle. The effect is known as spring back. To correct the effect of spring back, the metal is bent through a greater angle so that when the load is removed the component will spring back to the desired angle.  **Figure Bending operation**	**02 marks for explanation, 02 marks for sketch**
	d	**Laser Beam welding** Laser is an acronym for light amplification by stimulated emission of radiation. Laser Beam Welding (LBW) is a fusion joining process that produces coalescence of materials with the heat obtained from a concentrated beam of coherent, monochromatic light impinging on the joint to be welded. In the LBM process, the laser beam is directed by flat optical elements, such as mirrors and then focused to a small spot (for high power density) at the workpiece using either reflective focusing elements or lenses. It is a non-contact process, requiring no pressure to be applied. Inert gas shielding is generally employed to prevent oxidation of the molten puddle and filler metals may be occasionally used. The major advantages of LBW is A vacuum is not required, and the beam can be transmitted through air.	***02 Marks For explanation & 02 Marks For Sketch***



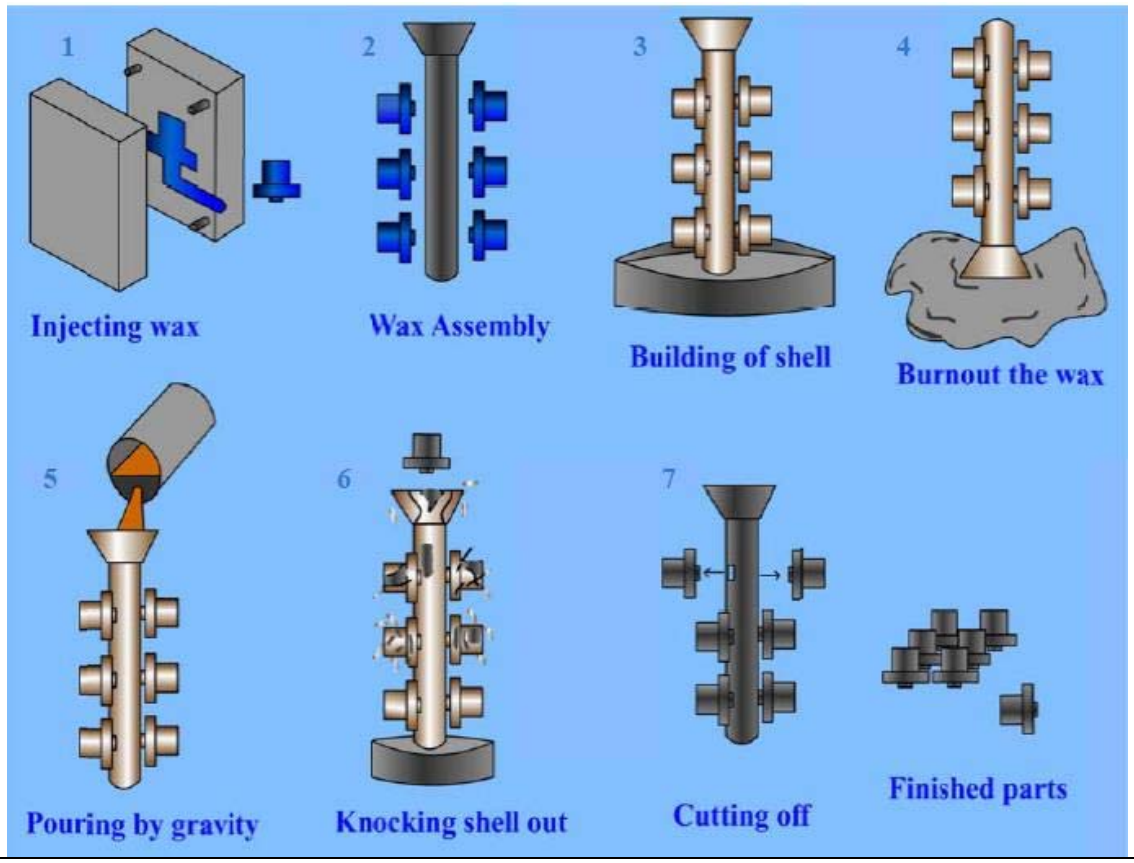
e **Investment Casting Process** — ***02 Marks For explanation & 02 Marks For Sketch***

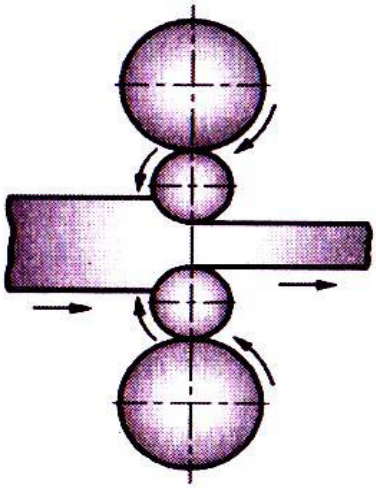
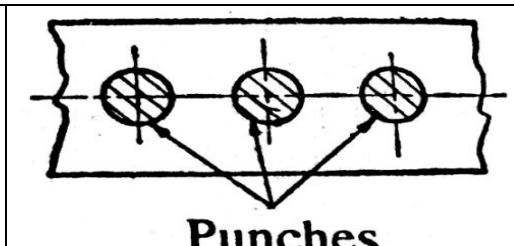
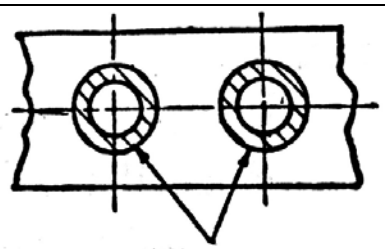
The investment casting process, which is commonly referred to as the "lost wax method",

The investment casting process initiates with the production of wax replicas or patterns of the required shape of castings. Each and every casting requires a pattern to be produced. Wax or polystyrene is made used as the injecting material. The assembly of large number of patterns are made and attached to a wax sprue centrally. Metallic dies are used to prepare the patterns. The pattern is immersed in refractory slurry which completely surrounds it and gets set at room temperature forming the mold. The mold is further heated, so that the pattern melts and flows out, leaving the required cavity behind. After heating, the mold gets further hardened and molten metal is poured while it is still hot. After the casting gets solidified, the mold is broken and it is taken out.

The basic steps of the investment casting process are as shown in figure.:

1. Preparing the heat-disposable wax, plastic or polystyrene patterns in a die.
2. Assembly of the prepared patterns onto a gating system
3. "Investing," (covering) the pattern assembly with a refractory slurry which builds the shell.

		4. Melting the pattern assembly (burning out the wax) by firing, for removing the traces of the pattern material 5. The metal in molten state is poured into the formed mold. 6. Once the metal solidifies, the shell is removed (knocked out). **7.** Fettling (cutting off) of the pouring basin and gates followed by finishing operations to get the desired dimensional tolerances and finish.  	
	f	1) Thermoplastics 2) Thermosetting Plastics Properties:- 1) Thermoplastics thermoplastics are low melting temperature and lesser strength compared to the thermo setting plastic, chemical resistance, durability, self lubrication, transparency and water proofing. 2) Thermosetting Plastics thermosets are generally stronger than the thermoplastics. thermosetting polymers are hard, tough, non-swelling and brittle, and cannot be softened and remolded as thermoplastic materials.	**Type 02 marks,** **properties 02 marks (01 mark each)**

3		**Attempt any FOUR of the following**	**16**
	a	**Explain four high roll mill with neat sketch.** This type of machine consist of four rolls, two smaller in size and other two bigger in size 1) The actual rolling is done by small size wheels and other two bigger wheels provide backup and necessary rigidity to the smaller rolls. 2) This mill is commonly used for hot as well as cold rolling of plates and sheets. By this rolling process different types of shapes are formed. Those are I-section, T-section, etc.  **Fig. Four high roll mill**	***02 Marks For explanation & 02 Marks For Neat Labelled Sketch***
	b	**Differentiate punching and blanking with neat sketch**  	***04 Marks For Neat Labelled Sketch***
	c	**Give any four properties of moulding sand.** 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	***01 Marks each For explanation of any four properties***

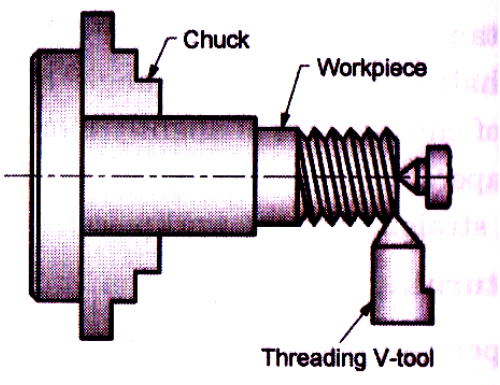
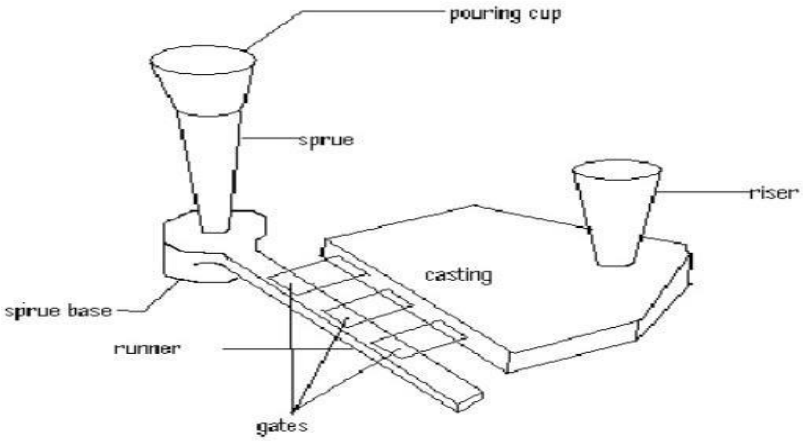
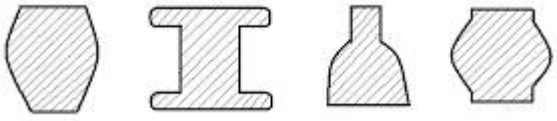
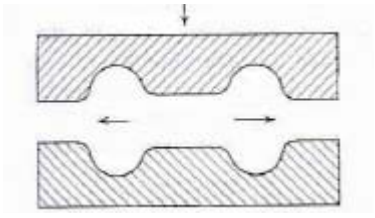
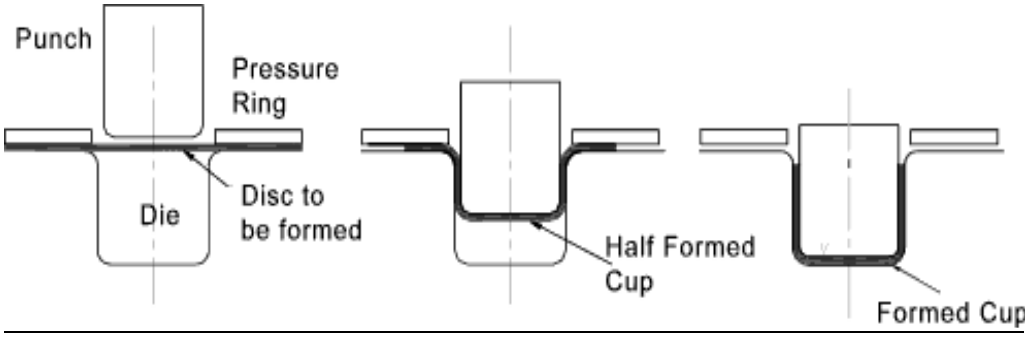
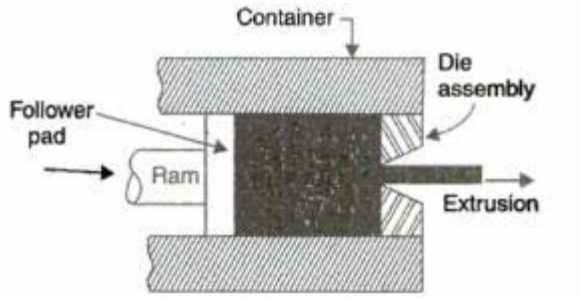
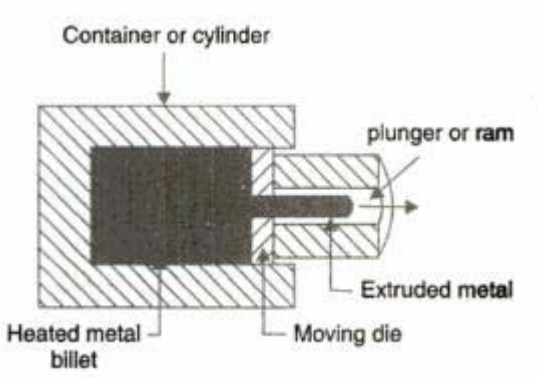
		closing. The mould may also be damaged during pouring by washing of the walls and core by the molten metal. The strength of moulding sand must, therefore, be sufficient to permit the mould to be formed to the desired shape and to retain this shape even after the hot metal is poured in the mould. **3. 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. **5. Cohesiveness:** 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. **6. Refractoriness:** The sand must be capable of withstanding the high temperature of the molten metal without fusing. Moulding sands with a poor refractoriness may burn on to the casting. Refractoriness is measured by the sinter point of the sand rather than its melting point.	
	d	**Explain thread cutting operation in lathe machine.** 1. Principle of thread cutting is to produce a helical groove on a cylindrical or conical surface 2. By feeding tool longitudinally when job is revolved between centre's or by a chuck 3. Longitudinal feed should be equal to the pitch of the thread to be cut per revolution of the workpiece 4. Lead screw through saddle receives traversing motion, has a definite pitch  	***02 Marks For explanation & 02 Marks For Neat Labelled Sketch***

		Fig. Thread cutting operation	
	e	**Explain various elements of gating system** **Elements of gating system**:- Gating system means all passages through the molten metal enters the mould cavity. 1. **Pouring basin –**from where molten metal is drained 2. **Runner –**it is a passage which connects basin and gate. 3. **Gate**- it is passage which connects runner and mould cavity. 4. **Riser**-after cavity is completely filled liquid level rises in riser passage and draining can be stopped.  	***02 Marks For explanation & 02 Marks For Neat Labelled Sketch***
	f	**Explain upsetting and fullering operations in forging.** **<u>Upsetting:-</u>** it is also known as jumping operation This applied to increase the cross sectional area of the stock at the expanse of the length. To achieve the length of upsetting force is applied in a direction parallel to the length axis. For example forming of a head.  **<u>Fullering:</u>** Fullering is used to reduce the cross-sectional area of a portion of the stock. The metal flow is outward and away from the centre of the fuller. i.e., forging of connecting rod for an internal combustion engine. 	***02 Marks For explanation & 02 Marks For Neat Labelled Sketch***

4		**Attempt any FOUR of the following**	**16**
	a	Drawing is one of the widely used sheet metal forming operations. Cup shaped objects, utensils, pressure vessels, gas cylinders, cans, shells, kitchen sinks etc are some of the products of drawing. In this process, a sheet metal called blank is placed on a die cavity, held in position using a holding plate or holding ring and pressed against the die cavity using a solid punch. The sheet metal attains the shape of the die cavity with flat bottom. Both die and punch should be provided with corner radius in order to avoid shearing of the sheet. During drawing of sheet into the die, there is thickening of the sheet up to 12%. Therefore, clearance is provided between the punch and die. The radial clearance therefore is equal to the sheet thickness plus the thickening of sheet. Punch pushes the bottom of the sheet into the die cavity. The flat portion of the sheet under the holding plate moves towards the die axis, then bends over the die profile. After bending over the die profile the sheet unbends to flow downward along the side wall. The vertical portion of the sheet then slips past the die surface. More metal is drawn towards the center of the die in order to replace the metal that has already flown into the die wall. Friction between holding plate and blank and that between die and blank has to be overcome by the blank during its horizontal flow.  	***02 Marks For explanation & 02 Marks For Neat Labelled Sketch***
	b	**Explain direct and indirect extrusion process and state its advantages.** **Direct extrusion (also called forward extrusion) :** A metal billet is loaded into a container, and a ram compresses the material, forcing it to flow through one or more openings in a die at the opposite end of the container. As the ram approaches the die, a small portion of the billet remains that cannot be forced through the die opening. This extra portion, called the butt, is separated from the product by cutting it just beyond the exit of the die. One of the problems in direct extrusion is the significant friction that exists between the work surface and the walls of the container as the billet is forced to slide toward the die opening. This friction causes a substantial increase in the ram force required in direct extrusion.	***2 Marks for explanation & 2marks for advantages***



Indirect extrusion, (also called backward extrusion and reverse extrusion):
The die is mounted to the ram rather than at the opposite end of the container. As the ram move, the metal is forced to flow through the clearance in a direction opposite to the motion of the ram. Since the billet is not forced to move relative to the container, there is no friction at the container walls, and the ram force is therefore lower than in direct extrusion.



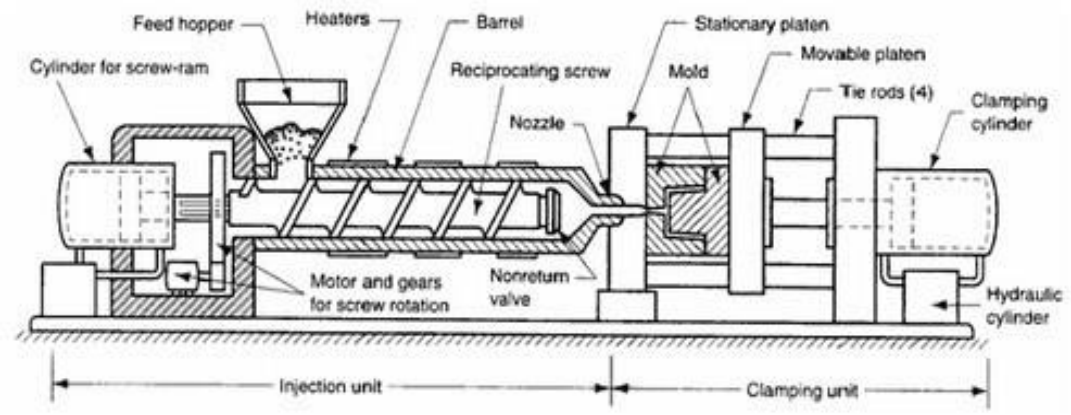
ii)Advantages of Direct and Indirect extrusion process:
Direct extrusion: The process allows for the use of brittle materials because only compressive and shear stresses are applied directly to the metal.
Indirect extrusion: The advantage of Indirect Extrusion is that there is reduced friction in the billet which helps in increasing the speed and efficiency of the manufactured product and extruder machine. No heat is formed due to friction in the process of indirect extrusion.

c **Explain various colour code used for pattern.** — ***Any 04 colour codes each carries 01 mark***

The patterns are normally painted with contrasting colours such that the mould maker would be able to understand the functions clearly. The colour code used is

1. Red or orange on surfaces not to be finished and left as cast
2. Yellow on surfaces to be machined
3. Black on core prints for unmachined openings
4. Yellow stripes on black on core prints for machined openings
5. Green on seats of and for loose pieces and loose core prints
6. Diagonal black stripes with clear varnish on to strengthen the weak patterns or to shorten a casting

<table>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>d</td><td>Differentiate between soldering and brazing
<table>
<tr><th>S. No.</th><th>Soldering</th><th>Brazing</th></tr>
<tr><td>1.</td><td>It is used in electrical industries to joint capacitor, resistor, wire etc. to the electronic plate.</td><td>It is used to mechanical industries to joint different metals.</td></tr>
<tr><td>2.</td><td>Soldering is done at temperature below 200 C.</td><td>Brazing is done at temperature above 450C but below the critical temperature of metal.</td></tr>
<tr><td>3.</td><td>These joints are weaker than brazing joints.</td><td>It forms stronger joint.</td></tr>
<tr><td>4.</td><td>In soldering an alloy of lead and tin is used known as solder.</td><td>In brazing an alloy of copper and zinc is used as filler metal.</td></tr>
<tr><td>5.</td><td>It does not need a special training to soldering.</td><td>It needs special trading.</td></tr>
<tr><td>6.</td><td>It is a cheaper process.</td><td>It is a costly process.</td></tr>
<tr><td>7.</td><td>Soldering does not need to preheat of base metal.</td><td>This process needs preheating of base metal.</td></tr>
<tr><td>8.</td><td>It is used to joint electronics component.</td><td>It is used in automotive industries and pipe fitting.</td></tr>
<tr><td>9.</td><td>This process is very flexible and easy to automate.</td><td>It is not so easy for automation except automation is done at automotive industries.</td></tr>
</table></td><td>Any 04 differentiating points each 01 marks</td></tr>
<tr><td></td><td>e</td><td>Explain various cutting parameters in lathe operation.
<u>Cutting Speed:</u> - It is the speed at which the metal is removed by the tool from the work piece. In lathe it is the peripheral speed of the work past the cutting tool expressed in meter per minute. Cutting speed is directly proportional to the surface or peripheral speed of the work. It considerably effects on the tool life and efficiency of machining. It affects on machining time there by productivity and the production cost
<u>Feed: -</u> It is the distance the tool advances for each revolution of the work. Feed is expressed in mm/ rev. It is influenced by the material being machined, geometry of the cutting tool, required degree of surface finish, rigidity of the machine tool being used, and type of coolant being used.
<u>Depth of cut:</u> - It is the perpendicular distance measured from the machined surface to the uncut surface of the workpiece. It determines the thickness of metal layer removed by the cutting tool in one pass.</td><td>4 Marks</td></tr>
<tr><td></td><td>f</td><td>Explain injection moulding with neat sketch.
1. The prepared thermoplastic is poured into the Hopper.
2. The material funnels down into the screw which is heated to melt the plastic.
3. The barrel is heated at staged temperatures along its length (approx. 5 zones) to allow the material to solidify and to move along the screw.
4. The screw rotates which moves the material forward with the pressure and speed determined to fill the cavity efficiently.</td><td>02 marks for detail explanation and 02 marks for sketch</td></tr>
</table>

		5. When the material exits the nozzle at the end of the barrel it is injected into the feed channels of the mould tool. 6. The feed channels allow this material to flow into the open cavity of the mould tool which forms the shape of the finished product. 7. The mould tool is held at a constant temperature to allow ease of material flow and to also draw out the heat from the product after injection, so, the material sets off to a solid form. 8. After a predetermined cooling time the mould tool is opened when the moving platen carrying the ejection half is retracted. 9. The mould tool opens with the product held in the ejection half of the tool. 10. The ejection system then moves forward to release the product from the mould tool. 11. The product is gathered in the collection box after the cycle is complete or the parts can be picked from the tool as required. 	
5		**Attempt any FOUR of the following**	**16**
	a	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 pieced 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.	***02 Marks For explanation & 02 Marks For Sketch***

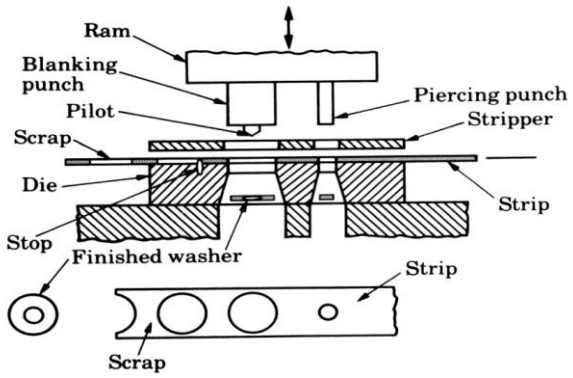


Figure: Progressive Die

b **a) Explain close die forging with neat sketch.** **02 marks for sketch, 02 marks for explanation**

Impression die forging is also called as close die forging. Impression die s generally contains preliminary shaping steps to permit the change from the original forging stock to the finished forging without mechanical defects. Simple symmetrical parts may be forged directly in the finished impression (finishing die cavity) without preliminary shaping. The more difficult or complex shapes may require several difficult steps to produce finished forging.

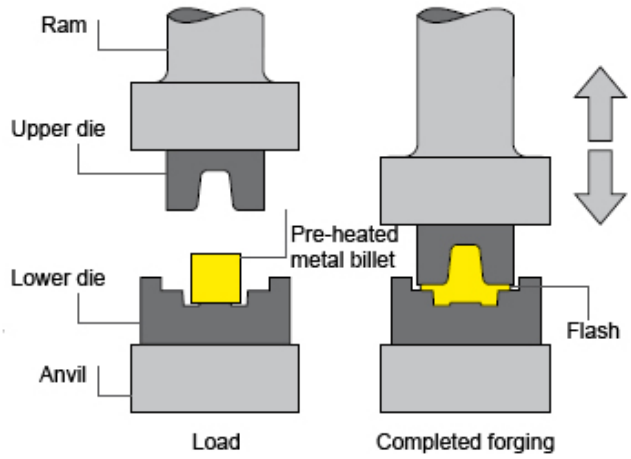
The most used preliminary forging step is the edger, which serves to proportion the cross sectional area along the length of the flowing metal from a section being reduced to a section being enlarged.

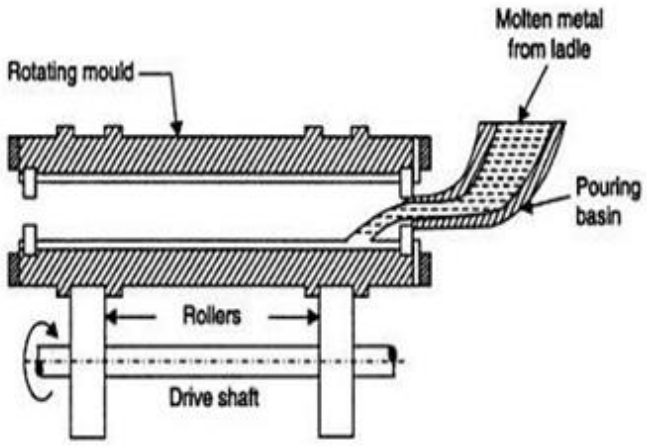
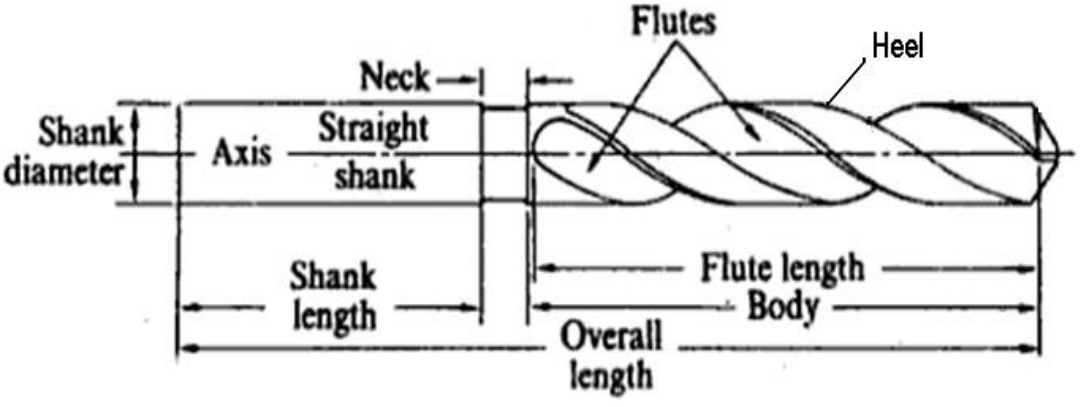
The fullering step or fuller reduces the cross sectional area between the ends of the forging stock without appreciable change to the end section.

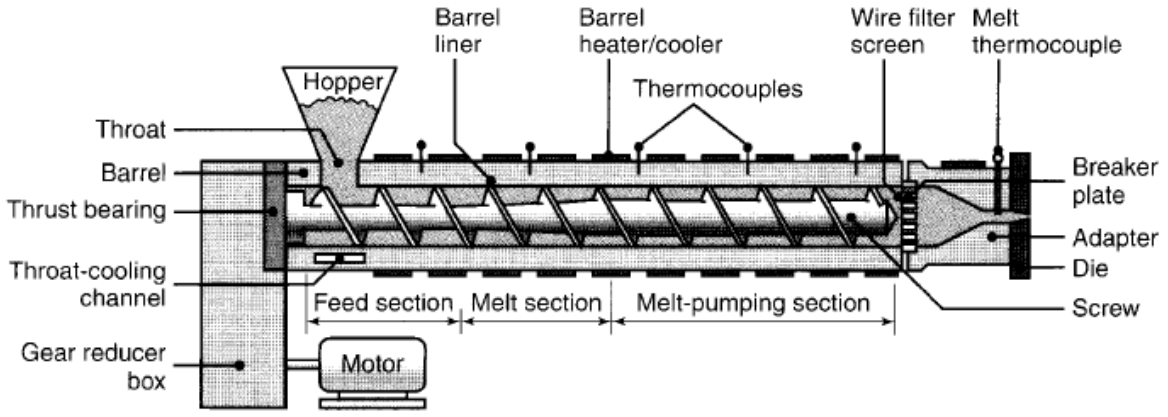
The bending step or bender forms the length of the forging stock to a shape for finishing impression.

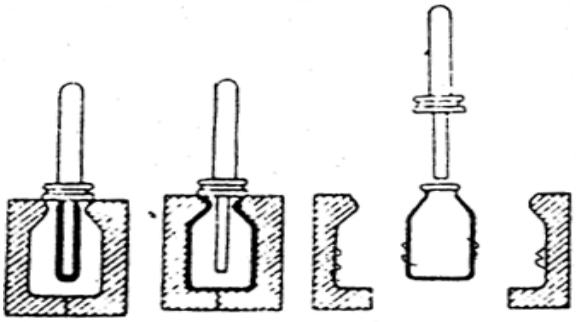
Excess material is allowed to run out between the flat die surfaces and this flash is sometimes removed or trimmed prior to forging in the finishing die.

Die must however be heated before the first forging is made. after forging operation the part must be trimmed to remove the flash.



	c	**Centrifugal casting:** 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**	**02 marks for sketch, 02 marks for explanation**
	d	 	**02 marks for sketch, 02 marks for naming**

	e	**Plastic Extrusion Process:-** In extrusion, which produces the largest volume of plastics, raw materials in the form of thermoplastic pellets, granules, or powder are placed into a hopper and fed into the barrel of a screw extrnder . The barrel is equipped with a helical screw that blends the pellets and conveys them down the barrel towards the die. The barrel heaters and the internal friction from the mechanical action of the screw heat the pellets and liquefies them. The screw action also builds up pressure in the barrel. Screws have three distinct sections: I. Feed section: Conveys the material from the hopper into the central region of the barrel. 2. Melt section (also called compression or transition section): Where the heat generated by the viscous shearing of the plastic pellets and by the external heaters causes melting to begin. 3. Metering or pumping section: Where additional shearing (at a high rate) and melting occur, with pressure building up at the die. The molten plastic is forced through a die . The extruded product is then cooled, generally by exposing it to blowing air or by passing it through a water-filled channel (trough).  	**02 marks for sketch, 02 marks for explanation**
	f	**Blow Moulding:** The blow moulding is used to make hollow article like bottles, drums, barrels and other liquid container. In this process, heated plastic tube (Parison) sticks to mould around the tube. The shape of parison stick is hollow. Air under pressure is blown through parison stick to expand the parison to required shape of the mould. After cooling, the mould is opened and the part is ejected.	**02 marks for sketch, 02 marks for explanation**

		 Blow Mould Blow moulding	

6 a **Die Casting Causes and Remedies:-**

Any eight defects with correct causes and remedies 01 mark each

Casting Defect	Causes	Remedies
Blow holes	1. Excess moisture content in molding sand. 2. Rust and moisture on Chills, chaplets and inserts 3. Cores not sufficiently baked. 4. Molds not adequately vented.	1. Control of moisture content. 2. Use of rust free chills, chaplet and clean inserts. 3. Bake cores properly. 4. Provide adequate venting in mold and cores
Shrinkage	Faulty gating and risering system. Improper chilling.	Ensure proper directional solidification by modifying gating, risering and chilling
Porosity	High pouring temperature, Gas dissolved in metal charge,Less flux used,Molten metal not properly degassed,Slow solidification of casting, High moisture and low permeability in mold.	Regulate pouring temperature, Control metal composition, Increase flux proportions, Ensure effective degassing,Modify gating and risering, Reduce moisture and increase permeability of mold.
Misruns	Lack of fluidity ill molten metal, Faulty design,Faulty gating.	Adjust proper pouring temperature,Modify design,Modify gating system.
Hot Tears	Lack of collapsibility of core,Lack of collapsibility of mold,Hard Ramming of mold.	Improve core collapsibility,Improve mold collapsibility,Provide softer ramming.
Metal penetration	Large grain size and used. Soft ramming of mold. Molding sand or core has low strength. Molding sand or core has high permeability.	Use sand having finer grain size, Provide hard ramming, Suitably adjust pouringtemperature.
Cold shuts	Lack of fluidity in molten metal,Faulty design.	Adjust proper pouring temperature,Modify design.
Inclusions	Faulty gating, Faulty pouring, Soft ramming of mold.	Modify gating system, Improve pouring to minimize turbulence.
Drops	Low green strength in molding sand and core, Too soft ramming, Inadequate reinforcement of sand and core projections	Increase green strength of sand mold, Provide harder ramming, Provide adequate reinforcement to sand projections and cope by using nails and gaggers.

b

MIG	TIG
1. This process utilizes a consumable electrode.	TIG is an inert gas shielded arc welding process using non-consumable electrode.
2. In this process the filler metal is transferred from the electrode to the joint.	No fluxes are used in TIG welding.
3.The consumable Electrode is continuously feed at a constant rate through the feed roller	It does not require electrode feed.
4. Normally DC arc machines are used.	Both AC and DC power supply can be used.
5. MIG is comparatively faster process.	TIG is comparatively slower process.
6.It can be used for deep groove of plates and castings but	Deep penetration can't be obtained
7. suitable for Welding most ferrous and nonferrous metals and is used extensively in the metal-fabrication industry suitable for welding of mild steel, stainless steel and aluminum.	Commonly used for welding of aluminum, magnesium, titanium, and the refractory metals.
8 this method is suitable only for thin sheets and sections of less than 6 mm.	this method is suitable for thin sheets.

Any eight points 01 mark each

c

i

Reaming:- This is the operation of sizing and finishing a hole already made by a drill. Reaming is performed by means of a cutting tool called reamer as shown in Fig. Reaming operation serves to make the hole smooth, straight and accurate in diameter.

Spot facing: - This is the operation of removing enough material to provide a flat surface around a hole to accommodate the head of a bolt or a nut. A spot-facing tool is very nearly similar to the
counter-bore.

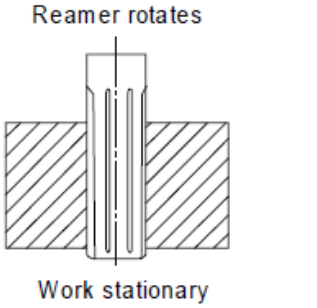


Fig. Reaming operation

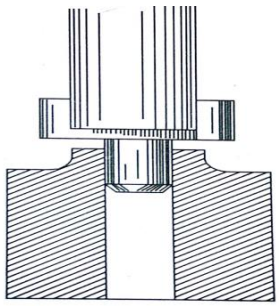
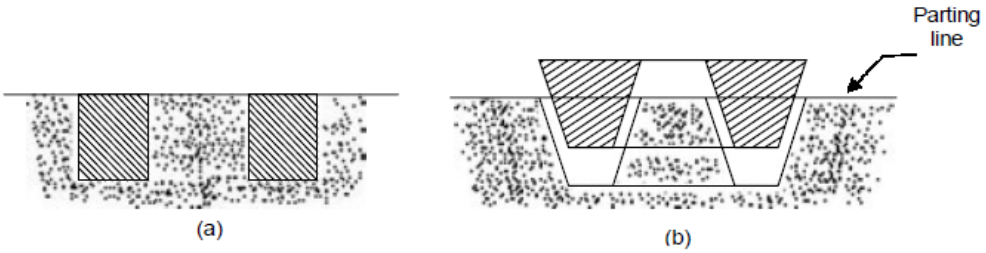


Figure: Spot-facing

01 mark for each explanation and 01 for each sketch

	ii	**PATTERN ALLOWANCES** **PATTERN ALLOWANCES** **1) Shrinkage: All** the metal shrinks when cooling except bismuth. This is because of the inter-atomic vibrations which are amplified by an increase in temperature. Solid shrinkage is the reduction in volume caused, when metal loses temperature in solid state. The shrinkage allowance is provided to take care of this reduction. The rate of contraction with temperature is dependent on the material. For example, steel contracts to a higher degree as compared to aluminium. The contraction also depends upon the metallurgical transformation taking place during the solidification. The shrinkage allowance is always to be added to the liner dimensions. Even in case of internal dimensions (e.g., internal diameters of cylinders), the material has a tendency to contract towards the entry and thus are to be increased. 2) **Draft: -** At the time of withdrawing the pattern from the sand mould, the vertical faces of the pattern are in continual contact with the sand, which may damage the mould cavity, as shown in Fig. .To reduce the changes of this happening, the vertical faces of the pattern are always tapered from the parting line. This provision is called draft allowance. Draft allowance varies with the complexity of the job. But in general, inner details of the pattern require higher draft than outer surface. Draft is always provided as an extra metal over above the original casting dimension.  **Fig.** Effect of Draft on Pattern Withdrawing 3) **Machining Allowance: -** The finish and accuracy achieved in sand casting are generally poor and therefore when the casting is functionally required to be of good surface finish or dimensionally accurate, it is generally achieved by subsequent machining. Also, ferrous materials would have scales on the skin which are to be removed by cleaning process. Hence, extra material is to be provided which is to be subsequently removed by machining or cleaning process. This depends on dimensions, the type of casting material and the finish required. This may range from 2 to 20 mm. 4) **Shake Allowance:-** Before withdrawal from the sand mould, the pattern is rapped all around the vertical faces to enlarge the mould cavity slightly which facilitates its removal. Since it enlarges the final casting made, it is desirable that the original pattern dimensions should be reduced to account for this increase. It is a negative allowance and is to be applied only to those dimensions which are parallel to the parting plane. One way of reducing this allowance is to increase the draft which can be removed during the subsequent machining. 5) **Distortion Allowance: -** A metal when it has just solidified is very weak and therefore is likely to be distortion prone. This is particularly so for weaker sections such as long flat portion, V, U sections or in a complicated casting which may have thin and long sections which are connected to thick sections.	**Any four 01 mark each for 01 allowance**