WINTER – 19 EXAMINATIONS

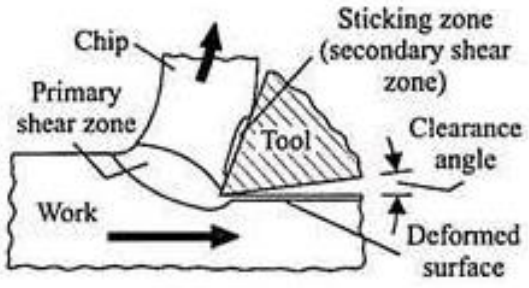
Subject Name: MFP **Model Answer** Subject Code: 22446

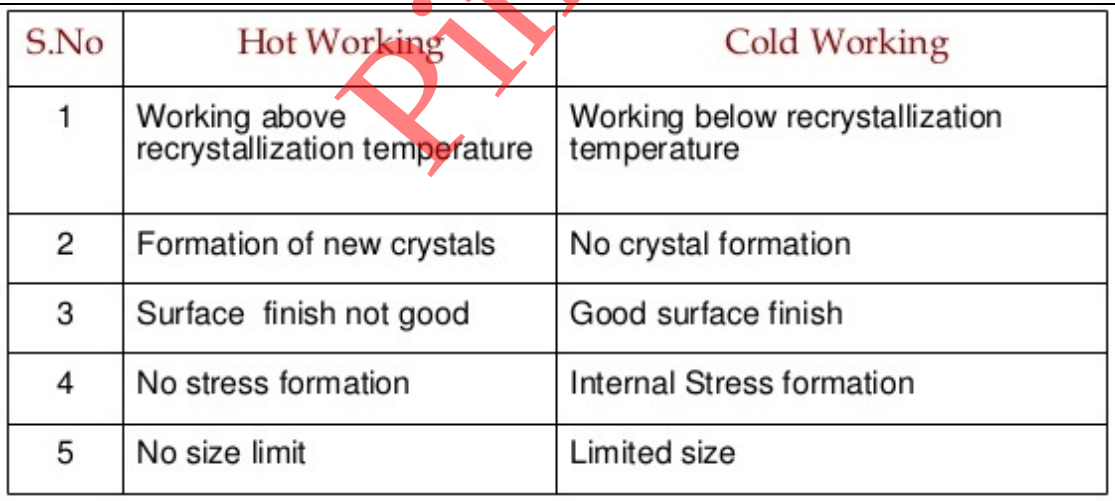
Important Instructions to examiners:

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.

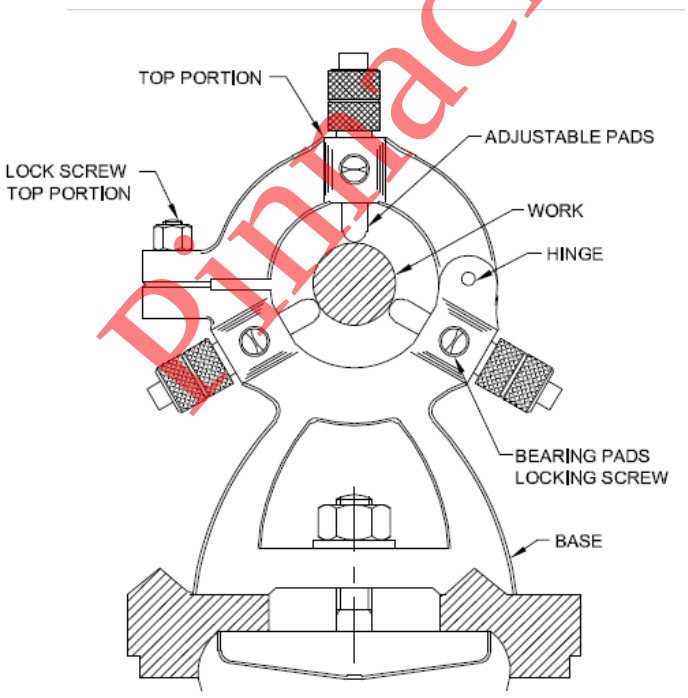
Q. No.	Sub Q. N.	Answer	Marking Scheme
Q.1		**Attempt any FIVE of the following:**	**10**
	a)	1. Back rake angle-8 2. Side rake angle-10. 3. End relief angle-6. 4. Side relief angle-6 5. End cutting edge angle-5 6. Side cutting edge angle-10. 7. Nose radius-0.8 mm.	**02 marks**
	b)	Types of shapers: **Based on the type of driving mechanism:** a) Crank type shaper. b) Geared type shaper. **Based on ram travel:** a) Horizontal shaper. b) Vertical shaper. **Based on the table design:** a) Standard shaper. b) Universal shaper.	**02 marks**

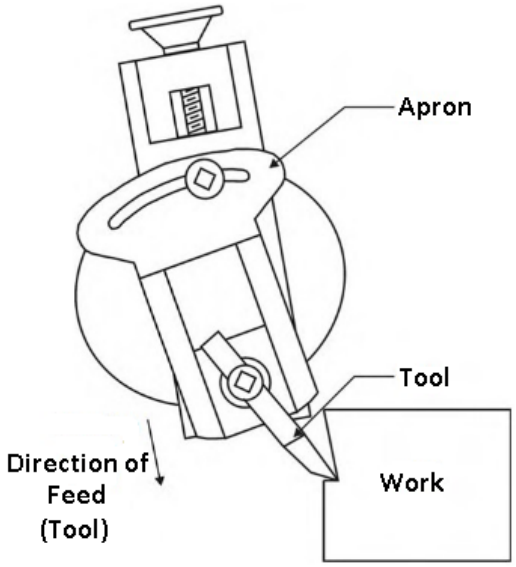
		Based on cutting stroke. a) Push cut type. b) Draw cut type.	
	c)	A sprue section reduces downwards to a smaller size at its bottom will create a choke which will help keep the sprue full of molten metal.	**02 marks**
	d)	Three Types of Electric furnaces: 1. Induction heating furnace. 2. Resistance heating furnace. 3. Arc furnace.	**02 marks**
	e)	**Jumping up operation**: This process makes metal shorter and thicker and carried out at near welding temperature. Metal can be either thickened at the ends of bars or swollen in the center.	**02 marks**
	f)	**Four advantages of MIG welding:** 1. High quality welds can be produced much faster. 2. Flux is not used there is no chance for the entrapment of slag in the weld metal resulting in high quality welds. 3. The gas shield protects the arc so that there is very little loss of alloying elements. Only minor weld spatter is produced. 4. It can be used with a wide variety of metals and alloys. 5. Least expensive and highly economic. 6. Little or no post welds cleaning.	**Any four ½ mark each**
	g)	**Brazing:** It is a metal joining process in which two or more metal items are joined together by melting and flowing a filler metal into the joint, the filler metal having a lower melting point than the adjoining metal.	**02 marks**
Q.2		**Attempt any THREE of the following:**	**12**
	a)	**Mechanics of chip formation:** The basic mechanics of forming a chip are the same regardless of the base material. As the cutting tool engages the workpiece, the material directly ahead of the tool is sheared and deformed under tremendous pressure. The deformed material then seeks to relieve its stressed condition by fracturing and flowing into the space above the tool in the form of a chip. The real difference is how the chip typically forms in various materials. Regardless of the tool being used or the metal being cut, the chip forming process occurs by a mechanism called plastic deformation. This deformation can be visualized as shearing. That is when a metal is subjected to a load exceeding its elastic limit. The crystals of the metal elongate through an action of slipping or shearing, which	**02 marks explanation and 02 marks sketch**

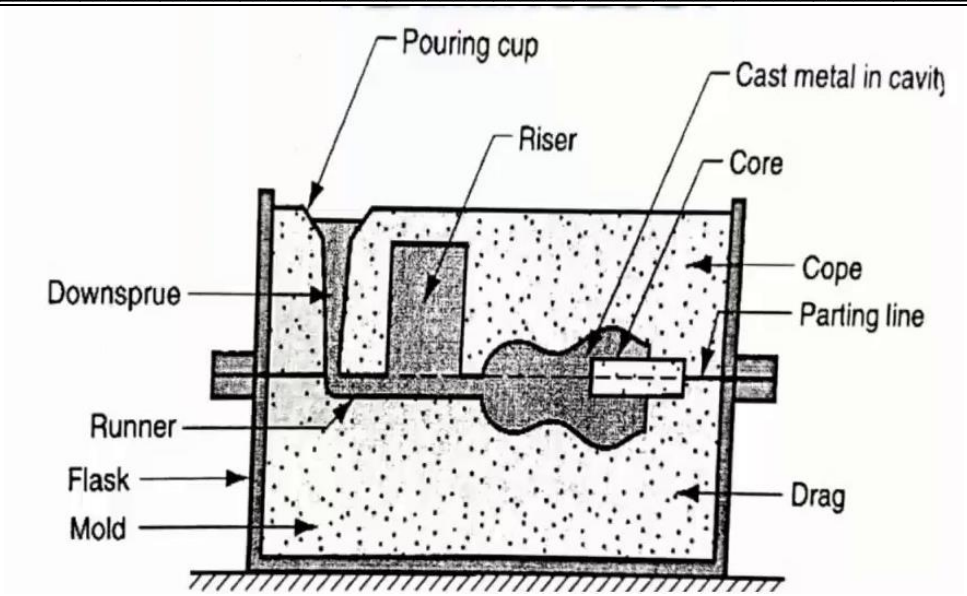
		takes place within the crystals and between adjacent crystals.  (a) Shear zones	
	b)	**Size and Specifications of a slotter** **Slotters Size :** It is given by 1. Maximum length of stroke of slotter ram (mm) e.g 400mm 2. Diameter of rotary table (mm) e.g.915mm 3. Longitudinal movement of table(mm) e.g 762 mm 4. Cross Movement of table (mm) e.g 559 mm 5. Motor power (H.P) e.g 7.5 HP 6. Number of speed 9 7. Floor space required 3050 mm x 1800mm **Slotter specifications:** 1. Maximum length of stroke of slotter ram (mm) 2. Diameter of work table 3. Type of drive 4. Maximum table travel 5. Power input required 6. Floor space required 7. No.of speeds available 8. No.of feeds available	**02 marks for size and 02 marks specification**
	c)	**Centrifugal Casting:** **Advantages:** 1. Relatively very light impurities move inwards towards center. So they can be removed easily thus helping in producing sound castings. 2. Gates and risers are not needed. 3. This technique is best suited for the mass production of symmetrical objects and	**For advantage 01/2 mark each (any two for disadvantages 1/2 mark**

		Castings yield is very high in some cases it is even equal to 100%. 4. Castings acquire high density, high mechanical strength and fine grained structure. 5. Inclusions and impurities are lighter. 6. These castings have a directional solidification starting from outside to inside. **Disadvantages:** 1. Skilled labors are to be employed for this process. 2. An inaccurate diameter of the inner surface of the casting. 3. Only some shapes can be generated by this casting process. 4. Not all alloys can be cast in this way. 5. Centrifugal castings require very high investments. **Applications:** 1. Bush bearings. 2. Clutch plates. 3. Paper making rollers. 4. Piston rings. 5. Cylinder liners. 6. Pipes of water gas sewage.	**each (any two 1/2 mark marks for each applicatio n (any four)**
	d)		**Any 4 points 1 mark each**
Q.3	C	**Attempt any THREE of the following:**	**12**
	a)	**Steps involved for internal thread cutting on lathe machine** **1)** Hole is first bored to the root diameter of the thread. **2)** Tool is fixed on the tool post or on the boring bar adjusted the angle of the top slide to 29.5 degrees and mounted the threading tool at the correct angle using a thread gauge/angle gauge. to get a symmetrical thread shape.	**04 marks explanati on**

S.No	Hot Working	Cold Working
1	Working above recrystallization temperature	Working below recrystallization temperature
2	Formation of new crystals	No crystal formation
3	Surface finish not good	Good surface finish
4	No stress formation	Internal Stress formation
5	No size limit	Limited size

		3) Zeroed both the cross slide and top slide to touch the interior surface of the tube. 4) Make sure the apron was well clear of the workpiece - towards the tailstock, Zero the cross slide. 5) Adjust the top slide to give the required cutting depth. 6) Engage the half-nut lever - making sure it was properly engaged. 7) Keep cutting until 15mm has been reached - disengage the half nuts. 8) Wind the cross slide in to make sure the cutting tool clears the workpiece. 9) Move the apron back towards the start. 10) Keep going until the calculated depth of cut has been reached on the top slide.	
	b)	**Accessory to support long work:** **A steady rest** is a tool for a lathe, enabling a machinist to make deep cuts in long, slender stock, bore out thin pieces of metal, and generally keeps thin stuff straight. Unlike a tool that follows the cutter, a steady rest is firmly attached to the bed of a lathe.  LATHE BED CLAMP	**02 marks explanation & 02 marks sketch**
	c)	In this shaper machine operation, an angular cut is done at any angle other than a right angle to the horizontal or to the vertical plane. The work is set on the table and the vertical slide of the tooth head is swiveled to the required angle either towards the left or towards right from the vertical position. The apron is then further swiveled away from the work so that the tool will clear the work during the return stroke. The down feed is given by rotating the down feed screw. The angular surface can also be machined in a universal shaper or by using a universal vice without swiveling the tool head.	**02 marks sketch and 02 marks explanation**

		 MACHINING OF ANGULAR SURFACE	
	d)	**Gating system:** 1. **Sprue**: The circular cross section that minimizes heat loss and turbulence is sprue, and the area of it is quantified from the choke area as well as the gating ratio. 2. **Sprue Well**: It is also designed to limit the free molten metal fall, by directing the metal in a correct angle to the runner. The sprue well aids in minimizing the turbulence and aspiration. 3. **Runner**: It primarily slows down the flow speed of the molten metal, during its free fall from the above-mentioned channel to the ingate. The runner cross section has to be not just bigger than the sprue exit but also allow filling the molten metal, before letting it enter the ingates. 4. **Ingate**: This is the component, which directs the liquid to the die cavity. Die casters recommend ingate be designed to minimize the metal velocity; the design has to facilitate easy fettling, should not lead to hot spot, and the molten metal flow from the ingate has to be proportional to the casting area's volume.	**02 marks explanation & 02 marks labeled sketch.**

			
Q.4		**Attempt any THREE of the following:**	**12**
	a	Given Data:- d = 10 mm f = 0.2 mm/rev v = 20 m/min thickness of plate t = 18 mm N = v*1000/(π *d) = 20 * 1000 / (π *10) = 636.619 rpm ----------**1 M** L = t+a (a=0.3 d) = 18 +(0.3*10) = 21 mm ----------**1M** T = L / (N*f) ----------**1M** = 21/ (636.619*0.2) T = 0.164 min ----------**1M**	
	b	• The slotted lever quick return mechanism is illustrated in Figs. *a* and *b* The crank *AB* (of adjustable length *R*) rotates with a uniform angular speed. • The crank pin *B* is in the shape of a die block which is free to slide inside the slot in the slotted lever *OBC*. This slotted lever is pivoted at *O* and the other end *C* is connected to the ram by a short link arm as shown in Fig. (*a*).	**02 marks for sketch, 02 marks for explanation**

- When the crank *AB* rotates clockwise from position *AB*1 to *AB*2, the ram moves forward from left to right and when it rotates from position *AB*2 to *AB*1 the ram returns back to its original position.
- Clearly the time taken to complete forward stroke is proportional to angle (refer to Fig. (*b*)) and the return stroke is completed in less time which is proportional to angle β.

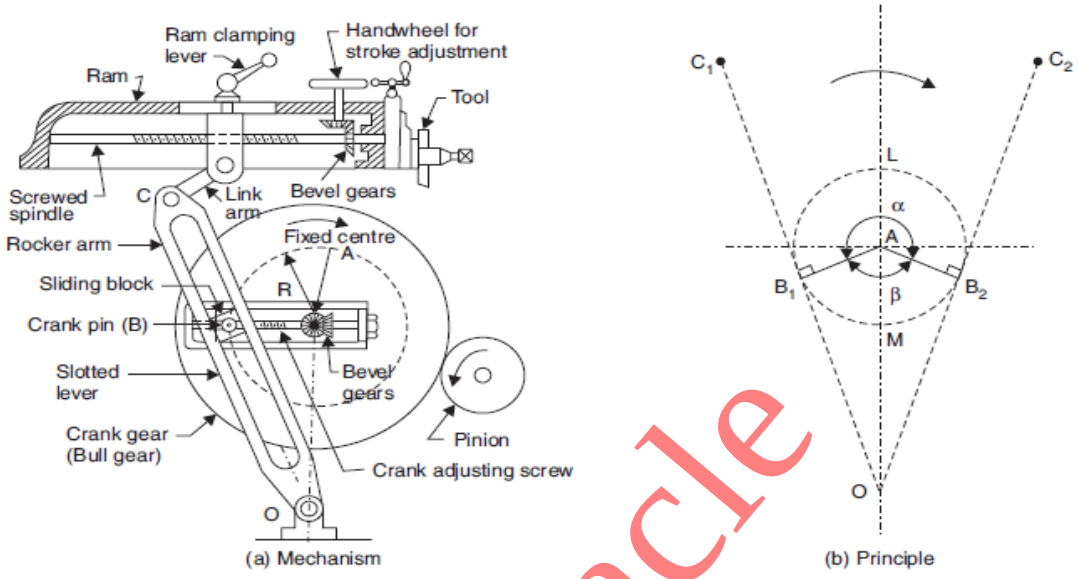


Fig. Quick return mechanism

c

Importance of Color coding used for pattern

- Identify the core prints, loose pieces etc.
- Identify quickly the main body of the pattern and different parts of the pattern to form the main body of a casting.
- Identify the surfaces to be machined or not to be machined.
- Indicate the type of metal to be cast.

The following color coding is generally used in Pattern making

RED:- Surfaces to be machined

BLACK:- Surfaces to be left unmachined.

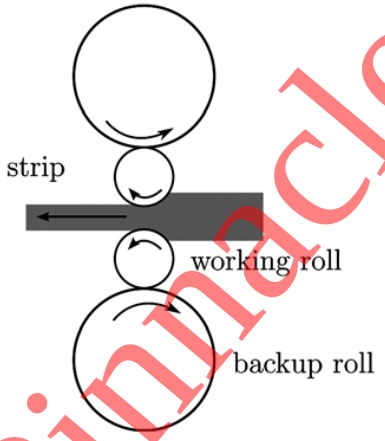
Yellow:- Core Prints

Red strips on yellow base:- Seats for loose pieces

Black strips on yellow base:- Stop offs

Clear or No colour:- Parting surface

½ for mark each reason (any four), ½ mark for each color (any four)

	d	i) Credit Card :- Plastic compounding and molding, Printing, Lamination, Cutting and Embossing. ii) Carrying case:- injection moulding iii) Hollow cylinder:- extrusion iv) Knobs:- compression moulding	**01 mark each**
	e	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. 	**02 marks for sketch, 02 marks for explanation**
Q.5		**Attempt any TWO of the following:**	**12**
	a	**Important Parts of Lathe and their Functions** **1. Bed** It is the main body of the machine. All main components are bolted on it. It is usually made by cast iron due to its high compressive strength and high lubrication quality. It is made by casting process and bolted on floor space. **2. Tool post** It is bolted on the carriage. It is used to hold the tool at correct position. Tool holder mounted on it. **3. Chuck** Chuck is used to hold the workspace. It is bolted on the spindle which rotates the chuck and work piece. It is four jaw and three jaw according to the requirement of machine. **4. Head stock** Head stock is the main body parts which are placed at left side of bed. It is serving as holding device for the gear chain, spindle, driving pulley etc. It is also made by cast iron.	**01 mark each any six**

		5. Tail stock Tail stock situated on bed. It is placed at right hand side of the bed. The main function of tail stock to support the job when required. It is also used to perform drilling operation. **6. Lead screw** Lead screw is situated at the bottom side of bed which is used to move the carriage automatically during thread cutting. **7. Legs:** Legs are used to carry all the loads of the machine. They are bolted on the floor which prevents vibration. **8. Carriage :**It is situated between the head stock and tail stock. It is used to hold and move the tool post on the bed vertically and horizontally. It slides on the guide ways. Carriage is made by cast iron. **9. Apron:** It is situated on the carriage. It consist all controlling and moving mechanism of carriage. **11. Guide ways:** Guide ways take care of movement of tail stock and carriage on bed. **12. Spindle:** It is the main part of lathe which holds and rotates the chuck.	
	b	**1. Blow holes:** It is smooth sound cavities produced in a casting due to entrapped bubbles of gases, steam. **Causes:-** i) Excessive moisture in the sand. ii) low permeability of sand iii) Sand grains are too fine iv) Sand is rammed too hard v) Venting is insufficient **Remedies:-** i) Moisture content of the sand must be well. ii) Sand of proper grain size should be used. iii) Ramming should not be too hard. iv) Vent holes should be provided. **2. Mis-run and cold shut:-** When molten metal fails to fill the entire cavity of the mould, incomplete casting is obtained. This defeat is called mis-run and imperfect fusion of two stream of molten metal in the mould cavity results in a discontinuity called cold-shut. **Causes:-** i) Too thin sections and wall thickness. ii) Improper gating systems. iii) Damaged pattern. iv) Slow and intermediate pouring. v) Pour fluidity of metal. vi) Improper ally composition. **Remedies:-** i) Use hotter metals ii) Frequent inspection and replacement of pattern. iii) Proper design of gating and raiser iv) Use of chills and padding.	**01 mark each (any six types of causes and their remedies)**

3. Drop: - This is an irregular deformation of the casting produced when a portion of the sand drops into the molten metal.

Causes:-

i) It is caused due to low strength

ii) soft ramming

iii) Insufficient reinforcement of hanging section

Remedies:

i) These can be controlled by adopting proper moulding, gating and melting techniques.

4. Dirt: - Presence of particles of dirt and sand in the casting.

Causes:-

i) improper handling of mould

ii) Presence of sand slag particles in molten metal

Remedies:-

i) Proper handling of mould

ii) Adopting proper moulding, gating and melting techniques.

iii) Proper design of gating and raiser

iv) Use of chills and padding

5. Shifts: - It is a misalignment of top and bottom parts of mould at parting line. This results in mismatch of the casting, incorrect dimension, incorrect location of holes.

Causes:-

i) misalignment of pattern parts, due to worn or damaged patterns

ii) misalignment of moulding box or flask equipment

Remedies:-

i) ensuring proper alignment of the pattern, moulding boxes

ii) correct mounting of pattern on pattern plates etc

6. Fins and flash: - It is a thin metal projection on casting.

Causes:-

i) incorrect assembly of moulds and cores

ii) Improper clamping of the mould

iii) excessive rapping of the pattern

iv) insufficient weight on the top part of the mould

Remedies:-

i)These can be controlled by adopting proper moulding, gating and melting techniques.

ii) insufficient weight should be placed on the top part of the mould

7. Swell: - It is un-intentional enlargement found on the casting surface due to liquid metal pressure.

Causes:-

i) improper ramming

ii) low strength of mould

iii) Pouring the metal too rapidly

Remedies:-

i) Proper ramming of sand

ii) uniform flow of molten metal into the mould

8. Run-out: - This defect occurs when molten metal leaks out to the mould during pouring. It results in incomplete casting.

Causes:-

i) defective moulding boxes
ii) inadequate mould weights
iii) excessive pouring pressure

Remedies:-

i) The corrective measures taken in respect of the above reasons will prevent this defect.

9. Warpage: - This is unintentional and undesirable deformation of casting produced during solidification of metal.

Causes:-

i) inadequate and improper gating, runners and risers
ii) continuous large flat surface on casting, indicate a poor design

Remedies:-

i) This defect can be eliminated by modifying the casting design and proper directional solidification.

10. Hot tears (Hot Cracks):- These are internal or external cracks resulting immediately after the solidification of metal.

Causes:-

i) abrupt changes in section
ii) poor design
iii) incorrect pouring temperature

Remedies:-

i) abrupt change in section should be avoided
ii) Pouring temperature should be correct
iii) there should be even rate of cooling

11. Core shift
12. Shrinkage
13. Core blow
14. Scabs
15. Pour short
16. Metal penetration
17. Rough surface finish

c

Direct extrusion	Indirect extrusion
Simple, but the material must slide along the chamber wall.	In this case, material does not move but die moves.
High friction forces must be overcome.	Low friction forces are generated as the mass of material does not move.
High extrusion forces required but mechanically simple and uncomplicated.	25–30% less extruding force required as compared to direct extrusion. But hollow ram required limited application.
High scrap or material waste—18–20% on an average.	Low scrap or material waste only 5–6% of billet weight.

01 mark for each point (any 02), ½ mark for each merit (any 02), ½ mark for each demerit (any 02) for direct and

		Advantages of Direct Extrusion:- 1) close tolerance can be achieved with production of long shells 2) Direct extrusion can be employed for extruding solid circular or non-circular sections, hollow sections such as tubes or cups **Disadvantages of Direct Extrusion:-** 1) Friction between the container and billet is high 2) greater forces are required 3) the corresponding extrusion pressure is also higher because of friction between container and billet. **Advantages of Indirect Extrusion:-** 1) There is less friction between the container and billet. 2) Fewer forces are required for indirect extrusion. 3) Indirect extrusion can produce hollow (tubular) cross sections, Disadvantages of Indirect Extrusion:- 1) Indirect extrusion cannot be used for extruding long extrudes. Support of the ram becomes a problem as work length increases.	**indirect extrusion**
Q.6		**Attempt any TWO of the following:**	**12**
	a	**Base or Bed** The base is rigidly built to take up all the cutting forces and the entire load of the machine. The top of the bed is accurately finished to provide guideways on which the saddle is mounted. The guide ways are perpendicular to the column face. **2. Column** The column is the vertical member which is cast integrally with the base and houses driving mechanism of the ram and feeding mechanism. The front vertical face of the column is accurately finished for providing ways in which the ram reciprocates. **3. Saddle** The saddle is mounted upon the guide ways and may be moved toward or away from the column either power or manual control to supply longitudinal feed to the work. The top face of the saddle is accurately finished to provide guide ways for the cross-slide. These guide ways are perpendicular to the guide ways on the base. **4. Cross-slide** The cross-slide is mounted upon the guideways of the saddle and maybe moved parallel to the face of the column. The movement of the slide may be controlled either by hand or power to supply crossfeed. **5. Rotary Table**	**03 marks for sketch, 01 mark for each part (any 03)**

The rotary table is a circular table which is mounted on the top of the cross-slide.

The table may be rotated by rotating a worm which meshes with a worm gear connected to the underside of the table.

The rotation of the table may be effected either by hand or power. In some

In some machines, the table is graduated in degrees that enable the table to be rotated for indexing or diving the periphery of a job in the equal number of parts.

T-slots are cut on the top face of the table for holding the work by different clamping devices. The rotary table enables a circular or contoured surface to be generated on the work piece.

6. Ram and Tool head Assembly

The ram is the reciprocating member of the machine mounted on the guideways of the column. It supports the tool at its bottom end on a tool head.

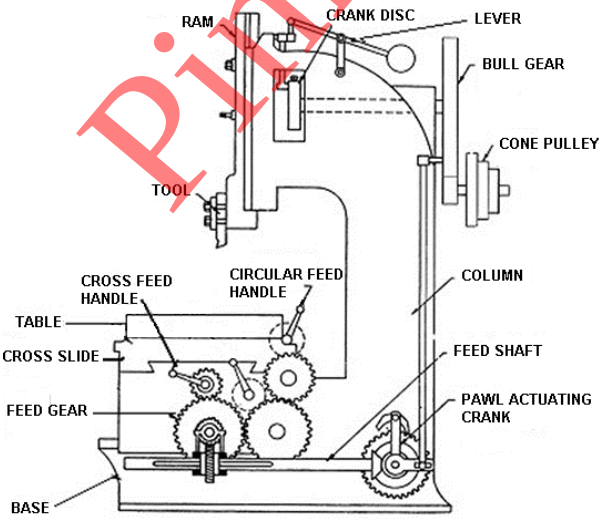
A slot is cut on the body of the ram for changing the position of the stroke.

In some machines, special type for tool holders is provided to relieve the tool during its return stroke.

7. Ram Drive Mechanism

A slotter removes metal during downward cutting stroke only whereas during upward return stroke no metal is removed. The reduce the idle return time quick return mechanism is incorporated in the machine. The usual types of ram drive mechanism are,

Whitworth quick return mechanism.
Variable speed reversible motor drive mechanism.
Hydraulic drive mechanism.



SLOTTER MACHINE

b

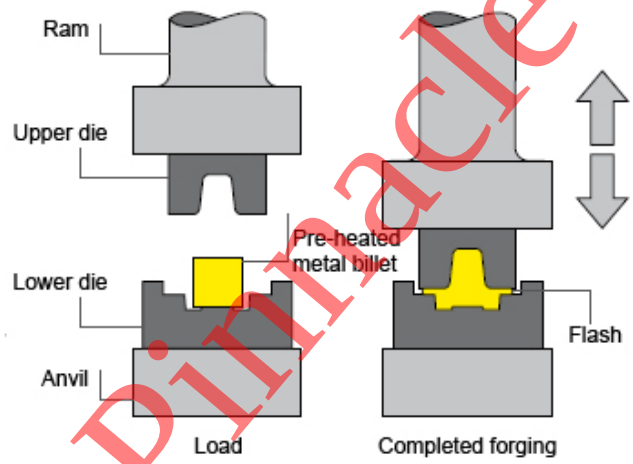
Classification of closed / Impression die forging:-

1) drop forging 2) press forging 3) machine forging 4) Single die 5) Multi die

close die forging :-

Close die forging is also called as Impression die forging. Impression die s generally contains preliminary shaping steps to permit the change from the original forging

02 marks for classification, 02 mark for sketch, 02 mark for explanati

		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.  	**on**
	c	**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 work piece 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.	**03 marks for sketch, 03 marks for explanation**

- 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.

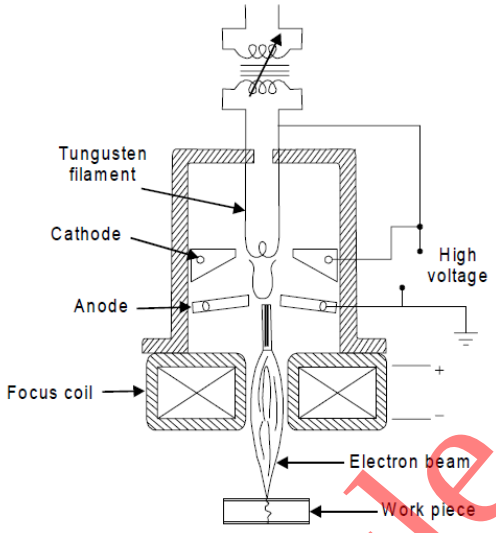


Fig. Electron beam welding set up