Summer-2017 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
Q1		Attempt any SIX of the following	
a)	(i)	State the working principle of closed die forging In close die forging, cavities or impressions are cut in the die block, in which the metal is forced to take its final shape and dimensions. The flow of metal is limited by the surfaces of the impressions. These forgings make good utilization of workpiece material.The grain flow of the metal is controlled to ensure high mechanical properties.	02
	(ii)	State any four applications of rolling Pipes, Tanks, Railway cars, Bicycle frames, Ships, Engineering and military equipment, Automobile and truck wheels frames and body parts. plates, bars, structural sections, channels production.	02
	(iii)	Name any four operations performed on Press. a) Punching b) Blanking c) Notching d) Lancing e) Shearing f) Drawing g) Bending h) Bulging i) Embossing	½ marks (Any Four)
	(iv)	What is forming/ Name any two forming operations. Operations that induce shape changes on the workpiece by plastic deformation under forces applied by various tools and dies. Rolling: Compressive deformation process in which the thickness of a plate is reduced by squeezing it through two rotating cylindrical rolls. Forging: The work piece is compressed between two opposing dies so	02

		that the die shapes are imparted to the work. Extrusion: The work material is forced to flow through a die opening taking its shape Drawing: The diameter of a wire or bar is reduced by pulling it through a die opening (bar drawing) or a series of die openings (wire drawing)	
	(v)	Name any 4 types of Patterns The various types of patterns are commonly used are i) Solid or Single piece pattern. ii)Split pattern iii) Gated pattern iv) Match Plate pattern. v) Cope and drag pattern vi) Loose piece pattern vii) Sweep pattern viii) Skeleton Pattern ix) Segmental Pattern. x) Shell Pattern xi) Follow board Pattern xii)Legged up Pattern xiii)Master Pattern (any four types of patterns half marks each)	02
	(vi)	Enlist different tools used to manufacture the patterns a) Planing tools:- Block plane, Robber plane , Router plane , Circular plane b) Spock shave c) Coping saw d) coping saw e)Dividers f) Trammels g) Callipers h) Pinch dogs i) Files j) chisels	½ marks (Any Four)
	(vi)	State the working principle of casting In casting the metal is melted , then poured into previously made mould or cavity which confirms to the shape of the desired component. After this molten metal is allowed to cool in mould & then it is removed & cleaned . Parts of intricate shapes can be produced.all the metals and alloys and some plastic can be cast.	02
	(viii)	What are the important properties of moulding sand i) Cohesiveness or (strength) of sand, ii) Permeability (Porosity) iii) Plasticity iv) Thermal Stability v) Refractoriness vi) Flow ability, vii) Adhesiveness, viii)Collapsibility ix) It should be reusable and should produce good casting surface. x) It should be bad conductor of heat. (any four properties half marks each)	02
	(i)		

Q 1 b)

Differentiate between soldering and Brazing

Brazing	Soldering
1) Strength of joint is more	1) Strength of joint is Less
2) Filler metals Copper or Silver	2) Filler metals Tin and lead alloy
3) Temperature of filler metal is above 420 ◦C	3) Temperature of filler metal is below 420◦ C
4) Cost is more	4) Cost is less
5) Used in refrigeration systems	5) Used in electrical and electronics systems

four marks for 4 differences(any)

(ii)

State the various important parts of a Lathe & give their functions

Bed:- It acts as base on which different fixed & operating parts are mounted. It has guide ways. It is strong to withstand cutting tool forces.

Headstock:-It is housing for driving pulleys & back gears. It supports main spindle. It has cone pulley, Live center & feed reverse lever.

Tailstock:-It is mounted on the bed of lathe such that it can slide along in alignment with Head stock. It supports the job between centers during operation.

Carriage:- It supports, guides & feed the tool against the job during operation. It consists of saddle , cross-slide, compound rest & tool post

four marks for 4 parts(any)

Apron Mechanism (Feed mechanism):-The gearing mechanism for feed by hand & machine is enclosed in Apron.It controls the feed operation by engaging & disengaging the gears.

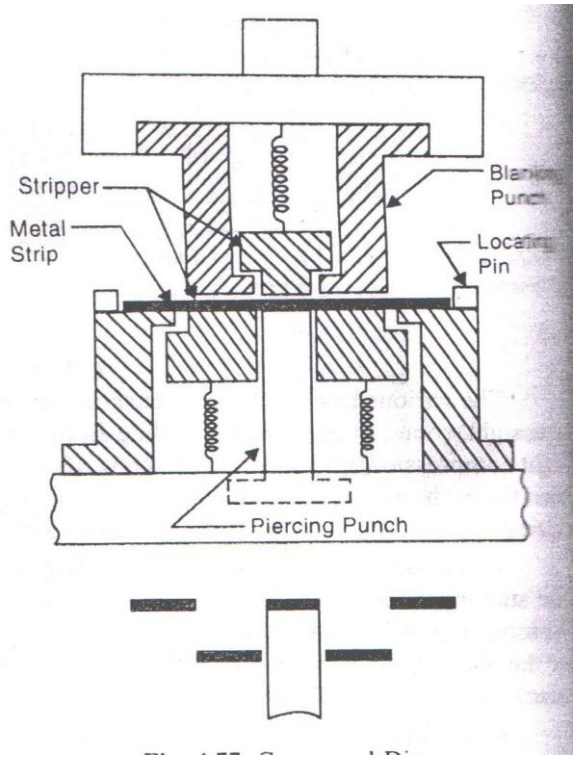
LEGS:- They support & carry entire load of machine. They are secured to the floor by foundation bolts to prevent vibrations in the machine

(iii)

State any four important properties of Plastics

a) Plastic is light in weight
b) Good resistance to most of the chemicals
c) Good corrosion resistance
d) Easy to shape & mould
e) They can be made transparent or coloured.
f) Non-conductance to heat
g) g) Resistant to moisture & grease.

Four marks for 4 points (anyfour)

Q2	a)	Enlist the factors which should be considered while selecting an appropriate press for a given job a) Tonnage :- It varies between 5 T to 4000 T b) Stroke:- Stroke is the distance travelled by ram from extreme top position to extreme down position c) Die space:- Tool surface area of bed & ram available for operation. d) Shut height:- The total opening between ram & bed when ran is in extreme down position. e) Ram speed;- Strokes per min required. f) Press adjustment:- the distance through which ram can be lowered below its shut height.	Four marks for 4 points(any four)
Q2	b)	Explain construction of compound die with neat Sketch  Compound Die. In these dies, two or more operations can be performed at one station .Such dies are considered as cutting tools. As shown in fig No. the washer is produced by simultaneous operation of blanking & peering. These dies are economical for mass production. These dies can be modified to combine more than one operation on single station.	2 marks for Sketch & 2 marks for explanation
Q.2	c)	Drawing is defined as a process of making cup shaped parts from sheet metal blank by pulling it in to dies with help of punch. In drawing operation sheet blanks are in hot or cold conditions. In drawing the	

c) clearance between the punch and die is greater than the shearing.

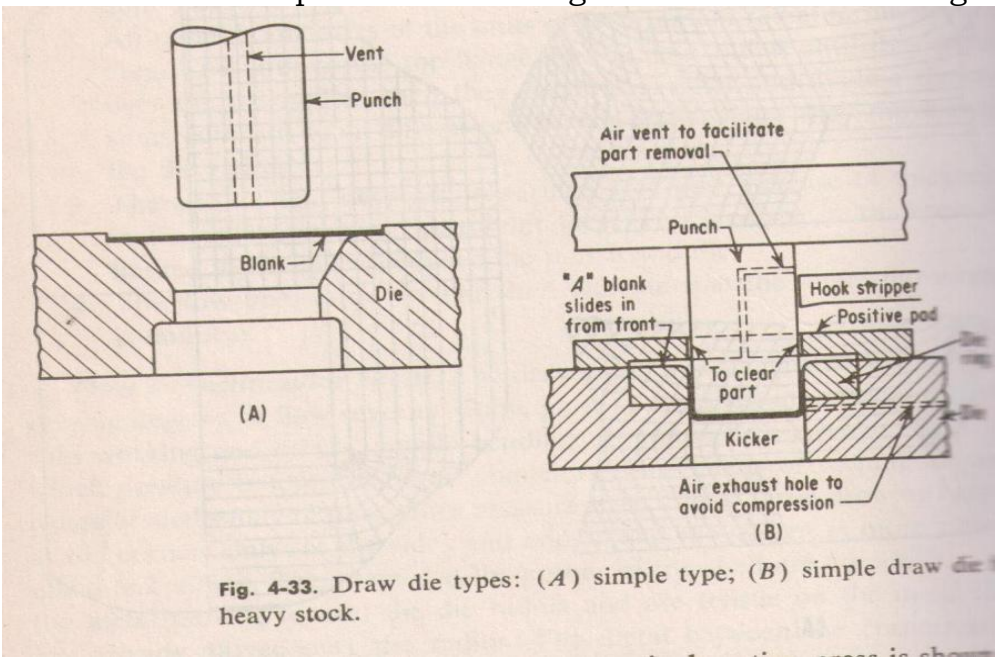


Fig. 4-33. Draw die types: (*A*) simple type; (*B*) simple draw die t heavy stock.

2 marks for Fig & 2 marks for explanation

d) Explain colour coding system used in pattern making

The following colour 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

4 Marks

e) List the various types of moulding sand and explain the important characteristics of any one type of moulding sand

Types of moulding sands

There are three types of moulding sand – (or general classification of moulding sand)

i) Natural moulding sand

ii) Synthetic or high silica sand

iii) Special sand

Important characteristics of **any one** foundry sands are as follows:-

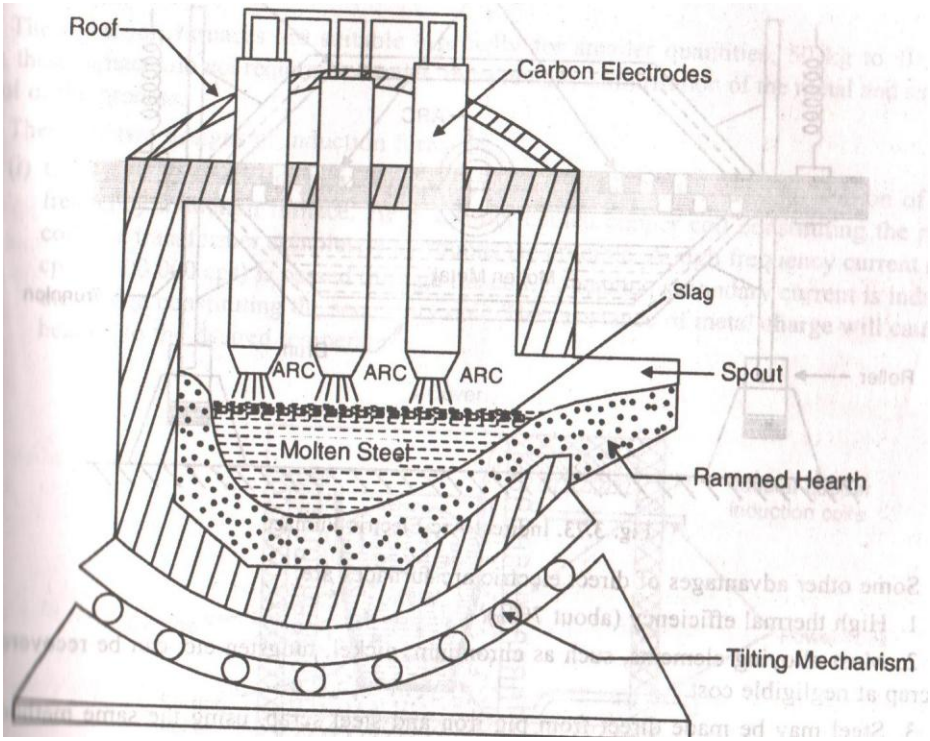
i) Natural molding sand : This is also called as green sand,

Types of sand- 2 marks characteristics 2 marks (any one sand)

		are taken from river beds or are dug from pits. They possesses an appreciable amount of clay which acts as a bond between the sand grains and are used as received with water added. The quantity and type of clay, mineral present affect the strength, toughness and refractoriness of the sand. ii) Synthetic sand ; these are basically high silica sand containing little or no binder (clay) in natural form. They occurs as loose or poorly consolidated deposits of sedimentary origin, dunes blown in land from the coast or accumulated deposits in estuaries and rivers along the coast. This allows greater flexibilities in the content of properties such as green and dry strength , permeabilites and others that can be easily varied as per will by adding additives. iii) Special sand : these are ideal in getting special characteristics which are not ordinarily obtained in other sands. Zircon, olivine , chamotte , chromite and chrome magnesite are often used as special sands. Zircon sand are suitable for cores of brass and bronze casting. Chromite and chrome magnesite are particulary useful where the chilling tendency is to be increased to control solicdification .	

Q. No.	Sub Q. N.	Answer	Marking Scheme
	(f)	**Electric furnace** Electric furnaces are used for melting iron & steel in factories. Since there are no products of combustion (as in crucible furnaces) the loss of elements is minimum. High quality metal is produced for foundry purpose. In this furnace the source of heat is a continuous arc established between carbon electrodes & charged material. The furnace consist of heavy cylindrical steel shell with either a spherical of flat base, which is mounted on rollers to enable tilting the furnace. The charge is contained in the bowl shaped hearth which along with furnace walls arc lined with suitable basic material, such as refractory bricks. Current is carried by three large vertical electrodes arranged in triangular pattern through the roof of furnace. these electrodes can be raised or lowered automatically with help of suitable mechanism. These furnace works on the principle that heat is generated when resistance is offered to the flow of electricity. The electrodes should have high electrical & low thermal conductivity.	Fig 2 marks Explanation 2 marks

(other method of electric furnace should also be considered)



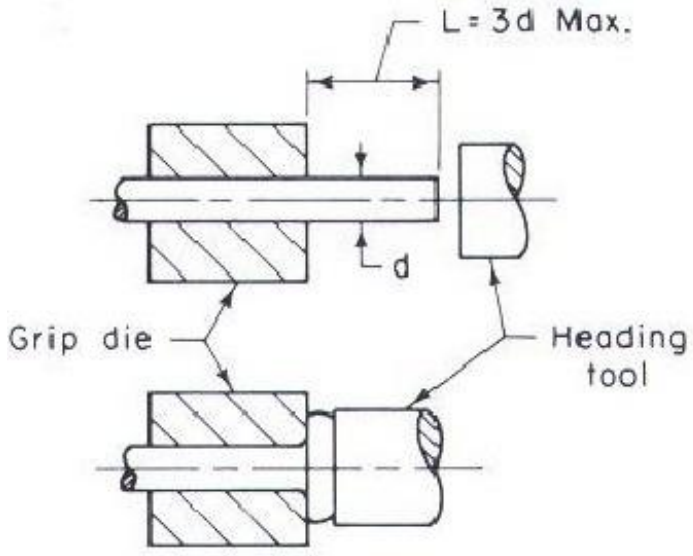
Q3. a) Difference between Direct Extrusion and Indirect extrusion:-

Any 4 points 04 Marks

S. No.	Direct Extrusion	Indirect Extrusion
01	Direct extrusion Employs a press operated Ram and Cylinder in to which work piece is placed for confinement.	Indirect Extrusion is similar to direct extrusion except that the extruded part is forced through the hollow ram.
02	In this process Metal Billet is Movable.	In this process Metal Billet is stable.
03	More Force is required	Less force is required
04	Equipment is Mechanically simple in construction.	Equipment is Mechanically more complicated.
05	Easy support system can be installed for butt.	Limitations of indirect extrusion are imposed by the lower rigidity of hollow ram and difficulty in supporting extruded product as it exists in die
06.	Close tolerances possible, especially in cold extrusion	generally used to produce discrete parts

b) **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.



Upset Forging

Explanation 02 Marks
Sketch 02 Marks

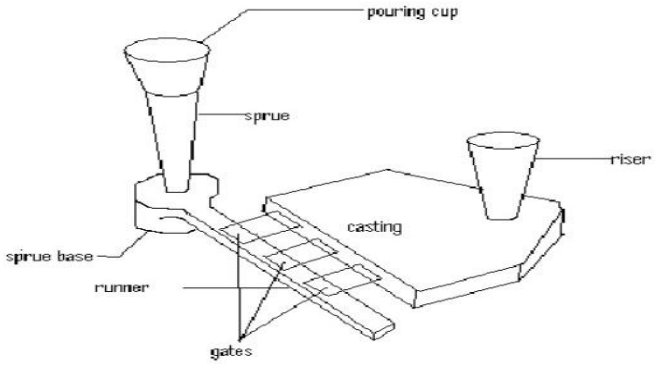
c) **Elements of gating system**:- Gating system means all passages through the molten metal enters the mould cavity.

Pouring basin –from where molten metal is drained

Runner –it is a passage which connects basin and gate

Explanation 02 Marks
Sketch 02 Marks

Gate- it is passage which connects runner and mould cavity.
Riser-after cavity is completely filled liquid level rises in riser passage and draining can be stopped.

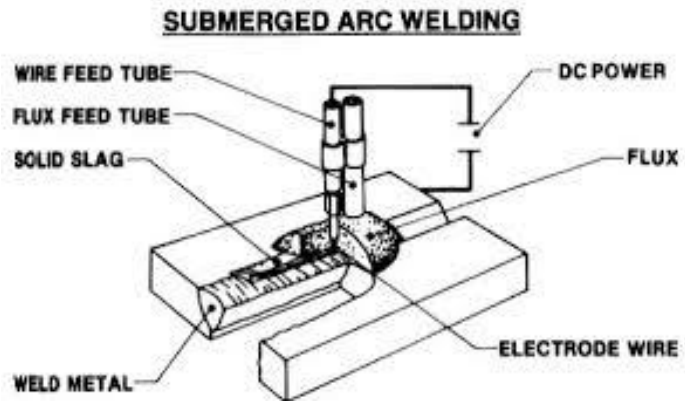


d) **Submerged-arc welding:-**

Submerged-arc welding (SAW) involves the formation of an arc between a continuously fed electrode and the work piece. A blanket of powdered flux, which generates a protective gas shield and a slag (and may also be used to add alloying elements to the weld pool), protects the weld zone. A shielding gas is not required. The arc is submerged beneath the flux blanket and is not normally visible during welding.

Explanation 02 Marks Sketch 02 Marks

SAW is usually operated as a mechanized process. Welding current (typically between 300 and 1000 amperes), arc voltage and travel speed all affect bead shape, depth of penetration and chemical composition of the deposited weld metal. Since the operator cannot observe the weld pool, great reliance must be placed on parameter setting and positioning of the filler wire.



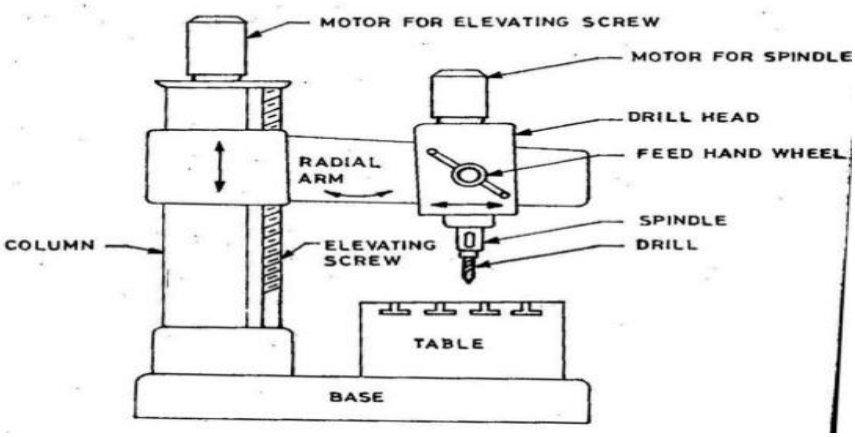
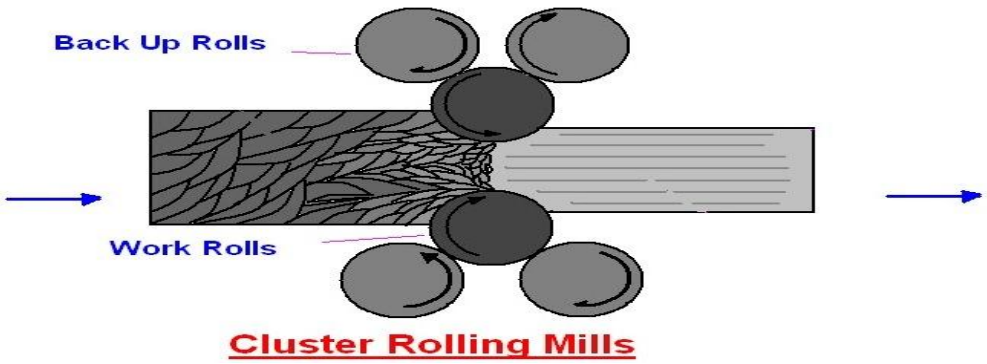
Submerged arc welding

e) Radial Drilling Machine: Functions of elements

Spindle/Drill Head:- To provide variable speed to spindle.

Radial arm :- To provide radial movement of the drilling head along with

Explanation

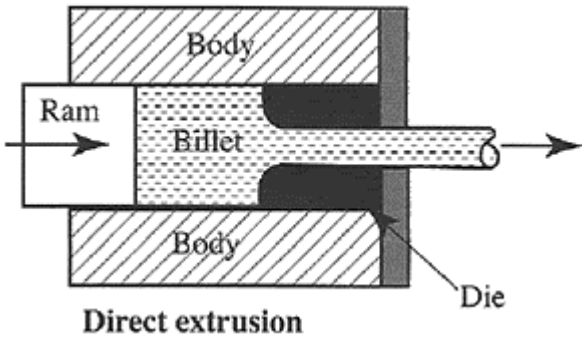
		drilling spindle around the column. Base :- It is the foundation on which all the parts of machine are mounted & it supports the Work piece table . Column:- To support the radial arm, which can be raised or lowered to accommodate jobs of different heights.  Fig No. Radial Drilling Machine	02 Marks Sketch 02 Marks
	f)	Cutting Speed, Feed and Depth Of Cut Related To Drilling Machine. 1. **Cutting Speed:**- Cutting Speed is basically the RPM with which drill bit is rotating with respect to the work piece. 2. **Feed** :- Feed is measure by the amount of material scraped off when a push is given to drill bit inside the work piece .This is the distance by which a drill bit moves along the axis of the hole in a single push. 3. **Depth of Cut** :- Depth Of Cut is the size of the hole we need to make There are different types of holes we generally make with the drillinf operation.	Explanation 04Marks
Q.4	a)	Cluster Rolling Mill:- 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 back up 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 working rolls can be obtained by using a cluster mill.  Fig. No.	Explanation 02 Marks Sketch 02 Marks

Q4 b)

Direct Extrusion

- This is a **hot worked process**
- This is where the ram pushes the metal into the other side through a nozzle
- This usually **requires more force** and is used with more ductile materials
- With application of ram pressure, the metal first plastically fills the cylinder shape, and it is then forced out through the die opening until a small amount remains in the container. It is then sawed off next to the die and the butt end removed.

Explanation 02 Marks
Sketch 02 Marks



Direct extrusion

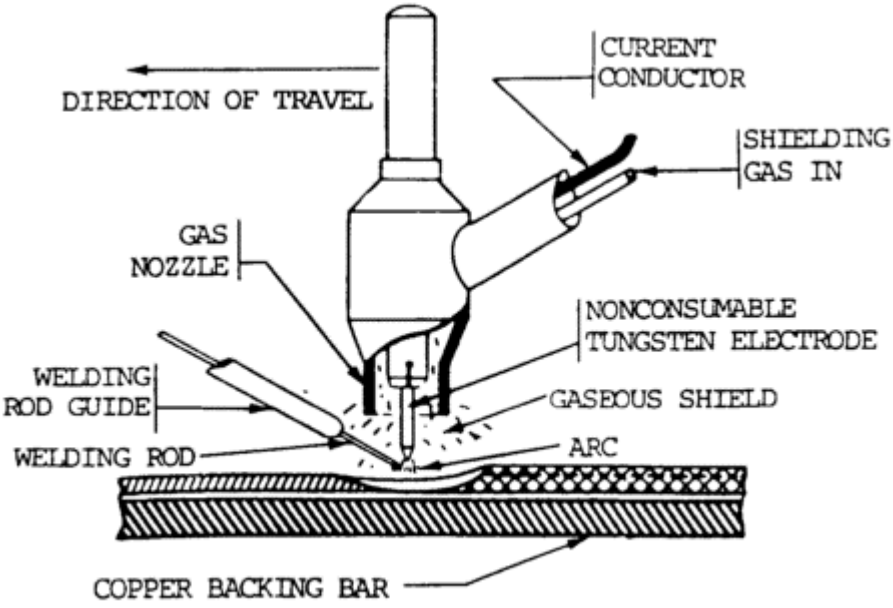
c)

Basic Steps of Soldering

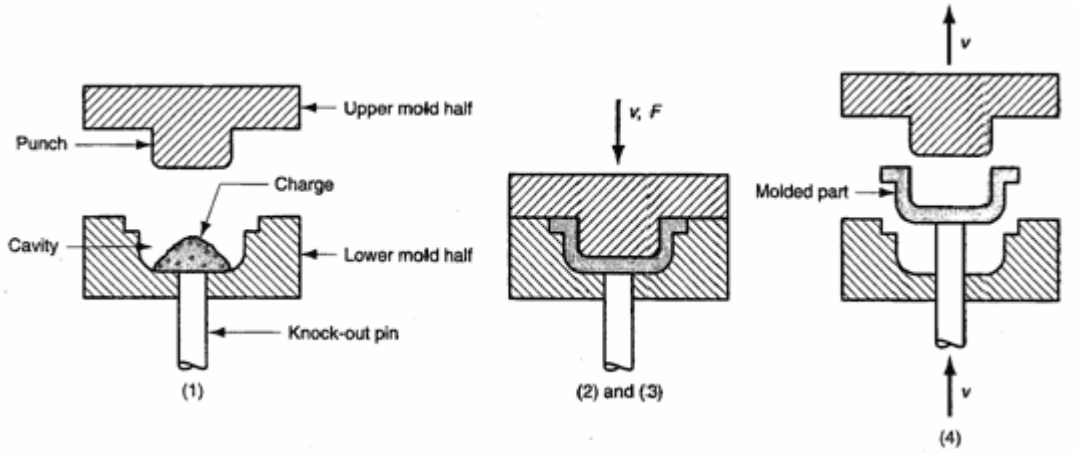
1. **Joint fitting**: A clearance of 0.005" is suitable for most soldering. When soldering precoated metals, a clearance of 0.001" is recommended for maximum mechanical strength.
2. **Cleaning of Joint include**:
   - Mechanical - Scotch Brite pad, emery cloth
   - Chemical - cleaning using acids to remove rust, scale or sulfides. Most commonly used acids are hydrochloric and sulphuric.
3. **Application of flux**
   - Flux should be capable of removing oxides and stop them from reforming.
   - Flux should permit displacement by the solder.
   - Flux should promote wetting of the surface by the solder.
4. **Application of heat**: Heating the joints evenly or uniformly is of utmost importance to insure a sound joint.
5. **Applying the Solder takes place in two steps**:
   1. Wetting the metal surfaces
   2. Filling the gap between the wetted surfaces with solder depending upon conditions dictated by the application, each step can be done separately. This allows for more easily controlled conditions.
6. **Cooling the Joint**:
   - As soon as possible after soldering the joint may be cooled using a water spray or air blast. Slow cooling could cause excessive alloying, resulting in a brittle joint.
7. **Flux Residue Treatment**: Removal is a must to prevent corrosion

Correct steps 04 Marks

Q.4		○ Non-corrosive fluxes are ones which are rosin base and do not require removal. Corrosive fluxes are fluxes containing zinc chloride.	
	d)	**Advantages of Brazing:** 1. Brazing does not melt the base metal of the joint, it allows much tighter control over tolerances and produces a clean joint without the need for secondary finishing. 2. Non-similar metals and non-metals (i.e. metalized ceramics) can be brazed together. 3. Brazing produces less thermal distortion than welding due to the uniform heating of a brazed piece. 4. Complex and multi-part assemblies can be brazed cost-effectively. Welded joints must sometimes be ground flush, a costly secondary operation that brazing does not require because it produces a clean joint. 5. Another advantage is that the brazing can be coated or clad for protective purposes. 6. Brazing is easily adapted to mass production and it is easy to automate because the individual process parameters are less sensitive to variation. **Limitations of Brazing:** 1. The lack of joint strength as compared to a welded joint due to the softer filler metals used. 2. The strength of the brazed joint is likely to be less than that of the base metal(s) but greater than the filler metal. 3. Brazed joints can be damaged under high service temperatures. Brazed joints require a high degree of base-metal cleanliness when done in an industrial setting. 4. Some brazing applications require the use of adequate fluxing agents to control cleanliness. 5. The joint color is often different from that of the base metal, creating an aesthetic disadvantage.	Advantages 02 Marks Limitations 02 Marks
Q.4	e)	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 a 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. 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.  Tungsten Inert Gas Welding	Explanation 02 Marks Sketch 02 Marks
Q.4	f)	Compression Molding :- is a method of molding in which the moulding 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 preforms. 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	Explanation 02 Marks Sketch 02 Marks

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.



Q.5 a)

Compression Molding

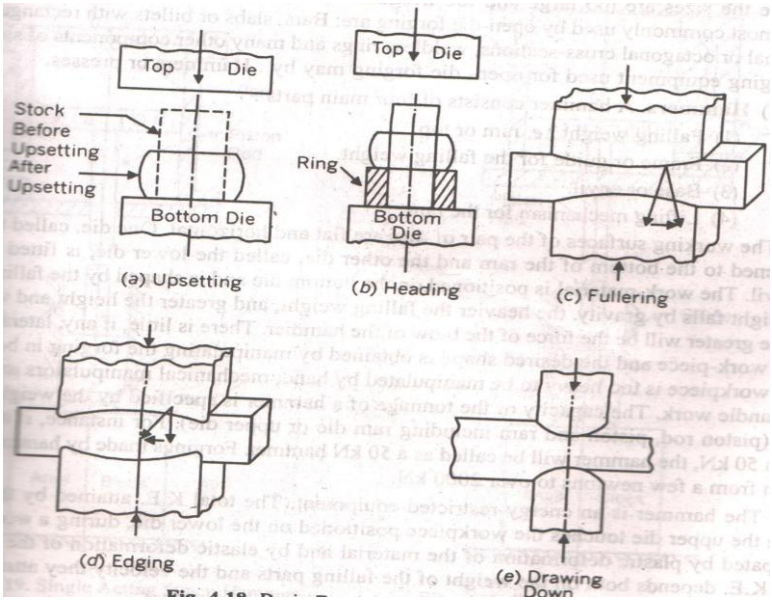
Various forging operations are:-

1. Upsetting	6. Bending	11. Punching
2. Heading	7. Flattening	12. Swaging
3. Fullering	8. Blocking	13. Coining
4. Edging	9. Cut off	
5. Drawing down	10. Piercing	

02 Marks for explanation,

Fig :- Basic forging operations

02 Marks Sketch



Forging operations

b)

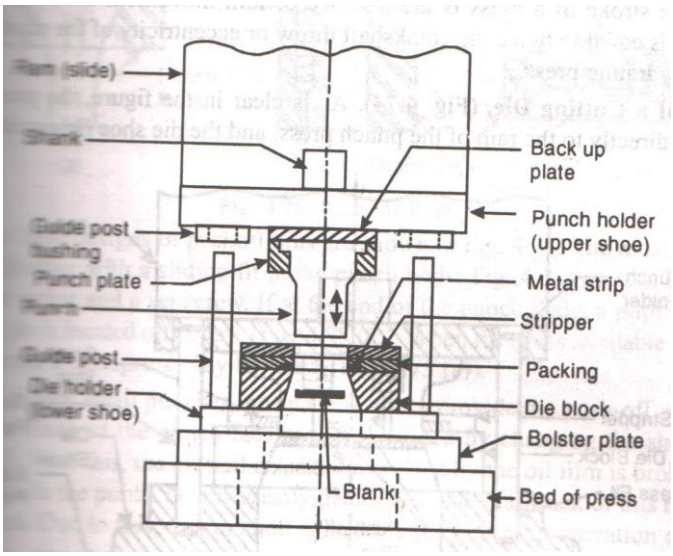
Hot Rolling	Cold Rolling
Hot rolled products have relatively rough surface.	cold rolled products have relatively high surface finish.
Lack of dimensional stability	Better dimensional stability
Machineabity is less	Machineabity is improves
Sheet thickness is generally up to 1.5mm	Sheet thickness is generally up to 6 mm

Or any other four points of differentiation

any 04 points 01 mark each

c)

Simple cutting die:-



2 Marks for Sketch & 2 Marks for components names

Components Name not Visible

d)

Classification of presses

1. Source of power - Mechanical , Hydraulic
2. Method of actuation of rams- Non geared , Geared
3. Number of slides- Single action, Multi action
4. Type of frame- Open, Closed, Inclinable

04 Marks

e)

Casting Defect	Causes	Remedies
Blow holes	Entrapped gases Excessive moisture in sand Venting insufficient Grain size of sand too fine	Moisture content in sand must be controlled Venting should be adequate Ramming should not be too hard
Shifts	Core misplacement Mismatch of top and bottom parts Misalignment of flasks	Proper alignment of the pattern, die parts Checking of flasks, locating pins

02 Mark each defects

02 Marks

f)

Die casting defects:-

Casting Defect	Causes	Remedies
Defects due to cooling of the die 1. Non filling 2. Cold shut 3. Chill 4. Flow lines	Quantity of metal is less than needed Cooling of die or metal Less period of metal shot Shot speed is less	Required quantity of metal must be used Do not allow metal or die to cool Heat metal to correct temperature Pre heating of die
Defects due to the heating up of the die or metal 1. Soldering 2. Crack 3. Bent 4. Broken parts	High temperature of the metal or die Excess of die lubricant Roughness of die surface Content of iron is less in the metal	Keep the temperature of metal and die optimum Do not use excess of lubricant Smoothen the die surface

02 Marks

2 Marks

Q.6

a)

Taper may be defined as a uniform increase or decrease in diameter of a piece of work measured along its length.

Taper turning methods:-

1. Compound rest method
2. Form tool
3. Setting over tail stock
4. Taper turning attachment

Compound rest method :- The compound rest is swiveled to required angle

4 Marks

(Expatiation any One)

$$\tan \alpha = D- d/ 2x L$$

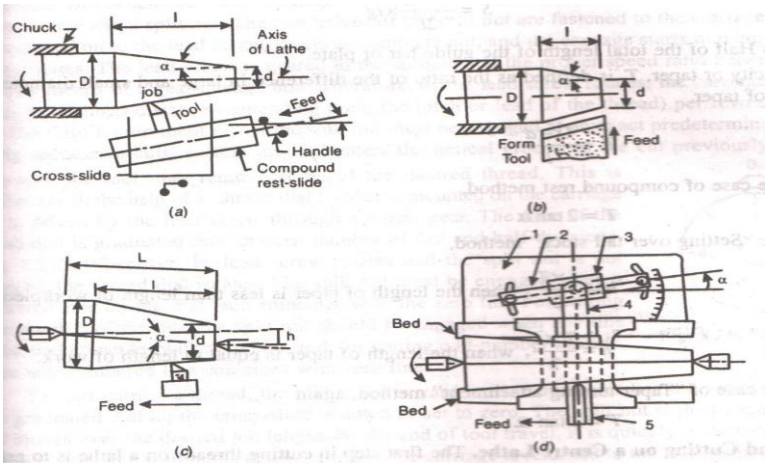
With form tool:- Short external tapers with various angles of taper can be turned with a form tool using cross feed. The width of the form tool slightly exceeds that of the taper being turned

Setting over tail stock:- Long work pieces with a small angle of taper are usually turned by setting over the tail stock center. Tail stock setting over or offset can be determined by

$h = L(D-d)/ 2 x L$

Taper turning attachment: - Long tapered work is frequently turned with a taper turning attachment, generally made up of bracket, guide bar slide.

4 Marks for Sketch



Taper turning methods (Any one of them

Q6 b)

Welding defects and causes

Welding defects	Explanation and causes
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 cause 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

(2 Marks for each defect)

	rod, improper position of the electrode or torch

c) Blow moulding :- In this process, a hot extruded tube of plastic, called a parison, is placed between two part open mould. The two halves of the mould move towards each other so that mould closes over the tube. The tube gets pinch off and welded the bottom by the closing moulds. The tube is then expanded by internal pressure, usually by hot air, which forces the tube against the walls of the mould. The component is cooled and the mould opens to release the component.

Advantages:

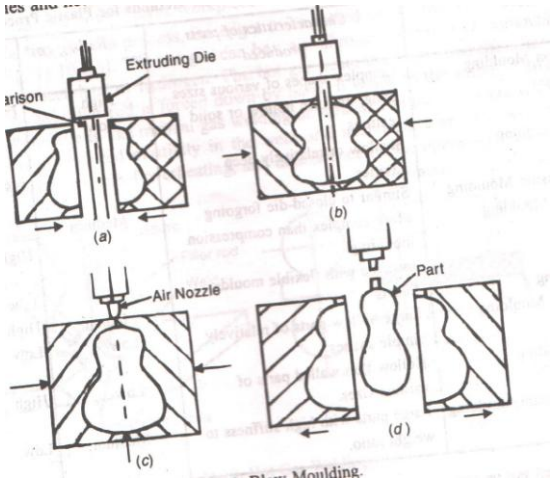
1. High rate of production
2. Better dimensional stability

Limitations:

1. Size of the component should not be too long
2. Wall thickness

Applications:

Bottles Containers



Blow moulding

3 Marks for Explanation

2 Marks for Advantage

2 Marks for Limitations

1 Mark for application