



Important Instructions to examiners:

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

Marks

1. a) Attempt any SIX of the following.	<b>12</b>
i) Name any four forgeable materials.	2
Answer : <b>Forgeable materials</b> - Any four (1/2 mark each)	
1. Aluminum alloys                      5. Low-alloy steels                      9. Titanium alloys	2
2. Magnesium alloys                      6. Martensitic stainless steels                      10. Tantalum alloys	
3. Copper alloys                      7. Austenitic stainless steels                      11. Molybdenum alloys	
4. Plain carbon steels                      8. Nickel alloys                      12. Tungsten alloys	
ii) Draw blanking operation with label.	2
Answer: <b>Blanking operation</b> (Sketch 1 mark, labeling 1 mark)	
	2



iii) Give classification of welding.	2
<p>Answer: <b>Classification of Welding</b> (Any four main/sub points ½ mark each)</p> <p><b>1. Arc welding</b></p> <ul style="list-style-type: none"><li>a. Carbon Arc Welding;</li><li>b. Shielded Metal Arc Welding (SMAW)</li><li>c. Submerged Arc Welding (SAW)</li><li>d. Metal Inert Gas Welding (MIG, GMAW)</li><li>e. Tungsten Inert Gas Arc Welding (TIG, GTAW)</li><li>f. Electro slag Welding (ESW)</li><li>g. Plasma Arc Welding (PAW)</li></ul> <p><b>2. Resistance Welding (RW)</b></p> <ul style="list-style-type: none"><li>a. Spot Welding (RSW)</li><li>b. Resistance Butt Welding (UW) :<ul style="list-style-type: none"><li>1) Flash butt welding</li><li>2) Upset butt welding</li></ul></li><li>c. Seam welding</li><li>d. Projection welding</li><li>e. Percussion welding</li></ul> <p><b>3. Gas Welding (GW)</b></p> <ul style="list-style-type: none"><li>a. Oxyacetylene Welding (OAW)</li><li>b. Oxyhydrogen Welding (OHW)</li><li>c. Air acetylene gas welding</li></ul> <p><b>4. Solid State Welding (SSW)</b></p> <ul style="list-style-type: none"><li>a. Forge Welding (FOW)</li><li>b. Cold Welding (CW)</li><li>c. Friction Welding (FRW)</li><li>d. Explosive Welding (EXW)</li><li>e. Diffusion Welding (DFW)</li><li>f. Ultrasonic Welding (USW)</li></ul> <p><b>5. Thermit Welding (TW)</b></p> <p><b>6. Newer welding process</b></p> <ul style="list-style-type: none"><li>a. Electron Beam Welding (EBW)</li><li>b. Laser</li></ul>	2



iv) Enlist types of resistance welding.	2
<p>Answer: Any four (½ mark each)</p> <p><b>Types of Resistance Welding</b></p> <ul style="list-style-type: none"><li>a. Spot Welding (RSW)</li><li>b. Resistance Butt Welding (UW) :<ul style="list-style-type: none"><li>1) Flash butt welding</li><li>2) Upset butt welding</li></ul></li><li>c. Seam welding</li><li>d. Projection welding</li><li>e. Percussion welding</li></ul>	2
v) List any four surface cleaning processes.	2
<p>Answer: <b>Surface cleaning processes</b> (Any four main/sub points - ½ mark each)</p> <p><b>I. Chemical Cleaning</b></p> <ul style="list-style-type: none"><li>a. Solution</li><li>b. Saponification</li><li>c. Emulsification</li><li>d. Dispersion</li><li>e. Aggregation</li></ul> <p>Depending on cleaning fluids used, types of chemical cleaning are</p> <ul style="list-style-type: none"><li>1. Alkaline cleaning</li><li>2. Acid pickling</li><li>3. Electrolytic cleaning</li><li>4. Emulsified solvent cleaning</li><li>5. Vapour degreasing</li><li>6. Ultrasonic cleaning</li></ul> <p><b>II. Mechanical Cleaning.</b></p> <ul style="list-style-type: none"><li>a. Abrasive blast cleaning (Blasting)</li><li>b. Tumbling</li><li>c. Barrel rolling</li><li>d. Power brushing</li><li>e. Machine polishing &amp; buffing</li></ul> <p><b>III. Ultrasonic cleaning</b></p> <p><b>IV. Flame cleaning</b></p>	2





1. Initial cost of die is high.
2. High tool maintenance.
3. No cored holes.
4. Limitation in size and shape.
5. Heat treatment process increases cost of the product.
6. Brittle materials like cast iron cannot be forged.
7. Complex shape cannot be produced by forging.
8. Rapid oxidation of metal surface at high temperature wears the dies

2

ii) Explain with neat sketch open die and close die forging.

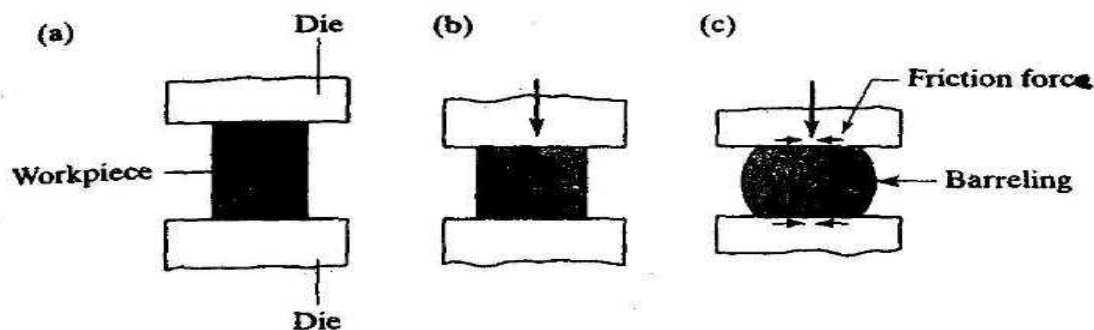
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Answer:-(*Open Die Forging – 2 Marks & Close Die Forging – 2 Marks*)

**Open die forging:** (*Explanation - 1 mark & Sketch-1 mark*)

This process also known as flat die forging. A solid work piece is placed between two flat face dies as shown in fig. Deformation of work piece takes place in between two flat face dies. It reduces their height by compressing it. The open die forging is used to produce relatively simple forging. Due to constant volume, reduction in height increases the diameter of forged part. But in actual working conditions part gets developed in barrel shape as shown in fig. In open die forging Complex shape with great accuracy is very difficult to forge.

1



1

**Fig:-Open Die forging**

**Closed Die forging:** (*Explanation - 1 mark & Sketch-1 mark*)

It is also known as impression die forging. Close die forging process consist of specially prepared dies to manufacturing forged parts in large quantities. The work piece takes the shape of the die cavities (impression) during forging process. Some materials come outwards and form a flash. Generally this process is used for mass production with high degree of accuracy. Complex shaped parts can be forged by this forging process.

1

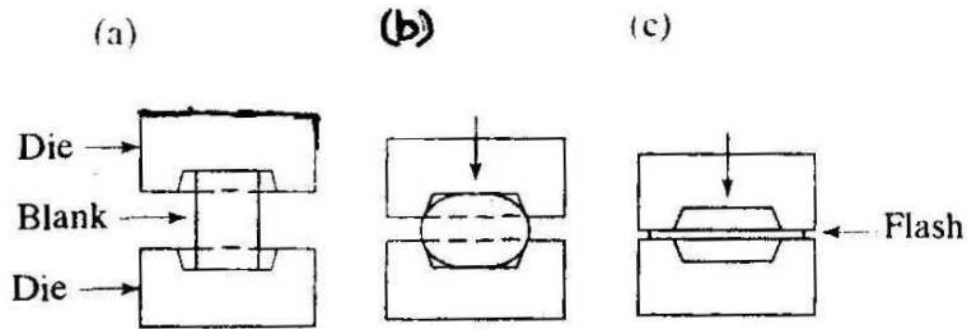


Fig:-Closed Die forging

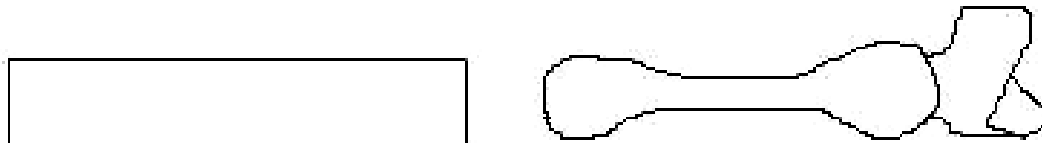
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iii) Describe forging sequence for connecting rod with neat sketch.

4

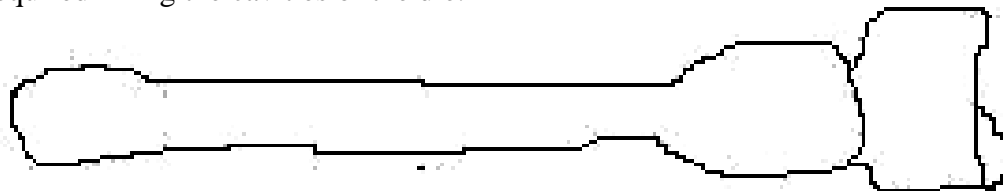
Answer :- **Forging sequence of connecting rod:** (Sketch:-2 marks, explanation 2 marks)

1) Fullering - The heated stock is elongated by reducing its cross section in first die.

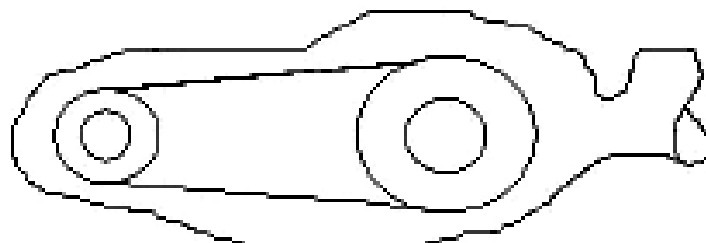


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2) Edging- The metal is redistributed, increasing the cross section at certain places and reducing at others as required filling the cavities of the die.

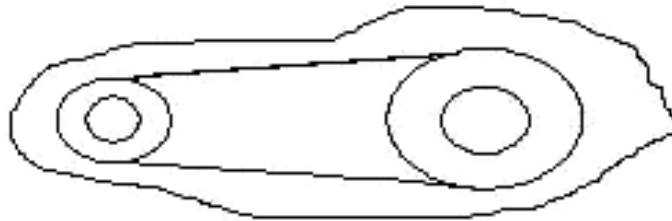


3) Blocking - General shape is given in first blocking die.

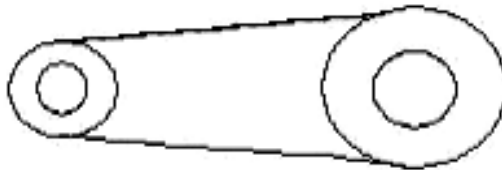




4) Impression die- Finished shape is given to forging in final impression die



5) Flash is removed.



6) Heat treatment and machining is done as per requirement

**OR**



Blank (bar stock)



Edging



Blocking



Finishing



Trimming

**Fig. Forging sequence of connecting rod**



<b>2. Attempt any <u>FOUR</u> of the following</b>	<b>16</b>
a) Give classification of forging process.	4
Answer : <b>Classification of forging processes</b> ( <i>Any four</i> ) I. Open die forging: a) Hand forging b) Power forging: i. Hammer forging ii. Press forging II. Close die forging: a) Drop forging b) Press forging c) Machine forging	1 mark each
b) Explain any two forging defects and states its remedies.	4
Answer : <b>Forging defects:</b> ( <i>Any two- 1 mark for Defect; and 1 mark for remedy each</i> ) <b>Most commonly found forging defects and their remedies in metals:</b>  1. <b>Cold Shuts:</b> Short cracks at corners and at right angles to the surface of forging. It is caused due to metal surface folding against itself during forging. <b>Remedy:</b> Die design should make properly. 2. <b>Pitting:</b> Small pits (Depressions) on surface. It is caused by scale. When scales are removed from surface, depressions remain which are known as scale pits. <b>Remedy:</b> Pure ingots should be selected and dies must be cleaned properly before operation. 3. <b>Die shift:</b> It is caused by misalignment between top and bottom forging dies. <b>Remedy:</b> Proper mechanism should be used to avoid mismatching 4. <b>Incomplete filling of dies:</b> Undersize of forging due to less amount of metal. It is caused by insufficient amount of metal, insufficient number of blows, incorrect die design or low temperature of stock. <b>Remedy:</b> Ingot size must be sufficient, hammering should be done properly, die should be designed correctly and temperature of stock should be sufficient 5. <b>Dents:</b> Dents are the result of careless work. <b>Remedy:</b> Proper care should be taken while handling of hot billets etc.	4
c) Describe fly press with neat sketch.	4
Answer: <b>Fly press</b> ( <i> sketch - 2 marks, construction- 1 mark, working -1mark</i> ) <b>Construction :-</b> It is simplest type of all presses, called as hand press / ball press/single side fly press. It consists of robust cast iron frame. Top portion of frame forms the nut. Vertical screw which can 2 go through the nut. Screw carries an arm. Arm supports two cast iron weights (balls) at two ends. Handle used for rotating the arm. Frame extended below the nut to form guides. Ram attached at the bottom of the screw. Ram carries punch at its bottom. Die is fixed at the press base.	1

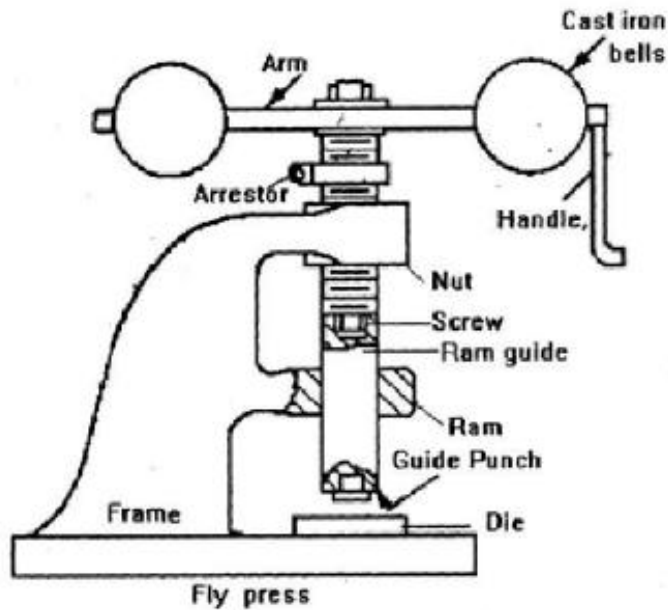




**Working :-**

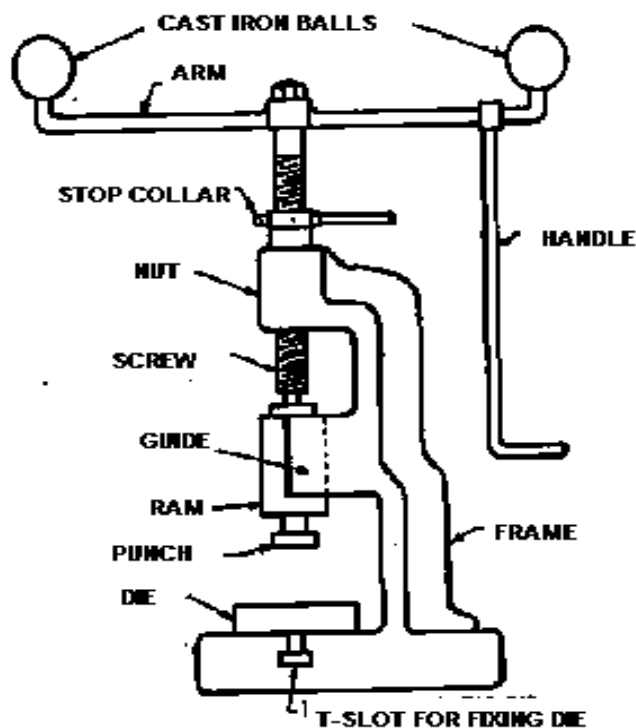
Sheet metal placed over the die. Arm gets quick rotation with the help of handle. Heavy balls stores kinetic energy for long time movement of screw. Movement of screw causes movement of 2 ram & punch downwards. Stroke of the collar adjusted with help of Stop Collar / Arrestor. Advance type of fly press is double side Press.

1

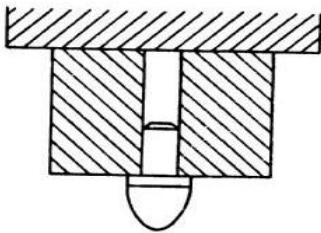
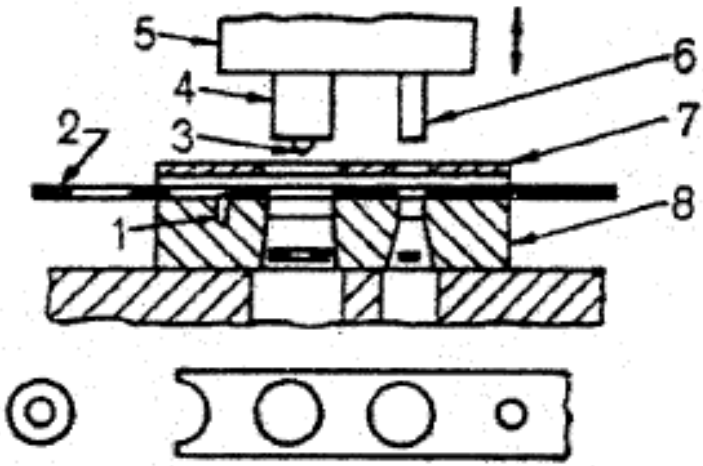


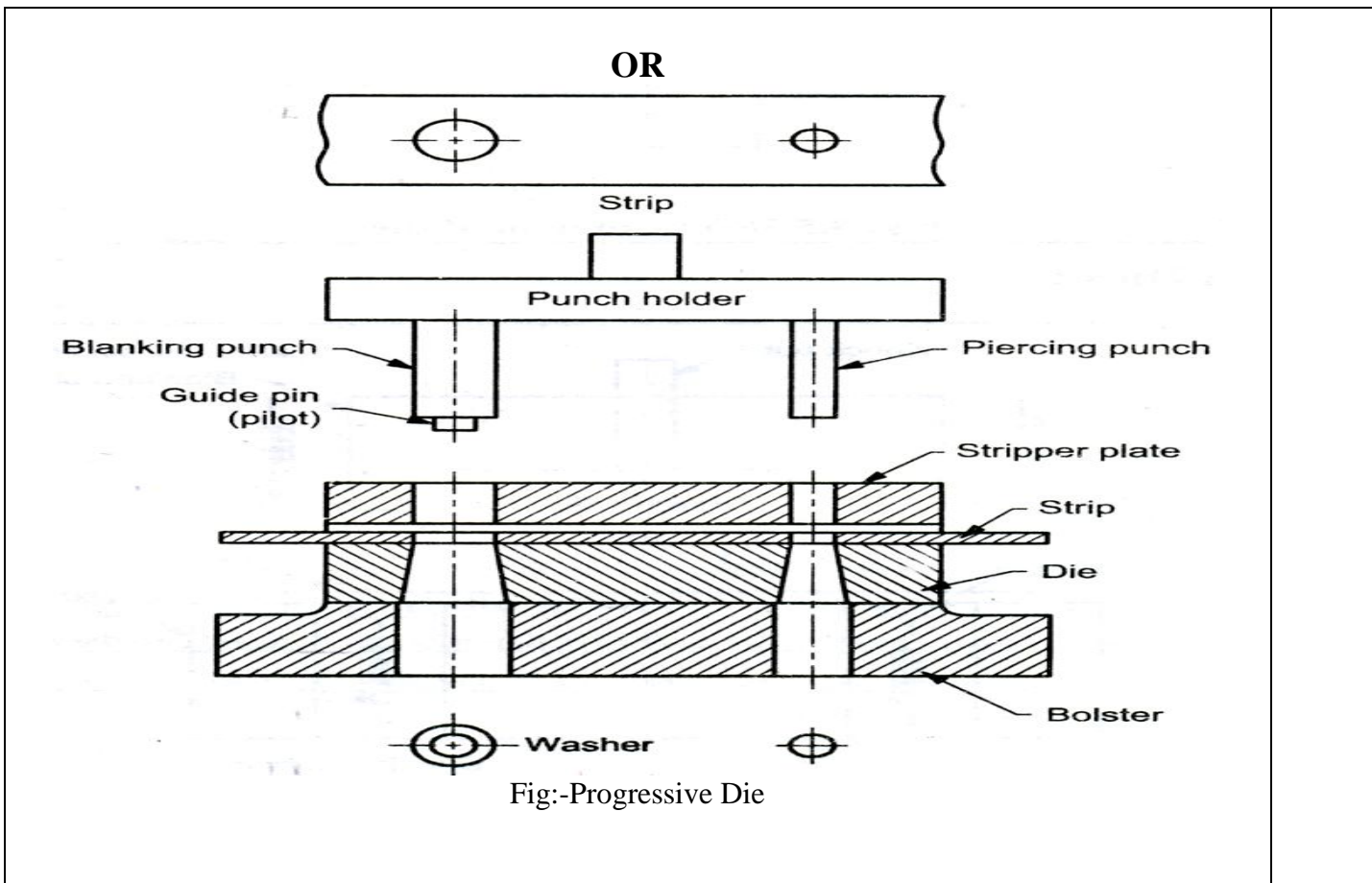
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OR



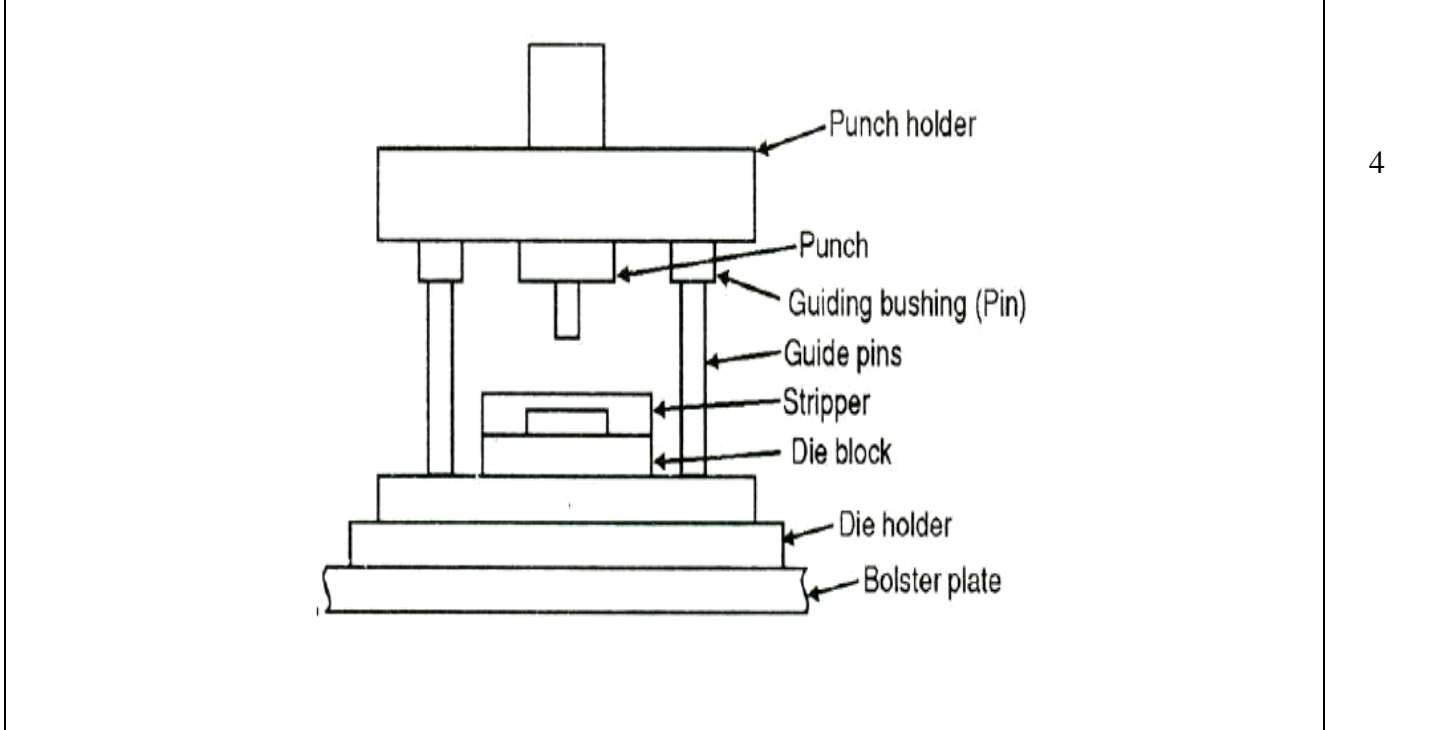


<p>d) Enlist any four die accessories and explain use of pilots.</p>	<p>4</p>
<p>Answer: <i>List -2 marks ,sketch-1 mark ,explanation -1 mark</i>  <b>List of die accessories:- any four (2 marks)</b>          1)Stop          2)stripper          3)pilot          4)knock out          5)Pressure pad</p> <p><b>Use of Pilots: (1 mark sketch, 1 mark explanations)</b>          The pilot illustrated in Fig. enables the correct location of the blank when it is fed by mechanical means. The pilot enters into the previously pierced hole and moves the blank to the correct position to be finally spaced by the stops. The pilots are fitted to the punch holders.</p> 	<p>2</p> <p>1</p> <p>1</p>
<p>e) Explain progressive die with neat sketch.</p>	<p>4</p>
<p>Answer: <i>(Sketch - 2 marks explanation- 2marks)</i>  <b>Progressive Die:</b>          In a progressive die two or more operations are performed simultaneously at two or more stations with each press stroke by mounting separate sets of dies and punch. The metal is progressed from one station to other. Figure shows progressive punching and blanking die .The sheet metal is fed into the first die where a hole is pierced by piercing die set in first cutting stroke of ram .The plate is then advanced in next station. In the second stroke of ram the pilot enters into the pierced hole and correctly locate it while the blanking punch descend and shear the plate to form a washer</p>  <p>1. Stop 2.Sheet metal 3.Pilot 4.Blanking punch 5.Ram 6.Piercing punch 7.Stripper 8.die</p>	<p>2</p> <p>2</p>



f) Draw and identify parts of standard die set. 4

Answer: (Sketch :-2 marks, labelling -2marks)





**3. Attempt any FOUR of the following:**

**16**

a) Distinguish between compound die and combination die.

4

Answer: **Difference between compound die & combination die** (any four )

1  
mark  
each

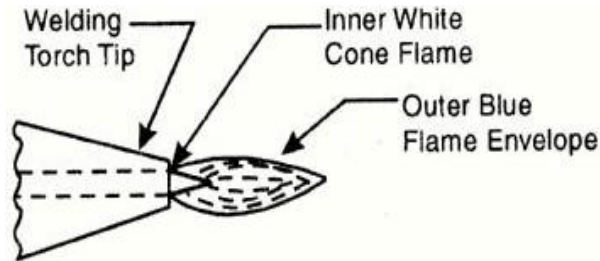
Compound die	Combination die
1. Any two cutting operations can be performed at one station.	1. Both cutting and forming operations can be performed at one station.
2. Both operations are performed in a single stroke of press	2. Two separate strokes of press are required.
3. Jobs produced with high accuracy and close tolerance.	3. Care need to be taken to produce jobs with high accuracy and close tolerance.
4. Blanking, piercing or punching operations are performed.	4. Blanking drawing, bending operations performed .
5. e.g. washer	5. e.g. drawing cup shaped part

b) State types of gas welding flames and enlist their application

4

Answer: (Types- 2 mark , applications -2 mark)

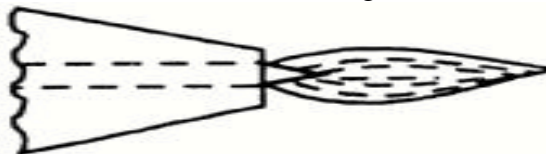
1) **Neutral Flame** :- A neutral flame is obtained when equal amounts of oxygen and acetylene are mixed and burnt in a torch.



4

**Applications** :- stainless steel, cast iron ,copper ,mild steel and aluminium

2) **Oxidizing Flame** :- If more oxygen is added, the cone becomes darker and more pointed, while the envelope becomes shorter and is called Oxidizing flame



**Applications**:- copper base alloy, zinc base metal, Brass and Bronze

3) **Carburizing Flame**: A carburizing or reducing flame is obtained when acetylene is supplied more than oxygen.



**Applications**:-high carbon steel, nonferrous alloy

c) Describe TIG welding process with neat sketch.

4

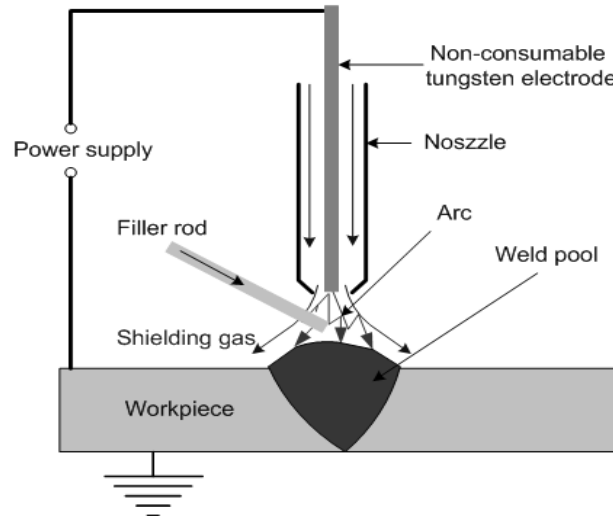
Answer: (Sketch- 2 marks, explanation- 2marks)

**TIG Welding:- Tungsten Inert Gas Arc Welding (TIG, GTAW):**

It is a welding process, in which heat is generated by an electric arc struck between a non-consumable tungsten electrode and the work piece. The weld pool is shielded by an inert gas (Argon, helium, Nitrogen) protecting the molten metal from atmospheric contamination. The heat produced by the arc melts the work pieces edges and joins them. Filler rod may be used, if required. Tungsten Inert Gas Arc Welding produces a high quality weld of most of metals. Flux is not used in the process.

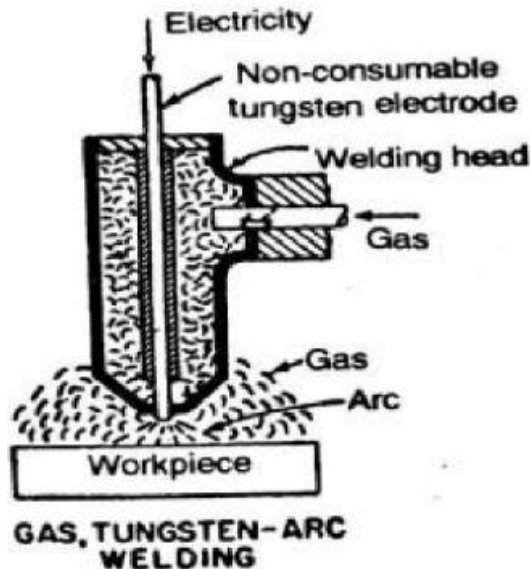
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**Tungsten inert gas arc welding  
(TIG, GTAW)**



2

OR



d) Explain seam welding.

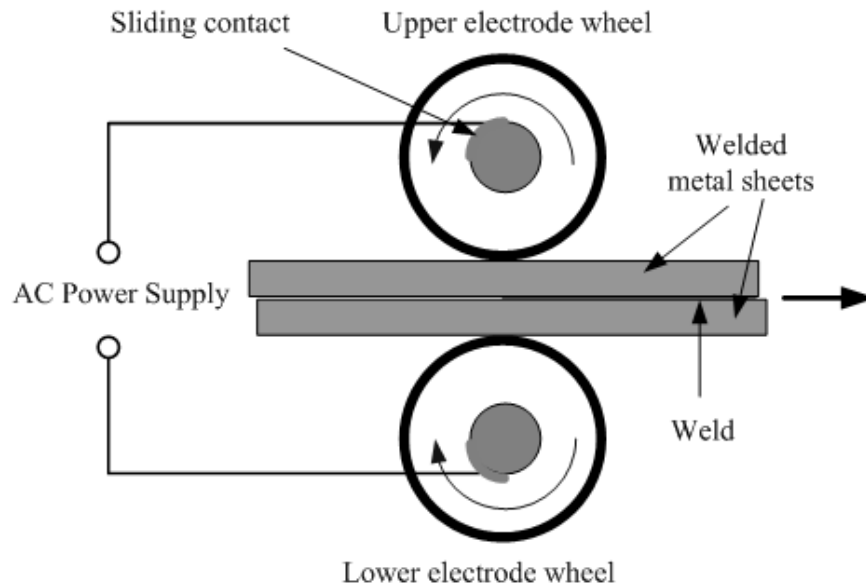
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Answer: *(Sketch - 2 marks, explanation- 2marks)*

**Seam Welding:**

**Seam Welding** is a Resistance Welding (RW) process used for producing continuous joint of overlapping sheets by passing them between two rotating electrode wheels. Heat generated by the electric current flowing through the contact area and pressure provided by the wheels are sufficient to produce a leak-tight weld. Seam Welding is high speed and clean process. Coolant is used to conserve the electrodes and cool the work rapidly to speed up the operation.

2



2

e) Compare arc welding with resistance welding.

4

Answer: **Difference between arc welding and resistance welding** *(Any Four points )*

4

Sr. No.	Arc Welding	Resistance Welding
1)	It is fusion welding	It is plastic welding
2)	Arc is produced by heating with an electric arc, mostly without application of pressure and filler material	Arc is produced by heat due to resistance to flow of current by work & by application of pressure
3)	Filler metal may used	Filler metal is not used
4)	Low welding speed	High welding speed can achieved
5)	Supply can be A.C or D.C.	Supply is A.C only.
6)	Striking voltage is high	voltage require is low
7)	No external pressure is required	External pressure is required.
8)	Welding of similar and dissimilar welding is quite difficult.	Both similar and dissimilar metal can be welded easily.
9)	Reliability & reproducibility depends on skill of worker	Reliability & reproducibility does not depends on skill of worker
10)	More skilled operator can do the job.	Less skilled operator can do the job.



11)	In some arc welding process like TIG, MIG, Plasma arc we use inert gases like argon, helium, CO <sub>2</sub> etc.	In this, inert gases like argon, helium, CO <sub>2</sub> etc. are not used.
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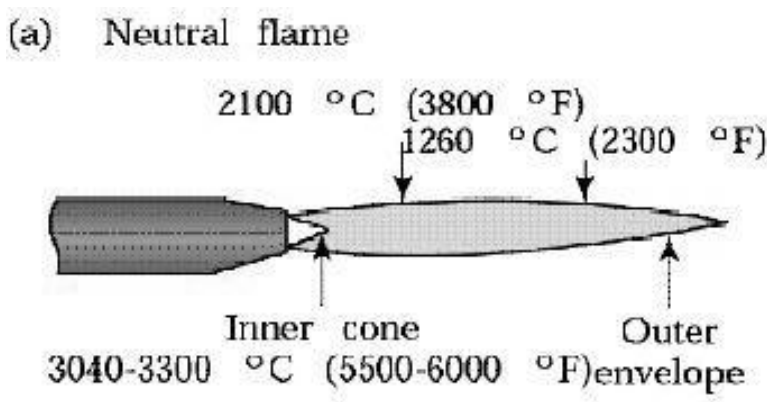
f) Enlist the materials used in press work for automobile application. 4

<p>Answer: <b>Materials used in press work</b> (Any Four)</p> <ol style="list-style-type: none"> <li>1. Aluminium,</li> <li>2. Copper,</li> <li>3. Brass,</li> <li>4. Mild steel,</li> <li>5. Galvanized iron (G.I) sheets,</li> <li>6. Duralumin, Y-alloys is used for deep drawing operation.</li> <li>7. Copper alloys such as naval brass, cartridge brass, and Babbitt metal are used for blanking &amp; punching operation. Brass used in press work may be annealed, quarter hard, half hard, hard, extra hard, etc. Cartridge brass (70% cu and 33% zn ) is used extensively for deep drawing operations.</li> <li>8. Other materials used in press work are stainless steel &amp; its alloys, different types of steels &amp; its alloys., alloy steels, electrical steels, stainless and heat resistance steels, wrought aluminum alloys, wrought magnesium alloys, zinc and zinc alloys, titanium and its alloys etc.</li> </ol>	4
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**4. Attempt any FOUR of the following:** **16**

a) Explain the working principle of gas welding. 4

<p>Answer: <b>Working Principle of gas welding</b></p>	4
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Gas Welding is a fusion welding process. It joins metals, using the heat of combustion of the oxygen/air and combustible gas (i.e. acetylene, hydrogen, propane, or butane) mixture. The purpose of flame is to heat and melt the parent metal and filler rod of the joint. The intense heat produced melts the edges of parts and fuses together to form the welded, generally with the addition of a filler metal. The torch mixes a combustible gas with oxygen in the proper ratio and flow rate providing combustion process at a required temperature.

The flame temperature is determined by a type of the combustible gas and proportion of oxygen in the combustion mixture: 4500°F - 6300°F (2500°C - 3500°C). Depending on the proportion of the fuel gas and oxygen in the combustion mixture, the flame may be chemically



neutral (stoichiometric content of the gases), oxidizing (excess of oxygen), and carburizing (excess of fuel gas). Welding does not require the components to be forced together under pressure until the weld is forms and solidifies.

b) Explain electrolytic cleaning process

4

Answer: **Electrolytic Cleaning:**

This is effective as final cleaning process for removing oil and grease from machined surface when extreme cleanliness is required. It is almost always used for final cleaning of steel parts prior to electro-plating.

4

In electrolyte cleaning, an alkaline cleaning solution is used with electric current passing through the bath in which the parts to be cleaned is either anode or cathode. If the part being cleaned is the cathode, hydrogen is liberated on the surface of the metal being cleaned and process is called cathode cleaning.

If the part being cleaned is the anode, oxygen is liberated on the surface of the metal being cleaned and process is called anodic cleaning. Parts of soft metals must be cleaned cathodically because they would be badly itched if cleaned anodically.

c) Explain lapping process with neat sketch.

4

Answer: **Lapping Process** :- (Sketch- 2 marks explanation -2 marks )

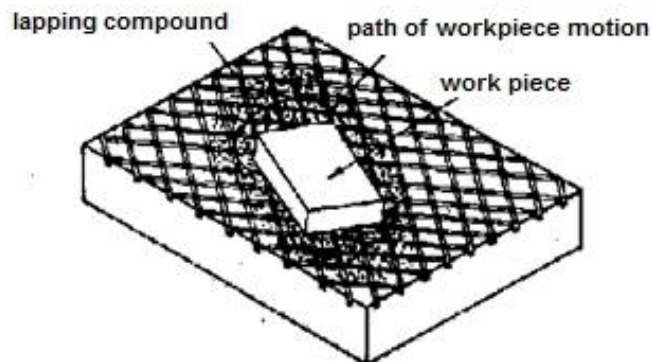
Lapping is basically an abrasive process in which loose abrasives function as cutting points with momentary support of the lap.

Lapping is done in the following two ways: **(Any one of the following)**

**(1) Hand Lapping:**

Lapping can be done by hand held tools for both flat work and external cylindrical work explained as follows: In hand lapping, as shown in Fig., either the lap or the work piece is held by hand and motion of the other enables the rubbing of the two surfaces in contact. This method is used for lapping presswork dies, dies and metal moulds for castings, etc. Sometimes a lapping compound is placed between the two surfaces and then they are moved against each other.

2



2

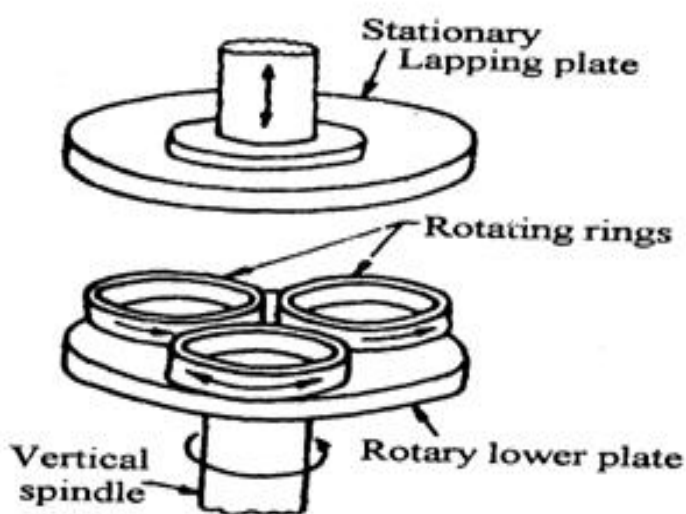
Figure: Hand Lapping





**(2) Machine Lapping:**

In Lapping machines for obtaining flat surfaces, work pieces are placed loosely in holders and are held against the rotating lap by means of floating head, the holders rotating slowly move the work piece in an irregular path. When two parallel surfaces are to be produced, two laps may be employed, one rotating below and other above the work piece. Various types of machines are available for lapping round surfaces. A special type of centerless lapping machine is used lapping small cylindrical parts, such as piston pins and ball bearing races.



**Figure : Machine lapping**

d) Differentiate between galvanizing and electroplating process

4

Answer: **Difference between galvanizing and electroplating process** (Any four)

4

Electroplating process	Galvanizing Process
1) In this the steel is immersed in an aqueous bath, and electricity is used to induce anodes to dissolve in the aqueous solution, transport the ions, and electroplate them onto the work.	1) In galvanizing the work is immersed in molten zinc. As it is withdrawn, the zinc cools and forms a coating of zinc on the work
2) Electroplating coatings are almost always several times thinner	2) Galvanized coatings are almost always several times thicker
3) Electroplated zinc coatings can be smooth and shiny, and preferable for aesthetic reason	3) Galvanizing may be spangled, or gray and drippy.
4) Less corrosion resistant as compared with galvanizing	4) More corrosion resistant
5) Electroplating is thin and usually does not cause any problems with fasteners specially dimensioned to take the coating into account	5) Galvanized coatings are heavy and will interfere with fastener threads unless they are specially dimensioned to take the coating into account



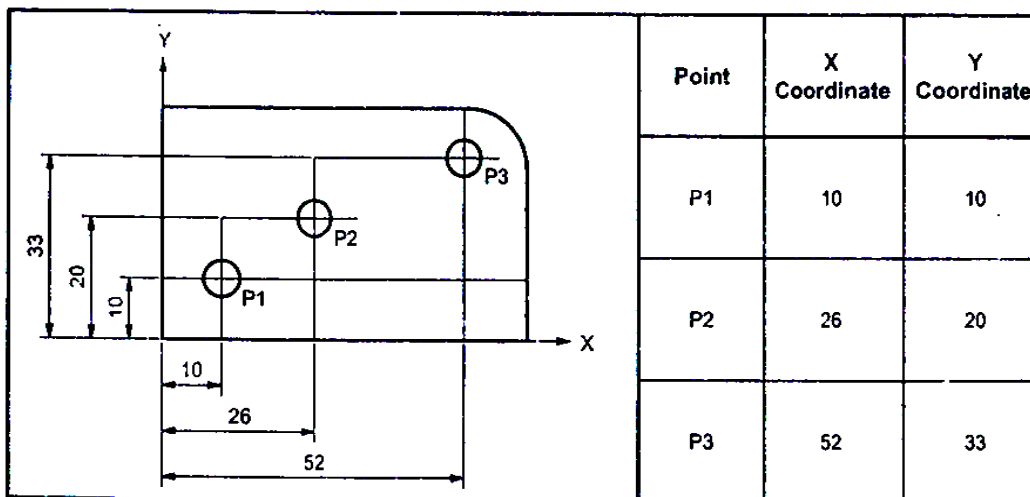
6) Electroplated zinc coatings are not often adequate for direct outdoor exposure. i.e. applicable to indoors in dry climate	6) Galvanized coatings are up to 10x as thick and applicable to outdoor or more wet climate	
7) The cost should be significantly lower than the cost of hot dip galvanizing	7) Cost is more as it is significantly thicker	

e) State absolute and incremental co-ordinate system with neat sketch.

4

Answer:

**Absolute Programming Method** (1 mark explanation, 1 mark sketch)



1

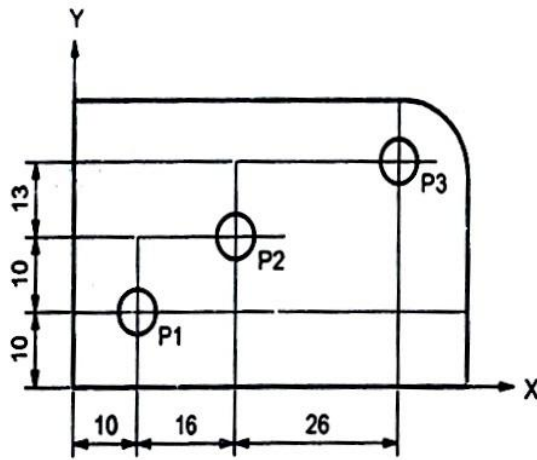
It is a system in which coordinates of the points are referred to one reference point, which is the origin / set point. All the position coordinates are given from origin point. The main advantage of this system is that error in calculating the coordinates of one point is not introduced in coordinates of other point. Checking of the program in this system is easy. The G-code used for incremental programming is G-90.

1

**2) Incremental Programming Method:** (1 mark explanation, 1 mark sketch)

In incremental system the co-ordinates of any point are calculated with reference to previous point i.e. the point at which the cutting tool is positioned is taken as datum point for calculating the co-ordinates of next point to which the movement is to be made. It is difficult to check a part program written on incremental dimension mode. The G-code used for incremental programming is G-91

1



Point	X Coordinate	Y Coordinate
P1	10	10
P2	16	10
P3	26	13

1

f) Give classification of CNC.

4

Answer: **Classification of CNC machines.** (Any Four – 1 Mark Each)

**A. According to control loop feedback system:**

- 1) Open – loop system
- 2) Closed – loop system

**B. According to type of tool motion control system:**

- 1) Finite positioning control system:
  - a) Point – to – point system
  - b) Straight cut system
- 2) Continuous path system:
  - a) Two axes contouring
  - b) Two & half axes contouring
  - c) Three axes contouring
  - d) Multi – axis contouring

**C. According to programming methods:**

- 1) Absolute programming method
- 2) Incremental programming method

**D. According to type of controller:**

- 1) NC based controller system
- 2) CNC based controller system

4

**5. Attempt any FOUR of the following:**

16

a) Give advantages of CNC over NC machine.

4

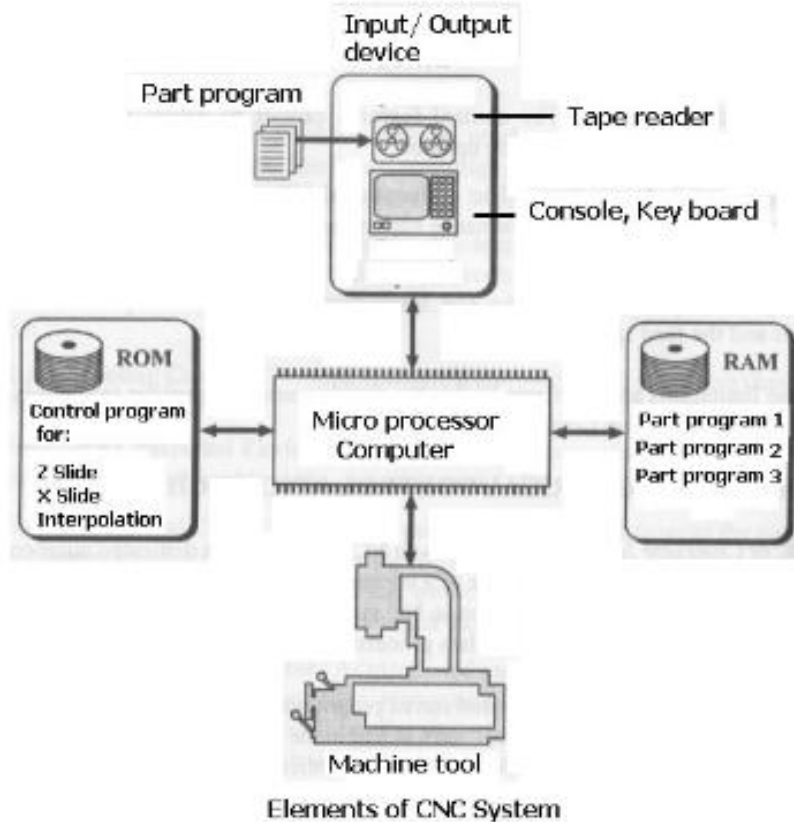
Answer: **Advantages of CNC Machines over NC Machines:** (Any eight, ½ mark each )

1. Complex machining operations can be easily done.
2. It requires less inspection.

½  
mark  
each



<ol style="list-style-type: none"><li>3. It reduces scrap &amp; waste.</li><li>4. It gives high production rate.</li><li>5. It reduces human error</li><li>6. It gives more operator safety.</li><li>7. It gives more operator efficiency.</li><li>8. Tool life gets increased.</li><li>9. Lead time is reduced.</li><li>10. In case of CNC lathe the carbide tip tools are used hence cutting speed faster than conventional lathe &amp; also high feed rate.</li><li>11. CNC lathe movement is controlled by computer (which runs the program while in conventional lathe manual or auto feed is given. More flexibility available in CNC lathe.</li><li>12. CNC lathe can achieve higher accuracy with closed tolerance and very good surface finish as compared to conventional lathe.</li><li>13. Once the program is prepared and fed, less manual interference required in case of CNC lathe hence less skill operator can work on the machine.</li><li>14. Though the initial cost of CNC lathe is more but for mass production and accuracy and quality job CNC lathe has very good option than conventional lathe.</li><li>15. Program can be stored in the memory and can be used when ever required in batch production. Such facility is not available in conventional lathe.</li><li>16. Machines are comparatively small; need not required rigid foundations as conventional machines. Less vibration.</li><li>17. For superior repeatability, reduce machine down time as fast machining cycle.</li><li>18. Tool path simulation is available in CNC lathe which gives idea about job. This feature is not available in conventional machine</li></ol>	
b) Explain working principle of CNC machine.	4
<p>Answer: <b>Working Principle of CNC machine:-</b>(Sketch - 2mark,explanation -2mark)</p> <p>A CNC machine also has a tape reader or any other input media for entry of the part program. CNC uses the part program in a different manner though there is similarity between NC and CNC. In CNC, entire program is first fed to the inbuilt computer memory. Once the program is stored, the machine cycle is then executed by the program. Software with control algorithms converts the part program instructions into actions by the machine tool. This is done by generating pulses for each axis from the controller. Each pulse produces one small unit of motion (SUM). The slide travel is thus decided by the number of pulses. In a closed loop system, the pulses are fed to a reference. The feedback device also sends the signal to the reference. These two signals are compared and necessary action is controlled.</p>	2



c) Explain types of tools used on turning center and VMC.

4

Answer: **Tools used On the Basis of Cutting Tool Material** (Any TWO)

**a) High Speed Steel:** The H.S.S. is carbon steel to which alloying elements like tungsten, chromium, Vanadium, cobalt and molybdenum to be added to increase their hardness and wear resistance.

**b) High Carbon Tool Steel:** High carbon tool steel is suitable for low cutting speeds and low temperatures. The hardness of this tool is determined by the carbon contents.

**c) Cast Alloy:** This is a non ferrous alloy and gives high machining performance than that of H.S.S. Steel. Its hardness and toughness are high at higher temperatures.

**d) Cemented Carbides:** It contains 5% carbon, 13% cobalt and 81% tungsten. this tool is widely used in modern costly machines as tip tools. The tool setting time is reduced.

**e) Ceramics:** It can be used for higher cutting speed, superior surface finish and great machining flexibility. The Aluminium oxides, boron carbides, silicon carbide, titanium borides and titanium carbides are known as ceramics.

**f) Boron Nitride**

(a) High wear resistance.

(b) Used for machining hardened steel and high temperature alloys.

**g) Diamond**

2



<p>(a) Low friction and high wear resistance (b) Good cutting edge. (c) Single crystal diamond is used to machine copper to a high surface finish</p> <p><b>B) Tools on the Basis of Cutting Tool Construction (Any TWO)</b> <b>Solid Tools:</b> Solid tools are usually made of High speed steel or High carbon steel. These tools are used on high speeds with sufficient quantity of cutting fluid to get good surface finish and longer tool life. <b>Brazed Tools</b> A forged shank of high strength steel with belt of high speed steel, tungsten carbide stellite brazed to the shank on the cutting edge. <b>Inserted Bit Tools:</b> The tools with indexable inserts of harder and special grade carbide or ceramic materials. A wear resistant layer of Titanium nitride or Titanium carbide is coated on the insert it reduces the cost of tool. Inserts can be easily removed from the tool holder. So tool changing time and cost of machining are less.</p>	2
<p>d) State function of following ISO codes G00, G02, M02, M30.</p>	4
<p><b>Answer: Functions of ISO Codes (1 mark each)</b> <b>G00</b>-Rapid Transverse <b>G02</b>-Clockwise Circular Interpolation <b>M02</b>-Program end <b>M30</b>-Program stop &amp; Tape rewind</p>	1 1 1 1
<p>e) Give procedure for developing part program</p>	4
<p><b>Answer: Procedure for developing part program (Any one method four marks)</b> There are two methods of part programming: manual part program and computer assisted part programming. <b>Manual part programming:</b> 1. To prepare a part program using the manual method. The programmer writes the machining instructions on a special form called a part programming manuscript. The manuscript is a listing of the relative tool and work piece location. 2. The NC tape is prepared directly from the manuscript. 3. Define the axis coordinates in relation to the work part. 4. Define safe (target point) point and origin point (work zero). 5. The tape is inserted to read the first block in to the system. 6. The functions like machining, tool changing, spindle ON/OFF, coolant ON/OFF, program stop and tape rewinding are carried out as per the program.</p>	4



OR

**Computer- assisted part programming:**

This method is useful for most critical and complex parts. The part programmer and the computer are main tools in this method.

- 1.The part programmer first defines the work part geometry
- 2.He specifies the operation sequence and tool path
- 3.The computer interprets the list of part programming instructions, performs the necessary calculations to convert this into a detailed set of machine tool motion commands, and then controls a tape punch device to prepare the tape.
4. The tape is verified for accuracy.
5. The NC system machines (makes) the part according to the instructions on tape.

f) Explain honing process with application.

4

Answer: **Honing Process** (*Sketch -2 marks, explanation -2marks*)

Honing is mostly used for finishing round hole by means of bonded abrasive stones called hones. It is used to correct roundness, taper, tool marks and axial distortion .Honing stone made from common abrasives and bonding material with sulphur, resin or wax to improve cutting action and tool life. When honing is done manually tool is rotated and work piece is passed back and forth over the tool .For precision honing tool is given slow reciprocating motion as it rotates .Honing tool is loosely held in holders ,cemented into metal shells which are clamped in holders .Some stones are spaced at regular intervals around holders. Honing tool may be made such that floating action between work and tool take place and pressure exerted on tool may be transmitted equally to all sides. Coolants are essential to remove small chips and keep temperature uniform

2

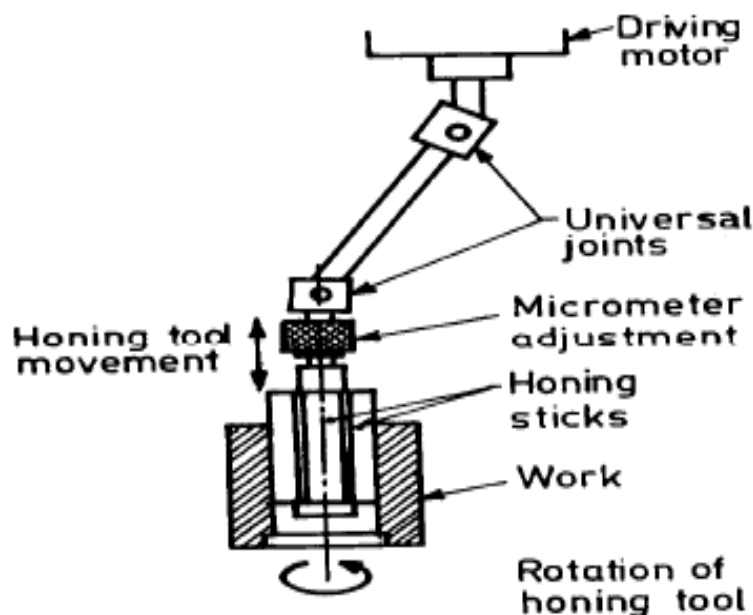


Fig. Honing.

2



6 Attempt any **TWO** of the following

16

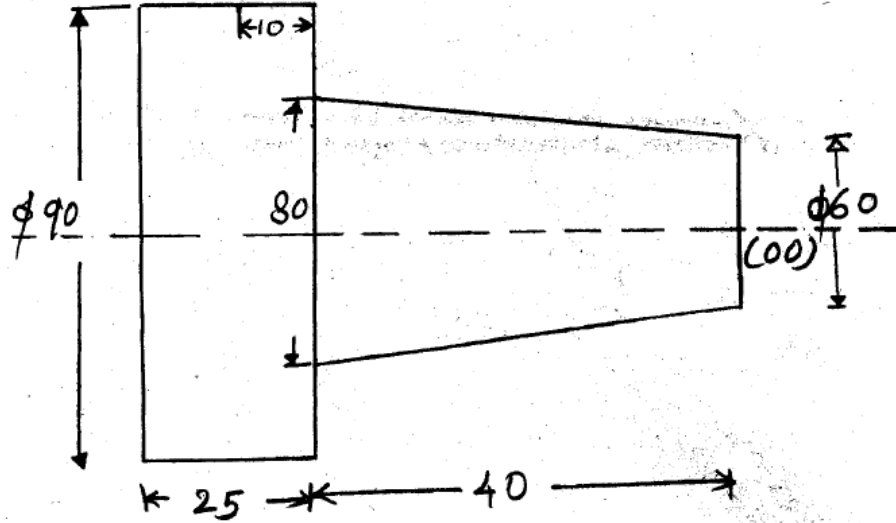
a) Write part program for following component. Also give co-ordinate system.

8

Answer: (for co-ordinate system- 2marks, for part program -6 marks)

Note – students can assume the data for following parameters :

Spindle speed, feed rate, co – ordinate system, tool no., tool starting & ending position



Point	X	Z
P0	0	2
P1	0	0
P2	60	0
P3	80	-40
P4	90	-40
P5	90	-50
P6	95	20

2

**PART PROGRAM**

```

N01 G90 G71 G95 E0B
N02 M06 T01 E0B
N03 M03 M08 S1000 E0B
N04 G00 X0.0 Z2.0 E0B
N05 G01 X0.0 Z 0.0 F0.1 E0B
N06 G01 X60.0 Z 0.0 E0B
N07 G01 X80.0 Z -40.0 E0B
N08 G01 X 90.0 E0B
N09 G01 Z -50.0 E0B
N10 G00 X95.0 Z 20.0 E0B
N11 M05 M09 E0B
N12 M30 E0B
  
```

1

4

1





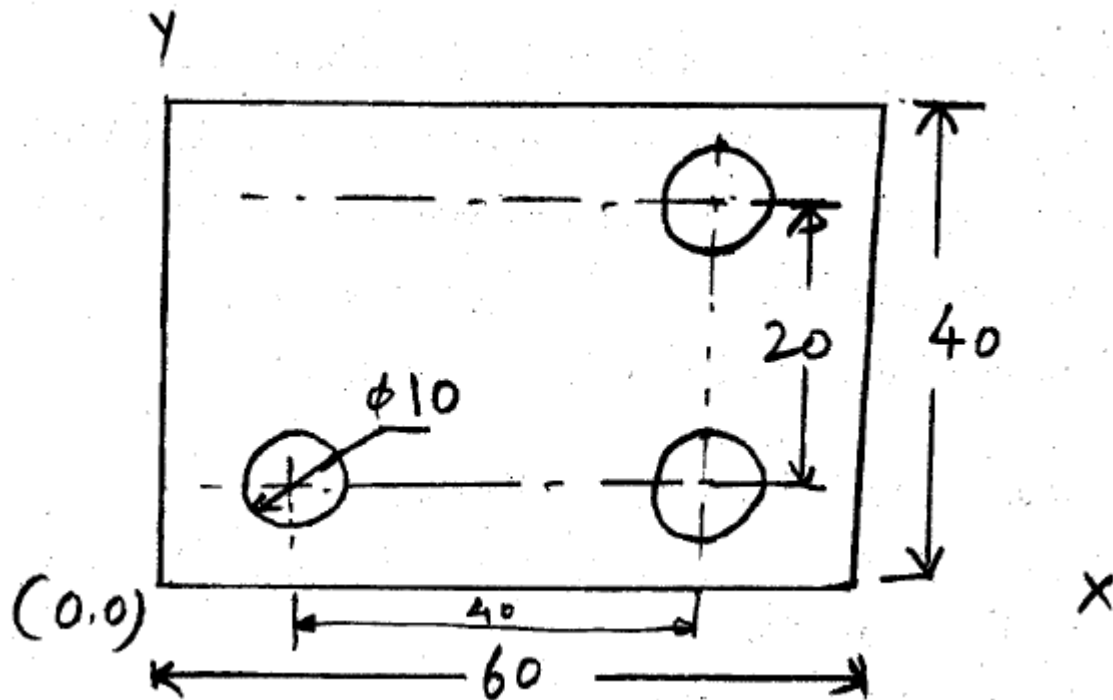
b) Write point to point part program for following plate having 10mm thickness and drilling holes of 10mm diameter.

8

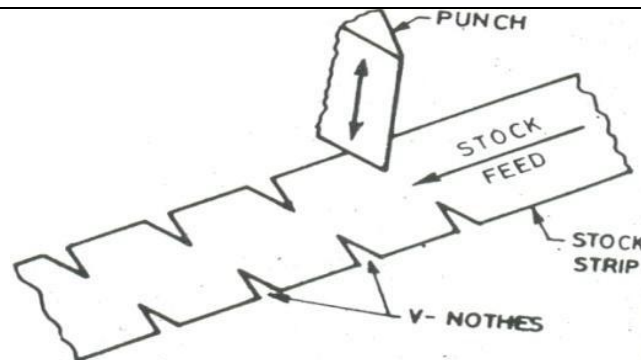
Answer: (for co-ordinate system- 2marks, for part program -6 marks)

Point	X	Y	Z
P0	10	10	2
P1	10	10	-10
P2	10	10	2
P3	50	10	2
P4	50	10	-10
P5	50	10	2
P6	50	30	2
P7	50	30	-10
P8	50	30	20
P9	0	0	20

2

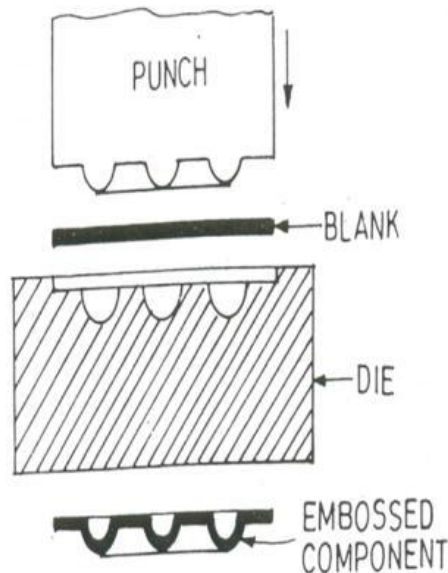




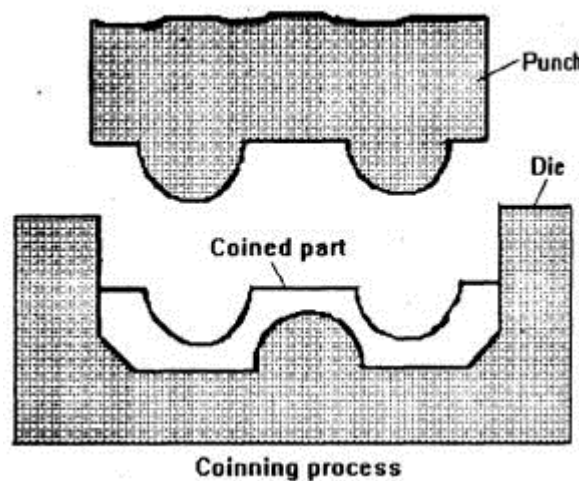


**3. Embossing:**

It is the process through which specific shapes are produced on sheet metal blanks with the help of punch & dies. It is used for decorative purpose / names, trademarks. Punch operates relatively at low speed to allow metal to stretch .



**4. Coining:-:** The coining is the operation of production of coins, medals or other ornamental parts by squeezing operation





**5. Piercing:**

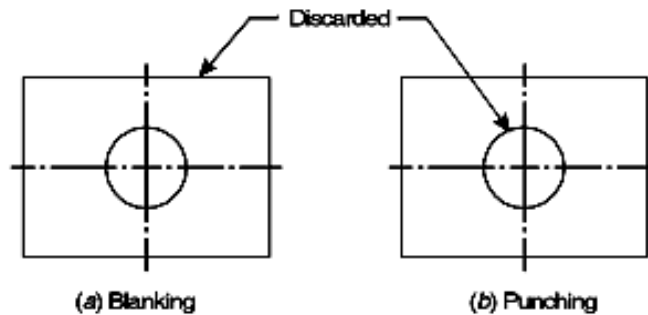
The piercing is the operation of production of hole in a sheet metal by the punch and the die. The materials punched out to form the hole constitute the waste.

**6. Punching:**

The punching operation is similar to the piercing operation. The difference between the punching and the piercing is that in the case of punching a cylindrical hole is produced, whereas in the case of piercing the hole produced may be of any other shape

**7. Blanking:**

The blanking is the operation of cutting of flat sheet to the desired shape. The metal punched out is the required product and the plate with the hole left on the die goes as waste.



**8. Cutting off:**

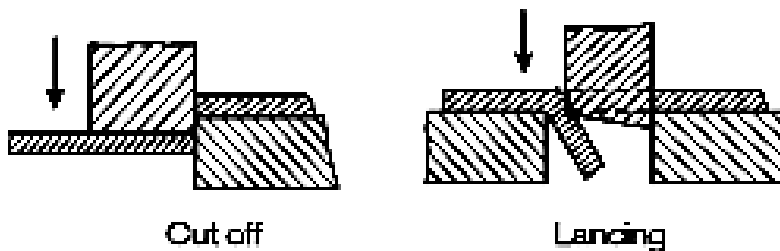
Cutoff is a shearing operation in which blanks are separated from a sheet-metal strip by cutting the opposite sides of the part in sequence.

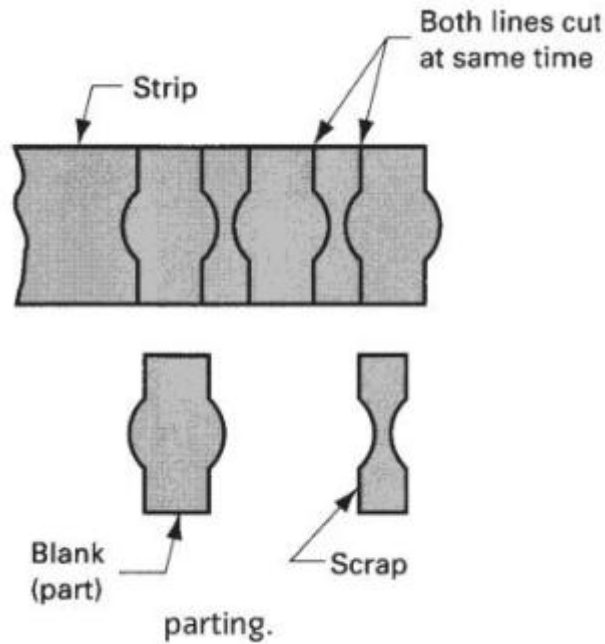
**9. Parting:**

cutting a sheet-metal strip by a punch with two cutting edges that match the opposite sides of the blank

**10. Lancing:**

The lancing is the operation of cutting a sheet metal through part of its length and then bending the cut portion .





11. **Bending operation:**The bending operation is illustrated in Fig. While 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



12. **Drawing operation:**The drawing is the operation of production of cup shaped parts from flat sheet metal blanks by bending and plastic flow of the metal. The operation is also known as cupping