



WINTER- 18 EXAMINATION

Model Answer

Subject Name: Automobile Manufacturing Process

17403

Important Instructions to examiners:

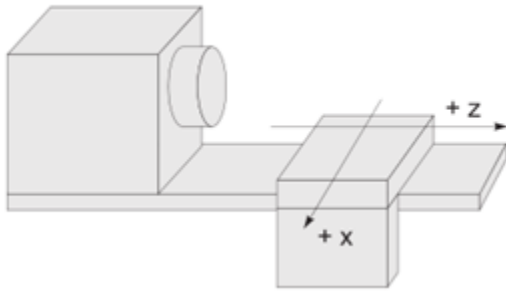
- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling 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
01	a)	Attempt any <u>SIX</u> of the following:	12
	i)	Define forgeability	02
		Answer: (<i>Definition 2 mark</i>) Forgeability : Forgeability can be defined as the tolerance of a metal or alloy for deformation without failure. OR Forgeability is defined as the ability of a metal to change size and shape when heated to required temperature and compressed by applying some pressure.	02
	ii)	Enlist names of any four parts of automobile that can be manufactured by forging.	02
		Answer: <i>Any Two -1/2 mark each (Credit Should be given to suitable component)</i> Following are few automotive components that can be manufactured by forging Process: 1. Connecting rod 2. Crankshaft 3. Camshaft 4. Gears 5. Alloy wheel	02
	iii)	State the function of pilot and stopper in a die.	02



	<p>Answer: (1mark for each) Function of pilot and Stopper:</p> <p>Pilots: The pilot positions the stock strip accurately and bring it into proper position for blanking and piercing operations. They act as guides during the piercing or blanking operations.</p> <p>Stopper: The stoppers are used for correct spacing of the sheet metal as it is fed below the punch to give the greatest output in given length of the plate.</p>	02
iv)	Define blanking and piercing.	02
	<p>Answer: (1mark for each)</p> <p>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.</p> <p>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.</p>	02
v)	Enlist any four demerits of soldering	02
	<p>Answer: (1/2 mark for each –Any 4)</p> <ol style="list-style-type: none">1) Strength of soldered joint is low.2) Soldered joint cannot be used in high temperature applications.3) Limitation for joining large sections.4) Careful removal of flux residual is required to prevent corrosion.5) Flux may contain toxic components.	02
vi)	What are the maximum temperature ranges for oxidizing and neutral flames	02
	<p>Answer: (1mark for each)</p> <p>The neutral flame has a temperature between 5,600 and 5,900 degrees Fahrenheit.</p> <p>Oxidizing flame has a temperature between 6,000 and 6,300 degrees Fahrenheit.</p>	02
vii)	State function of ATC in CNC machine.	02
	An Automatic tool changer or ATC is used in computerized numerical control (CNC) machine tools to improve the production and tool carrying capacity of the machine. ATC changes the tool very quickly, reducing the non-productive time.	02
viii)	Enlist any four demerits of VMC	02
	<p>Answer: (Any- 4, 1/2 mark each)</p> <ol style="list-style-type: none">1) Machine is costly.2) It needs trained operator having knowledge of programming.3) Maintenance is difficult and costly.4) Cost effective only for large production.5) Tooling cost is high.	02

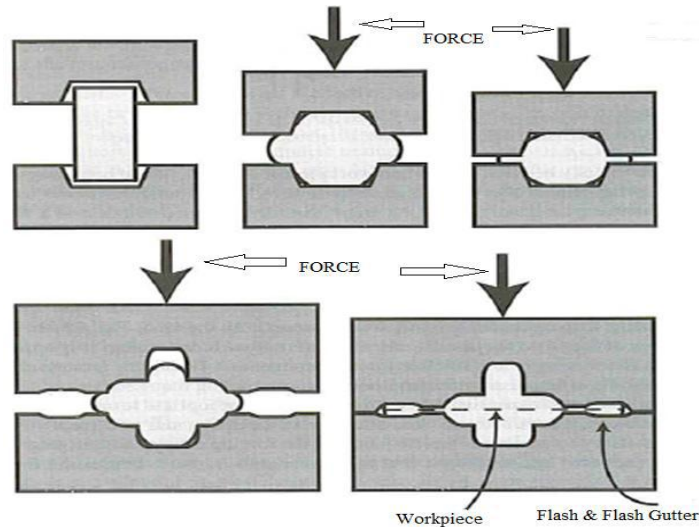


1	B	Attempt any <u>TWO</u> of the following:	08
	(i)	State the function of following codes: (1) G18, (2) G71, (3) M05, (4) M30	04
		Answer: (1mark for each) G18 – aligns the arc plane with the X and Z axes G71 -Metric Input or input in mm, M05 - Spindle stop M30 -End of program & reset	04
	(ii)	Explain axes identification of CNC machine with neat sketch	04
		Answer: (<i>Sketch of axis identification & sign convention - 02 marks, explanation - 02 marks</i>) The first axis to be identified is the Z axis. This is then followed by the X and Y axes respectively. Z axis and motion: Location: The Z axis motion is either along the spindle axis or parallel to the spindle axis. In the case of machine without a spindle such as shapers and planers, it is identified as the one perpendicular to the work holding surface, which may or may not be passing through the control point (e.g. the cutting tool tip in case of shaper). Direction: The tool moving away from the work holding surface is designated as positive Z direction. This means during machining tool moves in negative Z direction. X axis and motion: Location: It is perpendicular to the Z axis and should be horizontal and parallel to the work holding surface wherever possible. Direction: When looking from the principal spindle to the column, the positive X is to the right. For turning machines it is radial and parallel to the cross slide. Y axis and motion: It is perpendicular to both X and Z axes and the direction is identified by the right hand Cartesian coordinate system. Rotary motions: A, B and C define the primary rotary motions. Location: These motions are located about the axis parallel to X, Y and Z respectively. Direction: Positive A, B and C are in the directions which advance right-hand screws in the positive X, Y and Z directions respectively.	02
			

	<p>(a) For Horizontal-Z (b) For Vertical-Z (c) Cartesian Coordinates</p>	02
(iii)	Explain honing with neat sketch	04
2	<p>Honing Process (micro finishing process):</p> <p>To correct hole geometry in component, honing is used as a micro finishing process. Honing is an abrading process used mainly for finishing round holes by means of bonded abrasive stones called hones. Honing is primarily used to correct out of roundness, taper, tool marks and axial distortion. Abrasives used in honing are Silicon carbide, aluminium oxide, diamond or cubic boron nitride. When honing is done manually; the honing tool is rotated and workpiece is passed back and forth over the tool. Length of motion is such that the stones extend beyond the workpiece surface at the end of each stroke. For precision honing, the work is usually held in a fixture and the tool is given a slow reciprocating motion as it rotates (shown in Fig.). The stones are thus given a complex motion as rotation is combined with oscillatory axial motion. These two motions combine to give a resulting cross-hatch lay pattern. Honing stones may be held in the honing head by cementing them into metal shells, which are clamped into holder or they are cemented directly into holders. Coolants are essential to the operation of this process, to flush away small chips and to keep temperatures uniform.</p> <p style="text-align: center;">Fig. Honing.</p>	02
2	Attempt any FOUR of the following:	16
a)	Explain closed die forging with neat sketch	04
	<p>Answer: (Note: Explanation Impression die & Closed die forging – 02 marks & Sketch- 02 marks)</p>	

Impression die & Closed die forging process:

Closed Die forging 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 is placed between cavities of dies as shown in fig. which 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 easily forged by this forging process.



02

02

b) Differentiate between hot and cold forging

04

Answer: (any four- 1 marks each)

SI No	Hot forging	Cold forging
1	Forging Process is Performed above recrystallisation Temperature (950-1100 °C for steel)	Forging is performed at room temperature.
2	Less precise tolerance	High precision
3	Good ductility	Low ductility
4	Complex shapes can be produced	Only Simple shapes can be produced.
5	Internal stress gets relieved.	Residual stress occurs.

04

c) List out any four characteristics of forged parts

04

Answer: (1mark each- Any Four)

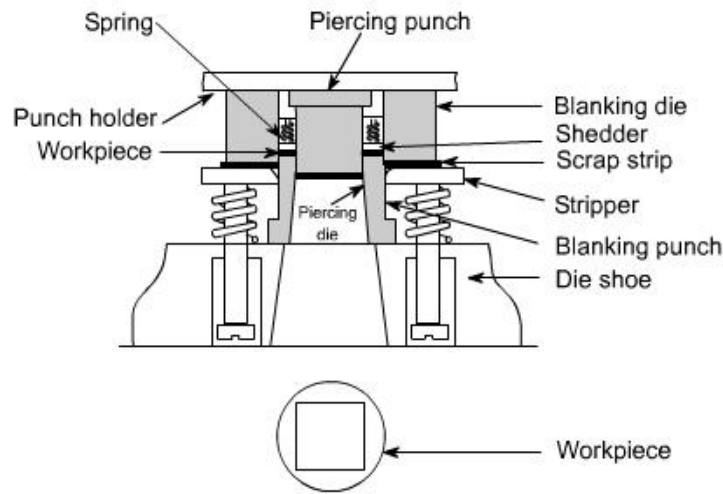
- 1) Forging produces predictable and uniform grain size and flow characteristics and has directional toughness.
- 2) Proper orientation of grains ensures the fatigue resistance and maximum impact strength.
- 3) Grain orientation improves ductility.
- 4) Parts of complex shape can be forged.
- 5) The forged parts have higher density.
- 6) The strength to weight ratio is high.

04

d) Draw a neat sketch of compound die

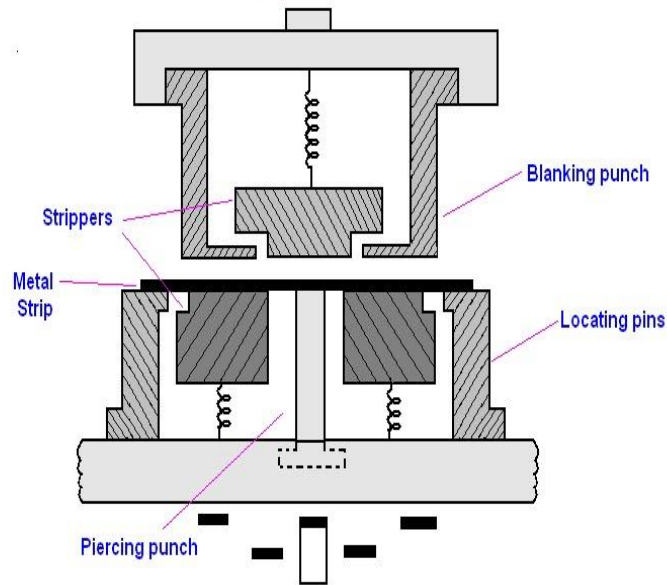
04

Answer:



OR

Compound Die



04

e) **Enlist any four merit and demerits of mechanical press**

04

Answer: (any 2 merits & 02 demerits- 1mark each)

Merit :-

1. Machine structure is rational and small.
2. It is very easy to operate and it operate at a high utilization ratio.
3. Less cost of machine
4. Simple in construction.

02

Demerit:-

1. The large no. of relative moving parts and subjected wear & tear.
2. Relatively limited tonnage capacity.

02

3. Limited stroke length.
4. The force does not remain constant throughout the stroke.

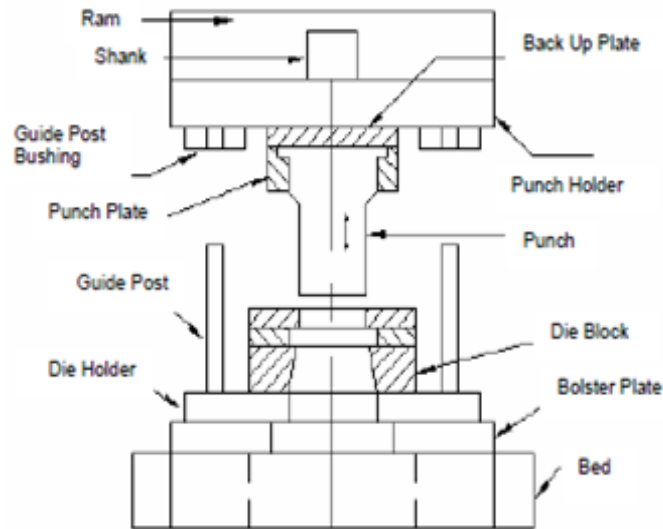
f) Explain simple die with neat sketch

04

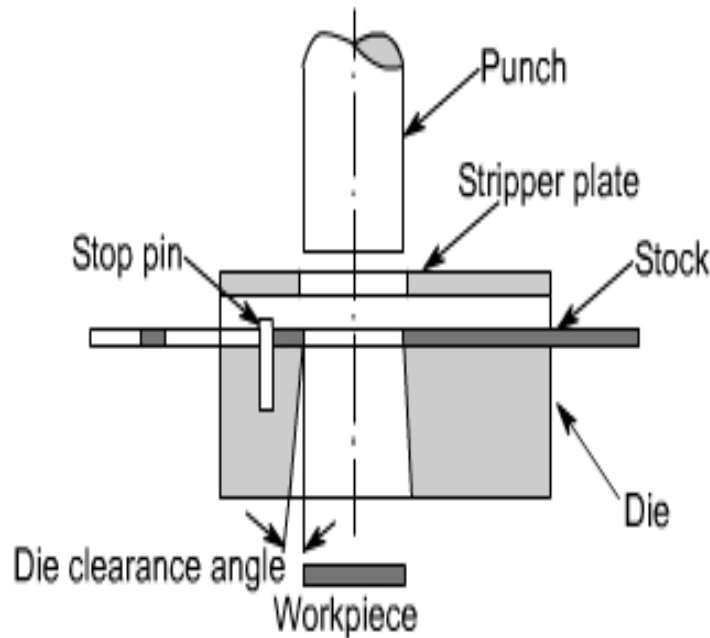
Simple Die:

Simple die or single action dies perform single operation for each stroke of the press slide. The operation may be cutting or forming operation such as blanking, punching, piercing etc. performed on these dies. The operations can be performed in a single action of the press slide giving output. These dies are simple in construction and can manufacture by conventional machining processes.

02



OR



03 Attempt any FOUR of the following

16

a) What are the steps in drop forging?

4

Answer:

Drop Forging Process:

Drop forging is carried out by using drop hammers. They are board or gravity hammer, air lift hammer and power drop hammer. Anvil of drop forging hammer is attached to the frame to permit accurate alignment of upper and lower dies. The ram is fastened to the lower end of vertical hard wood board.

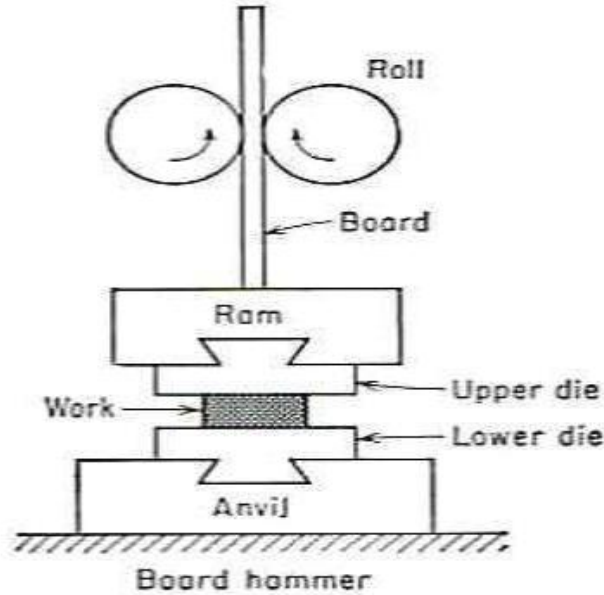


Figure: Drop Forging

Steps in drop forging.

- [1] The upper die and ram are raised by friction rolls gripping the board.
- [2] After releasing the board, the ram falls under gravity to produce the blow energy.
- [3] The hammer can strike between 60-150 blows per minute depending on size and capacity.
- [4] The board hammer is an energy restricted machine. The blow energy supplied equals the potential energy due to the weight and the height of the fall.
- [5] This energy will be delivered to the metal work-piece to produce plastic deformation.

b) What is trimming? Why it is necessary for forged parts?

4

Trimming: (Trimming – 2M and necessity 2M)
Trimming is the process of removing the flash around the edges of the finished forging in a separate press by trimmer dies.
Trimming basically presses a part through a cutting die that runs the periphery of the work. The cutting dies are precisely designed to remove the flash from a particular part. Most often it is desirable to perform this operation while the work is still hot for maximum efficiency; therefore it is usually incorporated into the larger production process.

Necessity of trimming for forged parts:

1. To remove the flash around the edge.
2. To obtain the geometric accuracy
3. To obtain the surface finish
4. To obtain the good appearance

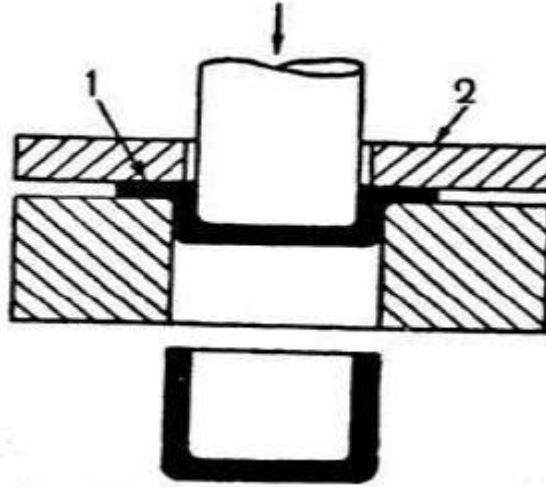
c) Explain drawing operation in press with neat sketch.

4

Drawing: (Explanation – 2M and Figure- 2M)
[1] The drawing is the operation of production of cup shaped parts from flat sheet metal blanks by bending and plastic flow of the metal.
[2] The blank is placed on die and while punch descends, the pressure pad holds the blank firmly on the die.

02

- [3] As the punch descend further, the blank is pushed in the cavity of the die and the metal is made to flow plastically while it is drawn over the edges to form sides of the cup. The operation is also known as cupping.
- [4] In this, clearance between punch and die is greater.
- [5] The drawing operation is illustrated in Fig.



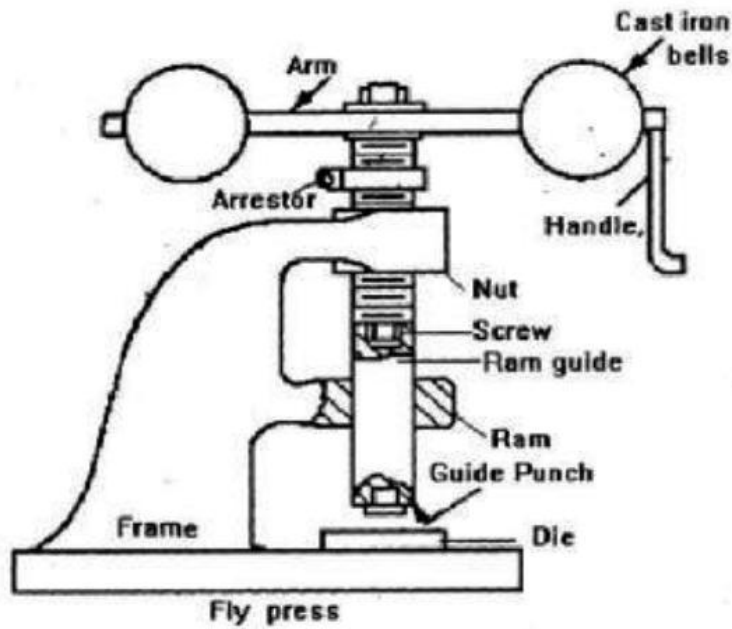
(1: Blank , 2:- Pressure Pad)
Figure:- Drawing Operation

02

d) Explain fly press with neat sketch.

04

- Fly Press :** *(Explanation – 2M and Figure- 2M)*
- [1] It is simplest type of all presses, called as hand press / ball press/single side fly press.
- [2] It consists of robust cast iron frame. Top portion of frame forms the nut.
- [3] Vertical screw which can go through the nut. Screw carries an arm.
- [4] Arm supports two cast iron weights (balls) at two ends. Handle used for rotating the arm.
- [5] Frame extended below the nut to form guides. Ram attached at the bottom of the screw.
- [6] Ram carries punch at its bottom. Die is fixed at the press base.
- [7] Sheet metal placed over the die. Arm gets quick rotation with the help of handle.
- [9] Heavy balls stores kinetic energy for long time movement of screw. Movement of screw causes movement of ram & punch downwards.
- [11] Stroke of the collar adjusted with help of Stop Collar / Arrestor. Advance type of fly press is double side Press.



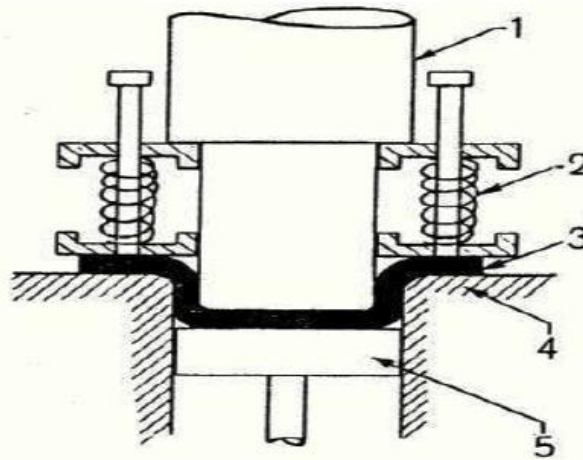
e) Explain the importance of pressure pads in a die with neat sketch.

4

Importance of Pressure pad:

(Explanation – 2M and Figure- 2M)

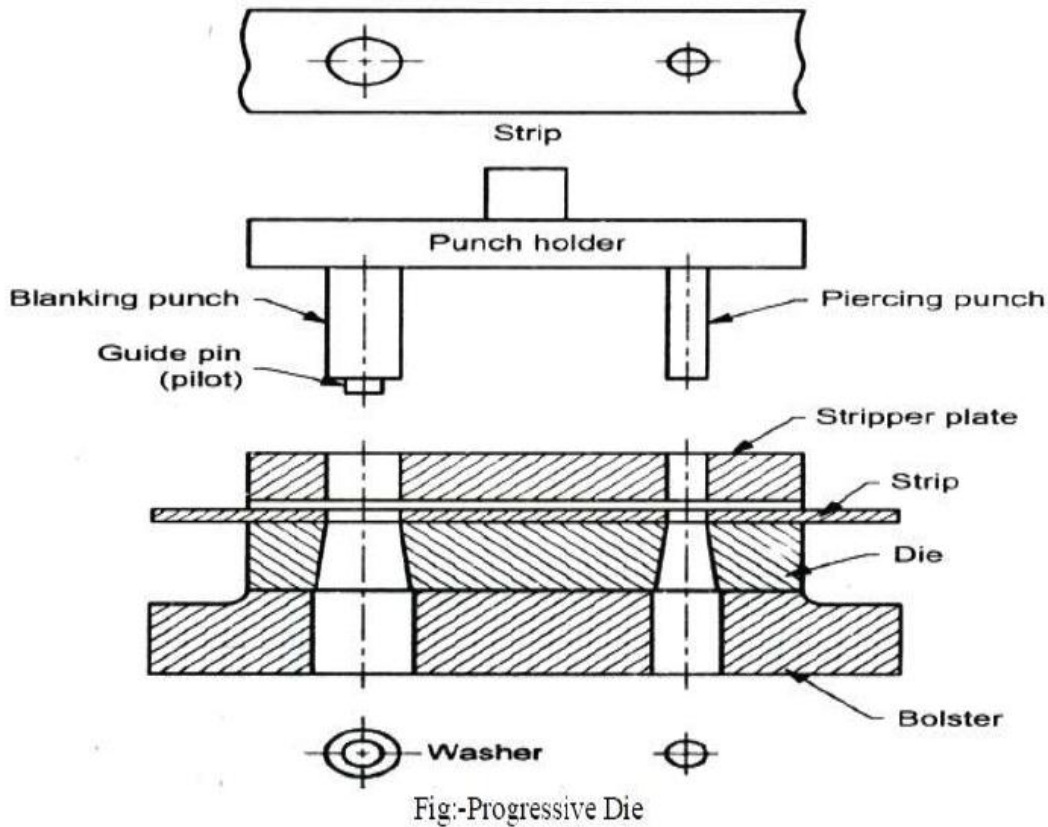
It is used for drawing operation for maintaining flat surface of the cup. A pressure pad presses against the material during L bending or U bending, and is used for preventing the springing back of the material and the sliding of the material during forming. There is also the purpose of stripping off the material from the punch after forming.



1. Punch, 2. Helical spring, 3. Blank, 4. Die, 5. Pressure pad.

f) Draw a neat sketch of progressive die.

4



04

04 Attempt any TWO of the following

16

i) MIG and TIG Welding

4

(At least 4 points of 1 Marks each)

Sr. No	MIG Welding	TIG Welding
1	In tungsten inert gas arc welding, non-consumable tungsten electrode is used.	In metal inert gas arc welding consumable metallic electrode is used.
2	Both A.C and D. C. can be used.	D.C. with reverse polarity is used.
3	Filler metal may or may not be used.	Filler metal not used as electrode itself serves both purpose of producing arc and filler metal.
4	Not used for welding plated thicker than 6 mm.	Best suited for welding jobs thicker than 6 mm.
5	Welding speed slow	Welding speed fast
6	Electrode feed not required	Electrode need to be feed at constant speed form wire reel
7	Penetration not so much deeper	Deeper penetration is obtained
8	Requires skilled operator.	No so much is required for operators.

ii) Carburizing and Oxidizing flame.

4

(At least 4 points of 1 Marks each)

Sr. No.	Carburizing flame.	Oxidizing flame.
1	This is obtained by more quantity of acetylene	This is obtained by more quantity of Oxygen
2	The flame has three zones 1) Sharply defined inner cone 2) An intermediate cone of whitish	The flame has two zones- 1) The smaller inner cone which has purplish tinge,

	colour. 3) Bluish outer cone	2) The outer cone or envelope
3	The inner zone is surrounded by a secondary luminous zone and extends into the outer envelope.	The inner cone is very much shortened and pointed and also the luminosity is reduced.
4	It is very suitable for welding steel as rate of welding is faster.	It is very suitable for cutting operations due to very high temperature and also for welding non-ferrous metals
5	The temperature of can be up to 5500 °F	The temperature of can be up to 6300 °F
6	It creates the base metal harder.	It creates a base metal oxide that protects the base metal

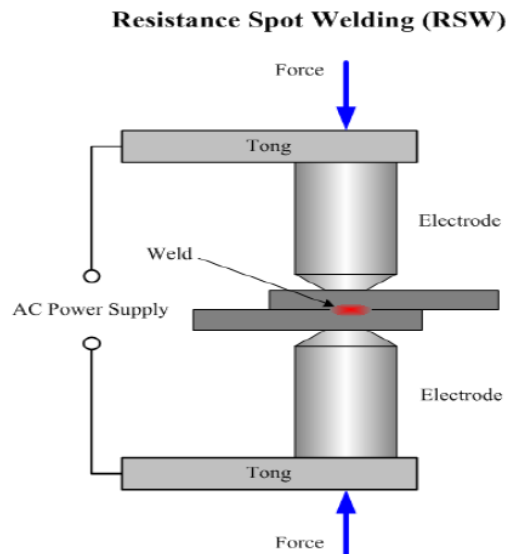
b) Explain any two types of resistance welding processes in detail.

8

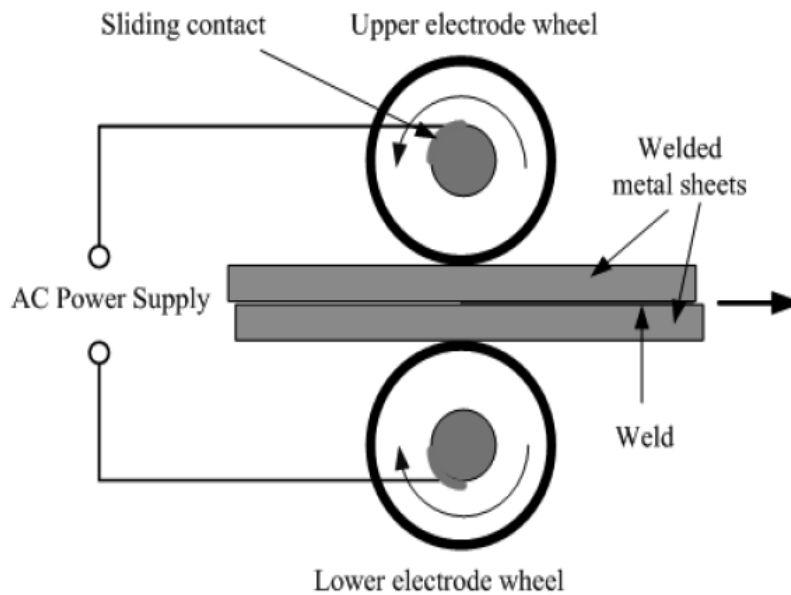
Answer: (Note: Explanation - 2 Marks & Sketch - 2 Marks) Resistance Welding Processes: (Any TWO type of the following)

1. Resistance Spot welding:

Spot welding is employed to join overlapping strips, sheets or plates of metal at small areas. The pieces are assembled between two electrodes, which must possess high electrical & thermal conductivity and retain the required strength at high temperatures, so they are made of pure copper for a limited amount of service, and of alloys of copper or tungsten, or copper and chromium for continuous working. When current is turned on, the pieces are heated at their contacts to a welding temperature, and with the aid of mechanical pressure the electrodes are forced against the metal to be welded.

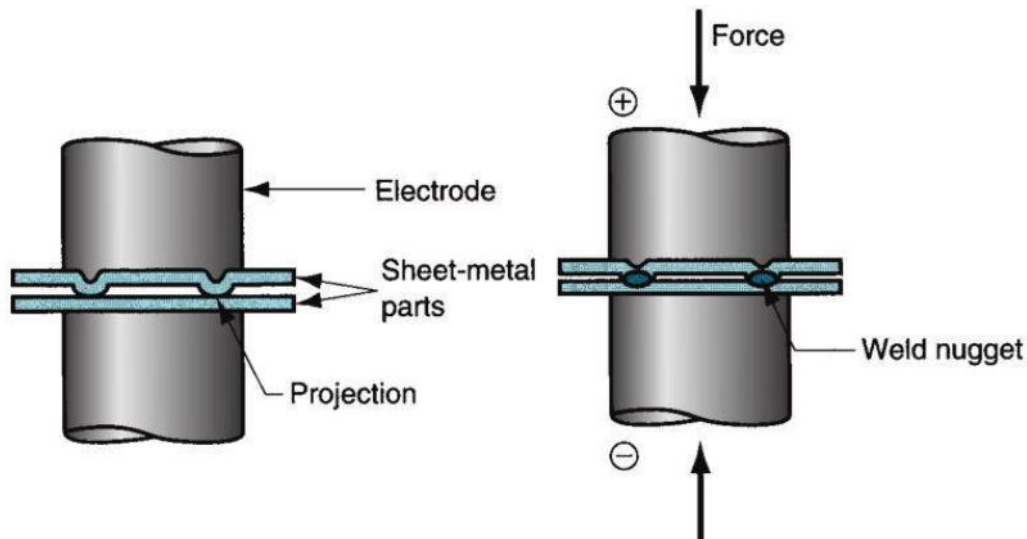


2. Seam Welding is a Resistance Welding (RW) process used for producing continuous joint of overlapping sheets by passing them between two rotating electrode wheels. Heat generated by the electric current flowing through the contact area and pressure provided by the wheels are sufficient to produce a 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



3.Projection Welding

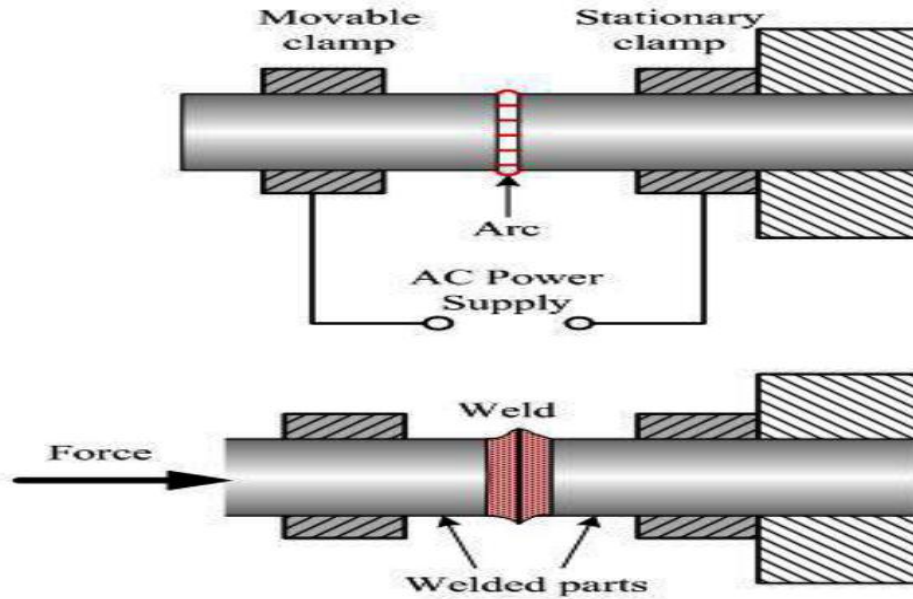
Projection welding is a modification of spot welding. The current and pressure are localised at the weld section by the use of embossed, machined or coined projections on one or both pieces of the Work. The flattening out of these projections under pressure results in good welds at all points of contact.



4.Flash Welding

It is a Resistance Welding (RW) process, in which ends of rods (tubes, sheets) are heated and fused by an arc struck between them and then forged (brought into a contact under a pressure) producing a weld. The welded parts are held in electrode clamps, one of which is stationary and the second is movable.

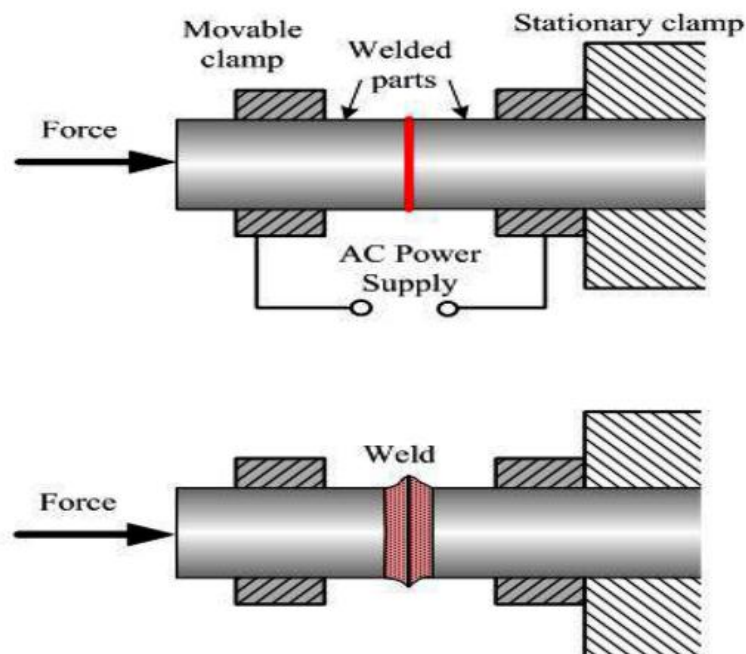
Flash Welding (FW)



5. Resistance Butt Welding:

It is a Resistance Welding (RW) process, in which ends of wires or rods are held under a pressure and heated by an electric current passing through the contact area and producing a weld. The process is similar to Flash Welding; however in Butt Welding pressure and electric current are applied simultaneously in contrast to Flash Welding where electric current is followed by forging pressure application. Butt welding is used for welding small parts. Butt Welding provides joining with no loss of the welded materials.

Butt Welding (UW)

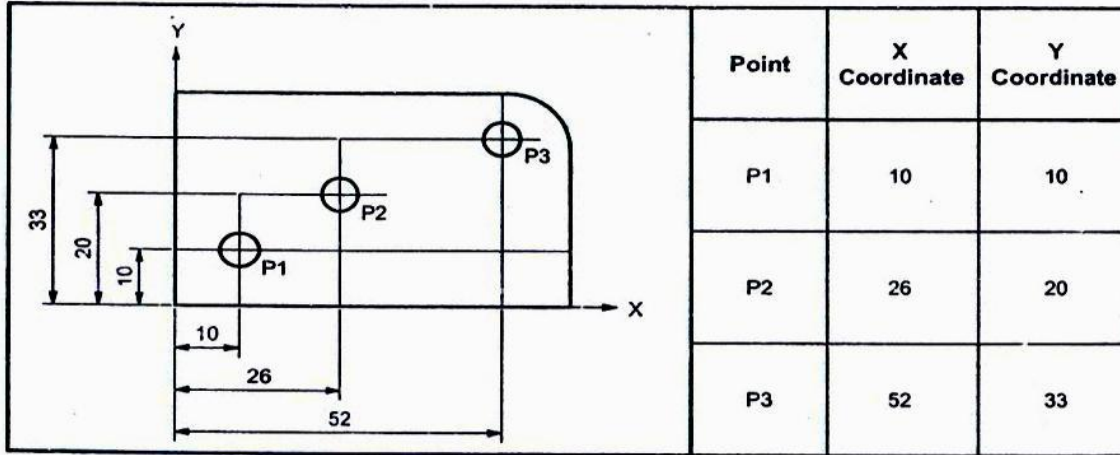


c) Explain:

i) Absolute Co-ordinate system

i) Absolute Co-ordinate system: (Explanation – 02 mark , Example – 02mark)

In Cartesian co-ordinate geometry system using absolute measurement. Each point is always specified using same zero of given co-ordinate system as shown in fig. It is a system in which all moving commands are referred to one reference point, which is the origin / set point. All the position commands are given from zero point. The main advantage of this system is that it forces the operator to stop the machine in case of interruptions.

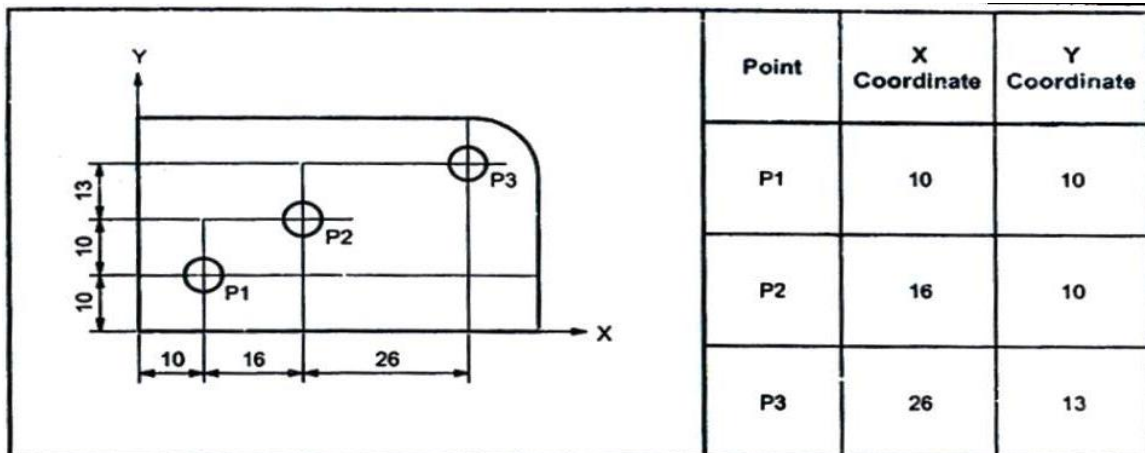


ii) Incremental Co-ordinate system

04

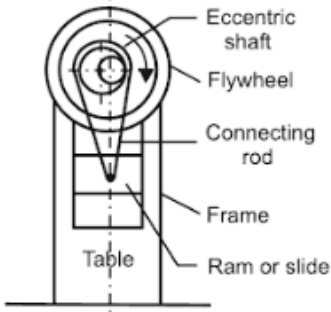
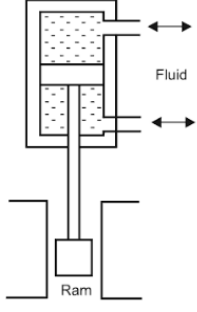
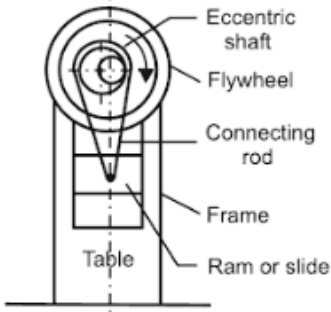
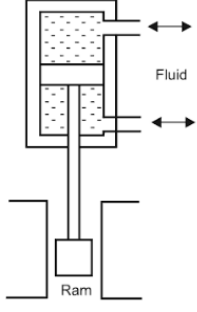
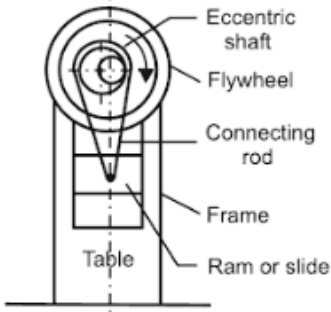
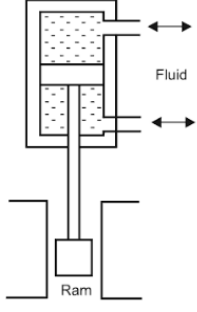
ii) Incremental Co-ordinate system: (Explanation – 02 mark, Example – 02mark)

In Cartesian co-ordinate geometry system using incremental measurement. Each point is always specified using the path differential from the preceding point position. So in such a programming, controller must store & process additional path measurement, as shown in fig. It is a system in which the reference point to the next instruction is the end point of the preceding operation. Each data of applied to the system as a distance increment, measured from preceding point.



5 Attempt any FOUR of the following:

16

a)	“CNC machine is having higher productivity than general lathe machine” Justify the statement.	04																		
Ans:	<p>CNC machining and conventional machining aim to achieve the same end, and both start with a raw chunk of metal or plastic and shape it into a part.</p> <p>“CNC machine is having higher productivity than general lathe machine” because the most basic difference between the two is the automation of CNC versus the manual nature of conventional lathe machine.</p> <p>With CNC, a skilled employee programs software to cut the part. With conventional, a skilled employee takes all the steps to setup and operate the machine. In the manual situation, a highly skilled operator must also set the gears, whereas CNC machining does not use gears.</p> <p>Imagine a hypothetical part, for example. A component needs concave and convex arcs, imperial and metric threads and two tapers of differing degrees. An automated CNC machine would use three tools to cut the part, while the conventional machine would require five tools and no doubt more time.</p>	04																		
b)	Differentiate between mechanical and hydraulic press.	04																		
Ans:	<p>Difference between mechanical and hydraulic press.(any four points 1marks each):</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 5%;"></th> <th style="width: 45%;">Mechanical press</th> <th style="width: 50%;">Hydraulic press</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td>In mechanical presses the linear movement of ram is obtained with the help of flywheel driven by electric motor.</td> <td>In Hydraulic press the linear movement of ram is obtained by utilising hydraulic power stored in accumulator.</td> </tr> <tr> <td style="text-align: center;">2</td> <td>Mechanical presses are not suitable for deep drawing operations where slow motion is desired.</td> <td>Hydraulic presses are used for deep drawing operation because of slow and uniform motion of ram.</td> </tr> <tr> <td style="text-align: center;">3</td> <td>Mechanical presses are recommended for blanking and punching operations.</td> <td>Hydraulic presses are not recommended for blanking and punching operations, as the break through stock is detrimental to the press.</td> </tr> <tr> <td style="text-align: center;">4</td> <td>The capacity of mechanical press is generally below 100 tonnes.</td> <td>The capacity of hydraulic press is generally above 100 tonnes.</td> </tr> <tr> <td style="text-align: center;">5</td> <td style="text-align: center;">  <p style="text-align: center;">Fig. Mechanical press</p> </td> <td style="text-align: center;">  <p style="text-align: center;">Fig. Hydraulic press</p> </td> </tr> </tbody> </table>		Mechanical press	Hydraulic press	1	In mechanical presses the linear movement of ram is obtained with the help of flywheel driven by electric motor.	In Hydraulic press the linear movement of ram is obtained by utilising hydraulic power stored in accumulator.	2	Mechanical presses are not suitable for deep drawing operations where slow motion is desired.	Hydraulic presses are used for deep drawing operation because of slow and uniform motion of ram.	3	Mechanical presses are recommended for blanking and punching operations.	Hydraulic presses are not recommended for blanking and punching operations, as the break through stock is detrimental to the press.	4	The capacity of mechanical press is generally below 100 tonnes.	The capacity of hydraulic press is generally above 100 tonnes.	5	 <p style="text-align: center;">Fig. Mechanical press</p>	 <p style="text-align: center;">Fig. Hydraulic press</p>	04
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5	 <p style="text-align: center;">Fig. Mechanical press</p>	 <p style="text-align: center;">Fig. Hydraulic press</p>																		
c)	Draw a schematic of a set up of shielded metal arc welding.	04																		
Ans:	Sketch 02 marks and labeling 02 marks																			

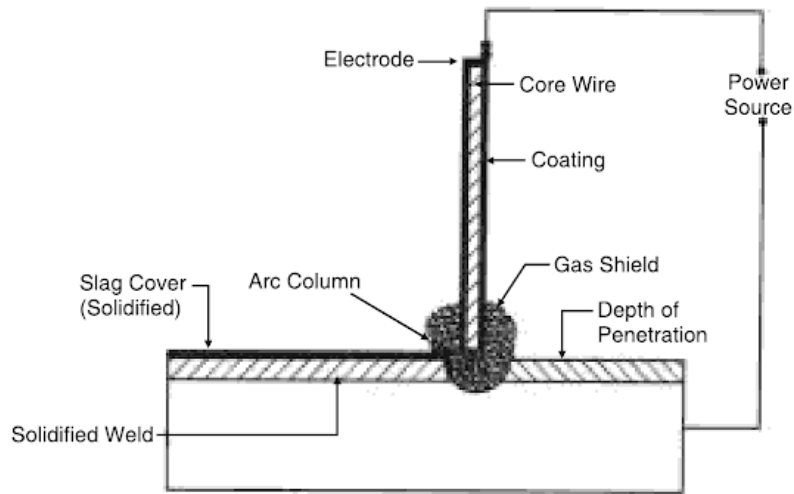


Fig. Shielded metal arc welding set-up

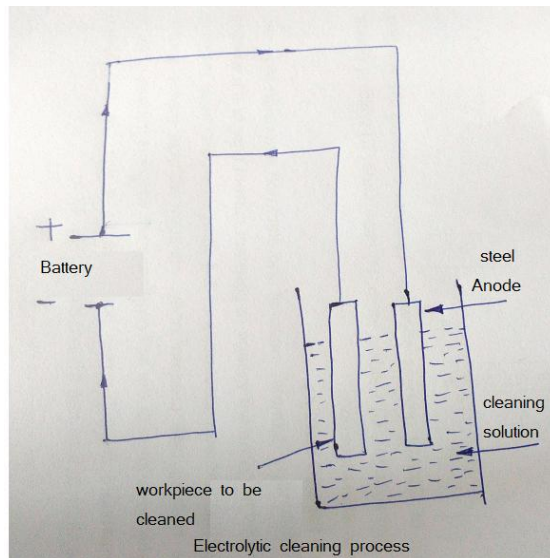
04

d) Explain electrolytic cleaning with neat sketch.

04

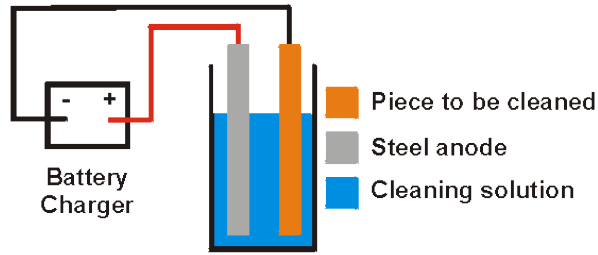
Ans: **Electrolytic Cleaning:** This is effective as final cleaning process for removing oil and grease from machined surface when extreme cleanliness is required. It is almost always used for final cleaning of steel parts prior to electro-plating. In electrolyte cleaning, an alkaline cleaning solution is used with electric current passing through the bath in which the parts to be cleaned is one electrode. This causes the emission of oxygen at the positive pole and hydrogen at negative pole. The material from which part is made and the cleaning action desired determine whether the part should be made anode or cathode. Parts of soft metals must be cleaned cathodically because they would be badly itched if cleaned anodically. Steel is anodically cleaned because of absence of embrittlement and smut deposition. Chlorides should be carefully avoided and the soap content should be low or excessive foaming with danger of explosion may result.

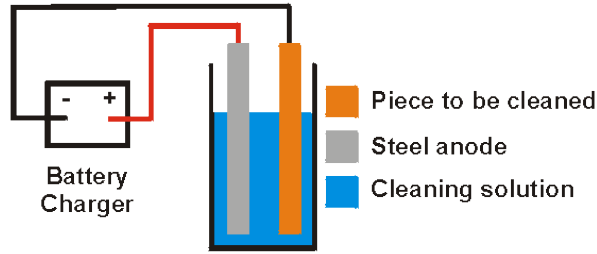
02



OR

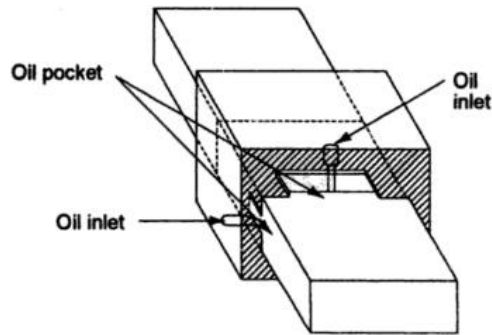
02



		 Fig. Electrolytic cleaning	
	e)	List out any four applications of lapping and buffing.	04
	Ans:	<p>Applications of Lapping: (Any Four ½ marks each)</p> <p>A. Hand lapping is used for</p> <ol style="list-style-type: none"> i. Press work dies ii. Moulding dies iii. Limit gauges iv. Surface plates v. Engine valve and valve seat <p>B. Machine lapping is used for</p> <ol style="list-style-type: none"> i. Races of ball and roller bearings ii. Gears iii. Piston rings iv. Slip gauges v. Crankshaft. <p>Applications of Buffing: (any four ½ marks each)</p> <p>Automobiles, motor-cycles, boats, bicycles, sporting items, tools, store fixtures, commercial and residential hardware and household utensils and appliances.</p>	02
	f)	“Surface cleaning is necessary for machined parts.” Justify the statement.	04
	Ans:	<p>Necessity of Surface cleaning:</p> <p>Components, particularly those made of steel, get contaminated during and after production. Scale is formed on components after hot working. Castings get contaminated with sand. In workshop components get contaminated with cutting oils, grease, wax, tars, dirt and scale.</p> <p>Thus surface cleaning is necessary</p> <ol style="list-style-type: none"> (a) to increase the life of the component, (b) to carry out further operations, and (c) to put it to practical use. 	04
6		Attempt any TWO of the following	16
	a)	Explain following constructional details of CNC machines with neat sketches.	
		<ol style="list-style-type: none"> (i) Hydrostatic slideways (ii) Recirculating ball screw and nut 	08
		(i) Hydrostatic slideways:	

In hydrostatic slideways, air or oil is pumped into small pockets or cavities into the carriage or slides which are in contact with the slide ways. The pressure of the fluid gradually reduces to atmospheric pressure as it seeps out from the pockets, through the gap between the slide and the slideways. The hydrostatic slideways almost a frictionless condition, it is very important that the fluid and slideways are kept clean. Also a hydrostatic slideways need a large surface area to provide adequate support.

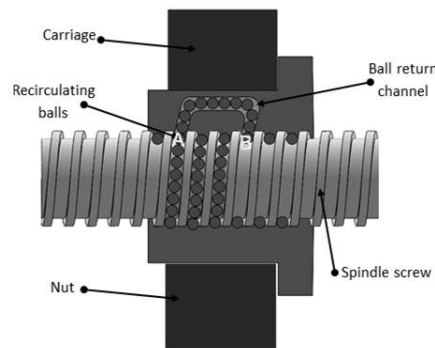
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02

Fig. Hydrostatic slideways

(ii) **Recirculating ball screw and nut:**



02

Fig. recirculating ball screw
OR

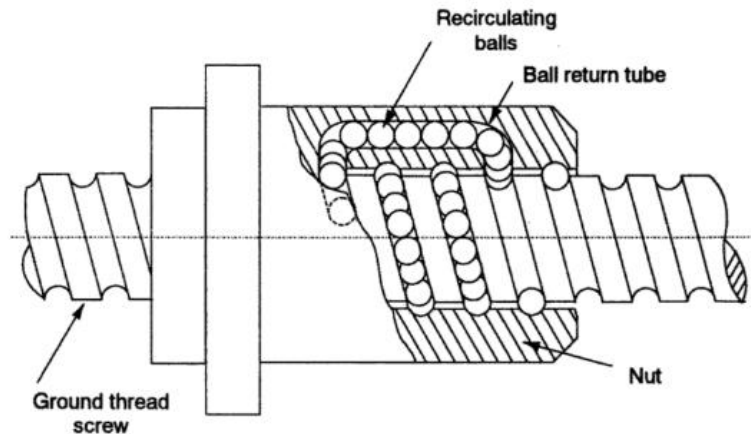


Fig. Recirculating Ball screw

Ball screw is also called as ball bearing screw or recirculating ballscrew. It consists of a screw spindle, a nut, balls and integrated ball return mechanism a shown in Figure. The flanged nut is attached to the moving part of CNC machine tool. As the screw rotates, the nut translates the

moving part along the guide ways. However, since the groove in the ball screw is helical, its steel balls roll along the helical groove, and, then, they may go out of the ball nut unless they are arrested at a certain spot. Thus, it is necessary to change their path after they have reached a certain spot by guiding them, one after another, back to their “starting point” (formation of a recirculation path). The recirculation parts play that role. When the screw shaft is rotating, as shown in Figure, a steel ball at point (A) travels 3 turns of screw groove, rolling along the grooves of the screw shaft and the ball nut, and eventually reaches point (B). Then, the ball is forced to change its pathway at the tip of the tube, passing back through the tube, until it finally returns to point (A). Whenever the nut strokes on the screw shaft, the balls repeat the same recirculation inside the return tube.

02

b) Write a part program for taper turning as shown in figure No. 01

08

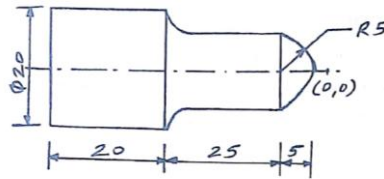


Fig. No. 1

Ans:

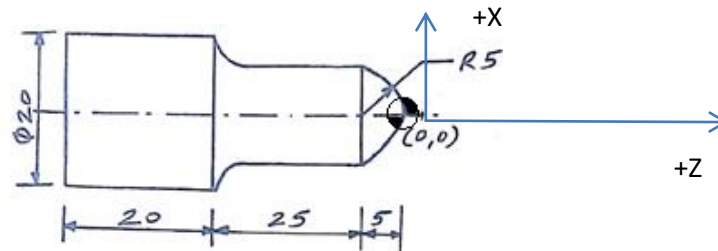


Fig. No. 1

Point	X	Z
0	0	2
1	0	0
2	10	-5
3	10	-25
4	20	-30
5	20	-50
6	30	10

N10 G90 G71 G95 EOB
 N20 T01 S400 M03 EOB
 N30 G00 X0.0 Z2.0 M08 EOB
 N40 G01 Z0.0 F0.25 EOB
 N50 G03 X 10.0 Z -5.0 R 5.0 EOB
 N60 G01 Z -25.0 EOB
 N70 G02 X 20.0 Z -30.0 R 5.0 EOB
 N80 G01 Z-50 EOB
 N90 G00 X 30 Z 10.0 EOB
 N100 G74 U0 W0 EOB
 N110 M05 M09 EOB
 N150 M30 EOB

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02



c) Write a part program for milling a mild steel plate of 20mm as shown in figure No. 02

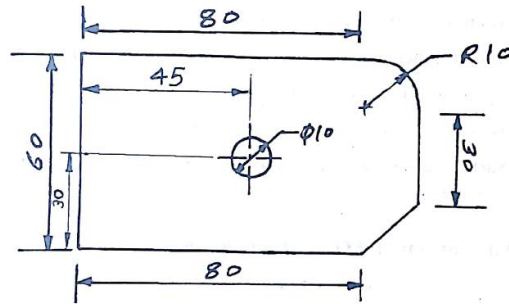


Fig. No. 2

Ans:

Point	X	Y	Z	
0	0	0	2	
1	0	0	-10	
2	80	0	-10	
3	90	20	-10	
4	90	50	-10	
5	80	60	-10	R10
6	0	60	-10	
7	0	0	-10	
8	0	0	2	
9	45	30	2	
10	45	30	-10	
11	45	30	2	
12	0	0	2	

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N10 G71 G90 G94 EOB
N20 M03 F200 S 1000 EOB
N30 G00 X0.0 Y 0.0 Z 2.0 EOB
N40 G01 Z -10.0 EOB
N50 G01 X 80.0 EOB
N60 G01 X90.0 Y 20.0 EOB
N70 G01 Y 50.0 EOB
N80 G03 Y60.0 R10.0 EOB
N90 G01 X 0.0 EOB
N100 G01 Y0.0 EOB
N110 G00 Z 2.00 EOB
N120 G00 X45.0 Y30.0 Z 2.0 EOB
N130 G01 Z -10.0 EOB
N140 G00 Z2 EOB
N150 G00 X0.0 Y0.0 EOB
N160 M02 EOB

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02

02

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02

