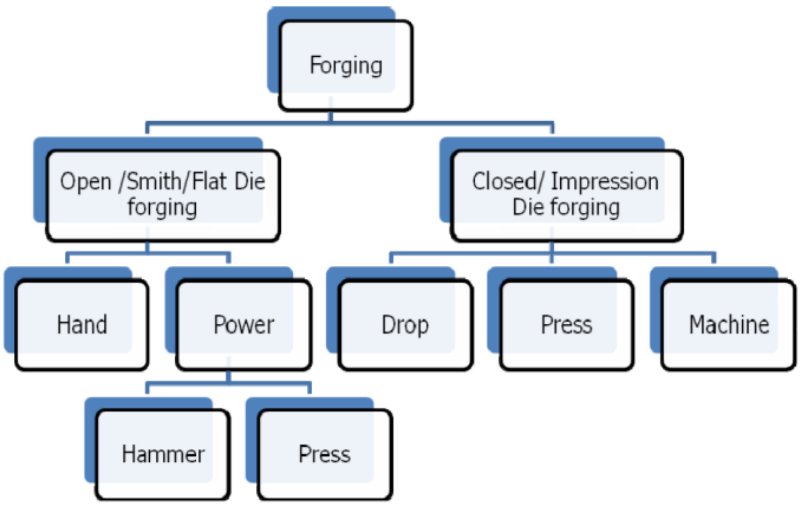
MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION
(Autonomous)
(ISO/IEC - 27001 - 2005 Certified)
SUMMER– 19 EXAMINATION
Model Answer

Subject: Automobile Manufacturing Processes **Subject Code: 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.

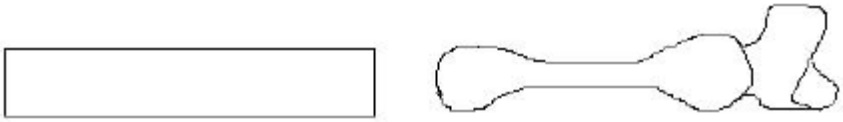
Q. No.	Sub Q. N.	Answer	Marking Scheme
1	a)	**Attempt any SIX of the following:**	12
	(i)	**State different methods by which forged components can be made.**	02
		Answer: Different types of forging method - I. Open die forging: a) Hand forging b) Power forging: i. Hammer forging ii. Press forging II. Close die forging: a) Drop forging b) Press forging c) Machine forging **OR**	02

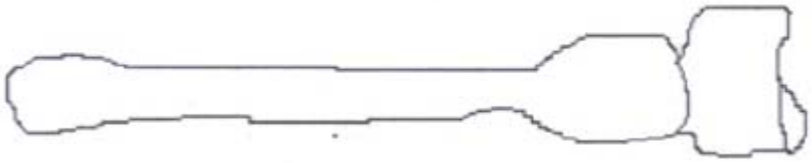
			
	(ii)	**Enlist the different materials used in press work for automobile application.**	**02**
		Answer: Materials used in press work *(Any four - 1/2 Marks Each)* 1) Aluminium, 2) copper, 3) brass, 4) mild steel, 5) Galvanized iron (G.I) sheets, 6) Duralumin, 7) Y-alloys, 8) naval brass, 9) cartridge brass, 10) Babbitt metal, 11) stainless steel & its alloys, 12) Different types of steels & its alloys.	**02**
	(iii)	**State any four applications of resistance welding.**	**02**
		Answer: Applications of resistance welding:(Any four = 2smarks) 1. Resistance welding is widely used in automotive industries. 2. Projection welding is widely used in production of nut and bolt. Projection welding is widely used in electrical, electronics, automotive and construction industries, and manufacturing of sensors, valves and pumps etc. 3. Seam welding is used to produce leak prove joint required in small tanks, boilers etc. Seam welding is mostly applied in manufacturing of containers, radiators and heat exchangers etc. 4. Flash welding is used to welding pipes and tubes 5. Spot welding is used for manufacturing of furniture and domestic equipment etc. 6. Resistance Butt welding is applied in manufacturing of wheel rims, wire joints and railway track joints etc.	**02**
	(iv)	**List various types of flames used in gas welding.**	**02**

		Answer: 1. Neutral Flame 2. Oxidizing Flame 3. Carburizing Flame	**02**
	(v)	**List various surface cleaning processes.**	**02**
		Answer: **Surface cleaning processes** *(Any four main/sub points - ½ mark each)* **I. Chemical Cleaning** a. Solution b. Saponification c. Emulsification d. Dispersion e. Aggregation Depending on cleaning fluids used, types of chemical cleaning are 1. Alkaline cleaning 2. Acid pickling 3. Electrolytic cleaning 4. Emulsified solvent cleaning 5. Vapour degreasing 6. Ultrasonic cleaning **II. Mechanical Cleaning.** a. Abrasive blast cleaning (Blasting) b. Tumbling c. Barrel rolling d. Power brushing e. Machine polishing & buffing **III. Ultrasonic cleaning** **IV. Flame cleaning**	**02**
	(vi)	**List any four G codes, give their meaning.**	
		Answer: (any four G codes, 02 marks)	**02**

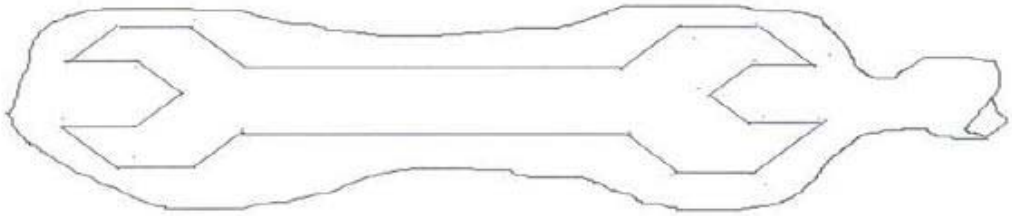
G Codes	Functions
G00	Rapid Point To Point Positioning Rapid Travel
G01	Linear Interpolation- Straight Linear Axis
G02	Clockwise Circular Interpolation
G03	Counter-Clockwise Circular Interpolation
G04	A Dwell, Stoppage of Axis Motion, Delay in Seconds
G22	CALL For Subroutine, Stored Stroke Limit ON
G25	Do Loop
G27	Zero Reference Point Return Check
G28	Home Position Of Tool
G70	Inch Mode Programming
G71	Metric Mode Programming
G74	Stock Removal In Facing On Turing Centers D = Depth Of Cut
G79	Canned Cycle ON
G80	Canned Cycle OFF
G90	Absolute Programming
G91	Incremental Programming
G94	Feed Rate Programming In "mm/min"
G95	Feed Rate Programming In "mm/rev"
G98	Subroutine Label, Return To Initial Level
G99	Return To Reference Level

	(vii)	**Give the classifications of CNC machines according to number of axes.**	**02**
		Answer: Classification of CNC machines according to number of axes 1. 2 axes CNC Machine 2. 3 axes CNC Machine 3. 4 axes CNC Machine **4.** 5axes CNC Machine	**02**
	(viii)	**Define forgeability. Name any two materials that are used in forging.**	**02**
		Answer: *(Definition 1 mark, materials 01 M)* **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. **Forgeable Materials**: (Any Two) 1) Aluminum alloys 2) Magnesium alloys 3) Copper alloys. 4) Carbon and low alloy steels	**01** **01**

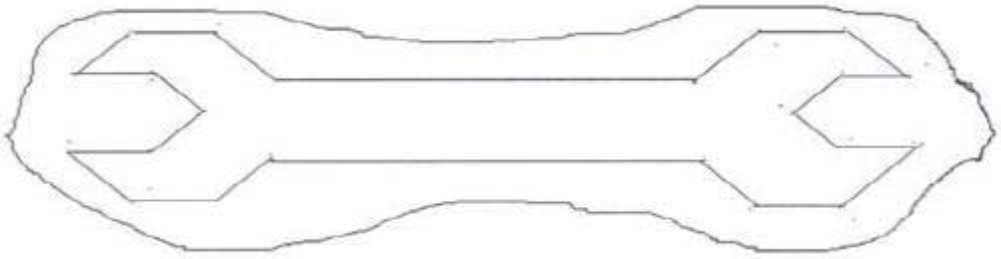
		5) Martensitic stainless steels 6) Austenitic stainless steels 7) Nickel alloys 8) Titanium alloys 9) Columbium alloys 10) Tantalum alloys 11) Molybdenum alloys 12) Tungsten alloys 13) Beryllium.	
	b)	**Attempt any TWO of the following:**	**08**
	(i)	**State various advantages and limitations of forging processes.**	**04**
		Answer: **Advantages of forging processes (Any Four ½ mark each)** 1) Complex shaped parts can be forged 2) Mass production with greater accuracy is achieved. 3) It is very easy to maintain close tolerances. 4) Relatively good utilization of materials. 5) Does not require highly skilled operator. 6) Better reproducibility. 7) Machining is not necessary to obtain final shape. **Limitations of Forging process:** *(Any four- ½ mark each)* **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	**02** **02**
	(ii)	**Explain forging process used to manufacture the spanners.**	**04**
		Answer: **Forging process used for production of spanner:** 1) Fullering -The heated stock is elongated by reducing its cross section in first die.  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.	**04**



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



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



(5)Trimming: Flash is removed.

(6) Heat treatment and machining is done as per requirement.

	(iii)	**Differentiate between open die forging and close die forging.**	04

Answer: ***(Note: Any four 1mark each)***

Difference between open die and close die forging:*(Any Four)*

Sr. No.	Open Die Forging Process	Close Die Forging Process
1.	It is also known as Flat or Smith Die Forging	It is also known as Impression Die Forging
2.	In this process dies have flat faces only.	In this process dies have cavities at inner surface.
3.	There may be chance to change shape & size of product.	There may be no chance to change shape & size of product due to cavity.
4.	Final shape of forging depends on skill of smith.	Final shape of forging depends on accuracy of die cavity.
5.	Complex parts can't be forged easily.	Complex part can be forged easily
6.	It is used to large volume of parts.	It is used to small volume of parts.
7.	Used for job production.	Used for Batch/ mass production.
8.	Less accuracy achieved.	More accuracy is achieved.

04

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

a) **Give detail classification of forging processes.** **04**

Classification of forging processes : (Any four , 01 Mark each) **02**

1.Open die forging:
a) Hand forging
b) Power forging:

i. Hammer forging
ii. Press forging

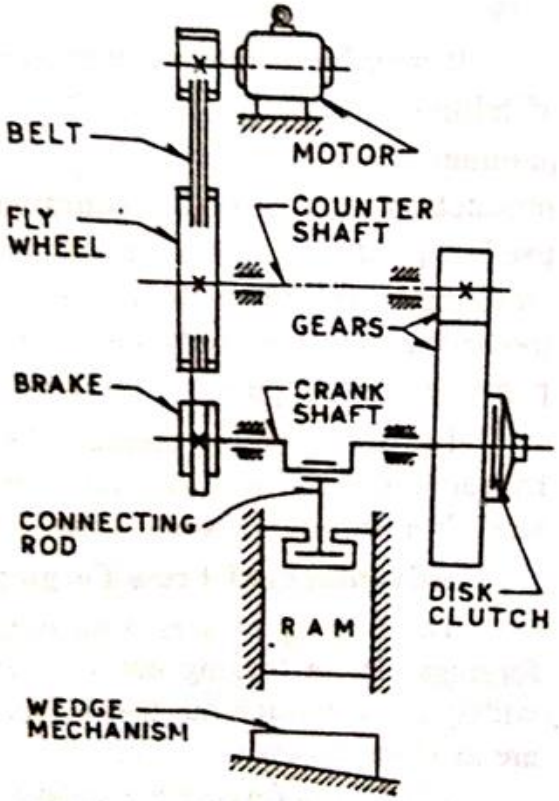
2.Close die forging: **02**
a) Drop forging
b) Press forging
c) Machine forging

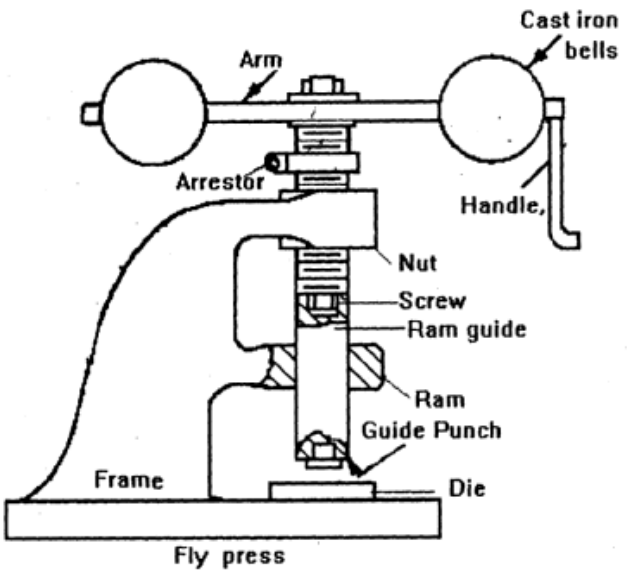
b) **Explain press forging with neat sketch.** **04**

Answer : **02**

Press Forging: In press forging, impression dies are used in which partd are made by plastically deforming a metal blank into die cavities by slow squeezing action. The forging pressure builds up from the start to the end of stroke, resulting in maximum penetration and in improved grain flow throughout the entire forging . completed forgings are ejected manually or mechanically from die-cavities.

The power flow diagram of a crank type mechanical press is as shown in fig.An electric motor is drives the flywheel mounted on the counter shaft by means of a belt drive. Torque from the counter shaft is transmitted to the crank shaft through gearing. From the crank shaft, reciprocating motion is given to the ram with the help of connecting rod. The bottom die is locked in position by means of wedge mechanism. Disc clutch is used

		to start and stop motion of ram which is brought to the gradual stop by means of brakes. Mechanical presses are faster than hydraulic presses and operate at about 25 to 100 stroke per minute. Their capacities range from 900 KN to 110 MN and they are generally employed for non-ferrous alloys weighting from upto about 135 N.  Crank Type Mechanical Press.	02
	c)	**Draw the neat sketch of fly press. Give the functions of important parts of it.**	**04**
		Answer: (Sketch with label 2 marks, functions of parts 02 marks)	**02**



OR

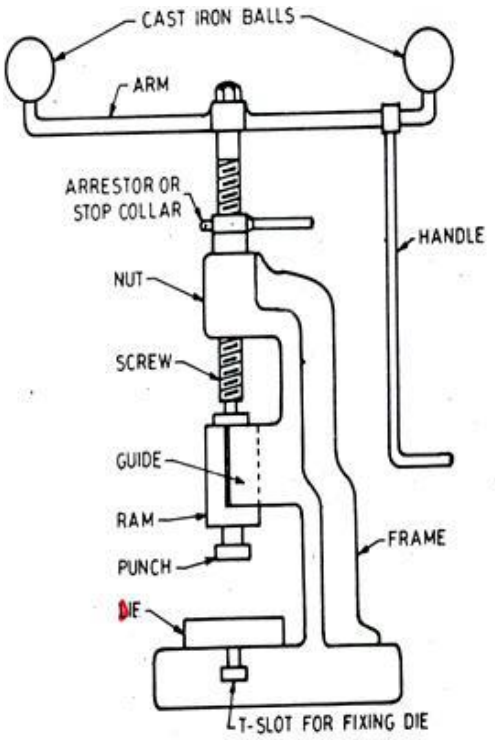
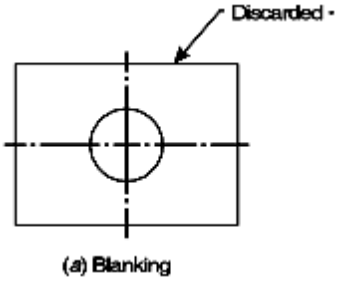
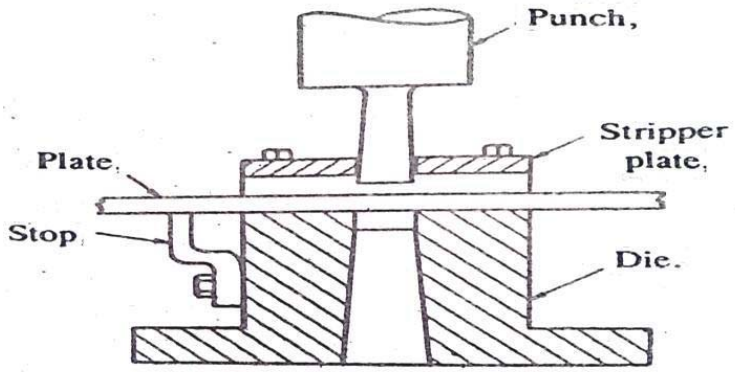


Fig. Fly Press **02**

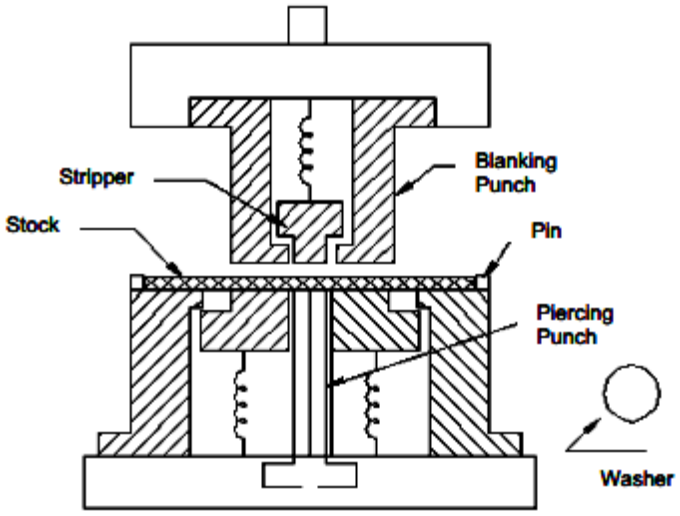
Functions of important parts of Fly Press.(any four parts)

1. Ram :
   This is main operating part of the press which works directly during processing of a workpiece. Ram reciprocates to and fro within its guideways with prescribed stroke length and power. The stroke length and power transferred can be

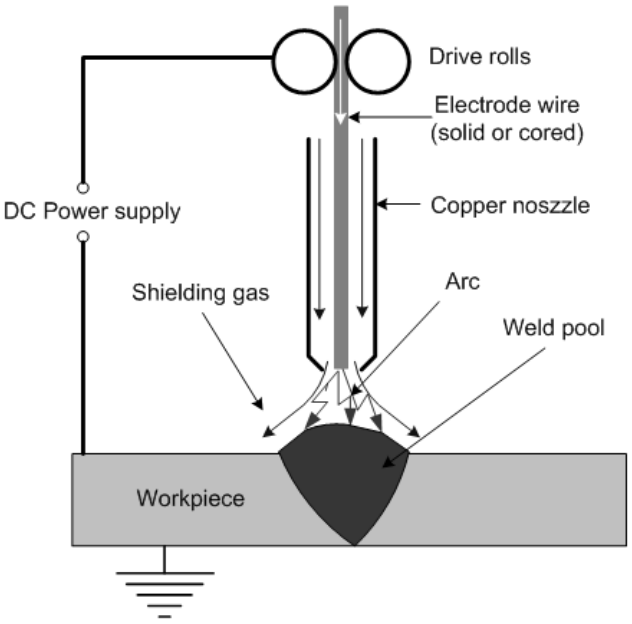
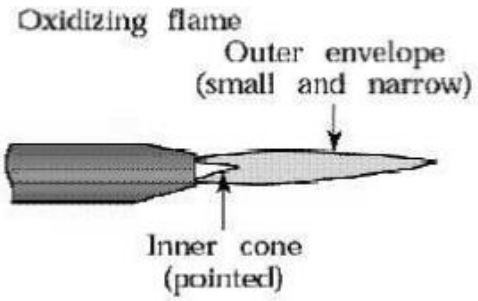
		adjusted as per the requirements. Ram at its bottom end carries punch to process the workpiece. 2. Guideways: It guides the ram. 3. Iron Balls : These are used to store the kinetic energy, for giving further movements to the screw. 4. Screw: The function of the screw is to move the ram and punch downwards which in turn provides enough thrust on metal sheet to do the necessary operations. 5. Frame of flypress: It supports all the parts. 6. Die: A **die** is a specialized tool used in manufacturing industries to cut or shape material mostly using a press	
	d)	**Explain blanking and piercing operation performed by press.**	**04**
		Answer: *Sketch 2 mark & Explanation 2 mark* **Blanking:** The blanking is the operation of cutting of flat sheet to the desired shape. The piece detached from strip is known a blank. The metal punched out is the required product and the plate with the hole left on the die goes as waste. While blanking the size of the blank is governed by the size of the die and the clearance is left on the punch. Blanking is always performed as the first operation.  (a) Blanking **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. The punch point diameter in the case of piercing is less than or equal to the work material thickness. The punch governs the size of the hole and clearance is provided on the die. Fig. shows punch and die set for piercing.	**01** **01** **01** **01**

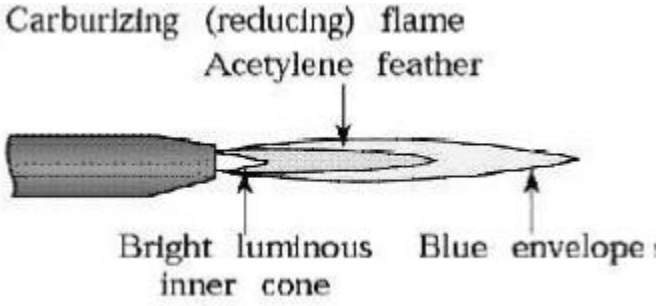
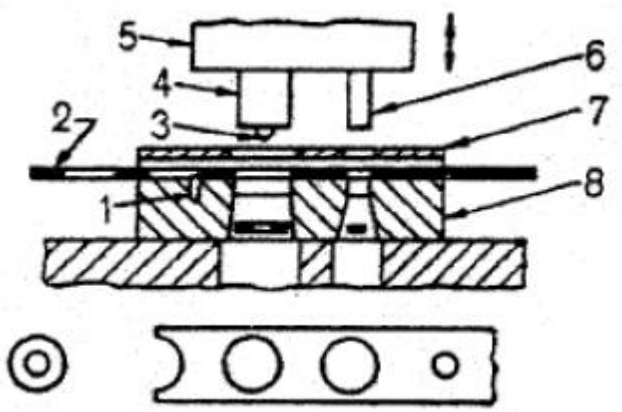
		 **Punch and die set up for piercing, punching and blanking**	
	e)	**State the functions of the following die accessories: pilots, stops, strippers, pressure pad.**	**04**
		Answer: Functions of die accessories. 1. **Pilots:** The pilot positions, the stock strip accurately and bring it into proper position for blanking and piercing operations. They act as guides during the piercing or blanking operations. 2. **Stops:** The stops 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. 3. **Stripper:** To remove scrap material from the punch as it cleans the die block. 4. **Pressure pad:** It is used for drawing operation for maintaining flat surface of the cup.	**04**
	f)	**Give detail classification of presses.**	**04**

		Classification of presses *(Any Four - 1 Mark Each)* • Basically classified into two groups : a) Manually operated – hand, ball or fly press b) Power operated – mechanical, hydraulic etc. • But Presses are briefly classified as : **a. According To The Type & Design Of Frame :** 1. Inclinable 2. Straight Side 3. Adjustable Bed 4. Gap Frame 5. Horning 6. Open End 7. Pillar **b. According To The Positions Of Frame :** 1. Inclinable 2. Inclined 3. Vertical 4. Horizontal **c. According To The Actions :** 1. Single Action 2. Double Action 3. Triple Action **d. According To The Mechanism Used For Applying Power To Ram :** 1. Crank 2. Eccentric 3. Cam 4. Toggle 5. Screw 6. Knuckle 7. Rack & Pinion 8. Hydraulic 9. Pneumatic **e. According To The Number Of Drive Gears :** 1. Single Drive 2. Twin Drive 3. Quadruple Drive **f. According To The Number Of Crankshaft Used :** 1. Single Crank 2. Double Crank **g. According To The Method of Transmission of Power From Motor To Crankshaft :** 1. Direct 2. Non – Geared 3. Single Geared 4. Double Geared 5. Multiple Geared **h. According To The Purpose For Which Used :** 1. Shears 2. Brakes 3. Punching 4. Seaming 5. Extruding 6. Coining 7. Straightening 8. Transfer 9. Forging	**04**
3		**Attempt any four of the following**	**16**
	a)	**Draw neat sketch of compound die, showing various parts of it.**	**04**
		Answer:(neat sketch 02 marks, labeling 02 marks)	

		 **Compound Die**	**04**
	b)	**Give detail classification of welding. State important factors upon which selection of welding process depends.**	**04**
		Answer**: Classification of Welding** (Any four main/sub points ½ mark each) **1. Arc welding** a. Carbon Arc Welding; b. Shielded Metal Arc Welding (SMAW) c. Submerged Arc Welding (SAW) d. Metal Inert Gas Welding (MIG, GMAW) e. Tungsten Inert Gas Arc Welding (TIG, GTAW) f. Electro slag Welding (ESW) g. Plasma Arc Welding (PAW) **2. Resistance Welding (RW)** a. Spot Welding (RSW) b. Resistance Butt Welding (UW) : 1) Flash butt welding 2)Upset butt welding c. Seam welding d. Projection welding e. Percussion welding **3. Gas Welding (GW)** a. Oxyacetylene Welding (OAW) b. Oxyhydrogen Welding (OHW) c. Air acetylene gas welding **4. Solid State Welding (SSW)** a. Forge Welding (FOW) b. Cold Welding (CW) c. Friction Welding (FRW) d. Explosive Welding (EXW)	**02**

		e. Diffusion Welding (DFW) f. Ultrasonic Welding (USW) **5. Thermit Welding (TW)** **6. Newer welding process** a. Electron Beam Welding (EBW) b. Laser **Factors affecting selection of welding processes: (Any four factors)** 1. material grade, material thickness, design, weld property requirement 2. equipment type, edge preparation design 3. tip / work piece distance, electrode angle 4. current, arc voltage, welding speed 5. Availability of equipment 6. Repetitiveness of the operation 7. Quality requirements (base metal penetration, consistency, etc.) 8. Location of work 9. Materials to be joined i.e. base metal composition 10. Appearance of the finished product 11. Size of the parts to be joined 12. Time available for work 13. Skill experience of workers 14. Cost of materials 15. Code or specification requirements 16. Mechanical properties desired in joints	**02**
	c)	**Differentiate between brazing and soldering.**	**04**
		Answer: Comparison of brazing and soldering **Point** | **Soldering** | **Brazing** **Temperatures used** | below 470°c | above 470°c. **Filler material** | Solder. | Spelter. **Joint strength** | Weak or less | More or strong. **Applications** | Connections of radio & T.V. sets, wiring joints in electric connections & battery terminals, Radiator brass tube, copper tubing, Brass halved bearings etc. | Parts of bicycle such as frames & rims, Exhaust pipe in motor engine, band saw, tipped tool, pipe joints subjected to vibration etc.	**04**
	d)	**Explain the working principle of MIG welding with neat sketch.**	**04**
		Answer: ***(Note: Explanation 02 marks & Sketch 02 marks)*** **MIG Welding:** Gas-metal-arc welding is a gas shielded metal arc welding process which uses the high heat of an electric arc between a continuously fed, consumable electrode wire and the material to be welded. Metal is transferred through protected arc column to the work. In	**02**

		this process, the welding machine is a D.C. constant voltage which at a given wire feed rate will produce necessary current to produce arc. The wire is fed continuously from a reel through a gun to constant surface which imparts a current upon the wire. The welding gun is either air cooled or water cooled depending upon the current being used. The fused electrode material is supplied to the surfaces of the work pieces, fills the weld pool and forms joint. The welding area is flooded with a gas (an inert gas i.e. Argon, helium, CO2, argon + Oxygen or other gas mixtures) which will not combine with metal. Carbon dioxide is most commonly used as it inexpensive. **Metal inert gas welding** **(MIG, GMAW)**  **Fig. Metal Inert Gas Welding**	**02**
	e)	**With neat sketch explain the features of oxidizing flame and carburizing flame.**	**04**
		Answer:(Description 01 marks each, sketch 01 marks each) O**xidizing Flame**: An oxidizing flame is one in which there is an excess of oxygen. The flame has two zones- the smaller inner cone which has purplish tinge, the outer cone or envelop.  	**01** **01**

		Carburizing Flame: A carburizing flame is one there is an excess of acetylene. The flame has three zones 1) Sharply defined inner cone 2) An intermediate cone of whitish colour. 3) Bluish outer cone  	**01** **01**
	f)	**Draw neat sketch showing various parts of die set.**	**04**
		Answer:(Sketch 02 marks, labeling 02 marks)  1. Stop 2.Sheet metal 3.Pilot 4.Blanking punch 5.Ram 6.Piercing punch 7.Stripper 8.die **Fig. Progressive Die** **OR**	**04**

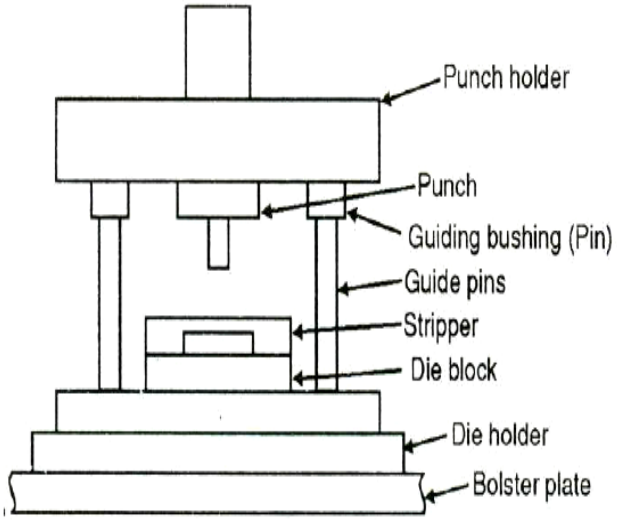
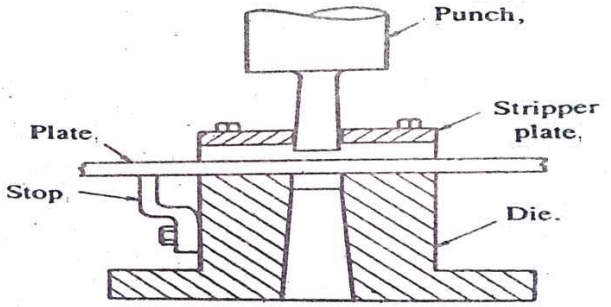
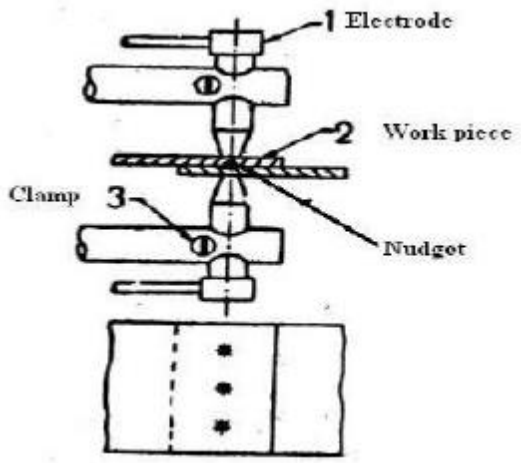


Fig. Standard Die Set



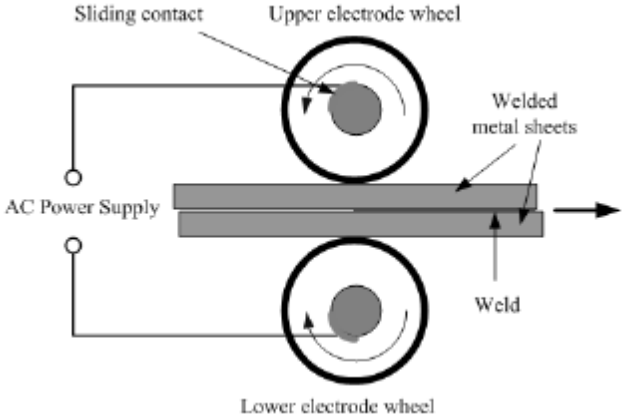
Punch and die set up for piercing, punching and blanking

4		**Attempt any four of the following:**	**16**
	a)	**Explain the working principle of resistance welding with neat sketch.**	**04**
		Answer: ***(Note: Explanation - 2 Marks & Sketch - 2 Marks)*** **Resistance Welding Process:** ***(Any one 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.	**04**



OR

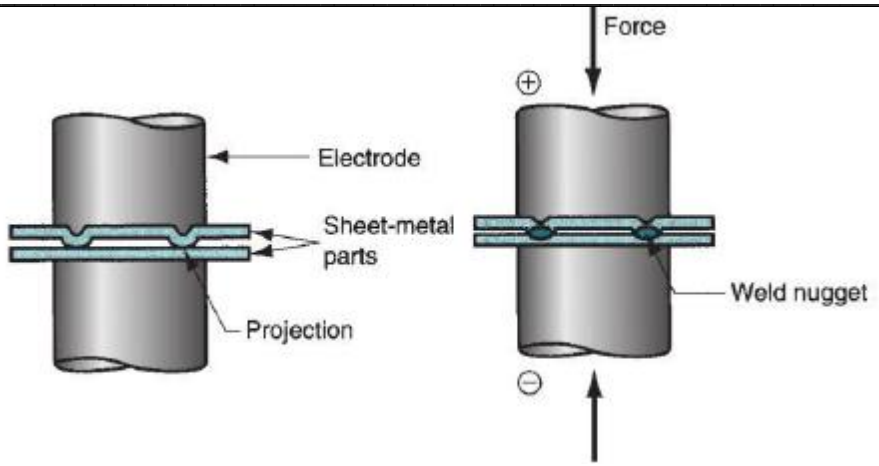
2. Seam Welding is a Resistance Welding (RW) process used for producing continuous joint of overlapping sheets by passing them between two rotating electrode wheels. Heat generated by the electric current flowing through the contact area and pressure provided by the wheels are sufficient to produce a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



OR

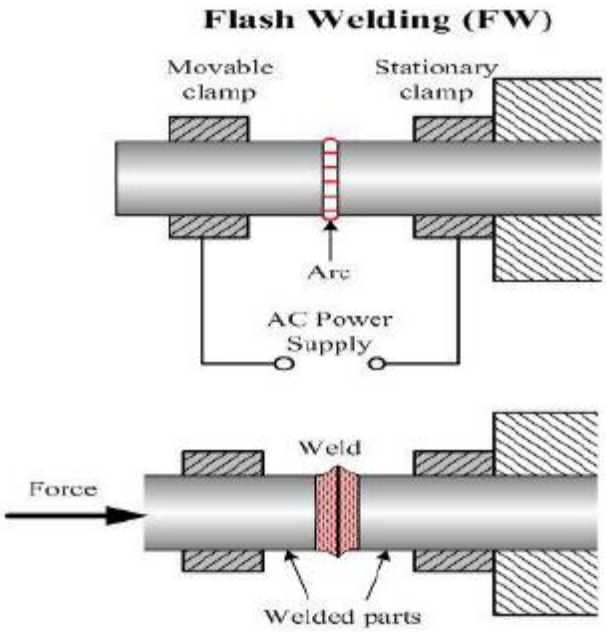
3.Projection Welding

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.

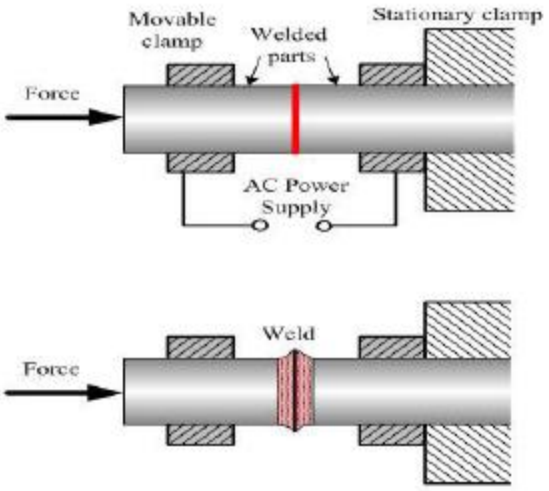


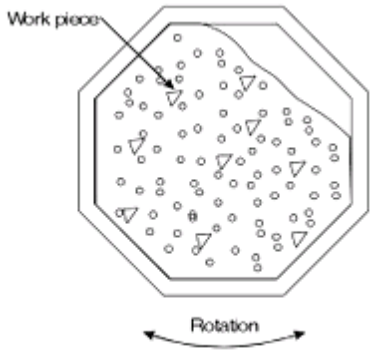
OR

4.Flash Welding 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.



5.Resistance Butt Welding:

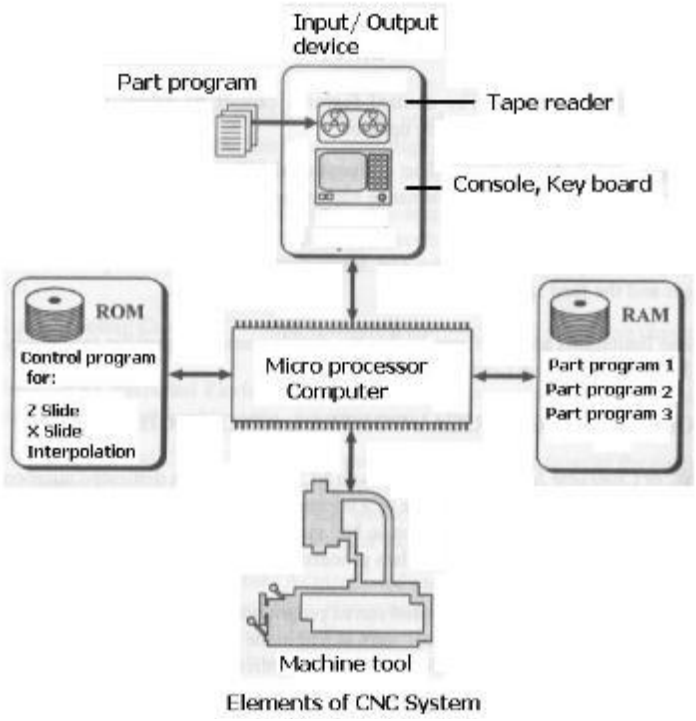
		It is a Resistance Welding (RW) process, in which ends of wires or rods are held under a pressure and heated by an electric current passing through the contact area and producing a weld. The process is similar to Flash Welding; however in Butt Welding pressure and electric current are applied simultaneously 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)**  	
	b)	**State advantages and limitations of honing process.**	**04**
		Advantages:(any four = 02 marks) 1. Less complex or low cost fixtures. 2. It is highly accurate. 3. It can be used for both long and short bores. 4. It maintains original bore centerline. 5. Any material can be finished regardless its hardness. **Limitations:** 1. Honing is though of as a slow process. 2. Horizontal honing may create oval holes unless the work is rotated or supported. If the workpiece is thin, even hand pressure may cause a slightly oval hole.	**02** **02**
	c)	**Explain the working principle of galvanizing process. Give its applications also.**	**04**
		Answer: **Galvanization** or **galvanisation** or **galvanizing** is the process of applying a protective zinc coating to steel or iron, to prevent rusting. The most common method is hot-dip galvanizing, in which parts are submerged in a bath of molten zinc.	

		Galvanizing protects in three ways: 1. It forms a coating of zinc which, when intact, prevents corrosive substances from reaching the underlying steel or iron 2. The zinc serves as a sacrificial anode so that even if the coating is scratched, the exposed steel will still be protected by the remaining zinc. 3. The zinc protects its base metal by corroding before iron. For better results, application of chromates over zinc is also seen as an industrial trend. **Applications:** Galvanizing: It is used for - **1.** all forms of outdoor structural parts **2.** Pipes **3.** Sheeting for roofs **4**.wash tubs **5.** All sort of containers **6.** telegraph wire **7.** fencing materials **8.**Transformer parts	**02** **02**
	d)	**Explain how tumbling process is used to clean the surfaces.**	**04**
		Answer: Tumbling process: *(Description :-4marks , diagram not necessary)* Tumbling process is used for removing rust and scale from metal parts. In this dry abrasive (deburring compounds) are effective for removing rust and scale from small parts of simple shapes. However parts with complex shapes, with deep recess and other irregularities, cannot be descaled uniformly by tumbling. It may require several hours if the method is used. The operation is accomplished by placing workpieces in a drum or barrel, and totally filled together with stars, jacks slugs or abrasive materials. The material can be sand, granite chips, slag. In operation, the barrel is rotated, and the movements of the workpiece and accompanying slugs or abrasive material against each other produces by friction a fine cutting action which removes the fins, flashes and scale from the product. Parts configuration and size are the primary limitations of the process  Barrel Tumbling.	**04**

	e)	**State the various advantages and limitations of CNC machine.**	**04**
		Advantages of CNC Machines:- (any four = 2 marks) [1] Greater machine utilization. [2] Complex machining operations can be easily done. [3] It gives high degree of accuracy. [4] It requires less inspection. [5] It reduces scrap & waste. [6] It gives high production rate. **Limitations of CNC Machines:- (any four = 2 marks)** 1) It has High Investment cost. 2) Higher maintenance cost. 3) Skill operator is required. 4) Training of operator is required. 5) High tooling cost. 6) Temperature, humidity & dust must be affect machining. 7) Initial cost is high.	**02** **02**
	f)	**Differentiate between conventional machines and CNC machine.(minimum four points each)**	**04**
		Answer: (four marks for any four points)	**04**

Sr. No	Conventional Machines	CNC machines
1)	Basically conventional m/c have maximum 2 axis, known as X & Y axis.	CNC m/c have minimum 3 axis, known as X,Y,Z axis.
2)	Lead screw is responsible for axis movement in conventional m/c	Ballscrew is responsible for axis movement in CNC m/c
3)	All operations are performed manually. (except some auto mode).	All operations are performed hydraulically or pneumatically.
4)	There is no use of Servo motors & stepping motors for slide movement	Use of Servo motors & stepping motors for slide movement
5)	No Display units are provided in conventional m/c	Display units are provided in CNC m/c
6)	conventional m/c have Less accuracy	CNC m/c have More accuracy
7)	conventional m/c More operator error	CNC m/c have Less operator error
8)	Less Guarding Arrangements For conventional m/c	More Guarding Arrangements For CNC m/c
9)	Small changes is **not** possible in conventional m/c	Small changes is possible in CNC m/c
10)	No facility for dry run.	facility for dry run.
11)	Additional information such as number of jobs produced, time per component **cannot** be obtained.	Additional information such as number of jobs produced, time per component **can** beobtained.
12)	It does **not allow** compensation for change in cutting tool dimension.	It does **allow** compensation for change in cutting tool dimension.

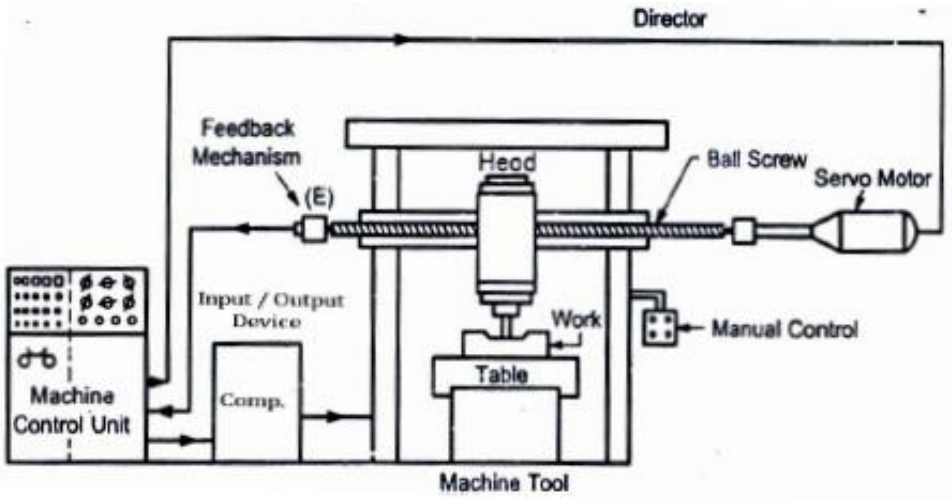
5.		**Attempt any four of the following**	**16**
	a)	**With neat sketch explain the working principle of CNC machines.**	**04**
		Answer: **Working Principle of CNC machine:-(Sketch - 2mark,explaination - 2mark)** A CNC machine also has a tape reader or any other input media for entry of the part program. 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.	**02**



Elements of CNC System

02

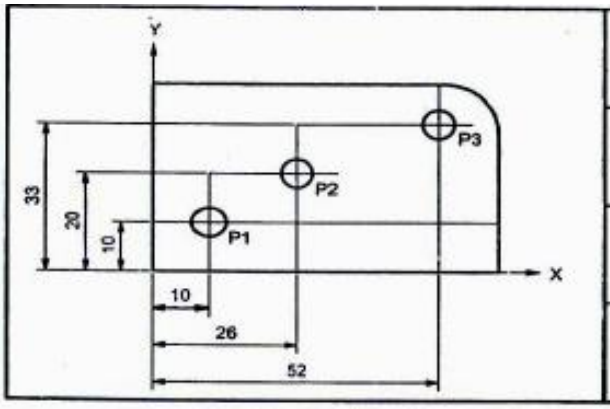
Or



	b)	**Explain absolute and incremental co-ordinate systems, with suitable example.**	**04**
		1. Absolute Co- ordinate system: (*Explanation 01 mark & example 01mark)* 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. **01**

Example:



Point	X Coordinate	Y Coordinate
P1	10	10
P2	26	20
P3	52	33

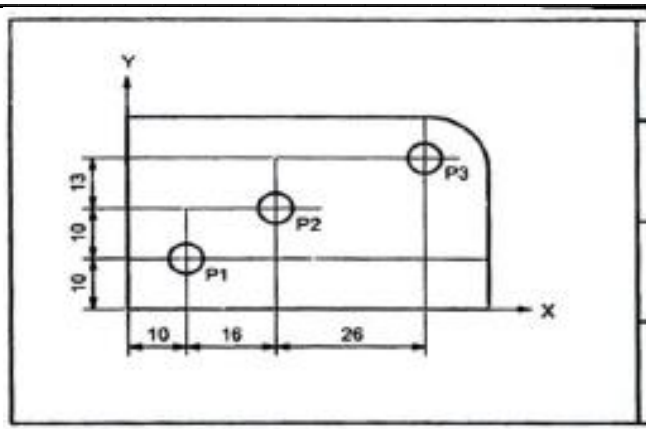
01

2. Absolute Co- ordinate system: (*Explanation 01 mark & example 01mark)* **01**

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 and 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.

Example:

01



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

c) **and give their functions.** **04**

Answer: (significance 02 marks, any four code 02 marks) **02**

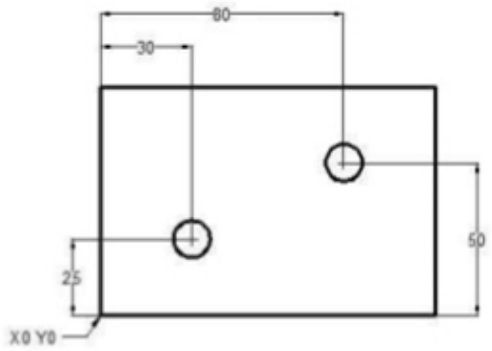
M- codes (Miscellaneous function)

The Miscellaneous function word is used to specify certain Miscellaneous function or auxiliary functions which do not relate to the dimensional movements of the machine. The Miscellaneou
e.g. M00, M05, M08, M30 etc.

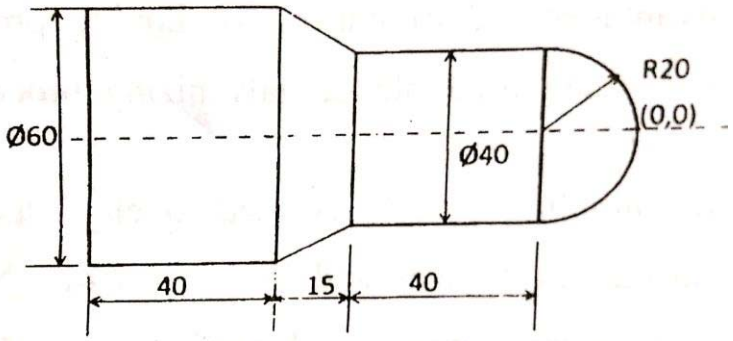
Sr. No.	M Code	Meaning of Code
1	M00	Program Stop (non-optional)
2	M01	Optional Stop: Operator Selected to Enable
3	M02	End of Program
4	M03	Spindle ON (CW Rotation)
5	M04	Spindle ON (CCW Rotation)
6	M05	Spindle Stop
7	M06	Tool Change
8	M07	Mist Coolant ON
9	M08	Flood Coolant ON
10	M09	Coolant OFF
11	M17	FADAL subroutine return
12	M29	Rigid Tapping Mode on Fanuc Controls
13	M30	End of Program, Rewind and Reset Modes
14	M97	Haas-Style Subprogram Call
15	M98	Subprogram Call
16	M99	Return from Subprogram

02

	d)	**Describe procedural steps for developing CNC part programme.**	**04**
		Procedure for developing part program There are two methods of part programming: manual part program and computer assisted part programming. **Manual part programming:** 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. **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.	**04**
	e)	**Give suitable example of canned cycle.**	**04**
		Canned cycles / fixed cycles: It is defined as a set of instructions, inbuilt or stored in the system memory, to perform a fixed sequence of operations**.** It reduces programming time and effort. Canned cycle is used for repetitive and commonly used machining operations. To save the repetition of programming of common operations, the cycle is used called affixed cycle/canned cycle. The sequence of standard cycle of operation is stored in the memory of the computer. When that information is required at the time of machining is activated from memory, by using proper G code. One of the most frequently used canned cycles is the drilling cycles. **Example of canned cycle:**	**02**

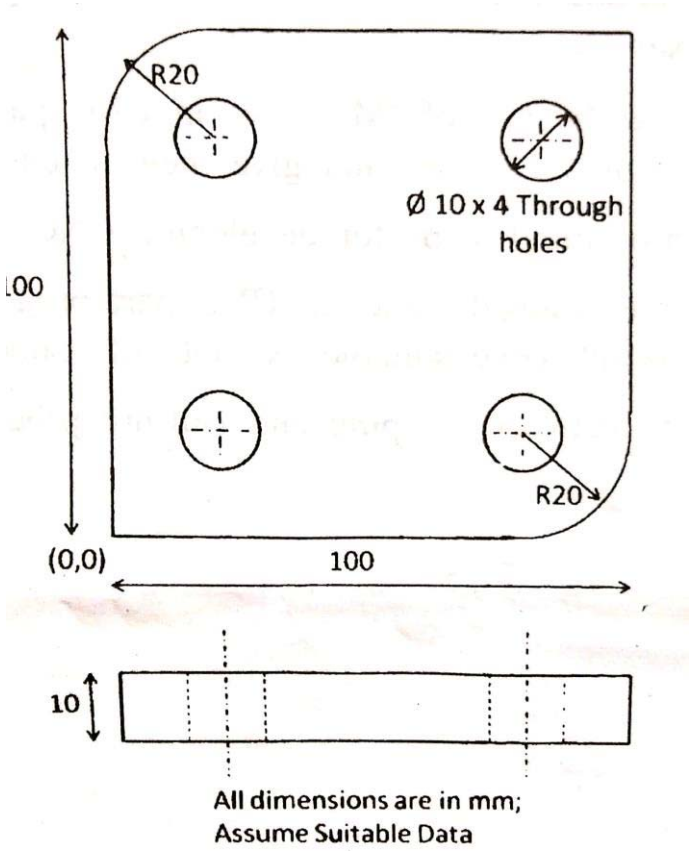
		Working Examples : N10 T1 M06 N20 G90 G54 G00 X30 Y25 N30 S1200 M03 N40 G43 H01 Z5 M08 N50 G81 Z-10 R2 F75 N60 X80 Y50 N70 G80 G00 Z100 M09 N80 M30 	**02**
	F	**Differentiate between Lapping and Buffing process.**	**04**
		Answer: difference between Lappin and Buffing process(Any four points , 4 marks)	**04**

Sr. No.	Lapping	Buffing
1	Lapping is a finishing process in which tool used is called as lap.	Buffing is finishing process in which tool used is called as buffing wheel.
2	The lapping process involves passing a part between one or two large flat-lap plates or wheels.	In this process, work piece is brought in contact with a revolving, cloth buffing wheel that has been charged with very fine abrasive
3	The process is used to correct minor imperfections of shape, refines surface finish.	Buffing is used to give higher, lustrous, reflective finish.
4	Lapping removes more material than buffing.	Buffing removes minute ammout of metal than lapping.
5	Applications: A. Hand lapping is used for i. Press work dies ii. Moulding dies iii. Limit gauges iv. Surface plates	Applications: Automobiles, motor-cycles, boats, bicycles, sporting items, tools, store fixtures, commercial and residential hardware and household

			v. Engine valve and valve seat B. Machine lapping is used for i. Races of ball and roller bearings ii. Gears iii. Piston rings iv. Slip gauges v. Crankshaft.	utensils and appliances.	
6		**Attempt any TWO of the following**			**16**
	a)	**Write the CNC part programme for turning the component as shown in fig. No. 1. Assume suitable date required.**			**08**
		Answer:  **Fig.01** **Points X Z R** **0 31 01** **1 00 01** **2 00 00** **3 20 -20 20** **4 20 60** **5 30 75** **6 30 115** **7 31 01**		**02**

Program:

N	G	X	Z	R	M	F	S	T	
N00	G90								
N01	G71								01
N02	G93				M41		S1500		
N03	G95								
N04	G28	X00	Z00						
N05					M06			T0101	
N06					M03		S1500		
N07	G00	X31	Z01		M08				
N08	G00	X00	Z00						
N09	G00	X00	Z00			F0.1			
N10	G03	X20	Z-20	20			S1500	D1	
N11	G01	X20	Z-60						04
N12	G01	X30	Z-75						
N13	G01	X30	Z-115						
N14	G00	X31	Z01						
N15	G00	X00	Z01						
N16	G28	X00	Z00						
N17					M05				01
N18					M09				
N19					M02				
N20					M30				

	b)	**Write the CNC part programme for machining the holes is as shown in fig. No. 2 in the components , as well as for finishing its all sides by CNC milling machine . assume suitable date.**	**08**
		Answer: 	**02**

POINT	X	Y	Z	R
1	00	00	05	
2	00	00	-10	
3	80	00	-10	
4	100	20	-10	20
5	100	100	-10	
6	20	100	-10	
7	00	80	-10	20
8	00	00	-10	

9	00	00	05		
10	20	20	05		
11	20	20	-10		
12	20	20	05		
13	80	20	05		
14	80	20	-10		
15	80	20	05		
16	80	80	05		
17	80	80	-10		
18	80	80	05		
19	20	80	05		
20	20	80	-10		
21	20	80	05		
22	-20	15	05		

Program:

01

N01 G00 G90 G95 G71 G41E0B
N02 G54 E0B (work of set x01 y0 defined)
N03 T01 M06 E0B
N04 S1000 M03 E0B
N05 M08 E0B
N06 G00 X0.0 Y0.0 Z5.0 E0B
N07 G01 Z-10 F0.1 EOB
N08 X 80.0 EOB
N09 G03 X100.0 Y20.0 I0 J20 EOB
N10 G01 Y100.0 EOB
N11 G01 X20.0 EOB
N12 G03 X 00.0 Y80.0 EOB
N13 G01 Y 00.0 EOB
N14 G00 X0.0 Y0.0 Z 5.0 EOB
N15 G00 X20.0 Y20.0 EOB
N16 M08 M03 S1000 EOB
N 17 G01 Z-10.0 EOB
N18 G00 Z5.0 EOB

04

		N19 G00 X80.0 Y20.0 EOB N20 G01 Z-10.0 EOB N21 G00 Z5.0 EOB N22 G00 X80.0 Y80.0 EOB N23 G01 Z-10.0 EOB N24 G00 Z5.0 EOB N25 G00 X20.0 Y80.0 EOB N26 G01 Z-10.0 EOB N27 G00 Z5.0 EOB N28 X-20.0 Y15.0 EOB N29 M05 M09 EOB N30 M30 EOB	**01**
	c)	**Explain constructional features, and working of progressive die. Also state the functions of any four parts of progressive die.**	**08**
		Answer: (Sketch is not compulsory, if drawn consider for marks) **Constructional features and Working of Progressive Die:** A progressive die consists of the following parts. 1. Stop 2. Sheet metal 3. Pilot 4. Blanking punch 5. Ram 6. Piercing punch 7. Stripper Plate 8. Ddie 9. Bolster Plate 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	**02** **02**

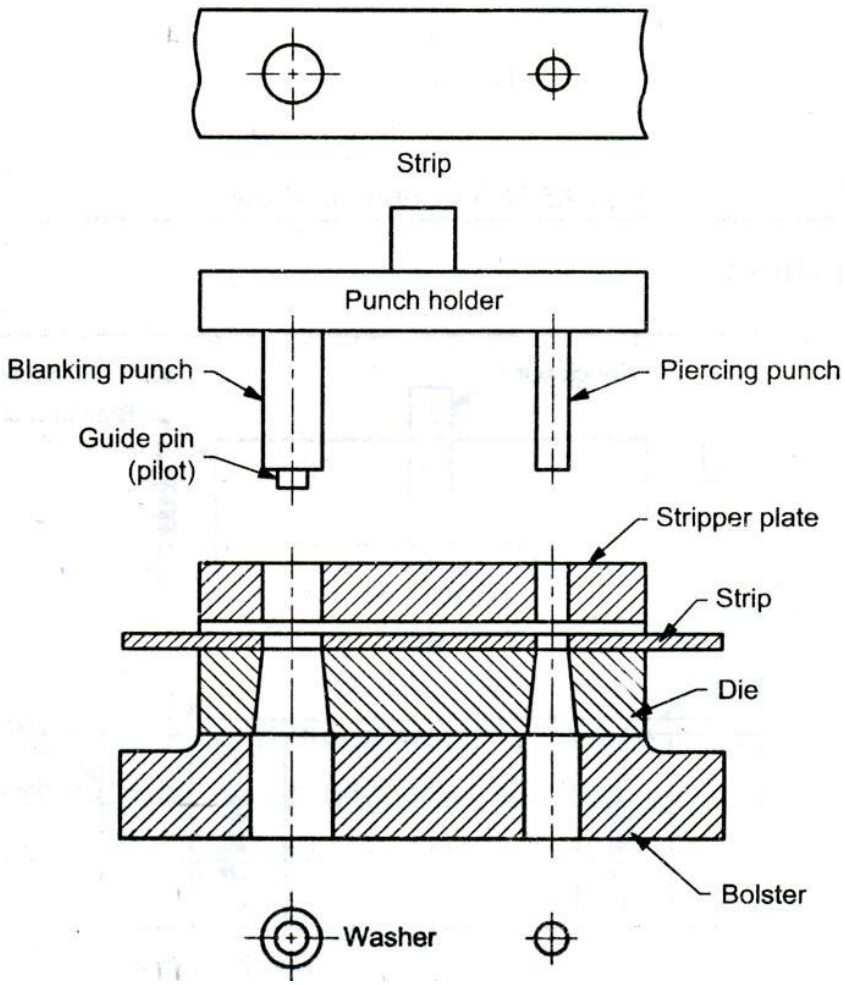


Fig Progressive Die

functions of parts of progressive die:(Any four = 4 Marks)

1. **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.
2. **Stops:** The stops 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.
3. **Stripper:** To remove scrap material from the punch as it cleans the die block.
4. **Bolster plate :** this is a thick plate secured to the press bed which is used for locating and supporting the die assembly. It is usually 5 to 12.5 cm thick.
5. **Die :** The function of the die to produce the work in a press operation.
6. **Blanking Punch:** The function of the blanking punch is to produce blank.
7. **Piercing punch:** The function of piercing punch is to produce punched holes into the sheet metal.

04