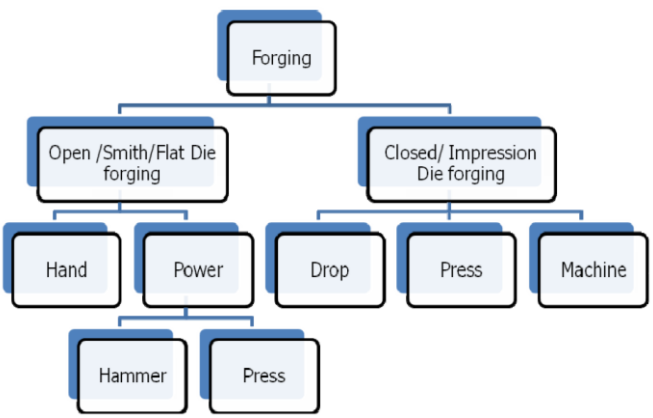
Important Instructions to examiners:

1) The Answer 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 Answer 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.

Model Answer	Marks
Q. 1. (A) Attempt any SIX of the following:	12
i) Define forging.	2
Answer: Definition of Forging: Forging can be defined as the controlled plastic deformation of metals at elevated temperatures in to a predetermined size or shape using compressive forces exerted, through some type of die, by a hammer, a press or upsetting machine. OR Forging is a plastic flow of metal by the application of compressive forces in which size and shape is changed permanently without failure. OR Forging is a deformation process in which work is compressed between two dies using either impact or gradual pressure to form the part. OR Forging refers to the production of those parts which must be heated in a close furnace to a desired temperature in order to acquire sufficient plasticity & shaping it in dies under the pressure of heavy hammers, forging machines & presses.	2
ii) List four materials used in press work.	2
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,	2

11) stainless steel & its alloys, 12) Different types of steels & its alloys.	
iii) State four advantages of welding process.	2
Answer: **Advantages of welding process** *(Any four - 1/2 Marks Each)* 1) It produce permanent joint. 2) Large number of metals can be welded. 3) Freedom in design. 4) Strong and tight joining 5) Cost effectiveness 6) Simplicity of welded structures design 7) Welding processes may be mechanized and automated.	2
iv) Define welding.	2
Answer: **Welding:** Welding is a process of joining similar metals by application of heat with or without application of pressure and addition of filler materials. **OR** Welding is defined as a localized coalescence of metals, where in coalescence is obtained by heating to suitable temperature with or without the application of pressure and with or without the use of filler metal.	2
v) List any two needs of surface treatment process.	2
Answer: **Needs of surface treatment process** *(Any Two – 1 Marks Each)* 1) Improve resistance to wear, erosion and indentation. 2) Reduce adhesion. 3) Improve lubrication. 4) Improve resistance to corrosion and oxidation. 5) Improve fatigue resistance. 6) Rebuild surface on worn components. 7) Modify surface texture. 8) Impart decorative features. 9) To alter surface properties according to the requirement.	2
vi) State meaning of following functions of programming codes. **1) G90** **2) G94**	2
Answer: meaning of functions of programming codes *(1 Mark Each)* **1) G90 -** Absolute Programming **2) G94 -** Feed Rate Programming In "mm/min"	2
vii) List any four advantages of CNC machines.	2
Answer: Advantages of CNC machines *(Any four - 1/2 Marks Each)* 1) Greater machine utilization. 2) Complex machining operations can be easily done. 3) It gives high degree of accuracy. 4) It requires less inspection.	2

5) It reduces scrap & waste. 6) It gives high production rate. 7) It has lower labour cost & tooling cost. 8) Elimination of operator error 9) It gives more operator safety. 10) It gives more operator efficiency. 11) It reduces space requirements 12) Flexibility in changes of component design. 13) Tool life gets increased. 14) Lead time is reduced. 15) Elimination of special jigs and fixtures. 16) Accurate costing & scheduling.	
viii) List any two limitation of forging process.	2
Answer: (Any Two - 1 Mark Each) 1. High tool cost. 2. High tool maintenance 3. No cord 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
Q. 1. (B) Attempt any TWO of the following:	8
i) Write classification of forging process.	4
Answer: Classification of forging process - 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  	4

ii) Compare drop forging and press forging.	4

Answer: Comparison of drop forging and press forging *(Any four – 1 Mark Each)*

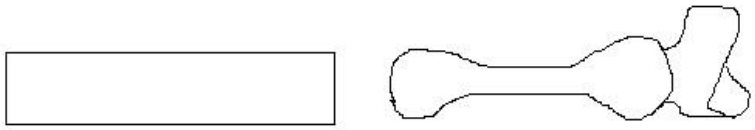
Drop forging	Press forging
1. This process involves **fast** squeezing of metal in dies by applying repeated blows by hammers.	1. This process involves **slow** squeezing of metal in dies by applying pressure.
2. The dies used relatively **more draft** and therefore more complicated shape cannot be forged.	2. The dies used relatively **less draft** and therefore more complicated shape can be forged.
3. Alignment of two dies is **difficult**.	3. Alignment of two dies is **easy**.
4. The life of machines and dies are **shorter**.	4. The life of machines and dies are **longer**.
5. This process **requires** highly skilled operator.	5. This process **does not** require highly skilled operator.
6. This process has **more** noise and vibrations.	6. This process has **less** noise and vibrations.
7. Production rate is **slower**.	7. Production rate is **faster**.
8. **Less** dimensional accuracy.	8. **Better** dimensional accuracy.

4

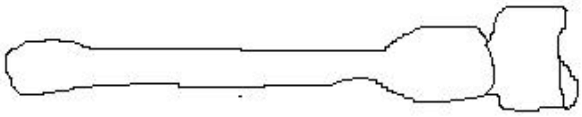
iii) Draw simple labeled sketches showing forging sequence for manufacturing connecting rod.	4

Answer: Forging sequence for manufacturing connecting rod *(Any four steps – 1 Mark Each)*

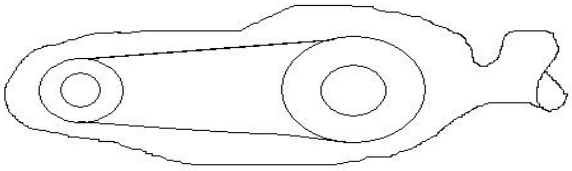
a. Fullering:



b. Edging:

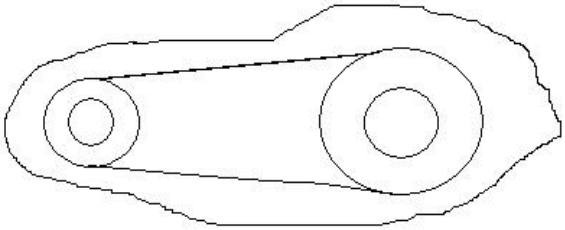


c. Blocking

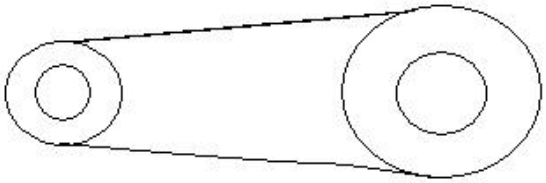


4

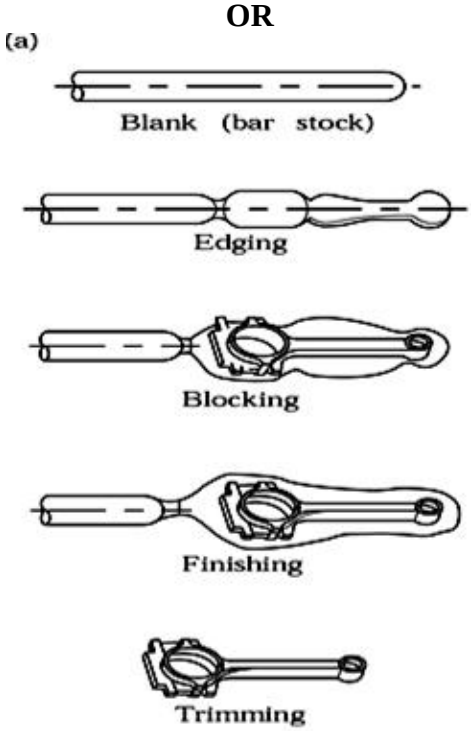
d. Finishing



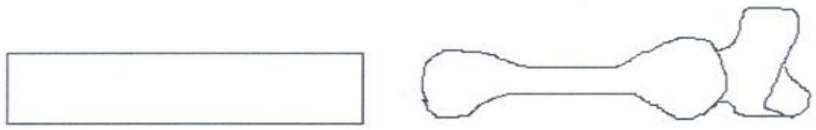
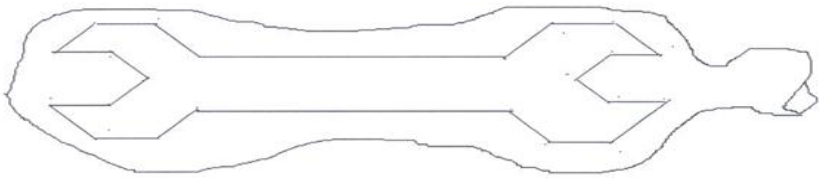
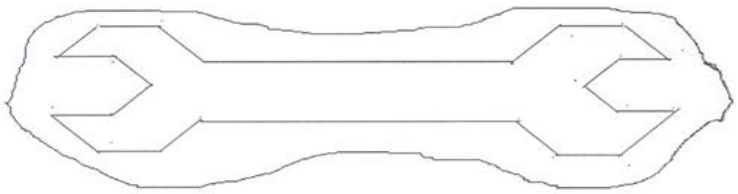
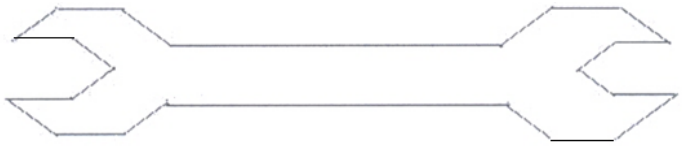
e. Trimming

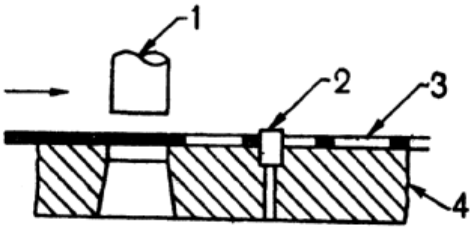
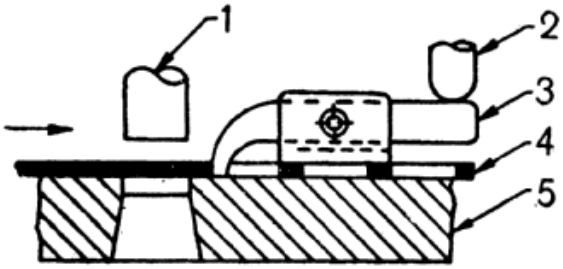
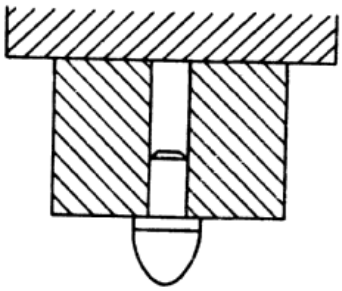


OR

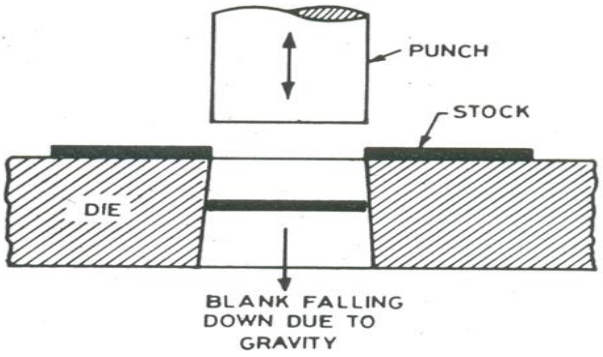
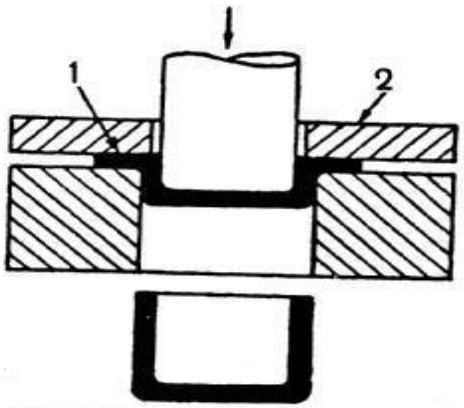


Q. 2. Attempt any FOUR of the following:	16
a) List four advantages of forging process.	4
Answer: Advantages of forging process *(Any four – 1 Mark Each)* **1. Strength:** • Forging reduces the failures. • High strength to weight ratio. • It can be able to withstand fluctuating stress caused by sudden shock loading. **2. Metal conservation:** • Practically there is no waste of metals.	4

3. Weight saving: • Strong thin-walled parts may be produced without damaging important physical requirements. **4. Machining time:** • Reduces machining time for finishing operations of the products. **5. Speed of production:** • High rate of production is possible. **6. Incorporation in welded structures:** • Parts can be welded easily due to fibrous structure. **7. It maintains uniform and same quality all over parts** **8. It gives close tolerances.** **9. It gives smooth surface finish.** **10. Allows the metal to be displaced where it is needed.** **11. Minimum machine finish carried out on the components especially when it is forged in dies.**	
b) Draw simple labeled sketches showing forging sequence for manufacturing spanner.	4
Answer: Forging sequence for manufacturing spanner *(Any four steps – 1 Mark Each)* **a.** Fullering:  **b.** Edging:  **c.** Blocking:  **d.** Finishing  **e.** Trimming 	4

c) Explain with neat sketch labeled sketch pilot and stops as die accessories.	4
Answer: Pilot and stops as die accessories *(Figure - 1 Mark & explanation - 1 Mark*)	
1. 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. Button stop and lever stop.	
Button stop: The button stop illustrated in Fig. is the simplest of the designs. A small pin or a button 2 is fixed to the die block 4 at a measured distance from the punch axis. After the end of each cut, the plate 3 is lifted and pushed aside till the edge of the next slot bears against the button 2. This makes the accurate spacing. The button stop is used in hand presses and in slow acting power presses.	1
	1
1. Punch, 2. Button, 3. Plate, 4. Die block. Figure. Button Stop	
OR	
Lever stop: - The lever stop illustrated in Fig., is operated by the machine. As the punch 1 descends, the pin 2 attached to the ram pushes the lever 3 which lifts the lever stop, leaving the blank 4 free. The plate is pushed aside immediately when the punch 1 starts moving in the upward strokes, and in the next instant the lever 3 is released from pin pressure that causes the stop to engage with the work making an accurate spacing.	
	
1. Punch, 2.Pin, 3. Lever, 4. Plate, 5. Die block	
2. Pilots:	
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.	1
	1
Figure. Pilot	

d) List any four die accessories and write their functions.	4
Answer: Die accessories *(Any Four - 1 Mark Each)* 1) **Stripper:** To remove scrap material from the punch as it cleans the die block. 2) **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. 3) **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. 4) **Knock out:** The function of knock out is to eject the finished components from the die cavity. 5) **Strip Feeder:** It is used for feeding the strip mostly in automatic operations. 6) **Pressure pad:** It is used for drawing operation for maintaining flat surface of the cup.	4
e) Give classification of presses.	4
Answer: **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	4

f) Explain blanking operation on a press with neat sketch.	4
Answer: (Sketch – 2 Marks & Operation – 2 Marks) **Blanking Operation:** • It is the operation of cutting of flat sheet to the desired shape. • The metal punched out (i.e. blank) is the required product & the plate with hole left on die goes waste. • The die used for banking is called as blanking dies. • The size of blank is governed by size of die and the clearance left on the punch. • Fig. shows blanking operation  	2 2
Q. 3. Attempt any FOUR of the following:	16
a) Explain drawing operation on press with neat sketch.	4
Answer: *(Sketch – 2 Marks & Operation – 2 Marks)* **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 blank is placed on die and while punch descend, the pressure pad holds the blank firmly on the die. • 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. • In this, clearance between punch and die is greater. • The drawing operation is illustrated in Fig.  **Drawing operation** 1. Blank, 2. Pressure pad.	2 2

b) Compare brazing and soldering on basis of **i) Temperatures used** **ii) Filler material** **iii) Joint strength** **iv) application**	4

Answer: Comparison of Brazing and Soldering *(Any Four – 1 Mark Each)*

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.

4

c) Explain with simple sketch, the method of welding used in manufacturing automobile bodies. — 4

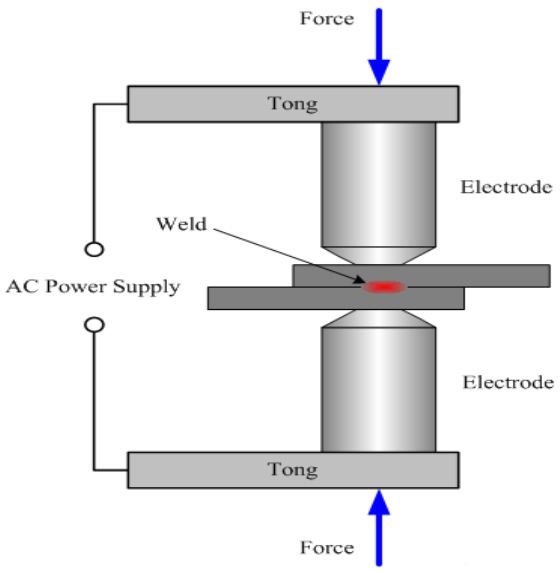
Answer: *(Note: Marks to be given to appropriate method: 2 Marks – Sketch & 2 Marks - Explanation)*

The most popular methods (Types) used for manufacturing automobile bodies:

- Spot Welding (RSW)
- MIG Welding (GMAW)

4

Resistance Spot Welding (RSW)

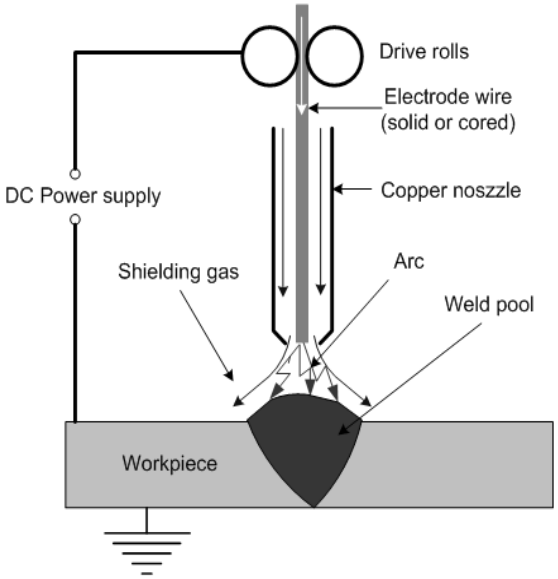


Spot Welding (RSW): It is used to join overlapping strips, sheets or plates of metals. The pieces are assembled and squeezed between two electrodes, which must possess high electrical & thermal conductivity. When the current is turned on, the pieces are heated at their areas of contact to a welding temperature, and with the aid of mechanical pressure the electrodes are forced against the metal to be welded.

OR

Metal inert gas welding

(MIG, GMAW)



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 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 is inexpensive.

d) Classify welding process on the basis of method of heat generation. — 4

Answer: Classification of Welding Process *(Any Four – 1 Mark Each)* — 4

Depending on method of heat generation American welding society classifies welding as

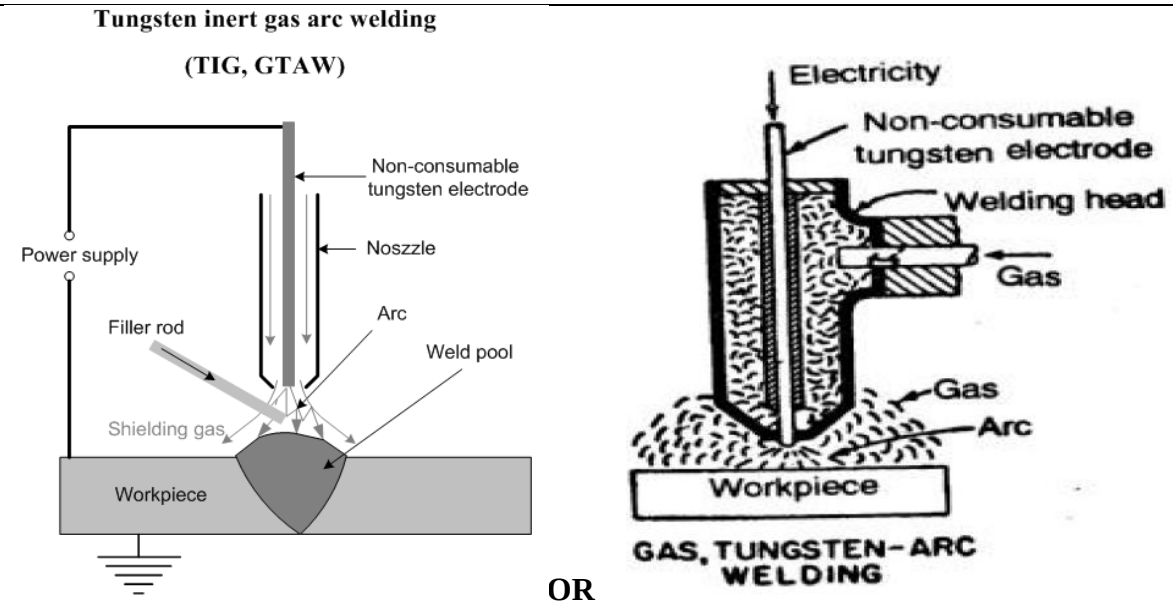
a. Arc welding
1) Carbon Arc Welding;
2) Shielded Metal Arc Welding (SMAW)
3) Submerged Arc Welding (SAW)
4) Metal Inert Gas Arc Welding (MIG, GMAW)
5) Tungsten Inert Gas Arc Welding (TIG, GTAW)
6) Electroslag Welding (ESW)
7) Plasma Arc Welding (PAW)

b. Resistance Welding (RW)
1) Spot Welding (RSW)
2) Flash Welding (FW)

3) Resistance Butt Welding (UW) 4) Seam Welding (RSEW) **c.** Gas Welding (GW) 1) Oxyacetylene Welding (OAW) 2) Oxyhydrogen Welding (OHW) 3) Pressure Gas Welding (PGW) **d.** Solid State Welding (SSW) 1) Forge Welding (FOW) 2) Cold Welding (CW) 3) Friction Welding (FRW) 4) Explosive Welding (EXW) 5) Diffusion Welding (DFW) 6) Ultrasonic Welding (USW) **e.** Thermit Welding (TW) **f.** Electron Beam Welding (EBW) **g.** Laser Welding (LW)	
e) List types of gas flames used in oxy acetylene welding and write their application.	4
Answer: Types of gas flames *(Any Two types – 2Marks & 2 Marks – Applications)* **TYPES OF FLAMES** • Neutral Flame – Steel, stainless steel, cast iron and aluminium. • Carburizing flame or Reducing flame – carbon steel • Oxidizing Flame – Brass & Bronze	4
f) Differentiate between compound die & combination die.	4
Answer: Difference between compound Die & Combination Die *(Any Four – 1 Mark Each)*	4

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 performed in a single stoke of press	2. Two separate strokes of press.
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.

Q. 4. Attempt any FOUR of the following:	16
a) Explain TIG welding with neat sketch.	4
Answer: 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.	2



2

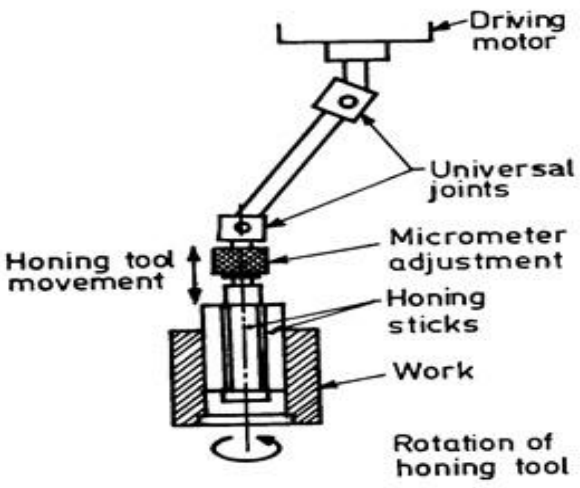
OR

b) Compare electroplating and galvanizing process. 4

Answer:

Comparison of electroplating and galvanizing process *(Any four points -1 mark each)*

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	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

c) Describe abrasive blast cleaning process and list any two applications.	4
Answer: **Abrasive blast cleaning (Blasting):** This method is widely used for removing all classes of scale and rust from forgings, castings, weldments, and heat treated parts. Depending on the finish requirements, blasting alone or blasting with pickling is used. In this process the parts are generally cleaned by the use of abrasive particles such as sand, steel grit or shot impelled against the surface to be cleaned. Some cleaning is performed by means of high-velocity air blast, with the blast directed by hand. In many cases, an airless blast machine that cleans by impact is also used. The abrasive is fed from an overhead storage hopper to the center of a radially rotating wheel, whereupon the metallic shot or grit is thrown in a controlled stream upon the work to be cleaned. All traces of sand, scale, oxides and other material are removed, providing an excellent surface for bonding final finishes. **Applications**: The airless blast machine is used for cleaning engine blocks, crankshafts, castings of different shapes and size, railroad cars, car wheels, oil and gas pipes, steel strip, and many other purposes.	3 1
d) Explain micro finishing process used to correct hole geometry in component.	4
Answer: **Honing Process (micro finishing process):** 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.  **Fig. Honing.**	

e) List any four components of CNC machines and write their functions.	4
Answer: Components of CNC machines *(Any Four components - 2 Marks & Function – 2 Marks)* The various components of CNC system are :- **1) Program input device:-** It is the medium of transmitting the part program to the computer. Three commonly used program input devices are punch tape reader, magnetic tape reader and computer. **2)Memory storage :-**The control program as well as manual instructions are stored in the memory storage **3)Microprocessor :-** It reads the instructions given by memory storage & sends the required signals to the CNC machine tool **4) Machine control Unit (MCU):-** It processes the information received from memory unit, operate and sends appropriate instructions to machine tool. **5) Drive system:-** A drive system consists of amplifier circuits, drive motors, and ball lead-screws. The control signals are augmented to actuate drive motors which in turn rotate the ball lead-screws to position the machine table. **6) Machine Tool: -**. It always has a slide table and a spindle to control of position and speed. The machine table is controlled in the X and Y axes, while the spindle runs along the Z axis. **7) Feedback system:-** It continuously monitor the position at which the cutting tool is located at any particular instant. **8) Programmable logic controller (PLC) :-**They developed to be re-programmed without hardware changes when requirements were altered and thus are re-usable. **9) Machine control panel:-**It is the direct interface between the operator and the NC system, enabling the operation of the machine through the CNC system. **10) Operator control panel:-**The Operator Control Panel provides the user interface to facilitate a two way communication between the user, CNC system and the machine tool.	4
f) Give classification of CNC machines.	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	

Q. 5. Attempt any FOUR of the following: 16

a) Differentiate between NC and CNC machines 4

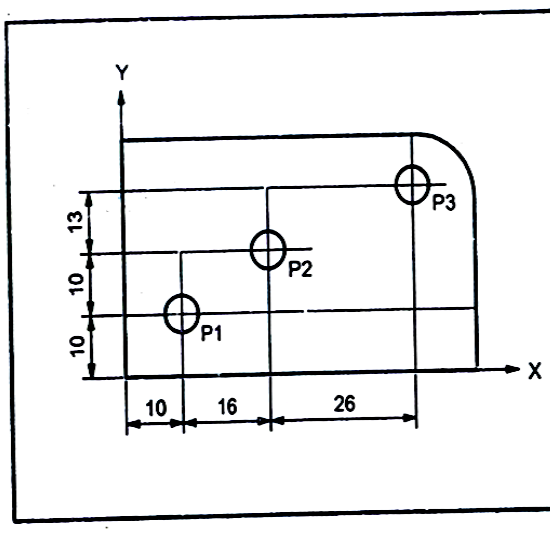
Answer: Comparison between NC and CNC machines *(Any Four – 1 Mark Each)* 4

NC Machines	CNC machines
1.Instructions fed through **external medium** i.e. Paper tape / magnetic tape.	1.Instructions fed through part program **(internal medium)** stored in computer memory.
2.Small changes in program are **not** possible on punch tape once produced.	2.Small changes in program are possible.
3.**No facility** for dry run.	3.**Facility** for dry run.
4.Additional information such as number of jobs produced, time per component **cannot** be obtained.	4.Additional information such as number of jobs produced, time per component **can** be obtained.
5.It does **not allow** compensation for change in cutting tool dimension.	5.It does **allow** compensation for change in cutting tool dimension.
6.It is hard wired system.	6. It is soft wired system.
7.Reliability is less	7.Reliability is more

b) Explain incremental programming method with suitable example. 4

Answer: Incremental programming method- 2

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.



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

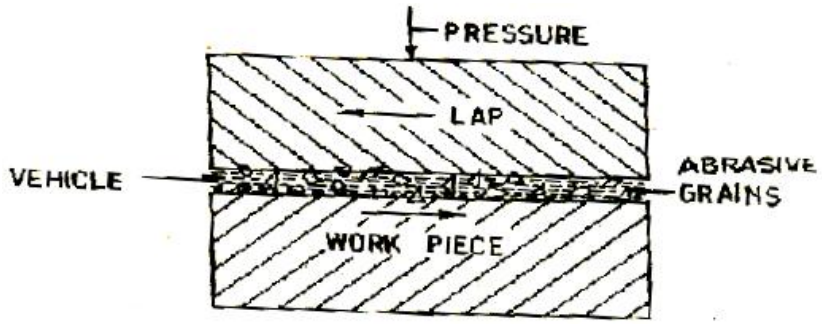
2

c) Describe qualified tools. List its four advantages. 4

Answer:

Qualified tools: Tool which fits into a location on the machine, where its cutting edge is accurately positioned within close limits relative to a specified datum on the tool holder or slide,

is known as qualified tool. These are tools in which the cutting tip or edge is maintained at a fixed distance within a tolerance (±0.05) with respect to the reference surface of the holder. **Advantages :***(Any four)* 1) Tools need not be measured individually. 2) No presetting device is used. 3) The dimensions of the tool holder which are fixed and known. 4) Set up time is reduced. 5) Control dimensions of the tool are nominal and fixed. 6) Higher control on resharpening e.g. drills reamers. 7) Cutters for better size control e.g. end mills, teamers. 8) Chip breaking facilities incorporated in tool. 9) Improved designs.	2 2
d) Write procedure for developing part program on CNC milling	4
Answer: Procedure for developing part program *(Any one method four marks)* There are two methods of part programming:- **A) Manual part programming:** To prepare a part program using the manual method 1) 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 & origin point (work zero) 5) The tape is inserted to read the first block in to the system. 6) The function like machining ,tool changing, spindle ON/OFF ,coolant ON/OFF, program stop and tape rewinding are carried out as per the program. **OR** **B) Computer –assisted part programming: -** This method is useful for most critical and complex parts. The part programmer and the computer are the main tool 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 device to prepare the tape. 4) The tape is verified for accuracy. 5)The NC system machine makes the part according to the instructions on tape	4
e) State G- code and M-code. State functions of programming codes. **i) M02** **ii) M06**	4
Answer: *(G-code &M-code- 1mark each,Functions-1mark each)* ❖ **'G' Codes (Preparatory Functions)** The preparatory function instructs the machine tool to get prepared for the operation to follow,	

the preparatory function is represented by two digits preceded by letter 'G' e.g. G00, G01, G99 etc. ❖ **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 Miscellaneous function is represented by two digits preceded by letter 'M' e.g. M00, M05, M08, M30 etc. **i)** **M02 -** Program end **ii)** **M06 -** Tool change	2 2
f) State principle of lapping and list four application of lapping.	4
Answer: Principle of Lapping Lapping is basically an abrasive process in which loose abrasives function as cutting points finding momentary support of the lap. The process has the following features. (a) Use of loose abrasives between the lap and the work (b) The lap and workpiece are not positively driven, but are guided in contact with each other (c) Relative motion between the lap and work surface should be constantly changing. The effective path is of cycloid in nature. Figure shows the principle of lapping process.  **Fig.** Principle of lapping. **Applications: (Any Four)** A. Hand lapping is used for i. Press work dies ii. Moulding dies iii. Limit gauges iv. Surface plates 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.	1 1 2

Q. 6. Attempt any Two of the following:	16
a) Draw a neat sketch of fly press. Write its construction and working.	8

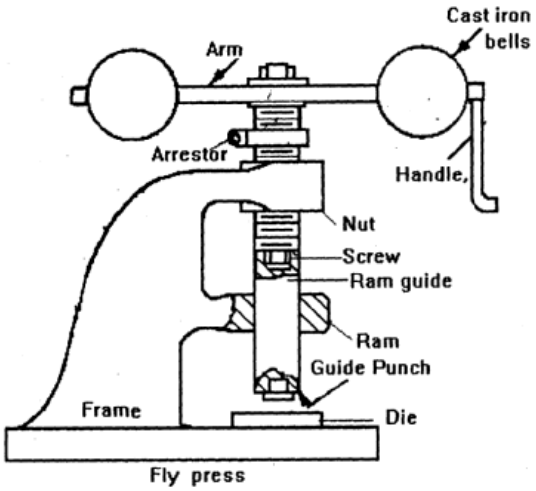
Answer: Fly Press:

CONSTRUCTION :

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 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. — 2

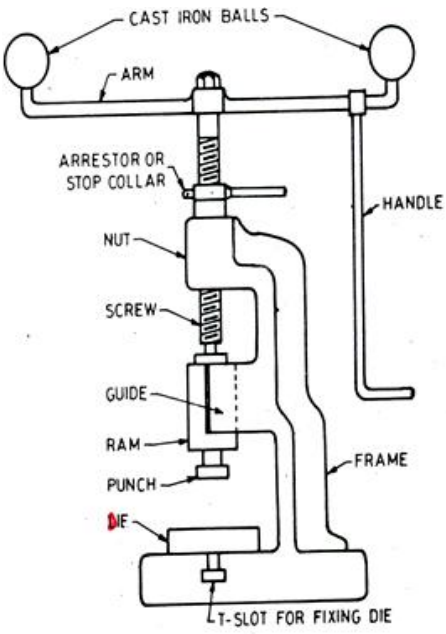
WORKING :-

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 ram & punch downwards. Stroke of the collar adjusted with help of Stop Collar / Arrestor. Advance type of fly press is double side Press. — 2



Fly press — 4

OR



b) Explain axis configuration as per ISO horizontal and vertical spindle CNC machines.	8

Answer: *(Sketch of axis identification & sign convention - 4 marks, explanation - 4 marks)*

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.

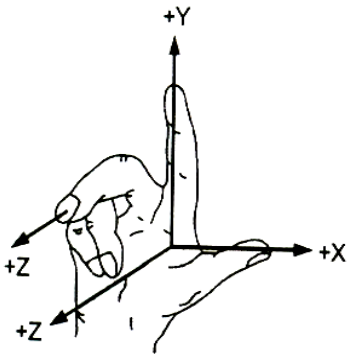
4

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.

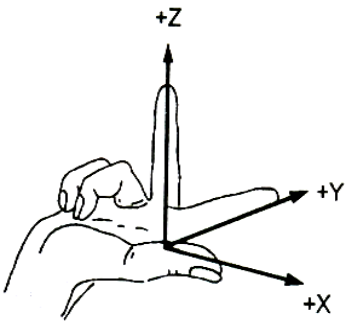
Rotary motions: A, B and C define the primary rotary motions.

Location: These motions are located about the axis parallel to X, Y and Z respectively.

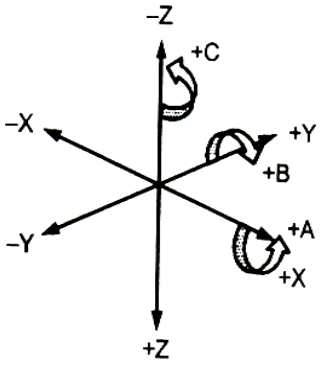
Direction: Positive A, B and C are in the directions which advance right-hand screws in the positive X, Y and Z directions respectively.



(a) For Horizontal-Z

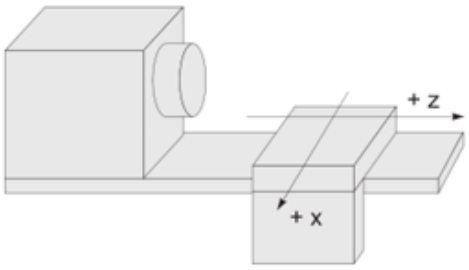


(b) For Vertical-Z



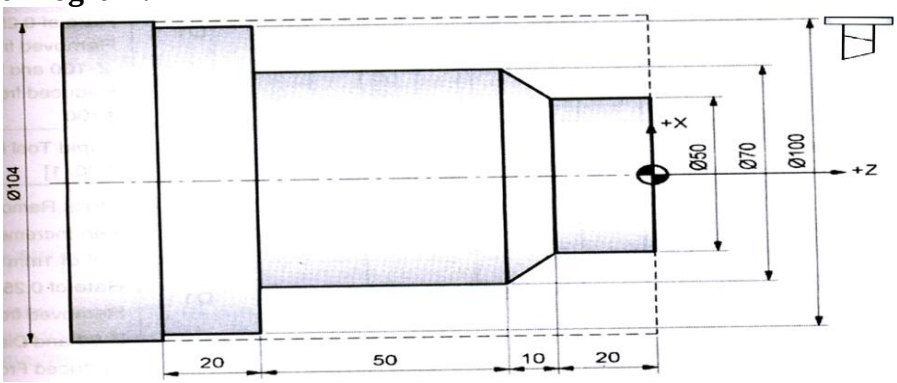
(c) Cartesian Coordinates

4



c) Write part program for component shown in figure No. 1 on CNC lathe machine. Use **i. Feed rate in mm/rev** **ii. Feed rate 0.25 mm/rev** **iii. Speed = 400 rpm.**	8

Answer: Part Program:



Point	X	Z
0	0	0
1	50	0
2	50	-20
3	70	-30
4	70	-80
5	100	-80
6	100	-100
7	104	-100
8	110	10

2

```
N10 G90 G71 G95 EOB
N20 T01 S400 M03 EOB
N30 G00 X0.0 Z2.0 M08 EOB
```

2

```
N40 G01 Z0.0 F0.25 EOB
N50  X 50.0 EOB
N60 Z -20.0 EOB
N70  X70.0 Z -30 EOB
N80 Z-80 EOB
N90 X100.0  EOB
N100 Z-100.0 EOB
N110 X104.0 EOB
```

2

```
N120 G00 X 110 Z 10.0 EOB
N130 G74 U0 W0 EOB
N140 M05 M09 EOB
N150 M30 EOB
```

2