MODEL ANSWER

SUMMER– 17 EXAMINATION

Subject Title: Advance Fabrication Process Subject Code: 17622

Important Instructions to examiners:

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

Q. NO.	MODEL ANSWER	MARKS
1	**Attempt any FIVE:**	**5*4**
a	Metal sawing is one of the important cutting operations chiefly concerned with cutting bar stock to a convenient length or size for machining. In metal sawing, the individual teeth of the saw "track" through the work, each tooth deepening the cut made by the preceding tooth in the direction of feed. Either the saw or the work may be fed and by controlling the direction of feed, either straight or curved cut can be produced. The width of the cut is approximately equal to the width of the saw itself.	**04 marks**
b	High strength friction grip bolts (HSFG): HSFG Bolts are of high tensile strength and used in conjunction with high strength nuts and hardened steel washers in structural steel works. The bolts are tightened to a specified minimum shank tension so that transverse loads are transferred across the joint by friction between the plates rather than by shear across the bolt shank. These bolts have high yield strength. They should conform to IS: 3757-1985. They are tightened by torque wrenches and require hardened washers to induce initial tensions, which causes friction between the plate surfaces. Due to	**02 marks**

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	friction, there is no slip in the joint and therefore the joints with HSFG bolts are called friction type or non-slip type joints. These bolts are made by a special cold working process which includes two operations: heading and thread rolling. Close tolerances ensure accuracy and heat treatment is carried out afterwards. The surfaces in contact must be free from paint, oil, dirt, loose rust and scale. Clearance --- The diameter of the bolt hole is usually 1.6mm larger than the nominal diameter bolt shank.	**01 mark** **01 mark**
c	**Effect of shearing angle:** The basic principle in bench shear and all guillotines used for straight line cutting is that one blade is fixed (bottom blade) and the moving blade (inclined to the fixed blade) is brought down to meet the fixed blade. When the cutting members are arranged parallel to each other the area under shear would be the cross-section of the material being cut i.e. length X thickness of plate If the moving blade is inclined(given a shearing angle of approximately 5^0) then the area under shear is greatly reduced and consequently the force required to shear the material ids also considerably reduced. **Effect of clearance and rake angle on blades:** **Rake Angle:** The shear blades are provided with a rake angle of 3^0(approx.) and an optimum rake angle enables the blades to dig into the material, thereby subjecting the internal fibres of the metal to plastic deformation prior to shearing. Too much of the rake angle weaken the blades and too less a rake angle requires more force to initiate plastic deformation. Clearance: There must be sufficient clearance between the cutting edges of the blades to help in the cutting action. An approximate rule is that the clearance should not exceed 10% of the thickness to be cut and must be varied to suit the particular material.	**02 marks** **02 marks**

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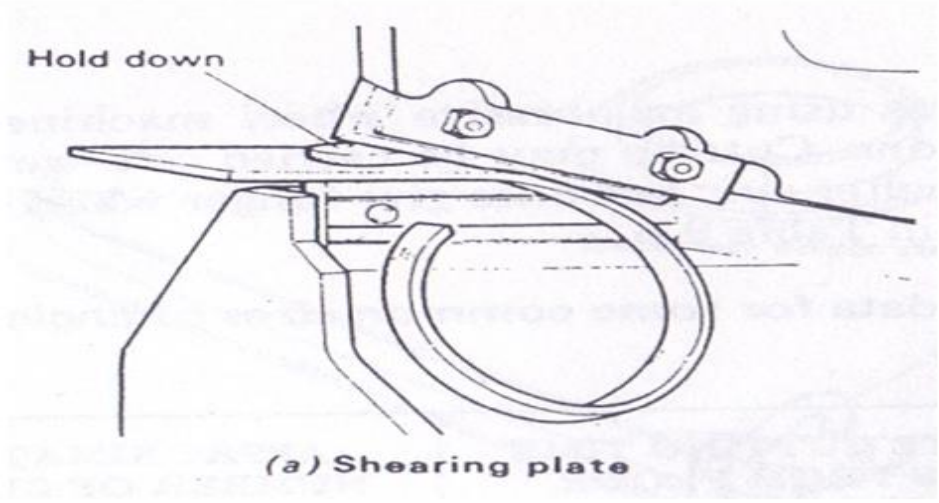
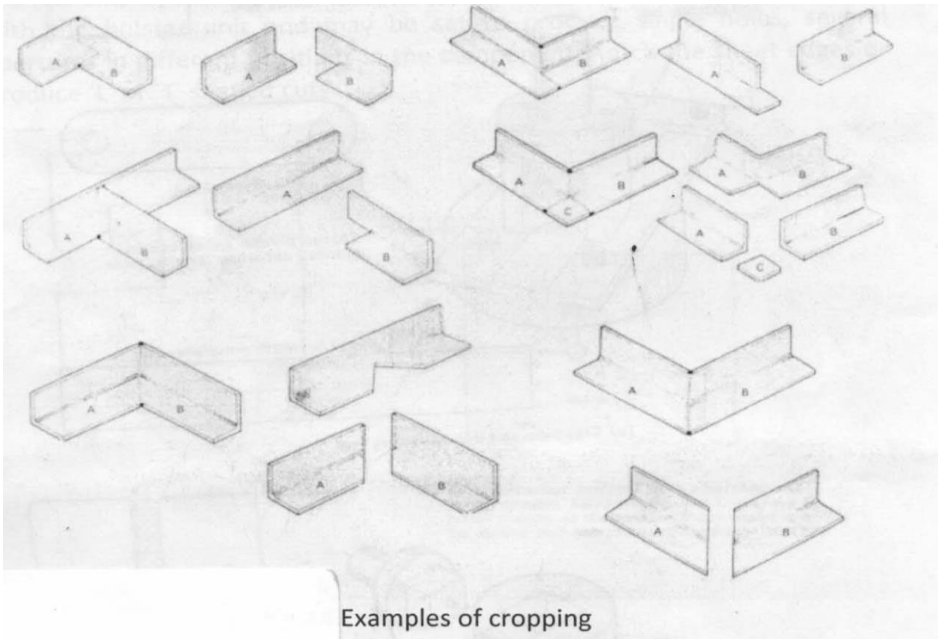
d	Cropping  (a) Shearing plate  Examples of cropping Cropping: Cutting by shearing is quick and probably the most economical production method. The shearing of rolled steel sections is performed indies designed to suit the section. The dies are mounted in a special shearing machine. This operation is commonly referred to as cropping.	**01 mark for any one diag** **01 marks for expln.**

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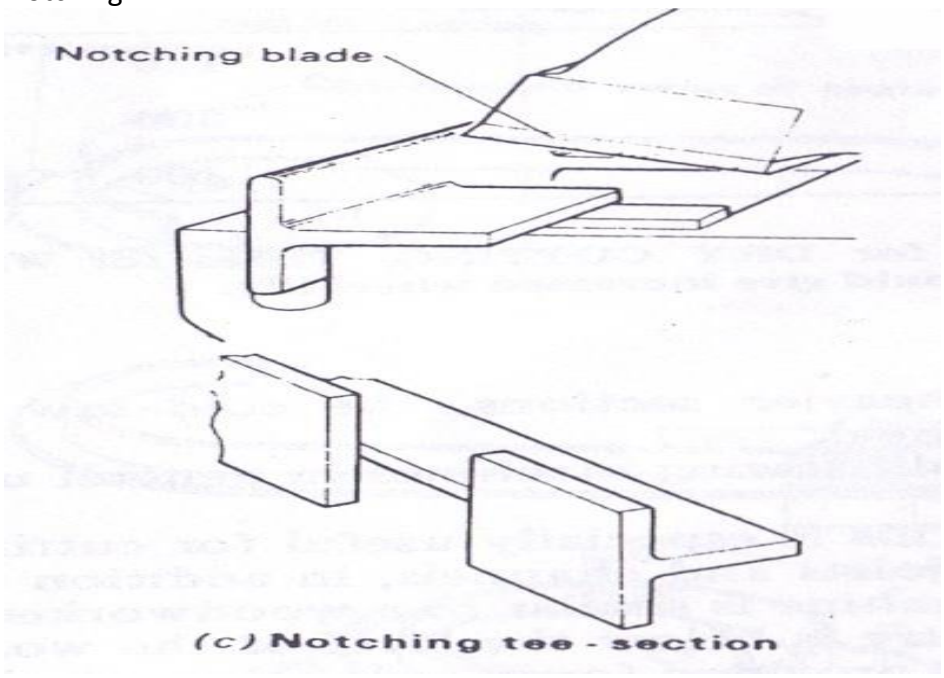
	Notching:  	**01 marks for any one diagram**

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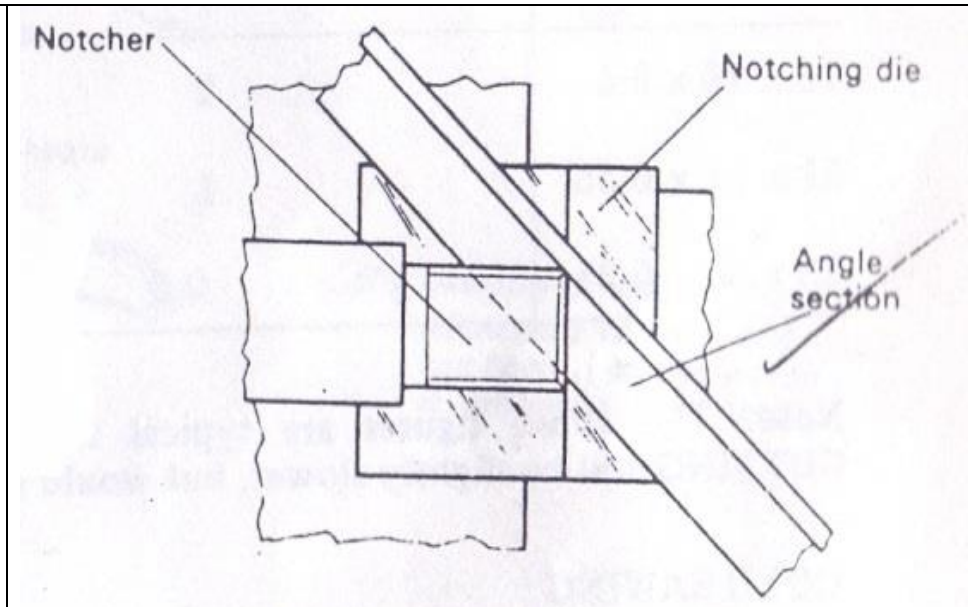
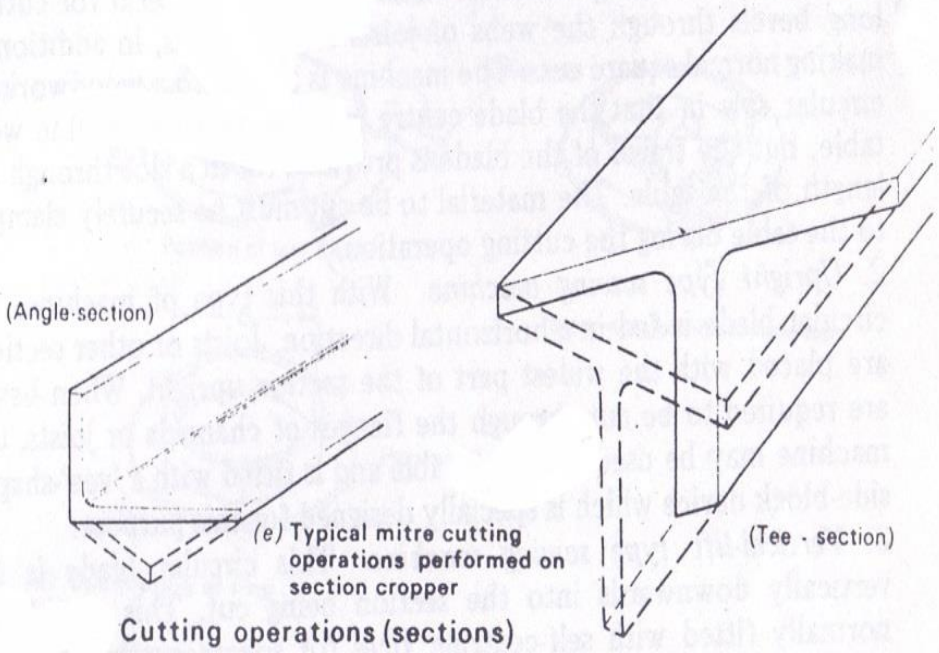


(d) **Mitring an angle flange with the notching tool**

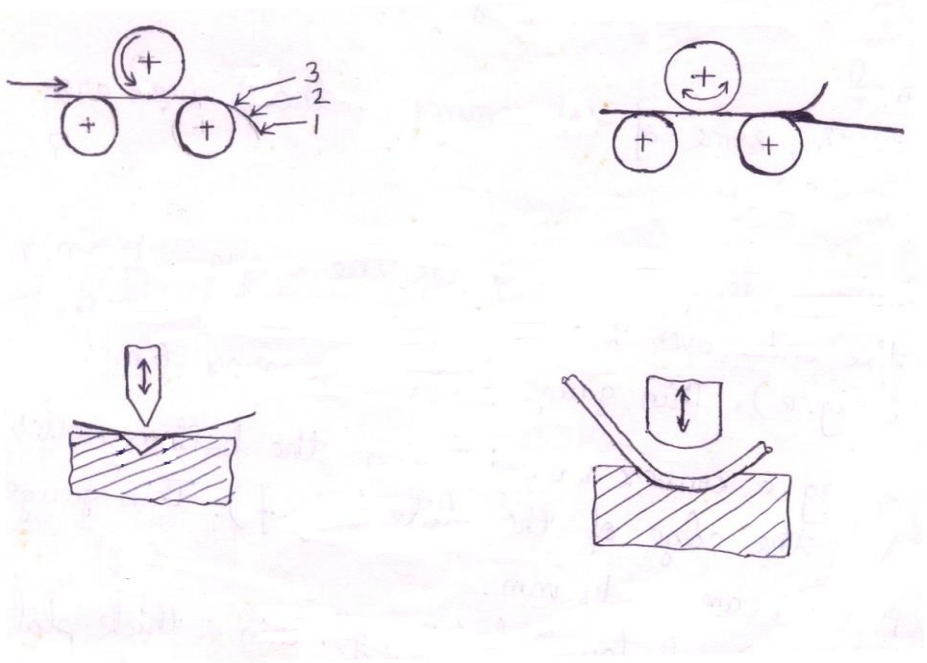


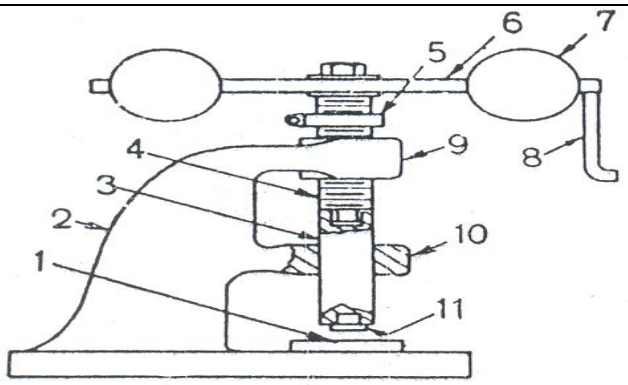
(e) Typical mitre cutting operations performed on section cropper

Cutting operations (sections)

Notching is removal of material by making a notch. In most fabrication shops, cutting operations on rolled steel sections are carried out on power machines. Machines are available which perform a combination

01 mark for expln.

	of cutting operations, such as punching, shearing and notching, the shearing operations including not only section shearing, but round and square bar cropping and plate shearing. Angle section has to be notched in order to permit it to be bent and most of the notches are of the 'V' notch or the square-notch type.	
e	 1. Roll Bending: Pre-forming of ends, prior to rolling of plates and sheet metals is important to obtain a true cylinder without flats where the opposite edges touch.Pinch rolls are designed to eliminate these flats at the start of the rolling operation, but other methods have to be employed when pyramid rolls are used. Briefly, some of the common methods used are as given below: i)Using a template to check the curve, hammer the ends over the bottom roller in increments as shown in fig. a. This method is used for thin gauge plate to approximately 6mm. ii)Using a convex bar between the bottom roller and the edge of the plate as shown in fig.b. This method is used for thin gauge plate to approximately 10mm. iii)'V' block and top tool as shown in fig.c is used for thin and thick plates. iv)Pressing between blocks (hot or cold) as shown in fig.d for very thick plates. 2. Partial loading of the plate on the pyramid roll is carried out and allowed to set for some time depending on the pre determined load.	02 marks for diag. any one method 02 marks for explanation any one method

	3. Checking the roll obtained with a pre designed template. 4. Increase the load incrementally as designed with set time and check with template for trueness and concentricity. 5. Complete the roll and check with template . 6. Tack weld the meeting edges. 7. Perform the longitudinal seam joint. 8. Evaluate the weld efficiency by NDT.	
f	 Fly press 1. *Die*, 2. *Frame*, 3. *Ram*, 4. *Screw* 5. *Arrestor*, 6. *Arm* 7. *Cast iron balls*, 8. *Handle*, 9. *Nut*, 10. *Guide*, 11. *Punch* It is the simplest of all the presses, operated by hand. The frame is a rigid 'C' shaped casting, with the front open to facilitate feeding of the job below the ram from the side. The two heavy cast iron balls are mounted at the two ends of the arm. The arm is bolted to the screw. Turning the handle causes the screw to rotate within a nut, provided at the top end of the frame. Attached to the lower end of the screw is a ram, which moves up and down in slides provided at the extension of the frame, only when the screw is rotated. The punch and die constitutes the press tools. The punch (i.e. upper member) is fixed to the lower end of the ram. The die (i.e. lower member) is fixed on a plate on the table, known as bolster. Both are of high speed steel (HSS).	**02 marks (diag.)** **02 marks (expln.)**

g	When a bending force is gradually applied to a work piece under free bending conditions, the first stage of bending is elastic in character. This is because the tensile and compressive stresses that are developed on opposite faces of the material are not sufficiently high to exceed the yield strength of the material. The movement or strain which takes place as a result of this initial bending force is elastic only, and upon removal of the force the work piece returns to its original shape. As the bending force is continued and gradually increased, the stress produced in the outermost fibres of the material eventually exceeds the yield strength. Once the yield strength of the material has been exceeded, the movement or strain which occurs is plastic. This permanent strain occurs only in the outermost regions furthest from the neutral plane. Between the outermost fibres and the neutral plane there is a zone where the strain produced is elastic. On release of the bending force, that portion adjacent to the neutral plane loses its elastic stress, whilst the outer portions, which have suffered plastic deformation, remain as a permanent set. **Thus the elastic recovery of shape in this zone on removal of the bending force is known as 'springback'.**	**02 marks for explanation**

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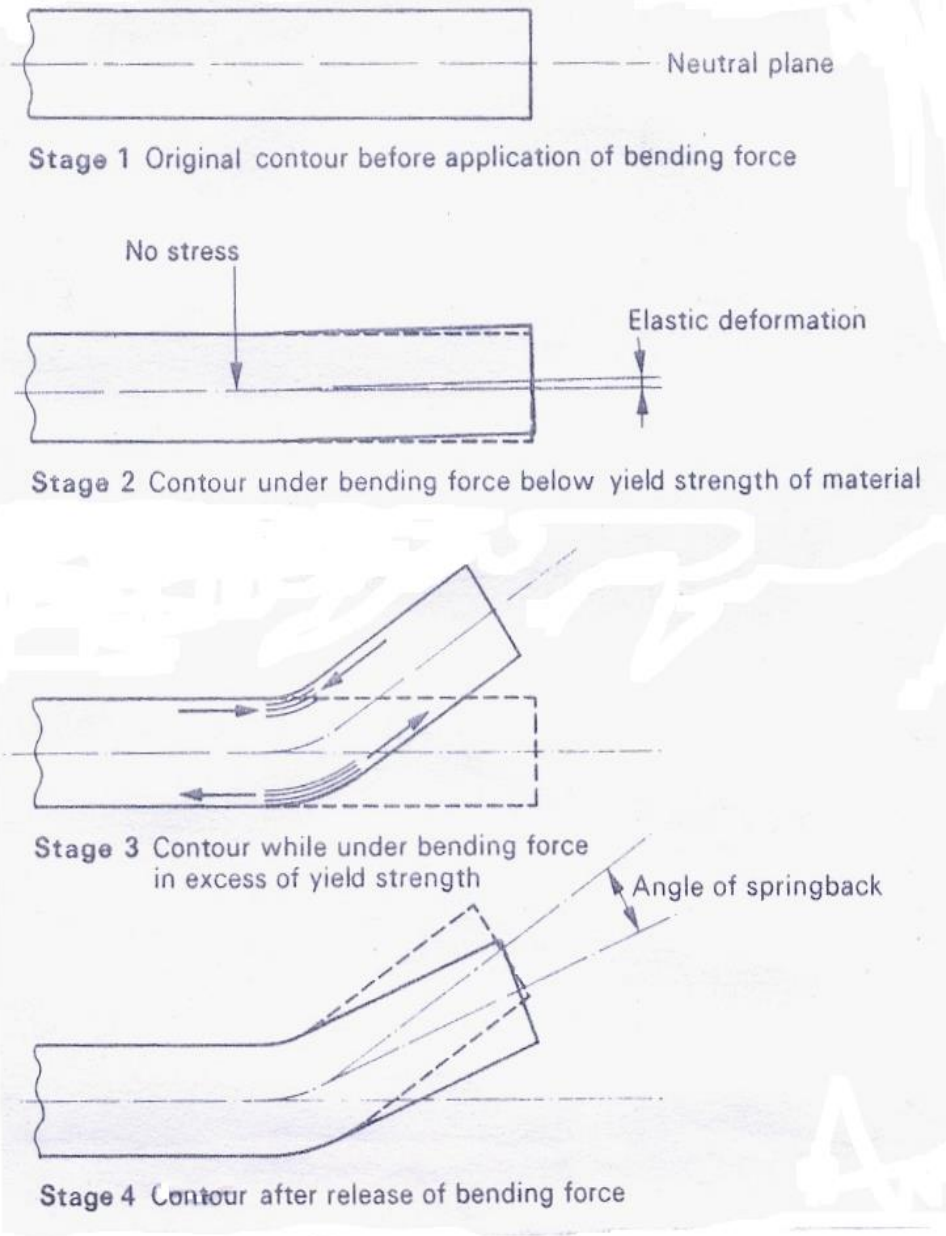

02 marks for diag.

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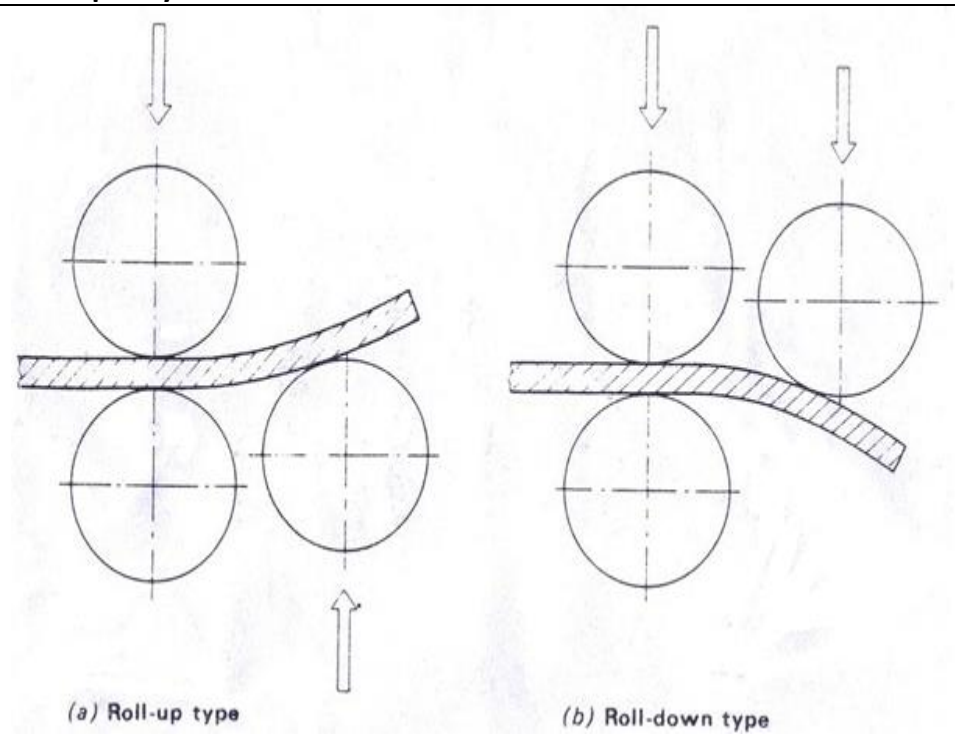
2	**Attempt any two:**	**8*2**
a	 Roll-up type in which the machines have adjustment in a vertical direction on the top or bottom pinch roll and in an upward direction on the back roller. This type will roll any size of curvature above the size of the top roll. Roll-down type in which the machines have adjustment in a vertical direction on top or bottom pinch roll and in a downward direction on the back roller. This type will not roll more curvature than will pass beneath the pedestal frame of the machine.	**02 marks for diag.** **02 marks for explanation**

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	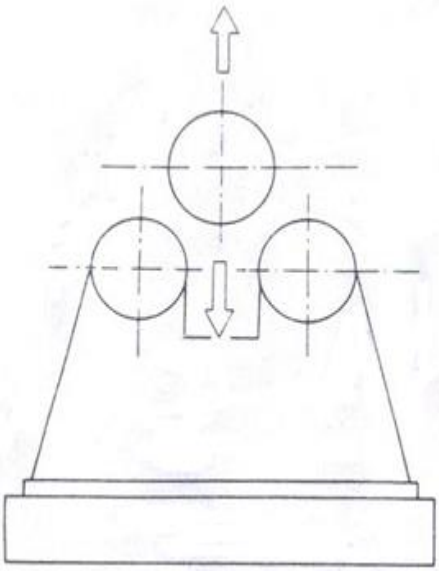 *(a)* Pyramid-type rolls (standard design) Pyramid-type rolls, as the name suggests have three rolls arranged in pyramid fashion as shown. Most plate rolling machines are provided with longitudinal grooves along the lower rolls to assist in gripping the plate. These grooves are useful for initial alignment of the plate.	**02 marks for diag.** **02 marks for explanation**
b	Hand riveting: The two methods in hand riveting are; direct riveting where there is access to both ends of the rivet and blind riveting where the closing head is inaccessible.	

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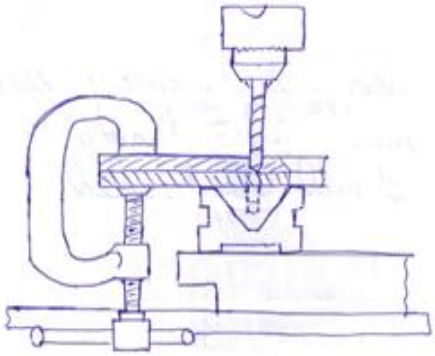
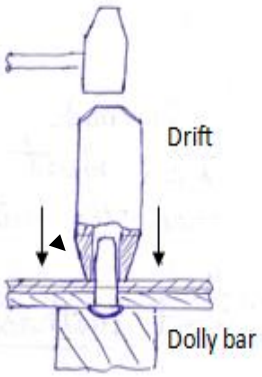
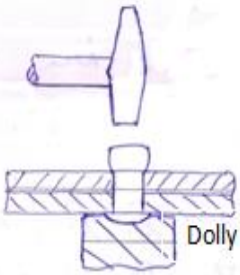
Direct method:



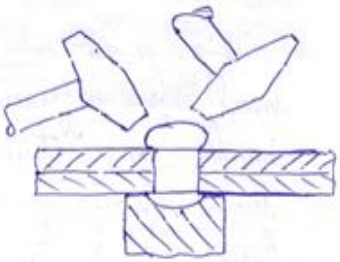
a) Drilling the rivet hole



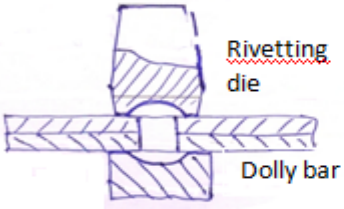
b) Tapping down plates with a drift to eliminate clearance between plates



c) Upsetting the rivet shank with minimum no. of blows by the hammer to prevent strain hardening



d) Shaping the closing head with the hammer by direct side blows



e) Final shaping of the closing head with riveting die

In case of countersunk head rivets, manufactured head should be made to rest on a flat anvil and the shank should be struck upon right along the axis. To make the joint even, first every second or third rivet, beginning with the extreme ones and then the rest of them should be headed.

Any one method

04 marks For diag.

04 marks for explanation

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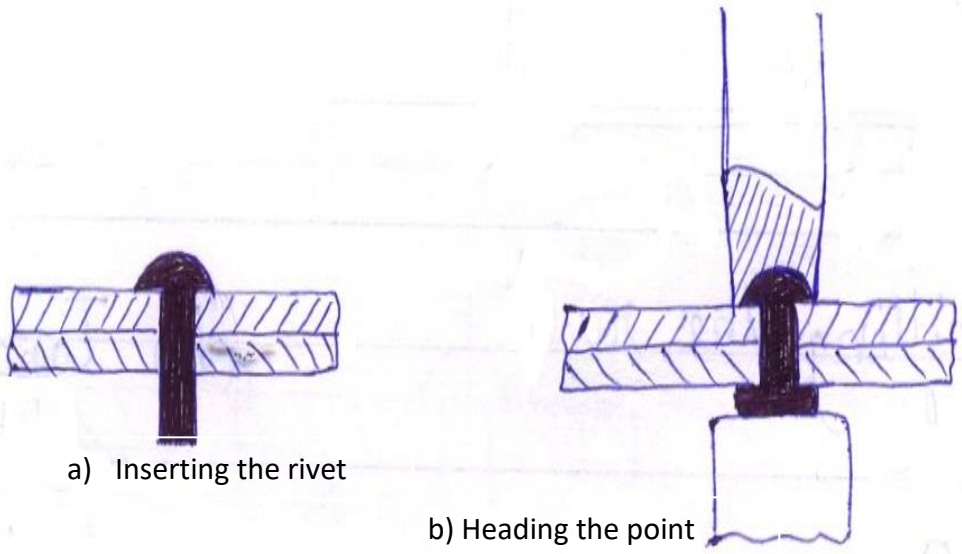
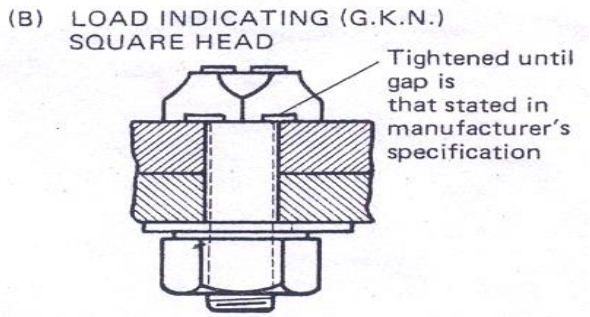
	OR Blind method:  a) Inserting the rivet b) Heading the point This method is used where access to the closing head is difficult. By this method, the manufactured head are struck upon. The shanks are inserted from above and dolly bar is held under the shank. The manufactured head is struck through a drift so that the dolly bar shapes the closing head. This method provides a somewhat lower quality of joints than the direct method. Tubular and explosive rivets are also set by the blind method.	**04 marks for diag.** **04 marks for explanation**
c i	Load indicating bolts:  As shown in the diagram above, the bolt tightening is checked with the gap present by the use of a feeler gauge. Tightening is stopped when the gap is as per the manufacturer's specification.	**01 mark (diag.)** **01 mark (expln.)**

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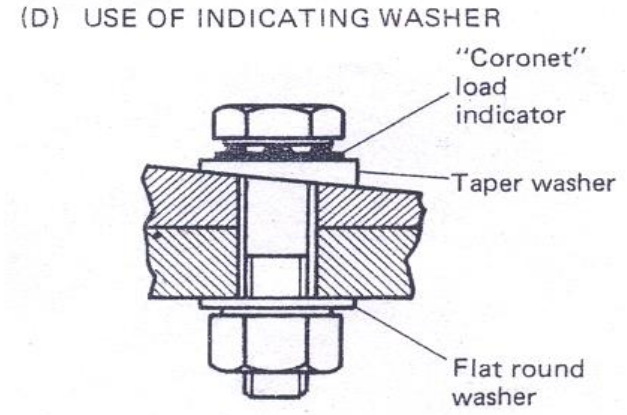
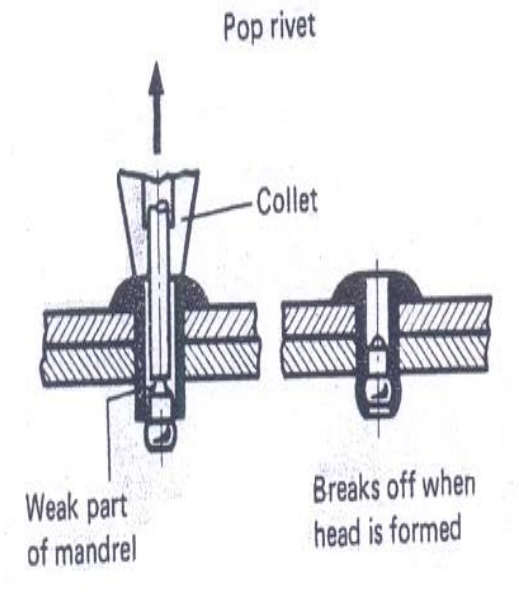
	Load indicating washer:  The 'Coronet' load indicator is an especially hardened washer with protrusions on one face. They bear against the underside of the bolt head leaving a gap. As the bolt is tightened, the protrusions are flattened and the gap is reduced. At a specified average gap, measured by a feeler gauge, the induced shank tension should not be less than the minimum required by standards.	**01 mark (diag.)** **01 mark (expln.)**
ii	Pop rivet:  	**02 marks**

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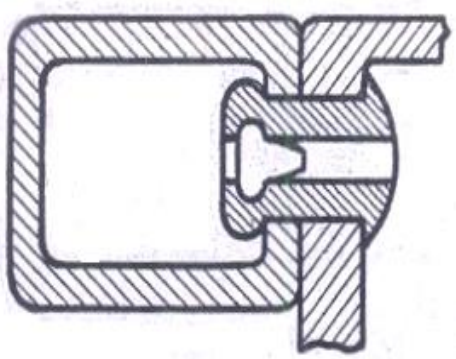
	Blind rivet 	**02 marks**
3	**Attempt any two:**	**8*2**

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a

Parameters	Reciprocating Power Hacksaw	Circular metal saw
Cost of machine	Low capital investment	Greater capital investment.
Sawing time	More time	Less time
Labor skill	Unskilled or semi-skilled.	Semi - skilled
Quality of product	Comparatively poor quality	Good quality finish as compared to reciprocating power saw

02 mark each

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b	Basic principle of flame cutting: Flame cutting process plays a prominent part in the preparation of M.S. plate material for welded fabrications. It is readily applicable to very large thicknesses of material and allows a multiplicity of shapes or contours to be cut which cannot be done on guillotine shear blades. Most metals oxidize. The rate of oxidation in air depends upon the type of material and the temperature. The properties of the oxides formed are different from that of the parent metal. When O_2 combines with a metal at a slow rate as in case of rusting of iron is referred to as 'Oxidation'. When the formation of oxide is very rapid, it is referred to as 'Combustion or Burning'. A rise in temperature of the metal has the effect of accelerating the rate of oxidation. Applications of flame cutting: -Useful for removing weld defects, lugs, cleats, tack welds, etc. -Dismantling structures -Removing risers -Gouging cracks prior to welding -Preparing a butting edge for welding Types of fuel gases used for flame cutting are -Acetylene -Propane -Natural Gas	**04 marks for explanation** **02 marks for any two applications** **02 marks for any two gases**
c	Types of folding machine are: - Mechanical folding machines - Pneumatic folding machines - Hydraulic folding machines The steps in folding a sheet metal job are: 1) Clamping: In clamping, the amount of lift of the clamping beam is important. It should be sufficient to allow the fitting and use of special clamping blades or to give adequate clearance for previous folds. 2) Folding: Care must be taken to see that the folding beam will clear the work, particularly when making second or third folds. Some folding machines are designed to fold radii above the minimum, either by the fitting of a radius bar or by adjustment of the folding	**03 marks** **02 mark** **02 marks**

	beam. 3) Removal of the work: Care must be taken in folding to ensure that the work may be easily removed on completion of final board. The sequence of folding must be carefully studied. The lift of the clamping beam is important here.	**01 mark**
4.	**Attempt any two:**	**8*2**
a	Neutral Line: The boundary line between the area under compression and the area under tension in any angle bend is called as neutral line. The neutral line is unaffected by the action of any forces (compression or tension). The neutral line tries to keep the component in original position. Bend allowances for sheet metal: When sheet metals are bent through angles of 90^o the material on the outside surfaces becomes stretched, whilst that on the inside surfaces of the bends is compressed. It is therefore necessary to make an allowance for these effects when developing a template or when marking out a blank sheet for bending. Thus, bend allowance implies determining the length of the neutral line in the portion of the bend instead of the inside or outside dimensions of the bent metal. The neutral line is an imaginary curve somewhere inside the metal in the bend. Its position does not alter from the original flat length during bending. For the purpose of calculating the allowance for a bend in sheet metal the neutral line curve is regarded as an arc of a circle whose radius is equal to the sum of inside bend radius and the distance of the neutral line in from the inside of the bend. Arc lengths are dependent upon their sector angles and can be determined by calculations as follows: Consider an arc of radius, r+x = 100mm whose subtended angle is θ=90°.	02 Marks 02 marks

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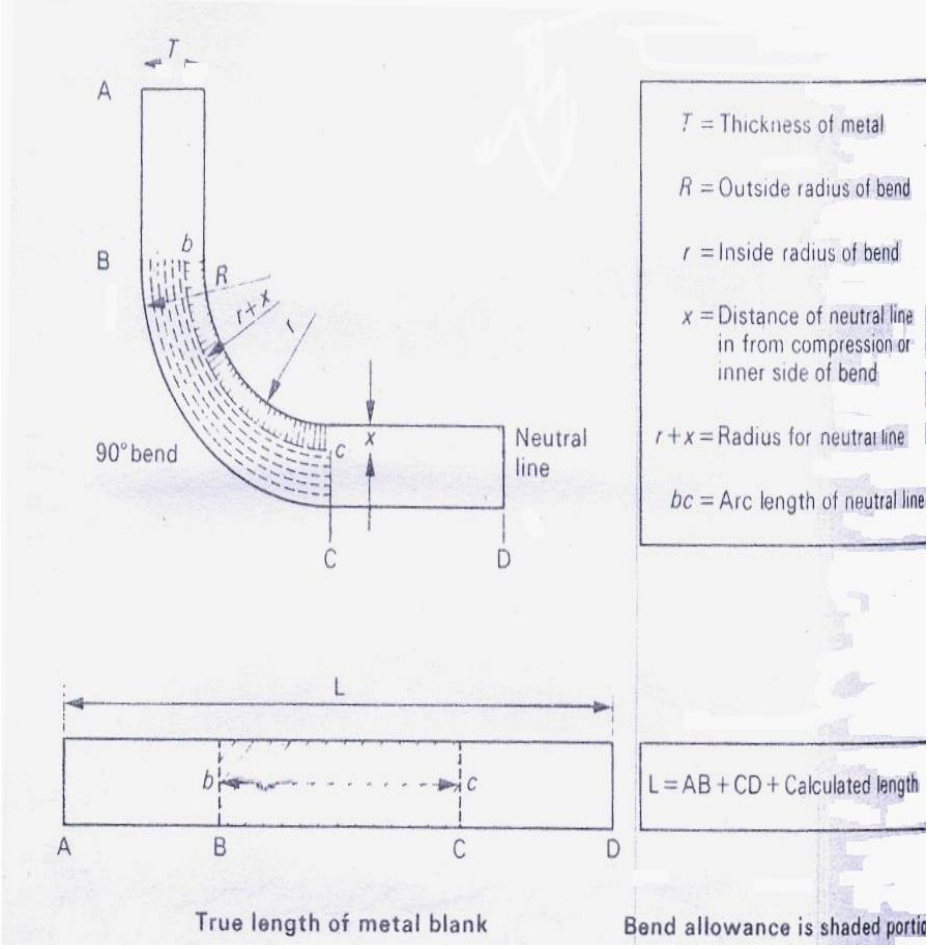

02 marks

Then its length will be;

$$90/360 \times 2\pi(r+x)$$

Alternatively, by inspection the ratio $2\pi/360$ is a constant which may be used for all bend allowance calculations i.e.

$$2\pi/360 = 2 \times 3.142/360$$
$$= 0.0175$$

02 marks

Thus the length of the arc will be :

$$0.0175 \times (r+x) \times \theta$$
$$= 0.0175 \times 100 \times 90°$$
$$= 157.5\text{mm}$$

From the above it will be seen that a formula is derived for calculating bend allowances as follows;

BEND ALLOWANCE = 0.0175 ×INSIDE RADIUS TO THE NEUTRAL LINE ×SUBTENDED ANGLE OF THE BEND

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b	• Die Ratio: Die ratio is defined as the ratio of 'Vee' opening in the bottom of tool(width at die opening) to the thickness of metal to be bent. Die Ratio = W/t Where, W= Width at the die opening t = thickness of metal to be bent • Mechanical drive systems: i) This has a fixed tonnage and delivers more force at the bottom of its stroke than at the half-way point. ii) Mechanical drives will cycle its ram at more strokes per minute than a hydraulically driven system of the same size. iii) The electric motor provides power to a flywheel which stores energy and provides speed and consistancy of motion to the drive shaft on a mechanical system. iv) The ram starts at high speed from the top of the stroke and automatically changes into low speed for the operating position of the stroke. At the bottom of its stroke, the ram again transfers into high speed for its return. A control mechanism provides short, medium and long periods of time for the ram at slow speeds. v) Mechanical press brakes are easier to overload. vi) Difficult to bring ram close to material for scribed line work. Difficult to control bending speeds. vii) Skilled operator needed to slip clutch. Clutches requirs adjusting. viii) Mechanical press brakes do not enable you to adjust the stroke length. You must complete the revolution and cycle the machine completely, you cannot return the ram at any position of the stroke.	02 Marks (any 3) 01 mark each

	• Hydraulic drive systems: i) These are available with pressing capacities upto 8000 tonnes. ii) A mechanically driven press brake of equal tonnage will not deliver the same pressure at the bottom of their strokes, it is rated at midstroke. iii) The hydraulic press brakes delivers its rated capacity over the entire stroke. The hydraulically driven press brake's tonnage and ram speed are variable upto the machine's rated limits. iv) A hydraulic drive allows a longer ram stroke than mechanical driven equipment. v) The ram speed control on a hydraulic press allows the best adjustments of the material being worked. vi) The tonnage of a hydraulic press brake is a function of the size of its cylinders, pump and circuit capacity. The hydraulic press brake's fixed tonnage cannot be surpassed so the brake can be bottomed at full tonnage repeatedly without risk. This is its advantage over the mechanical press brakes. vii) The hydraulic driven ram will stop when it reaches the selected tonnage. It can be withdrawn from any point on the job. viii) It is possible for the ram to be positioned within a thousandth of an inch. A job requiring repetition can be set up to produce identical parts in minutes. This capability is not available with mechanical press brakes. ix) The hydraulic press brakes delivers full rated power throughout its stroke and has a longer stroke than a mechanical brake which is limited in stroke length by its crankshaft design.	(any 3) 01 mark each

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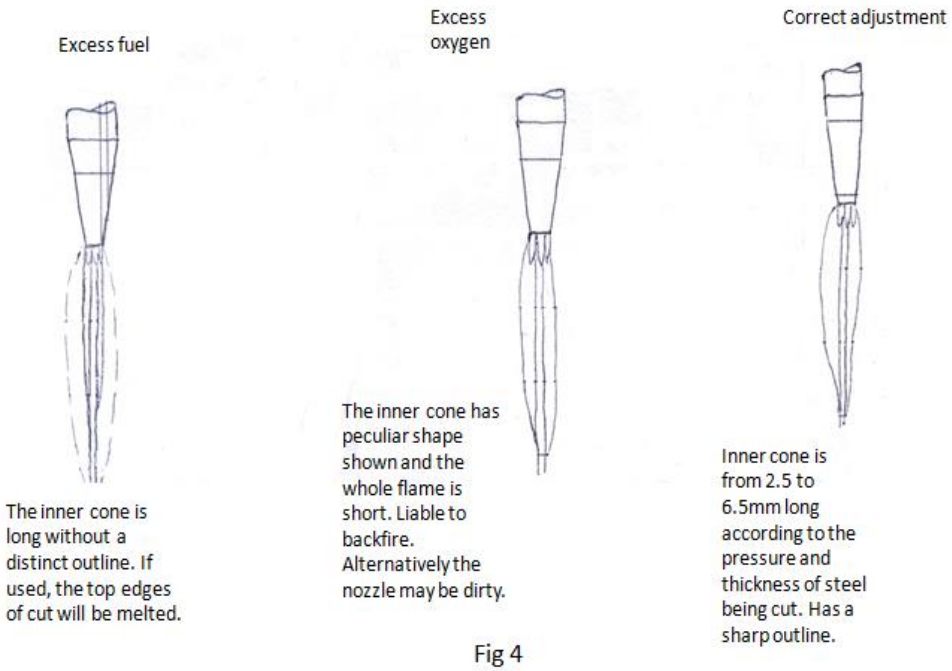
c	**Flame lighting:** The procedure used for lighting a welding torch is adopted when lighting a cutting torch, but with some difference. The fuel gas regulator is set to the correct working pressure in the normal way and the oxygen regulator is set to the correct working pressure with the cutting oxygen valve on the torch in the open position. --- The fuel gas is lit and the flame adjusted, until it ceases to smoke. --- The heating oxygen valve is then opened and adjusted (similar to a neutral flame setting) until there is a series of nicely defined white inner cones in the flame (in the case of the multi-port type nozzle) or a short white conical ring, if the nozzle is of the annular port type. --- The cutting oxygen valve is then opened at this stage and the flame readjusted to a neutral condition. The oxygen cutting valve is then closed and the torch is ready for use. **Flame adjustment:** When oxy-propane is used for cutting, the correctly adjusted pre-heating flame will be indicated by a small non-luminous central cone with a pale blue envelope. In the case of oxy-natural gas the flame is adjusted until the luminous inner cone has a clear definite shape, usually up to 8-10mm in length).  Fig 4	**03 marks** **03 marks**

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	Extinguish the flame: The correct procedure to extinguish the flame is as follows; --- Turn off the cutting oxygen. --- Close the fuel gas control valve. --- Close the heating oxygen control valve.	**02 marks**
5	**Attempt any two:**	**8*2**
a	Setting of the guillotines: The treadle and power guillotines are' fitted with front and side gauges. These usually consist of a fixed side gauge, sometimes referred to as the 'squaring guide" and a flat bar front gauge. On some machines, the side gauge can be extended for wide sheets and may be graduated in millimeters. The front gauge is adjustable across the bed or table and further along extension bars (arms fitted to the front of the machine). Figures a, b, c, d show the setting of the guillotines prior to the shearing operation. The use of the fixed side gauge, front gauge and back gauges are as follows: • The fixed side gauge is used for positioning the material. To square-off two adjacent sides of a sheet or plate, a trim cut of approximately 6mm is made on one edge. The second adjacent edge is then sheared at 90° to the first by holding the trimmed edge firmly against the side gauge which is normally located on the left-hand side of the table. After marking off from the trimmed edge (Datum Edges) further straight cuts are made by sighting each scribed line or witness mark, in turn on the edge of the fixed bottom cutting member of the guillotine . • If a number of identical blanks are required to be cut, the material is located against the side gauge and the back gauge. The back gauge is set about 6mm over the required dimension. Once, the blanks are cut, they are now located against the front gauge. The front gauge is set to the correct measurement and now the blanks are cut to the required dimensions . • Taper cutting can also be performed by setting the front gauge at an angle within certain limits. Figure a shows the plan view of the side and front gauge; Figs.b and c show how the front gauges are set.	**03 marks for explanation of any one step**

	I. Setting the front gauge using a rule (Fig.b): i) Make sure machine is switched off, ii) Place the rule between the blades, iii)Position front gauge against end of rule and sight as shown opposite, iv) Set each end of bar and lightly tighten bolts, v) Check each end and then fully tighten in position. II. Setting the front gauge using a steel tape (Fig.c): i) Slide the' end of the tape between the blades and hook it against the bottom blade, ii) Roughly position the front gauge and slightly tighten clamping bolts, iii)Adjust the bar to correct dimensions; check each end for parallelism and fully tighten the bolts. III. Setting the back gauge: The bulk of cutting performed on the guillotine is when the sheet or plate is located against a 'back gauge'. The simplest and usual standard type consists of an Angle Gauge Bar. The back gauges are mounted on an attachment fixed to the movable cutting beam and moves up and down with it as shown in Fig.d. The above simple type of back gauge can have an attachment for final fine adjustment. The guide is set in an approximate position and locking lever B tightened. The final setting is achieved by slackening lever A and turning the hand wheel on the fine adjustment screw. The back gauge is-then locked in position by tightening locking lever A.	

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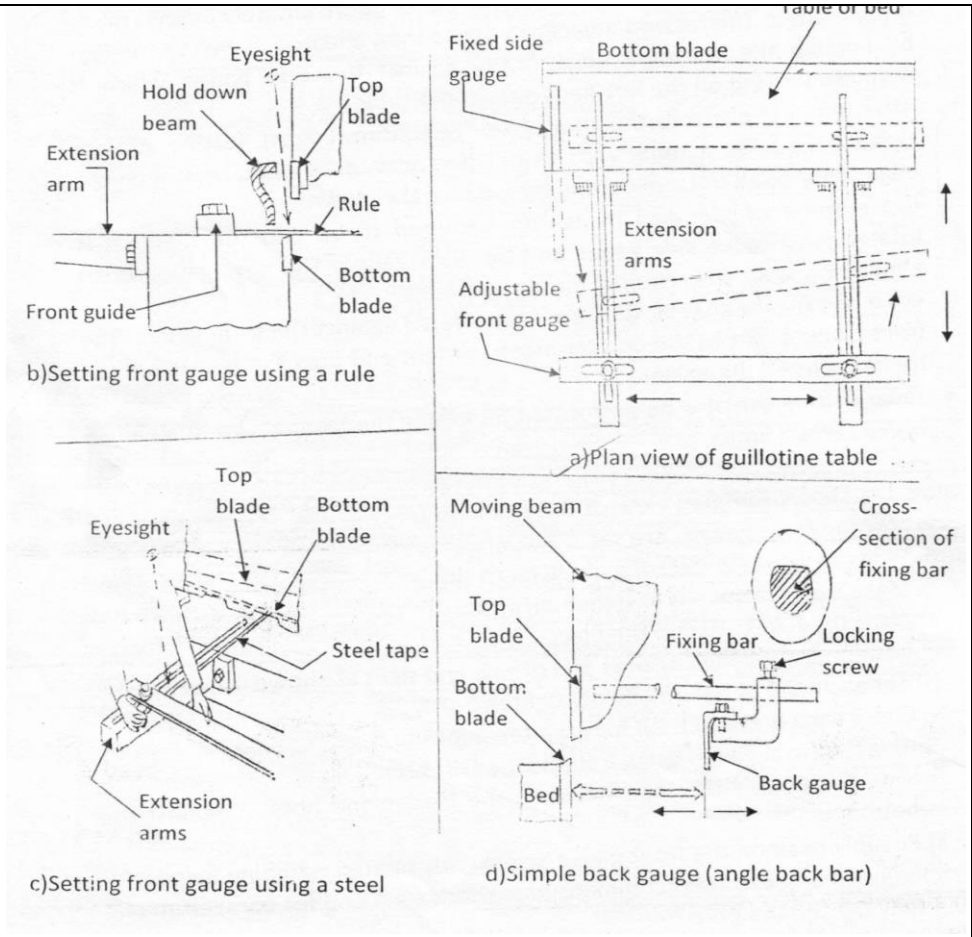

03 marks for any one Figure

Safety precautions :

1) Guards must be provided to prevent the operator's fingers from contacting the blades from either the front or rear of the machine
2) Only one person should be allowed to operate the machine at one time .
3) A hand operated guillotine machine should be made inoperative when not in use.
4) The shear edges of the blades should be maintained in good condition and blade clearance must be adjusted in accordance with the manufacturer's recommendation appropriate to the thickness of the material being cut.

01 mark for any two adv.

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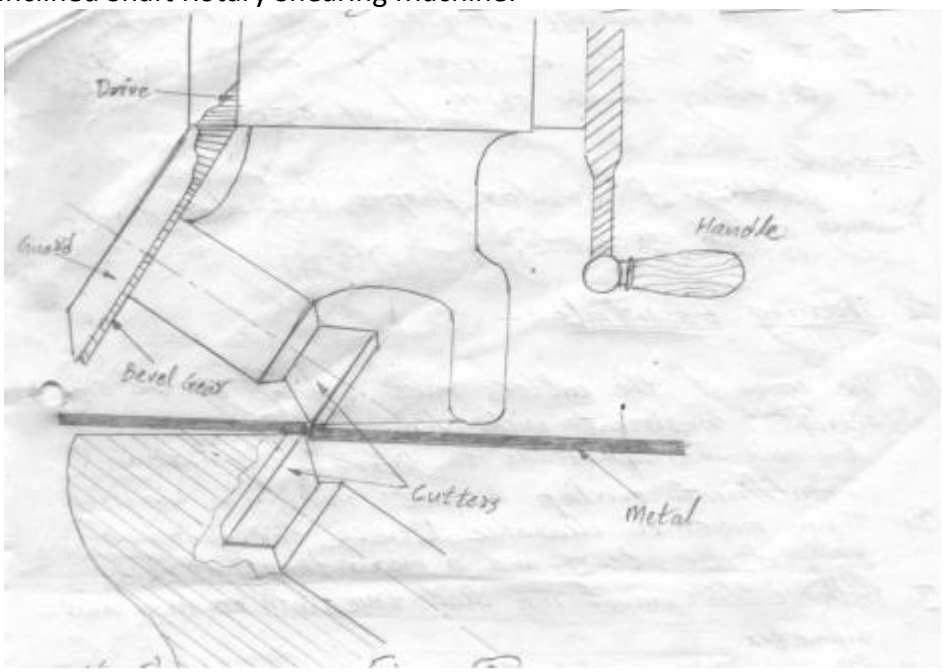
	5) A container should be provided for waste material from the guillotine.	
b	Inclined Shaft Rotary Shearing Machine:  Construction: In this type of machine the rotary cutters are inclined as shown in fig. The edge of cutter must overlap by the small amount consistent with clean cutting. There is handle provided which provides rotary motion to bevel gear, which in turn rotates the cutters. Working: When the handle is rotated it drives the cutters. The sheet is moved to get the desired cut. Because of bevel gears the motion is transmitted at inclined position. Advantages: 1) The main advantage of these types of machine is that the sheets of irregular shapes can be cut depending on the skills of operator. 2) There is no restriction on the length of cut. 3) The cutters rotate producing a continuous cutting action with very little distortion of the material. 4) These machine may be hand or power driven.	**02 marks for diag.** **02 marks** **02 marks** **02 marks for any 02 adv.**

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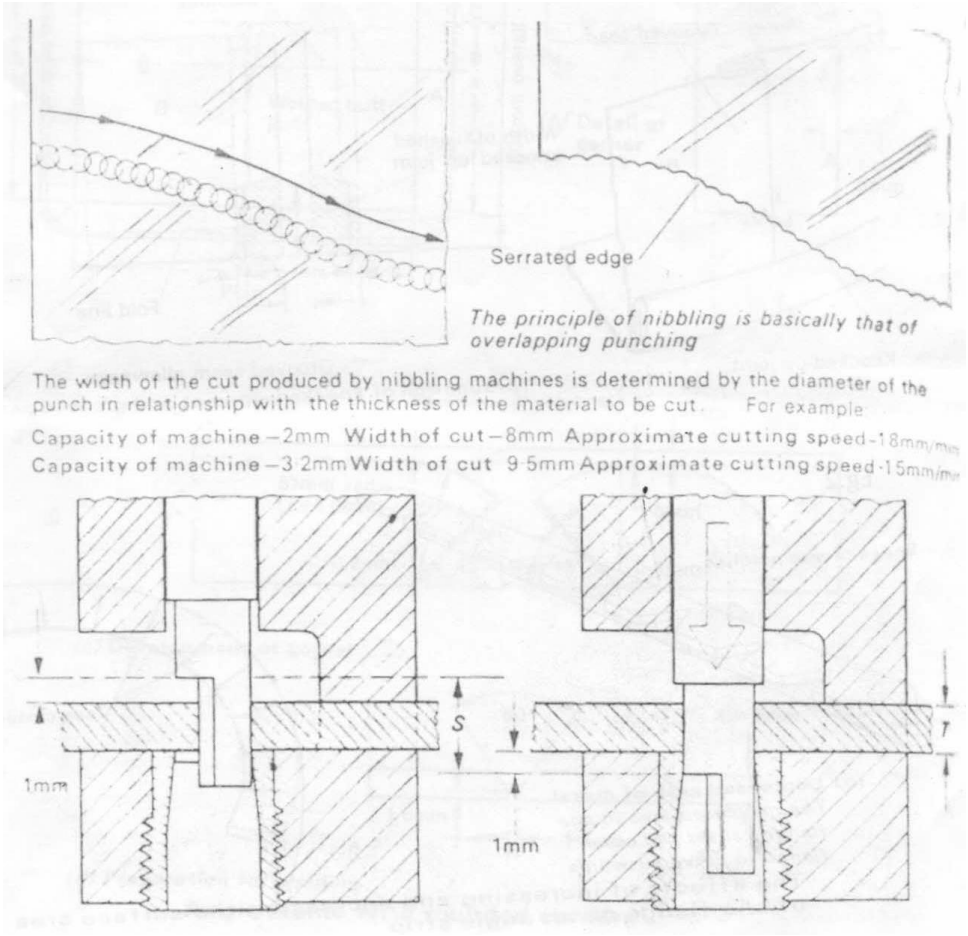
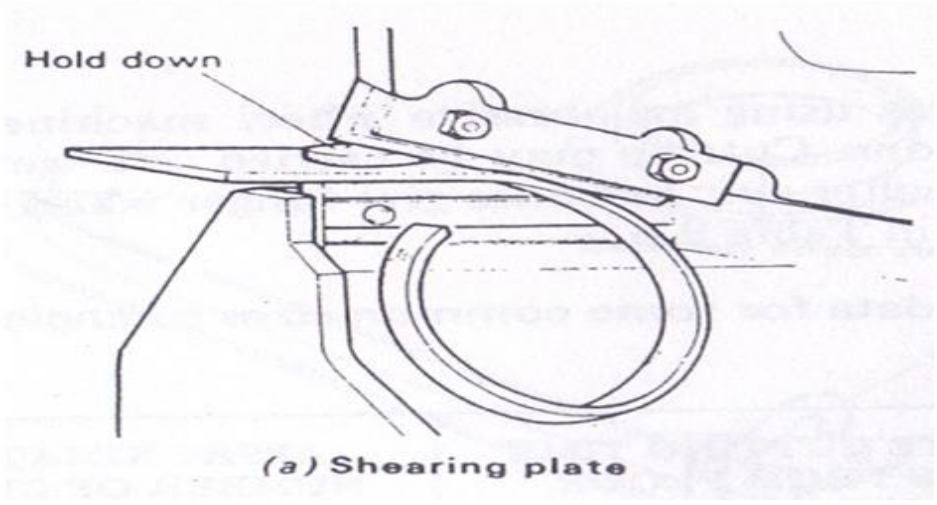
c	The punch type shearing machine(nibbler):  This portable nibbling machine does not operate on the same principle as the shear type. A punch and die is employed instead of shearing blades and the nibbling principle is a special application of punching. The advantage of these machines is that they will effect certain operations that cannot be accomplished on other shearing machines. For example, they may be used to cut out apertures which could only otherwise be produced by means of specially designed punches and dies set up in a powerful press. These portable power tools are used for rapid and accurate straight line or curved cutting of material from approximately 1.62mm to 3.2mm	**04 marks for diagram** **02 marks for expln.**

	thickness. Like the shear type machine the top cutting tool (a punch) reciprocates at fast short strokes. Punch type nibblers are available, in various sizes and the punch reciprocates at a rate of 350 to 1400 strokes per minute over a die nibbling out the material by the simple principle of overlapping punching and only a slight finishing is necessary to produce a smooth clean edge. Although these machines are generally used for cutting material up to 3.2mm thickness, there are heavy duty machines available capable of cutting steel up to 6.35mm thickness. One main advantage of nibbling over shearing is that there is less distortion of the work. The figures above shows details of the punch type nibbler. Advantages over shear type shearing machine: -They will effect certain operations that cannot be accomplished on other shearing machines. -Punch type nibblers are available in various sizes which is not possible in shear type. -Less distortion of work as compared to shear type. -It uses simple principle of overlapping punching.	**02 marks for any two adv.**
6	**Attempt any four:**	**4*4**
a	Cropping  (a) Shearing plate	**02 marks for any one diag** **Any two operations**

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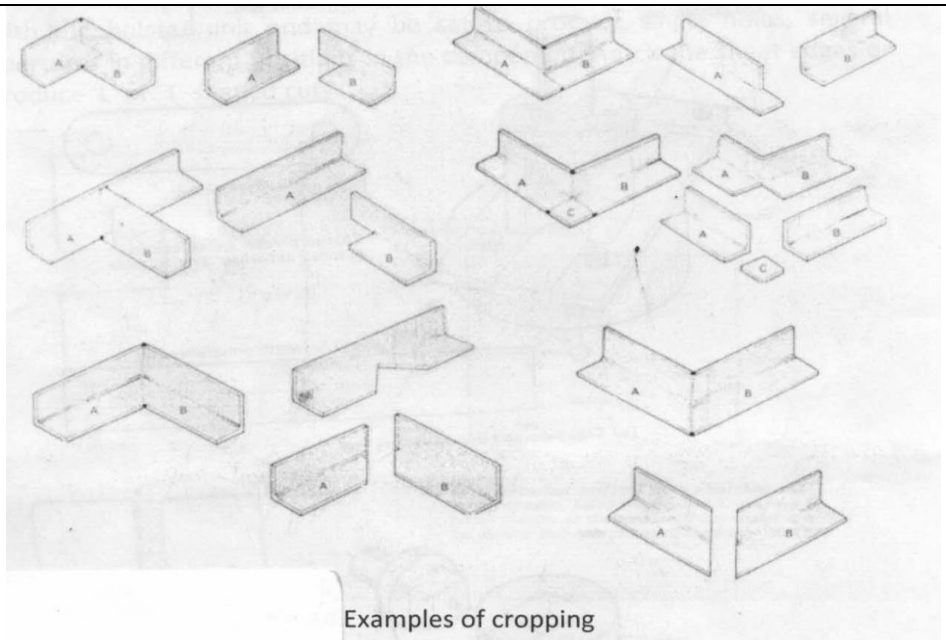

Examples of cropping

Cropping:

Cutting by shearing is quick and probably the most economical production method. The shearing of rolled steel sections is performed indies designed to suit the section. The dies are mounted in a special shearing machine. This operation is commonly referred to as cropping.

02 marks for expln.

Notching:

02 marks for any one diagram

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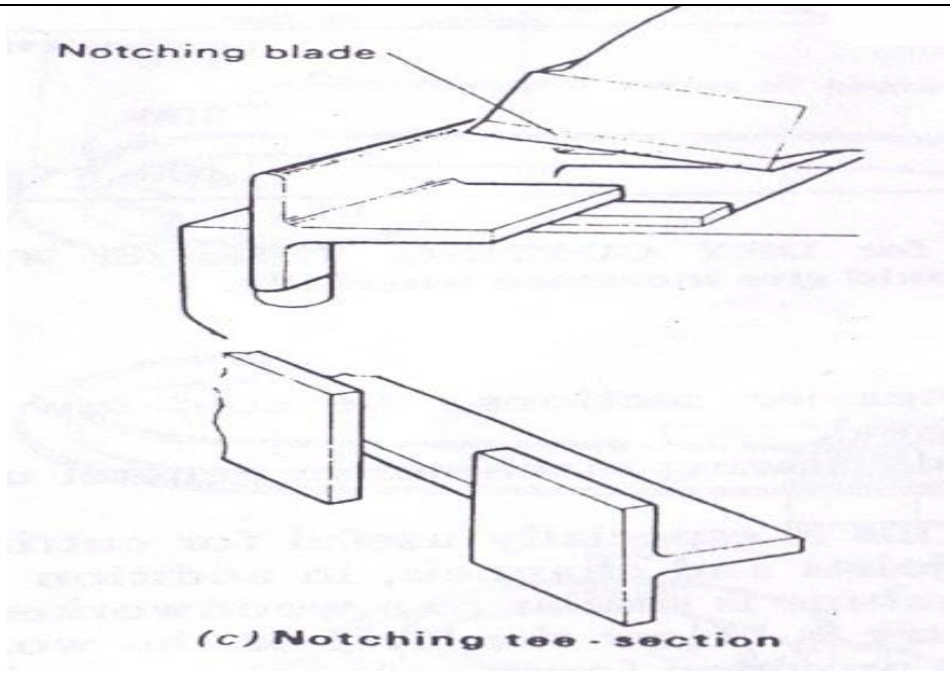
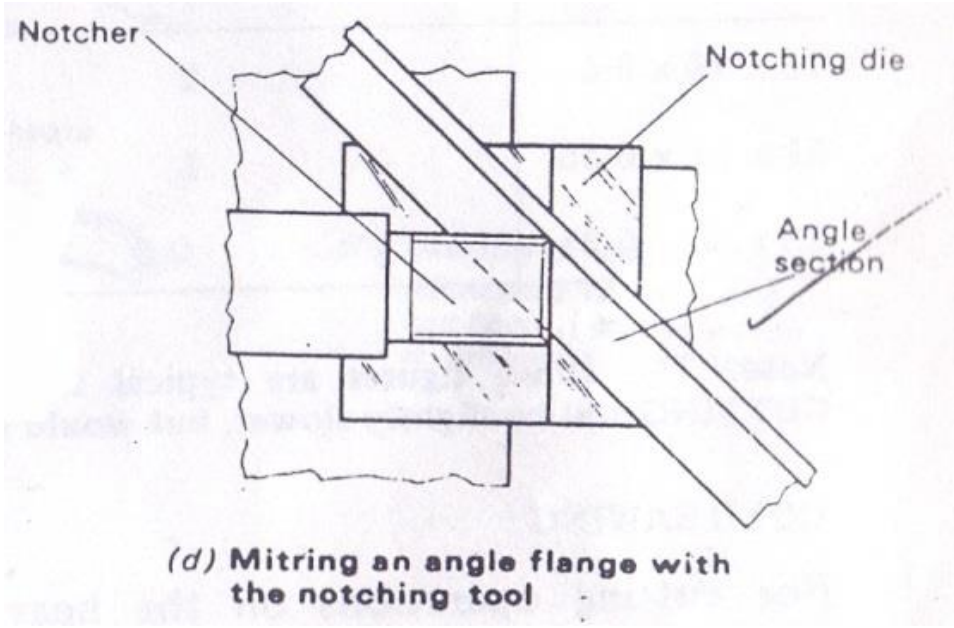


(c) Notching tee - section



(d) Mitring an angle flange with the notching tool

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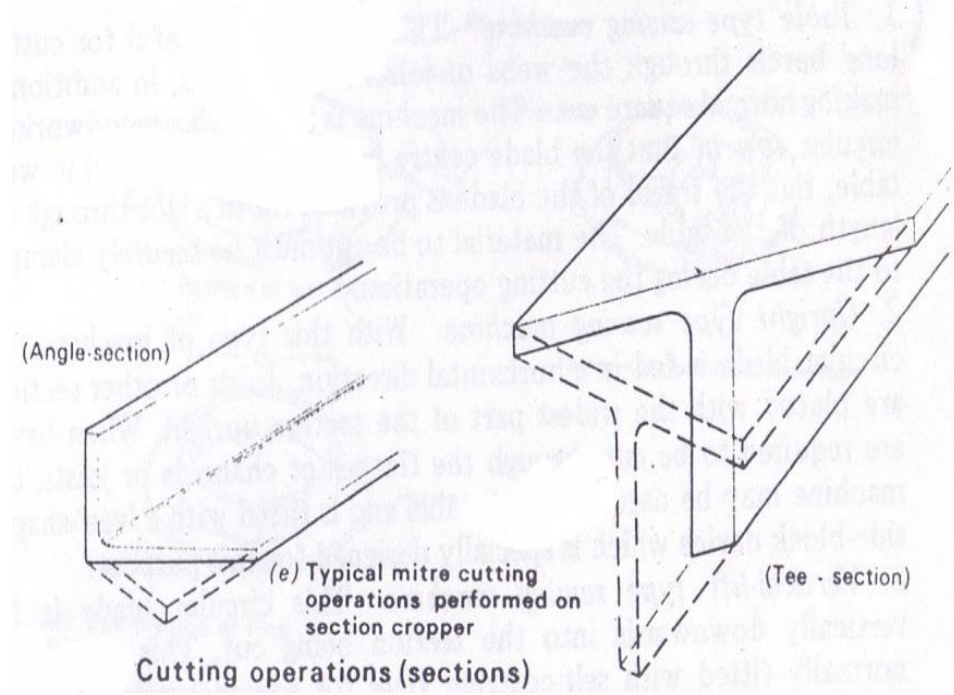

Notching is removal of material by making a notch. In most fabrication shops, cutting operations on rolled steel sections are carried out on power machines. Machines are available which perform a combination of cutting operations, such as punching, shearing and notching, the shearing operations including not only section shearing, but round and square bar cropping and plate shearing. Angle section has to be notched in order to permit it to be bent and most of the notches are of the 'V' notch or the square-notch type.

02 marks for expln.

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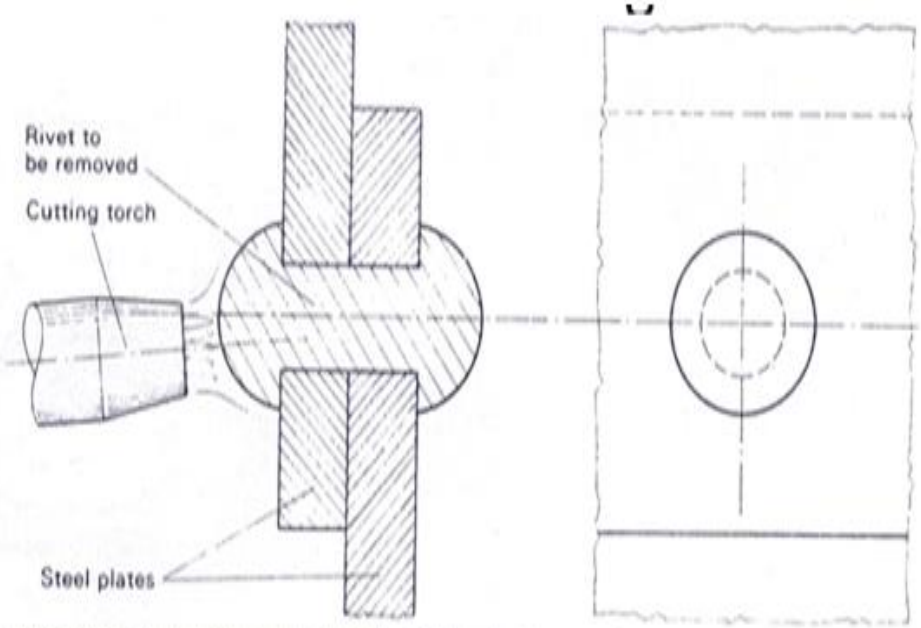
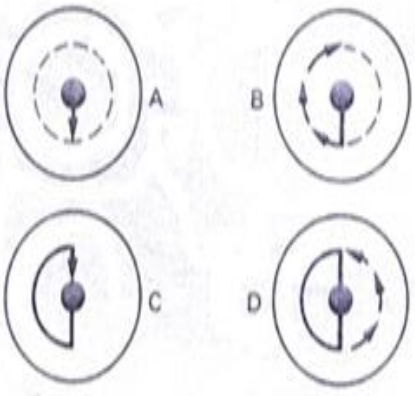
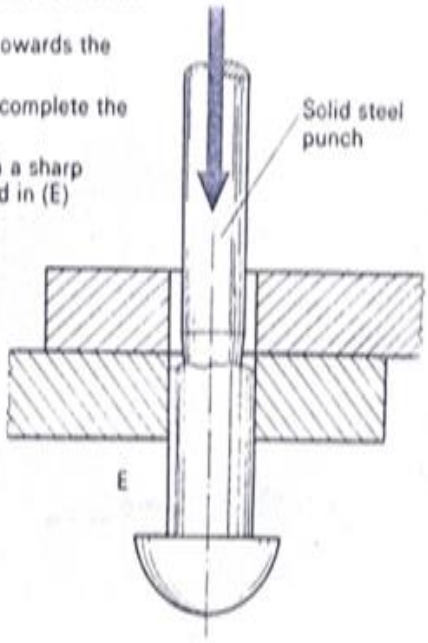
b	 1. The centre of the rivet head is heated until bright cherry red, and the edge of the hole becomes clearly visible (A) 2. The cutting oxygen jet is turned on, and with the torch slightly inclined towards the centre, a cut is carefully made around the edge of the hole, without damaging it (B) 3. On reaching the halfway point the cut is made towards the centre (C) 4. With the cutting torch slightly inclined inwards complete the cut around the edge of the hole (D) 5. The rivet is easily removed by knocking out with a sharp hammer blow on a solid steel punch, as indicated in (E)  	02 marks for diag. 02 marks for Explanation of any 02 points
c	**i)** Factors influencing the quality of cut: The success of the flame cutting operation depends upon; • Selecting the correct size of cutter nozzle for the thickness of the	04 marks

	material being cut. • Operating the cutting torch at the correct oxygen pressure. • Moving the cutting torch at the correct cutting speed. • Maintaining the nozzle at the correct distance from the plate surface. (If the torch is adjusted and manipulated correctly, a smooth narrow cut, termed the 'kerf', is produced). **ii)** Flame lighting: The procedure used for lighting a welding torch is adopted when lighting a cutting torch, but with some difference. The fuel gas regulator is set to the correct working pressure in the normal way and the oxygen regulator is set to the correct working pressure with the cutting oxygen valve on the torch in the open position. --- The fuel gas is lit and the flame adjusted, until it ceases to smoke. --- The heating oxygen valve is then opened and adjusted (similar to a neutral flame setting) until there is a series of nicely defined white inner cones in the flame (in the case of the multi-port type nozzle) or a short white conical ring, if the nozzle is of the annular port type. --- The cutting oxygen valve is then opened at this stage and the flame readjusted to a neutral condition. The oxygen cutting valve is then closed and the torch is ready for use. Flame adjustment: When oxy-propane is used for cutting, the correctly adjusted pre-heating flame will be indicated by a small non-luminous central cone with a pale blue envelope. In the case of oxy-natural gas the flame is adjusted until the luminous inner cone has a clear definite shape, usually up to 8-10mm in length).	
d	The difference between 'folding' and 'bending' is so slight that they are both carried out with the same purpose in view which is to deflect the metal from one flat plane to another so that it stays there permanently. If the deflection is sharp and the radius small, the metal is said to be folded .e.g. a single fold or hem. Should the curvature be large and the deflection cover a large area, it is called bending .e.g. the rolling of a hollow body, such as a cylinder. Folding or bending involves the deformation of a material along a straight line in two dimensions only.	02 marks 02 marks

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e	**Blanking Pressure:** The action of a punch in cutting material on the edges of a die is partly shearing and partly tensile rupture. With soft material, action of a pure shear is more nearly approached. With hard and strong material, the action will be more likely tensile type of failure The pressure required to produce a blank is measure of the combined tensile, shear and perhaps compressive strengths of the material. BLANKING PRESSURE = Ultimate shear stress of material X Area being sheared = Ultimate shear stress X Perimeter of blank thickness **Blanking operation:** It 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. The die governs the size of the blank produced and clearance is left on the punch	02 marks 02 marks
f	Riveting is the process of joining two or more parts with rivets. The riveted joint is related to permanent joints because it can be dissembled only by breaking the rivets. The process comprises of the following essential operations: • Making a rivet hole in the components to be joined by drilling or punching, • Countersinking the seat for the rivet head (for countersunk head rivets), • Setting the rivet into the hole, • Forming the closure head i.e. the riveting operation concluded properly. Bolting is the process of joining two or more parts with nuts, bolts and washers. The bolted joint is however a temporary joint because it can be dissembled easily. The process comprises of the following essential operations: • Making a bolt hole in the components to be joined by drilling or	02 marks 02 marks

	punching, • Setting the bolt into the hole and inserting the nut, • Tightening bolt and nut system by spanner.	