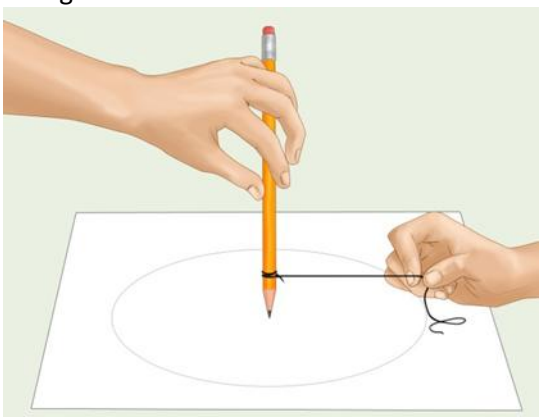
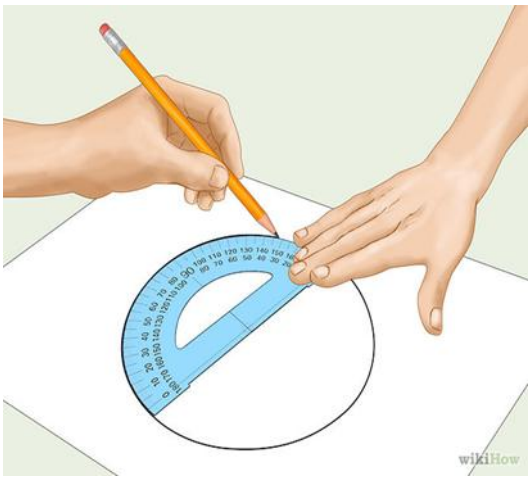
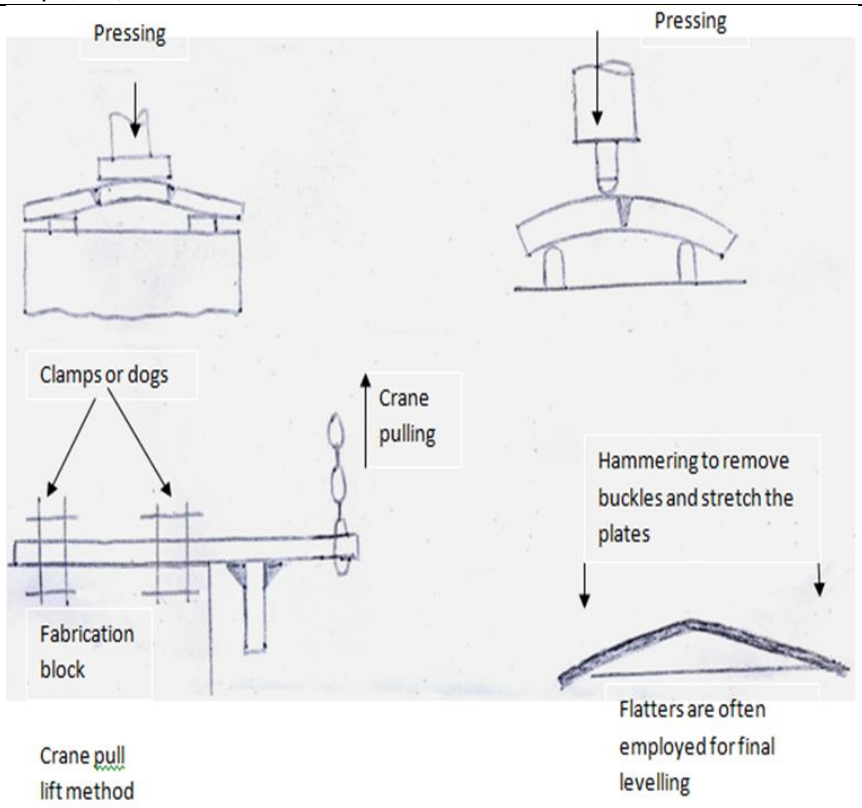
WINTER – 14 EXAMINATIONS

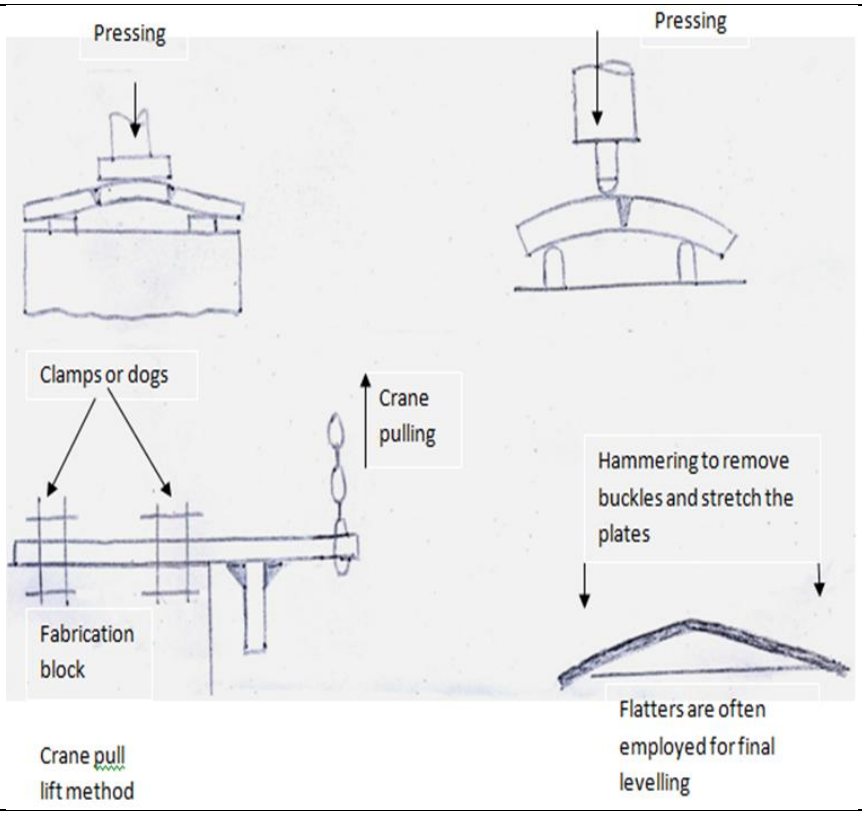
Important Instructions to examiners:

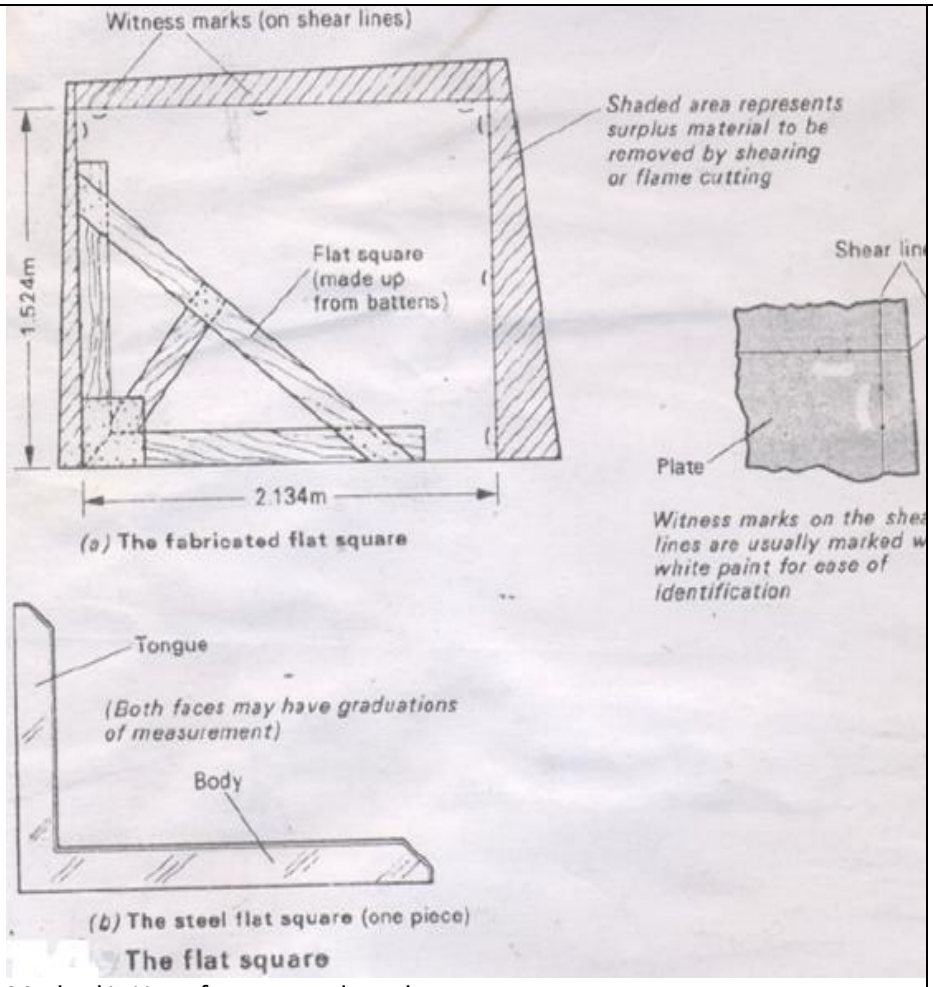
1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling 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	TOTAL MARKS
1.	**Attempt any TEN**:		20
I	Quantity is a property that can exist as a magnitude or multitude. Quantities can be compared in terms of "more", "less" or "equal", or, by assigning a numerical value in terms of a unit of measurement.	**2M**	2M
II	The standards of measurements are very useful for calibration of measuring instruments. They help in minimizing the error in the measurement systems. On the basis of the accuracy of measurement the standards can be classified as primary standards and secondary standards. OR A standard is defined as “something that is set up and established by authority as a rule for the measure of quantity, weight, extent, value or quality” .eg. the meter is the standard established by an international organisation for the measure of extent.	**2M**	2M
III	Scriber, beam trammels with steel tapes, bevel, pipe square, scratch gauge, centre punch, dot or nipple punch, etc	**2M**	2M
IV	The witness mark can locate the exact position where the operation is need to be performed.Because of the witness mark made on half of the assembly it becomes easy to join the part	**2M**	2M
V	String Method  **OR**	**2M**	2M

	Protractor Method 		
VI	Given D= 800 mm No of Bolt holes:- 8 For o8 no of bolt holes Constant taken from Table is 0.3827 Pitch= 800 X 0.3827 = 306.16 mm	**2M**	2M
VII	Plumb line Plummer Block Surveying Level Tensioned Wire Base plate	**2M**	2M
VIII	A line is said to be straight over a given length, if the variation of the distance of its points from two planes perpendicular to each other and parallel to the general direction of the line remains within the specified tolerance limits ; the reference planes being so chosen that their intersection is parallel to the straight line joining two points suitably located on the line to be tested and the two points being close to the ends of the lengths to be measured.	**2M**	2M
IX	•To avoid repetitive measuring and marking-off of the same dimensions, where a number of identical parts or articles are required. •To avoid unnecessary wastage of material. •To act as a guide for cutting processes. •As a means of checking bend angles and contours during forming and rolling operations. As a precise method of marking-off hole positions on sheet metal fabrications, plate work and structural sections such as angles, channels, columns and beams, gusset plates and angle cleats	**2M**	2M
X	It is defined as minimum distance between two planes within which all the points on a surface lie. A surface along which all the points lie along single plane is called as perfectly flat surface.	**2M**	2M

	Flatness is defined as a surface Having a horizontal surface without a slope, tilt, or curvature		
XI		**2M**	2M
XII	*For setting and maintaining the joint gap but can also be used to resist transverse shrinkage. Longitudinal shrinkage in butt welded seams often results in bowing, especially when fabricating thin plate structures. Longitudinal stiffeners in the form of flats or angles, welded along each side of the seam are effective in preventing longitudinal bowing. *For enhancing strength and rigidity in fabricated components *For removing sharp open edges and hence enable ease in handling fabricated components *For enhancing aesthetic qualities	2M	2M

XIII		**2M**	2M
XIV	Need for surface cleaning: The need to provide the above mentioned physical barrier for a long period of time, such materials should have inherently certain desired properties, be continuous and uniform in thickness. These requirements are fulfilled only if there exist an excellent adhesion between the surface and the coated layer. Pre-treatment is therefore the preparation of the substrate surface, by chemical and / or physical means, so that it becomes optimized to accept the powder coating finish. To do so, it is essential to ensure that the substrate is free of dirt, grease, oil and metal oxides, such as rust and mill scale	2M	2M
XV	Product Layout Process layout Fixed Layout Or Project Layout For pressure Vessels Fixed layout is used	2M	2M
2.	**Attempt any FOUR**:		16
I	Marking methods for large size plates (any one):	4M	4M



(2 marks for diagm.)
(2 marks for explan.)

Method1: Use of square and steel tape

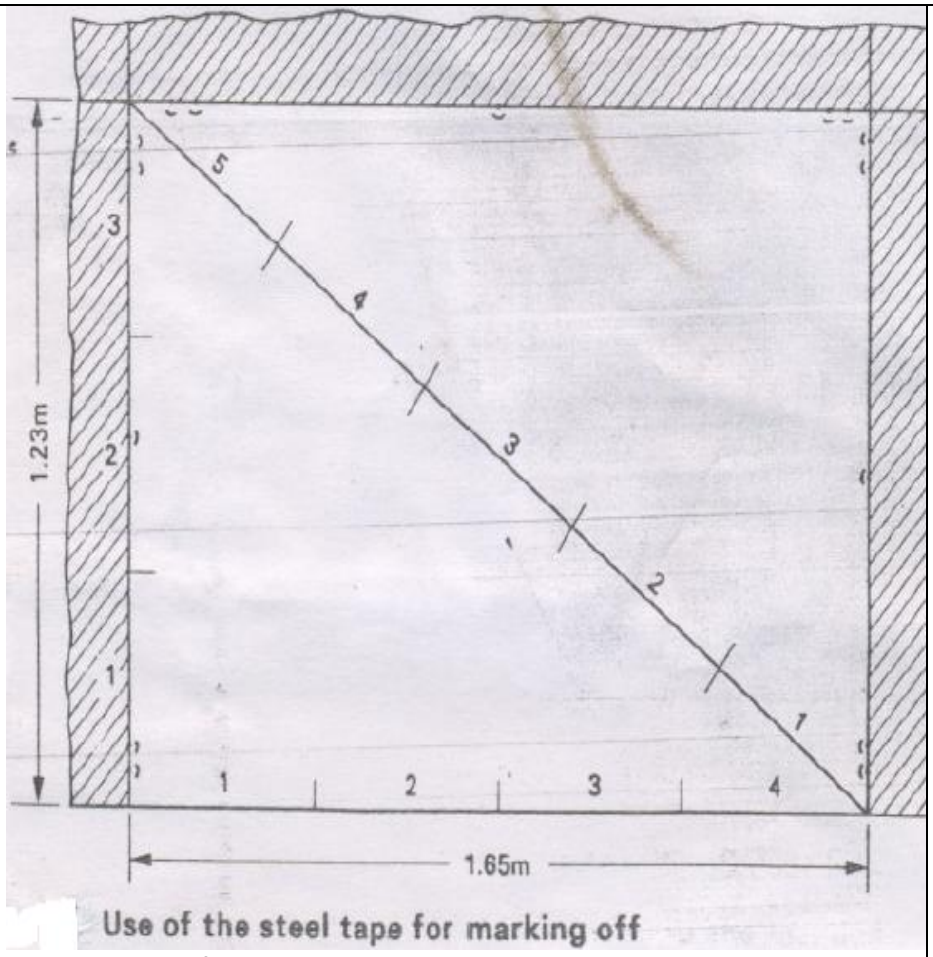
A Flat square is used for marking out on large flat surfaces. The flat square differs from an Engineer's try-square in that it is laid on the flat surface of the sheet metal or plate to be marked out. It is larger than the try-square and is made in one piece, consisting of a long arm termed the 'body' and a short arm termed the 'tongue'.

In many fabrication workshops use is made of a simple made-up square of either wood or light gauge steel. A suitable steel tape is used in conjunction with the flat square.

Before commencing to mark out a large plate:

1. Always check for squareness.
2. Where possible, select one straight edge and use as a base datum. Figure1 showed how square and steel tapes are used for marking-off a steel plate for cutting. Figure 2 shows how squareness may be checked.

OR



Use of the steel tape for marking off

Method2: Use of steel tape

Figure3 illustrates the use of a steel tape for marking-off a plate to measure 1.65m by 1.23m. Select one straight edge on the plate for straightness and use as a baseline, otherwise mark a datum line with the aid of a chalkline.

The method employed has been explained in Fig1. In this case a most suitable measurement to be used for the 3:4:5 ratio of the sides of a 90^o triangle will be 410 mm, giving the following dimensions to be used for the steel tape:

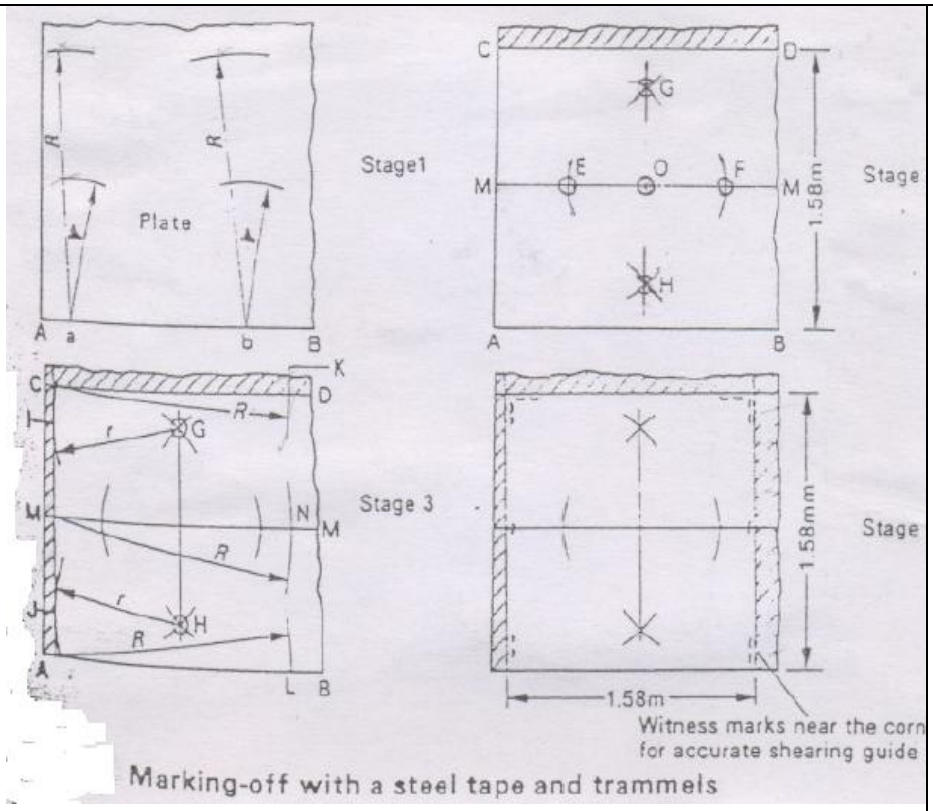
1230 mm (3 x410) : 1640 mm (4 x 410) : 2050 mm (5 x 410)

Once a line has been constructed at 90^o to the base datum, the dimensions of the sides are measured with the steel tape, the outlines made with a chalkline and witness marked. The outline is checked for true squareness as explained in

Fig2.

Arcs may be swung with a steel tape by holding the French Chalk in the hook at the zero end of the tape.

OR



Marking-off with a steel tape and trammels

Method3: Use of steel
tape and trammels

Figure4 illustrates the method of marking-off a steel plate which is required to be 1.58 m x 1.58 m with square corners, using a steel tape and trammels.

Stage1;

A suitable straight edge is selected and used as a baseline as shown at A-B. The trammels are set to the full width of the plate (R=1.58m) and with any two points ‘a' and ‘b’ (on the base line A-B) as centres, arcs are struck. With the same centres and the trammels set to approximately half this dimension (radius r) two other arcs are shown struck as in Fig.4

THE STEELTAPE IS USED FOR ALL MEASUREMENTS

Stage 2;

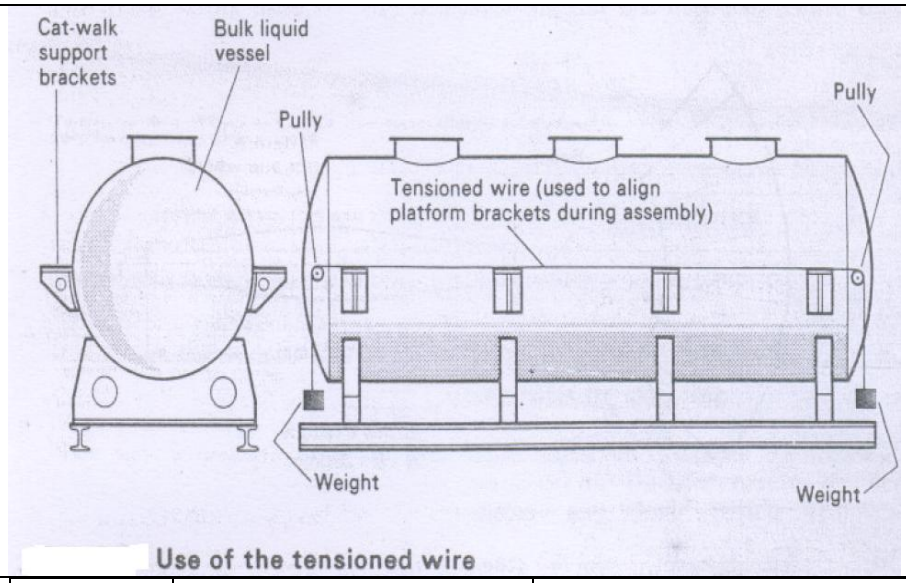
Parallel lines, C-D and 'M-M are marked with the chalkline held tangential to each pair of equal arcs, in turn. A light centre punch mark is made at 0 which is approximately half the width M-M.

From the point O on M-M construct a perpendicular G-H, and mark with the chalkline. Lightly centre-punch mark the points G and H.

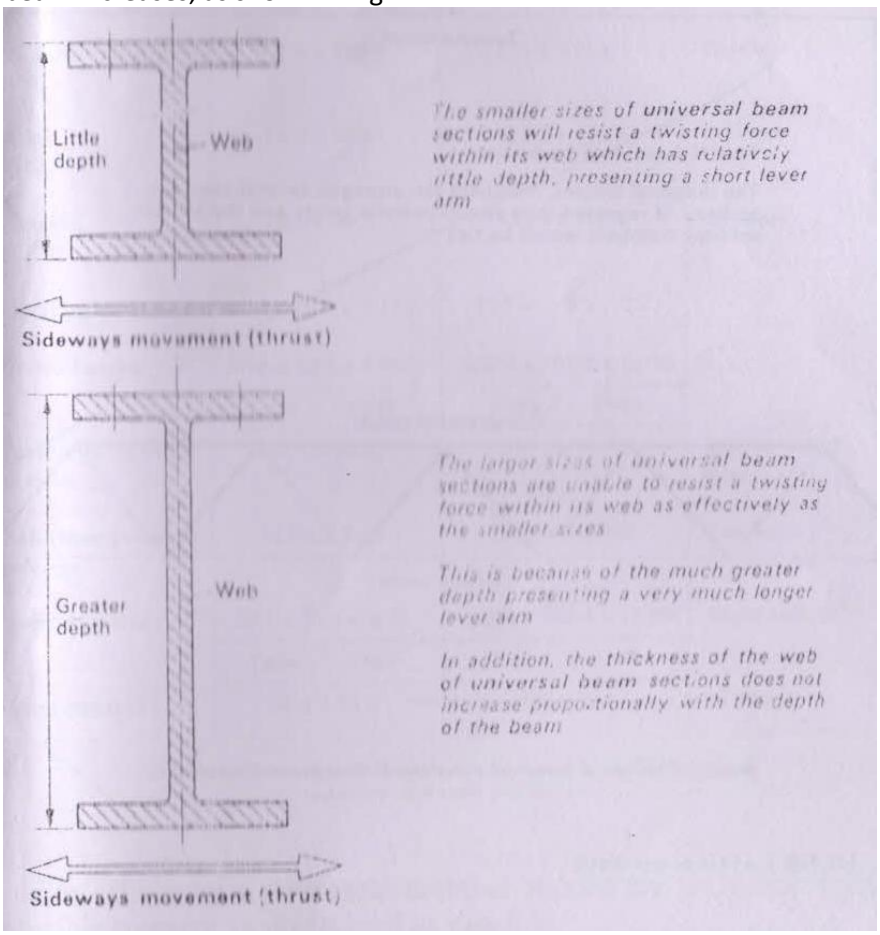
The points G, Hand 0 are used to check whether the edges of the plate are straight and parallel to this line of points, to enable use to be made of them.

Stage3;

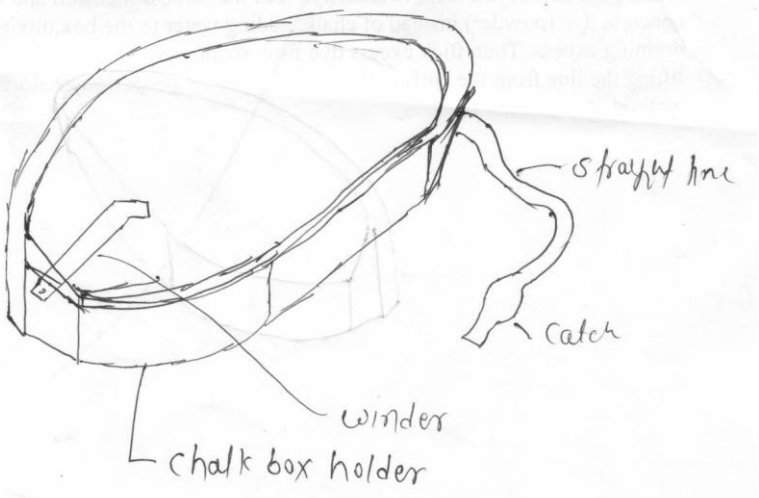
If both edges prove unsuitable for use, the trammels are set to radius r, and with centres G and H, arcs are struck to provide a suitable shearing margin at points I and J.

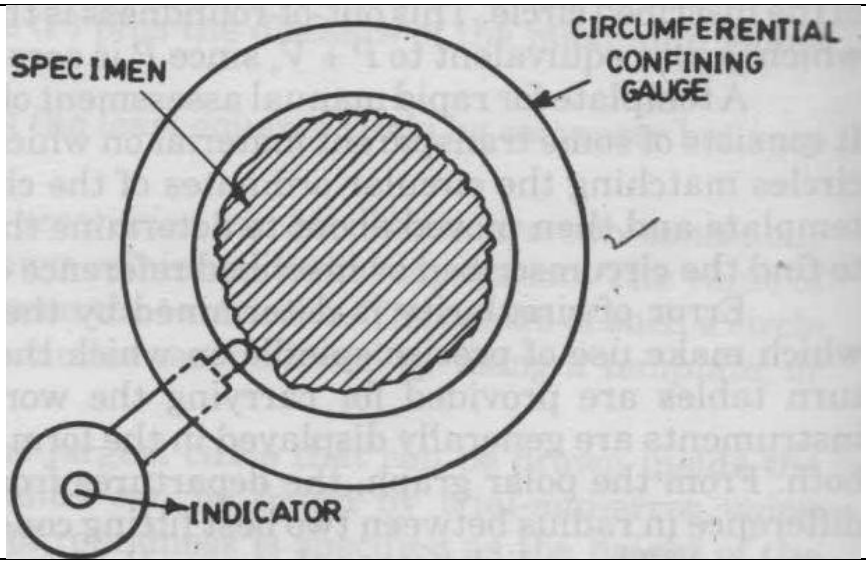
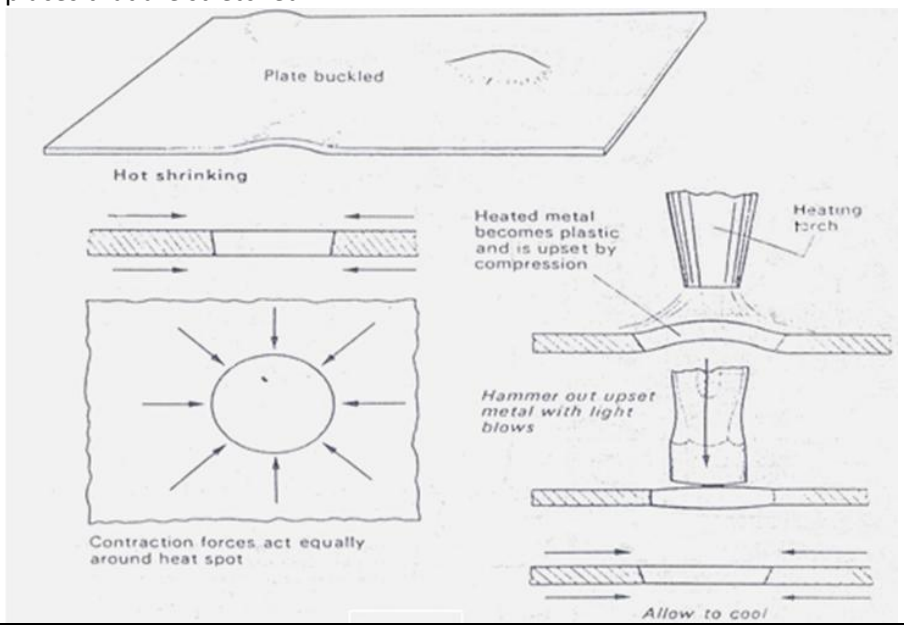
<table>
<tr><td></td><td>The end shear line is made with the chalk line held at a tangent to these arcs.
The plate edge measurements for the length of the plate are made from this line (through I and J). The trammels are set to R = 1.58 m, and a chalkline is made at a tangent to the arcs at points K, N and L, as shown in Fig.4
Stage 4;
The shear lines are witness marked with a centre punch, and white paint marks are made near them.
The finished outline is checked for SQUARENESS by measuring the diagonal lengths</td><td></td><td></td></tr>
<tr><td>II</td><td> 

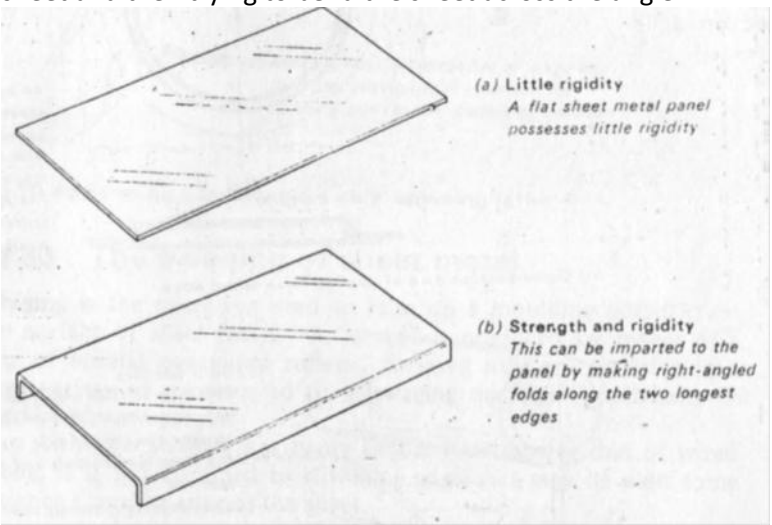
Use of the tensioned wire</td><td>4M</td><td>4M</td></tr>
<tr><td>III</td><td>
<table>
<tr><td>Sr. NO.</td><td>Direct Marking</td><td>Template Method</td></tr>
<tr><td>1</td><td>It is time consuming Process.</td><td>Time required is less as compared to direct method.</td></tr>
<tr><td>2</td><td>repetitive measuring and marking-off of the same dimensions, where a number of identical parts or articles are required.</td><td>No need of repetitive measuring and marking off.</td></tr>
<tr><td>3</td><td>Wastage of material may takes place</td><td>avoid unnecessary wastage of material.</td></tr>
</table>
</td><td>4M
(ANY 4)</td><td>4M</td></tr>
</table>

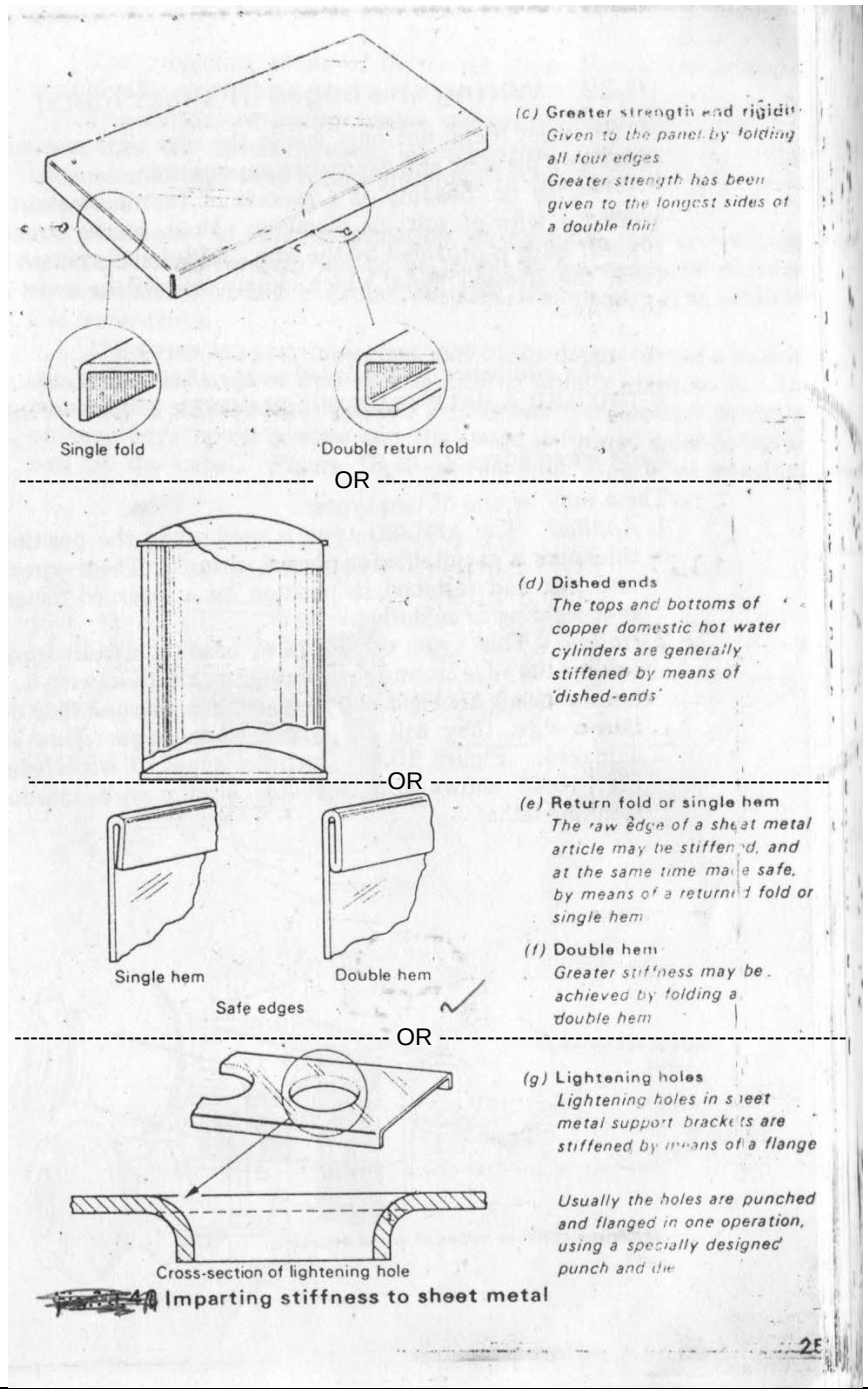
	4	Complicated Parts like angle sections cannot be marked	It is best suitable of complicated sections.		
	5	Less precise method	More precise method.		
	6	Skilled worker is required	Less skilled worker can do the process.		
IV	Web stiffeners . Web stiffeners are requited when a beam or plated structure is subjected to a twisting force (Torsion) or it sideways thrust. The need for veb stiflcncrs, or gussets, increaseses as the depth of the beam increases, as shown in Fig.  		4M (2 marks for needs) (2 marks for diagm.)	4M

V	In an alloy, the element getting introduced (solute) dissolves into the metal getting alloyed (solvent) to form a solid solution. It is akin to salt dissolving in water to form a salt solution except that the alloy is in solid form. One can not distingush them. In the case of composite, the metal forming the base of the composite (matrix) and the added element remain undissolved and could be identified. In the case of metal matrix composite, one finds carbon fibres or a ceramic matrial in the matrix of metal **Classification of composites:** Based on matrix material 1)Metal Matrix Composites (MMC): Metal Matrix Composites are composed of a metallic matrix (aluminum, magnesium, iron, cobalt, copper) and a dispersed ceramic (oxides, carbides) or metallic (lead, tungsten, molybdenum) phase. 2) Ceramic Matrix Composites (CMC): Ceramic Matrix Composites are 3) Polymer Matrix Composites (PMC): Polymer Matrix Composites are composed of a matrix from thermoset (Unsaturated Polyester (UP), Epoxy (EP)) or thermoplastic (Polycarbonate (PC), Polyvinylchloride, Nylon, Polystyrene) and embedded glass, carbon, steel or Kevlar fibers (dispersed phase).	2M 2M	4M
VI	1.Wiping Manually or mechanically wipe off with cloth or buff material. Inspection and sampling of mechanical polished surfaces is performed with the use of a clean room wipe andalcohol. First, scrub the surface with light to moderate pressure using an alcohol wipe over an approximately one square foot area. Next, inspect the wipe visually and/or under magnification to initially evaluate the severity and physical characteristics of the residue. **OR** Blasting Silica sand, steel grits and glass beads are air sprayed or projected with rotating wheels (Centrifugal projection).The surface can be cleaned by projecting a pressurized silica sand on the surface so that the burrs or an unnecessary material can be removed from the surface. **OR** 3) Grinding and Machining Grind with buffs or belts made of cloth or paper with abrasives. Mill surfaces of cast products.This is one of the most widely technique for surface preparion. The material is ground on a grinding machine so as to obtained the required surface finish.	4M	4M
3.	**Attempt any FOUR**:		16

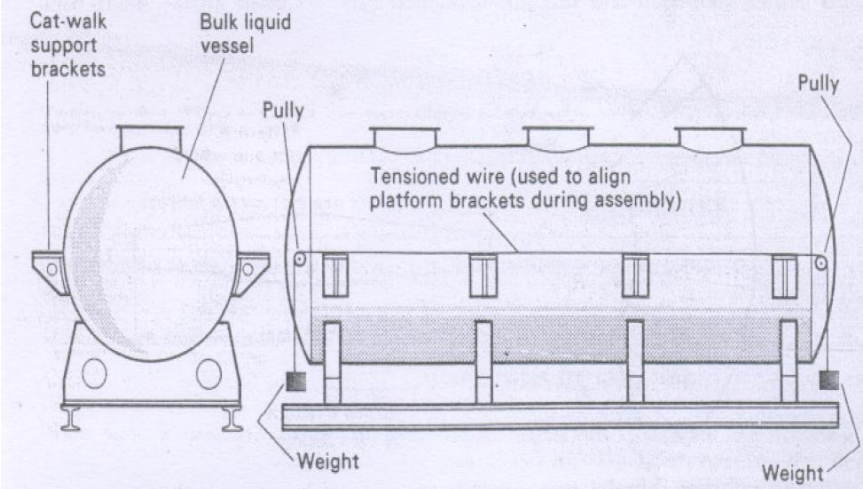
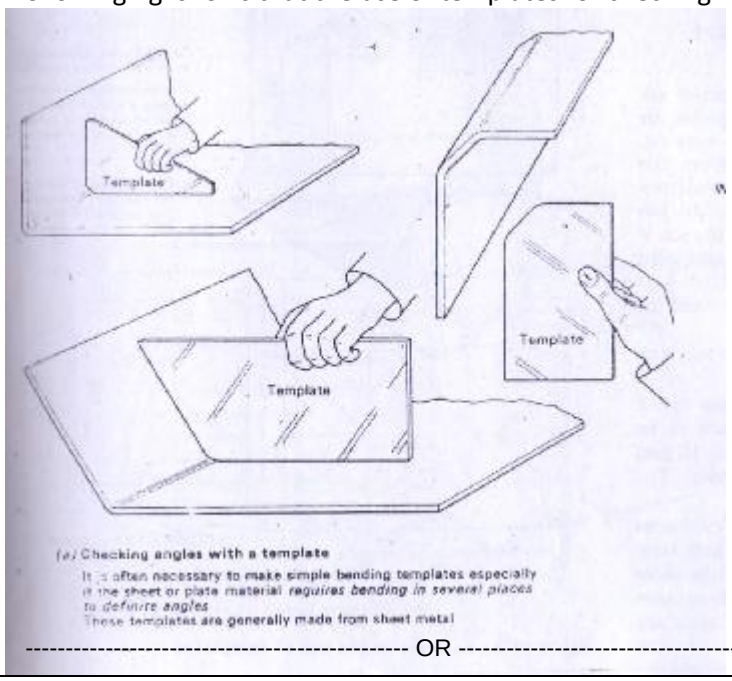
I	3(I) - A chalk line used to mark a straight line on flat surfaces. - This easy-to-use tool can be used to mark a straight line over longer distances. - It consists of a holder with chalk & a long line wound up inside the holder. - The holder is filled with chalk ~~red~~ usually red oxide or marking chalk. Steps 1) First coat the string with the chalk by shaking the holder. 2) Then work with the assistant & stretch the string across the floor, wall, piece of wood or whatever surface you are marking. If we dont have partner you can hook the or tape the string on the surface using the catch. - The line is now hooked tightly from the starting position over the length to be marked. - Pull the line up slightly from the surface, then release it. The chalk line will mark a straight line on the surface. - It is imp to pull the line vertically to avoid the line being released at an offset angle.  	4M (2 marks for explan.) (2 marks for diagm.)	4M
II	Diametral Method. In this method, the measuring plungers are located 180^0apart and the diameter is measured at several places. This method is suitable only when the specimen is elliptical or has an even number of lobes. Diametral check does not necessarily disclose effective size or roundness. This method is unreliable in determining roundness.	2M (explan.)	4M

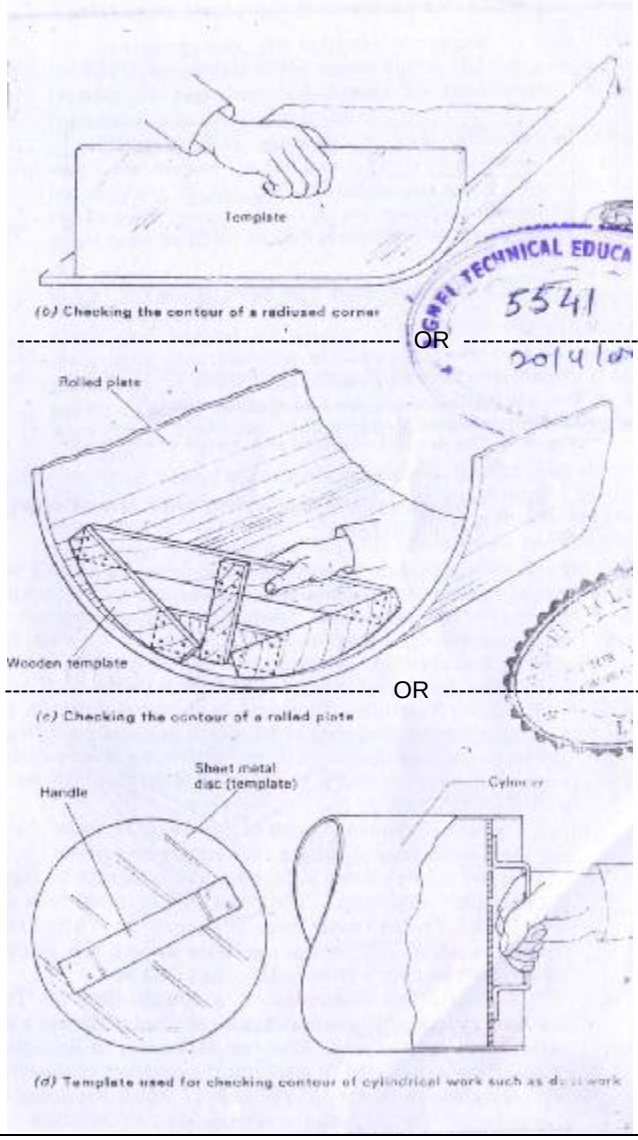
		2M (diagm.)	
III	Information given on templates . Typical information 'written up' on templates may be as follows: 1.. Job or cout ract number. 2. Size and thickness of the plate, 3. Steel section and length, 4 Quantity required, 5. Bending or folding instructions, 6. 'This side up', 'left hand' or 'right hand', 7. Driling requirements, 8.Cutting instruction, 9.Assembly reference mark.	4M (any 4)	4M
IV	The figures below illustrate the principle of shrinking a thin plate at the places that are stretched. 	4M (2 marks for diagm.) (2 marks for explan.)	4M

	•Hot shrinking •Use of heat strips •Use of heat triangles •Straightening simple sections by combination of heat strips and triangles Hot shrinking: It has been known that the application of heat can produce distortion. Heat can be used to advantage, for those same forces of expansion and contraction can be harnessed to remove distortion in plates or to straighten sections. The figures below illustrate the principle of shrinking a thin plate at the places that are stretched. A buckled or deformed plate may be straightened by the relatively simple process of 'hot shrinking'. A number of spots in the area of stretched (buckled) metal are heated to a cherry-red (approximately 750°C) and allowed to cool in turn. The metal which is locally heated becomes plastic, but the surrounding cold metal plate prevents thermal expansion. The plastic area becomes upset by compressive forces. When a heated spot is allowed to cool, the metal will tend to contract, and it is during this shrinkage that contractional stresses will occur. The process is repeated until the stretched areas of metal are compressed and the plate is restored to a straight and flat condition. This process is widely used in Light Vehicle Crash Repair And Panel-Beating Workshops.		
V	Methods of imparting stiftness to sheet metal The three main reasons for stiffening sheet metal are: 1. To give strength and rigidity to the material. 2. To produce a safe edge. 3. For decorative purposes. The simplest method of giving strength to metal is to form angle or flanges along the edges of sheets.A right angle bend greatly increases the strength of asheet as can be demonstrated bby forming a right angle bend in a thin sheet and then trying to bend the sheet across the angle.  (a) Little rigidity A flat sheet metal panel possesses little rigidity (b) Strength and rigidity This can be imparted to the panel by making right-angled folds along the two longest edges	4M (2 marks for diagm.) (2 marks for explan.)	4M

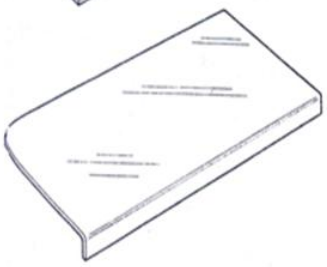
			
VI	Factors ınfluencıng layout: While deciding his factory or unit or establishment or store, a small-scale businessman should keep the following factors in mind: a) Factory building: The nature and size of the building determines the floor space available for layout. While designing the special requirments, e.g. air conditioning, dust control, humidity control etc. must be kept in mind. b) Nature of product: Product layout is suitable for uniform products	4M (ANY 4)	4M

	whereas process layout is more appropriate for custom-made products. c) Production process: In assembly line industries, product layout is better. In job order or intermittent manufacturing on the other hand, process layout is desirable. d) Type of machinery: General purpose machines are often arranged as per process layout while special purpose machines are arranged according to product layout. e) Repairs and maintenance: Machines should be so arranged that adequate space is avaible between them for movement of equipment and people required for repairing the machines. f) Human needs: Adequate arrangement should be made for cloakroom, washroom, lockers, drinking water, toilets and other employee facilities, proper provision should be made for disposal of effluents, if any. g) Plant environment: Heat, light, noise, ventilation and other aspects should be duly considered, e.g. paint shops and plating section should be located be in another hall so that dangerous fumes can be removed through proper ventilation etc. Adequate safety arrangement should also be made. Thus, the layout should be conducive to health and safety of employees. It should ensure free and efficient flow of men and materials. Future expansion and diversification may also be considered while planing factory layout.		
4.	**Attempt any FOUR** :		16
I	**Marking out bracket from a datum surface:** On large fabricated components, a tensioned wire may be used to check straightness and for checking alignment. Piano wire or stainless steel wire of about 0.55 mm in diameter is used for this purpose, and when not in use should be kept on a suitable reel. When in use for measuring or checking, both ends of the wire are hung over supports which are rounded, such as round bar section or pulleys, and weighted sufficiently to keep the wire in TENSION. Alternatively the wire may be secured by means of adjustable clamping devices. The figure below illustrates the use of a tensioned wire method.	2M (explan.)	4M

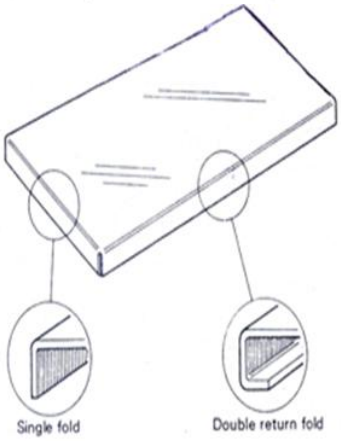
	 Use of the tensioned wire	2M (diagm.)	
II	Template As a means of checking:- These are usually made up of sheet metal or wood sometimes template making paper may be used. Following fig. shows that the use of templates for checking  (a) Checking angles with a template It is often necessary to make simple bending templates especially if the sheet or plate material requires bending in several places to definite angles These templates are generally made from sheet metal ---------- OR ----------	4M (2 marks for explan.) (2 marks for diagm.)	4M

			
III	The following figures show the methods of stiffening sheet metal components;	~~4M~~	~~4M~~

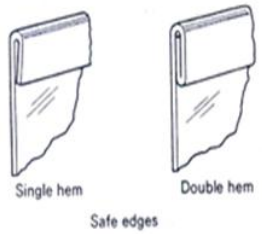
a)Little rigidity --- A flat sheet metal panel possesses little rigidity



b)Strength and rigidity --- This can be imparted to the panel by making right-angled folds along the two longest edges

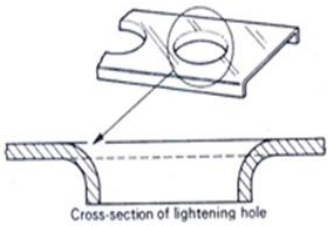


c)Greater strength and rigidity --- This can be imparted to the panel by folding all four edges. Greater strength has been given to the longest sides of a double fold



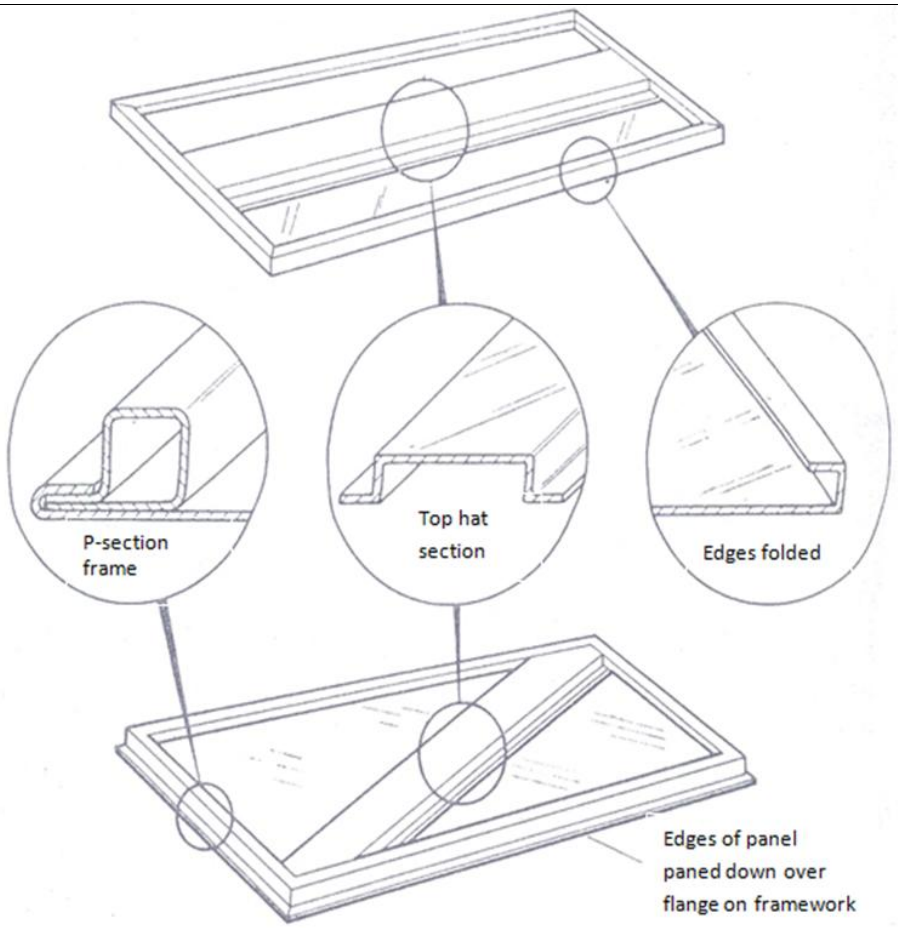
d)Return fold or single hem --- The raw edge of a sheet metal may be stiffened and at the same time made safe by means of a return fold or single hem

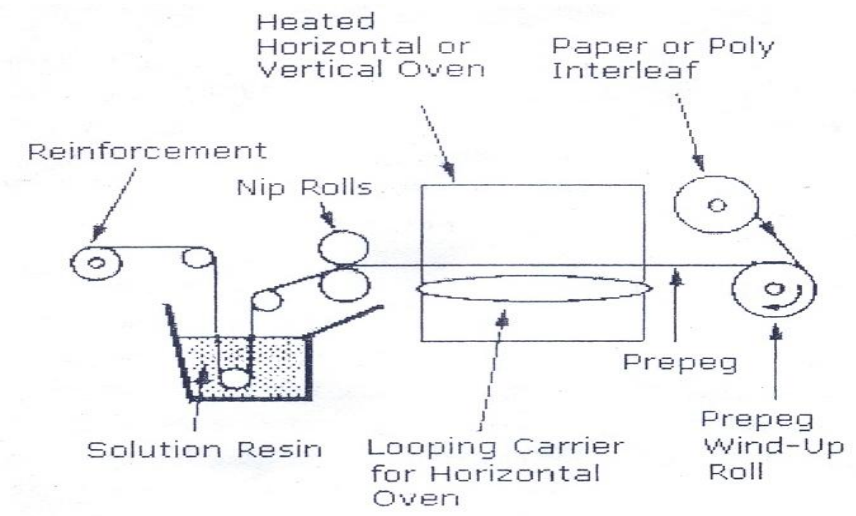
e)Double hem --- Greater stiffness is achieved by folding a double hem



f)Lightening holes --- Lightening holes in sheet metal support brackets are stiffened by means of a flange. Usually the holes are punched and flanged in one operation, using a specially designed punch and die.

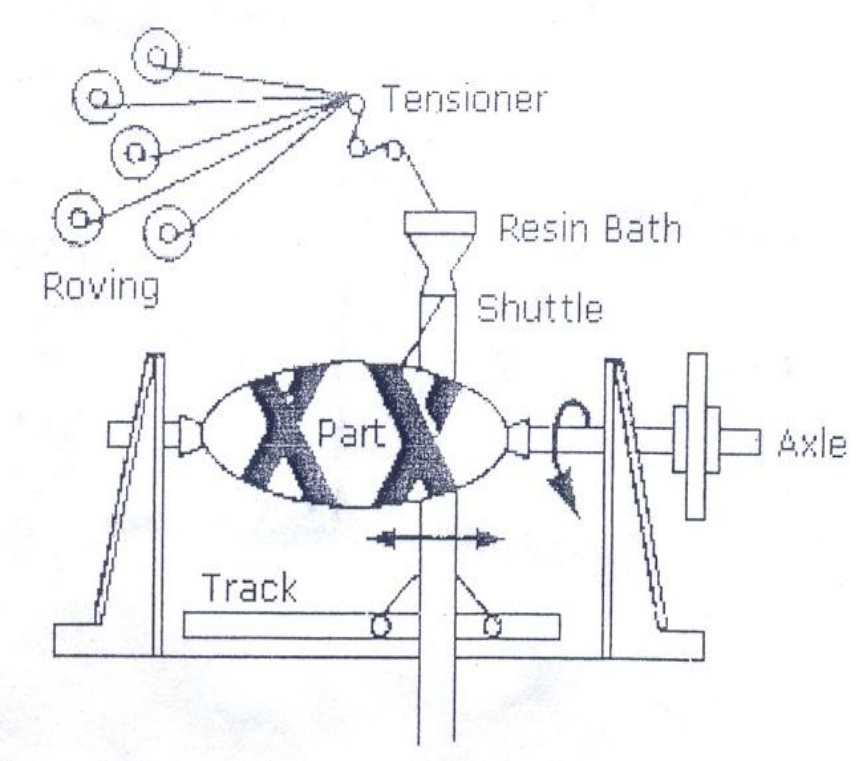
The stiffening of large panels is shown in the figures below;

	 A large sheet metal panel may be stiffened with all four edges made rigid by folding. 'Top hat section' is used to stiffen the centre section of the panel and is usually secured in position by spot welding. Another method of stiffening large sheet metal panels is to attach them to a rigid frame-work. The welded frame is fabricated from lengths of 'P-section' which has a very high Strength/weight ratio for a sheet metal section. All four edges of the panel are folded at 90^{o} to a suitable width. The panel is then placed in position over the frame and the edges 'paned-down' over the flange on the 'P-section'. The centre of the panel is stiffened by means of a diagonal top-hat section.	4M (2 marks for diagm.) (2 marks for explan.)	4M
IV	Description of processes: A brief description of each process with neat sketches is as follows; • Prepegging --- It involves the application of formulated resin products, in solution or molten form, to a reinforcement such as carbon, fibreglass or aramid fibre or cloth. The reinforcement is saturated by dipping through the liquid resin. In an alternative method called a Hot Melt Process the resin is impregnated through heat and pressure. The Hot Melt System uses resins with a very low percentage of solvents.	4M (2 marks for diagm.) (2 marks for explan.)	4M



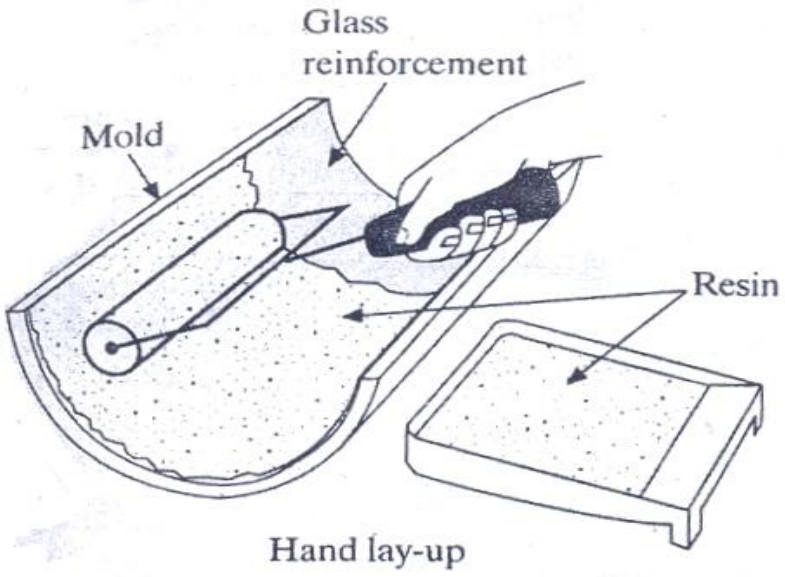
OR

- Wet filament winding --- In this process, continuous fibre reinforcement materials are drawn through a container of resin mixture and formed onto a rotating mandrel to achieve the desired shape. After winding, the part is cured in an oven. This process can also be used as preimpregnated fibre tows called towpregs.



OR

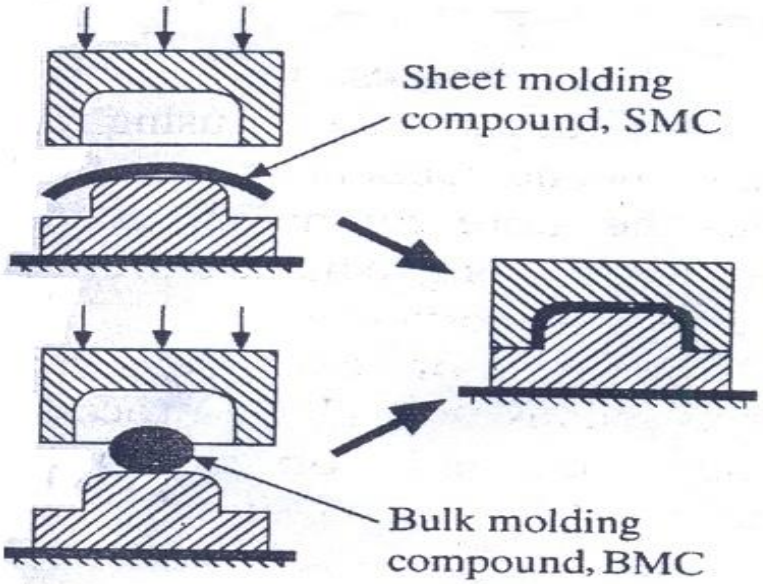
- Hand lay-up or contact moulding --- This involves coating a mould or form with a layer of resin; a layer of glass reinforcement is applied, and the reinforcement is thoroughly saturated with resin. The process is repeated until the desired composite thickness is achieved (the maximum thickness is usually 9mm). The polymer matrix is usually a polyester or epoxide.



OR

- Compression moulding --- It is similar to the process described for unreinforced thermosets, except that special techniques are required to introduce the glass reinforcement into resins that have to be catalyzed and have a limited pot life after catalyzation.
  In the sheet moulding process, catalyzed polyester or epoxy resin is kneaded into the glass reinforcement by rollers. Special fillers are added to keep the resin from being tacky and inhibitors are added to increase the pot life of the catalyzed resin. The finished sheet, called sheet moulding compound (SMC), consists of resin and reinforcement and this sheet can be cut to an appropriate size and pressed in a matched mould to make the finished part. The moulds are heated to complete the cross-linking of the resin.
  A similar product, called bulk moulding compound (BMC), is produced by adding thickeners to the resin; it is kneaded like dough with chopped fibres to make a compression moulding charge that resembles a glob of dough. The heating and pressing are the same as in sheet moulding.
  Both processes can be used for large mouldings such as automobile

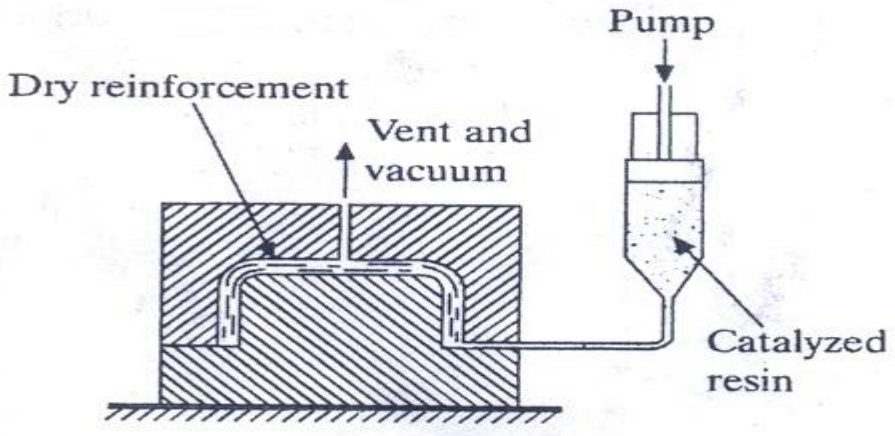
fenders.



Compression molding

OR

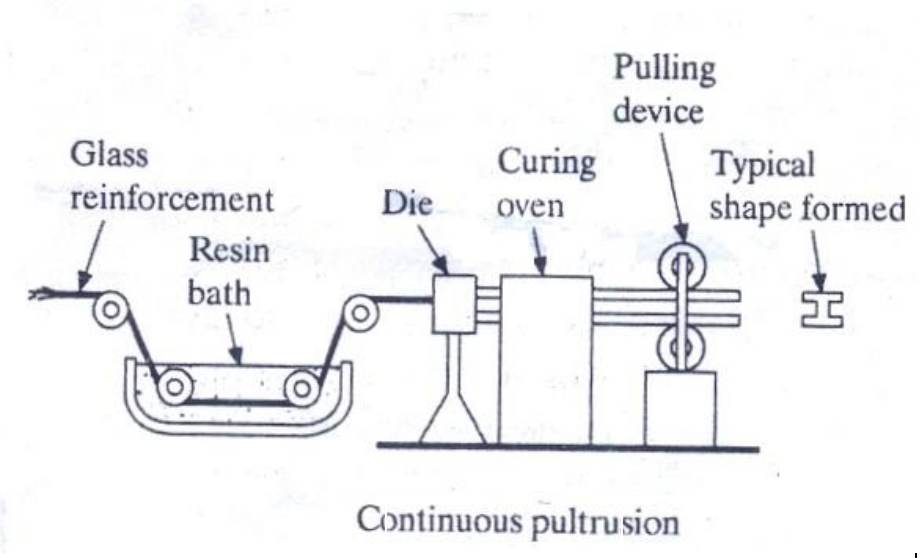
- Resin transfer moulding --- This process has evolved as a way to speed up contact and to improve the part by having two finished surfaces instead of one. This process requires a close fitting mould. Glass reinforcement is cut and shaped to the desired thickness in the open mould. The mould is then closed and evacuated and catalyzed resin is pumped into the bottom of the mould. When the mould is filled, the pump is shut off, the resin line is stopped off and the part is allowed to cure. This is becoming an important process for the production of large RTP boats. It is replacing hand lay-up.



Resin transfer molding

OR

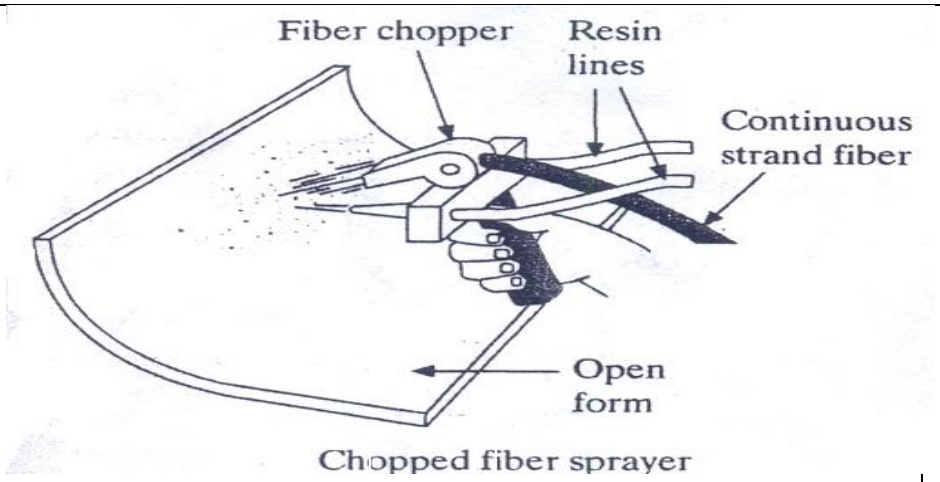
- Continuous pultrusion --- It is a process for making glass-reinforced shapes that can be generated by pulling resin-impregnated glass strands through a die. The glass is pulled through a resin bath; it is shaped as it goes through a heated bath and the resin cross-links in the heated die and combined curing section. Pipes, channels, I-beams and similar shapes can be generated. Pultrusion structural shapes are frequently used for decking and structural members around corrosive chemical tanks.



Continuous pultrusion

OR

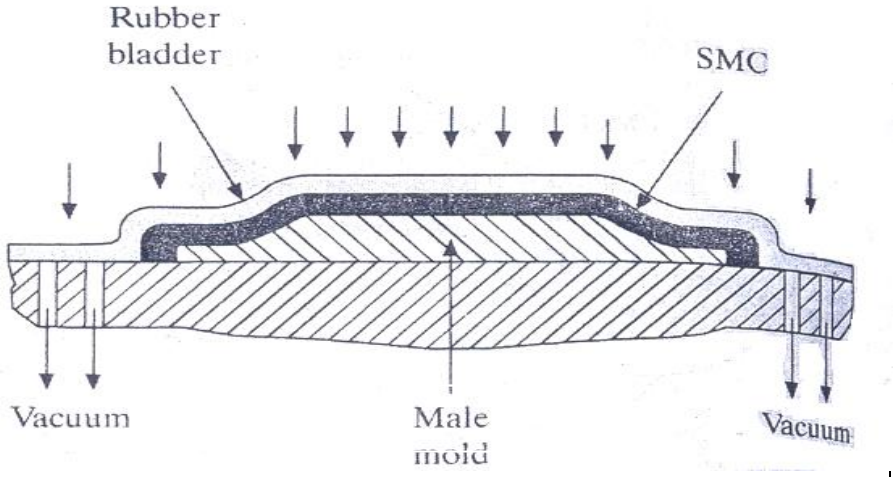
- Chopped fibre spraying --- It performs the same job as hand lay-up, but it is much faster. Two component resins are mixed in a hand-held gun and sprayed at a mould surface. A chopper is incorporated in the gun. It chops continuous strands of glass into short lengths to act as reinforcement in the composites. This process can be used to make large reinforced composites such as boats, shower stalls and bathtubs. Chopped fibre reinforcements, however are not as strong as hand lay-ups that are reinforced with mat or woven roving.



Chopped fiber sprayer

OR

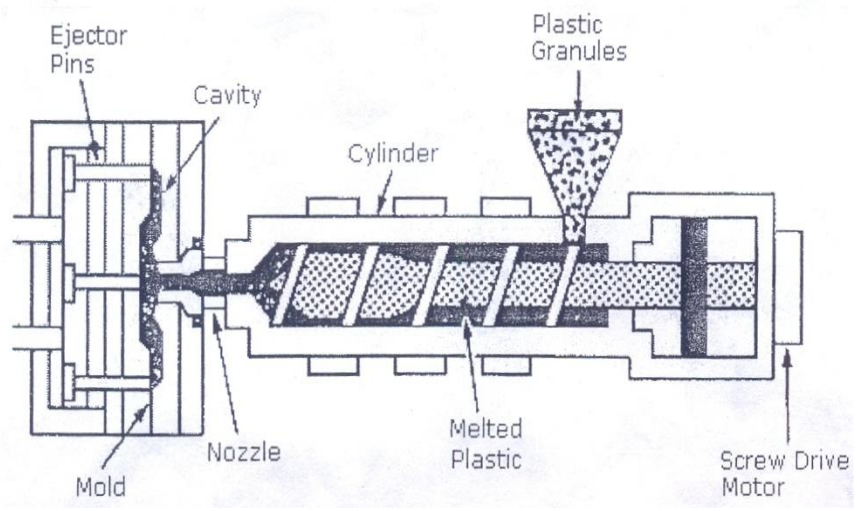
- Vacuum bag forming --- It is used to shape sheet moulding compounds to complex shapes. This process uses atmospheric pressure to do the forming, thus eliminating the high cost of matched metal moulds. It is possible to cure the SMC in the vacuum bag rig using temperature-resistant silicone rubbers for the forming bladder, but the more common practice is to use vacuum-bag forming to make a preform and cure the preform in another mould.



OR

- Injection moulding --- Chopped fibres and particulate reinforcements are blended into the moulding pellets/granules. However this method is not normally used in PMC processes due to fibre damage in the plasticating barrel. Thermoplastic granules are fed via a hopper into a screw-like plasticating barrel where melting occurs. The melted plastic is injected into a heated mould where

the part is formed. This process is often fully automated.



OR

Joining Composites:

Introduction: In any product, there are generally several parts or components joined together to make the complete assembly. These parts are interconnected with each other to make the final product. The purpose of the joint is to transfer loads from one member to another, or to create relative motion between two members.

Joints are but usually avoided in a structure as a good design policy. In any structure, a joint is the weaker area and most failures emanate from joints. Because of this, joints are eliminated by integrating the structure.

In an ideal product, there is only one part. Fibre-reinforced composites provide the opportunity to create large, complicated parts in one shot and reduce the number of parts in a structure.

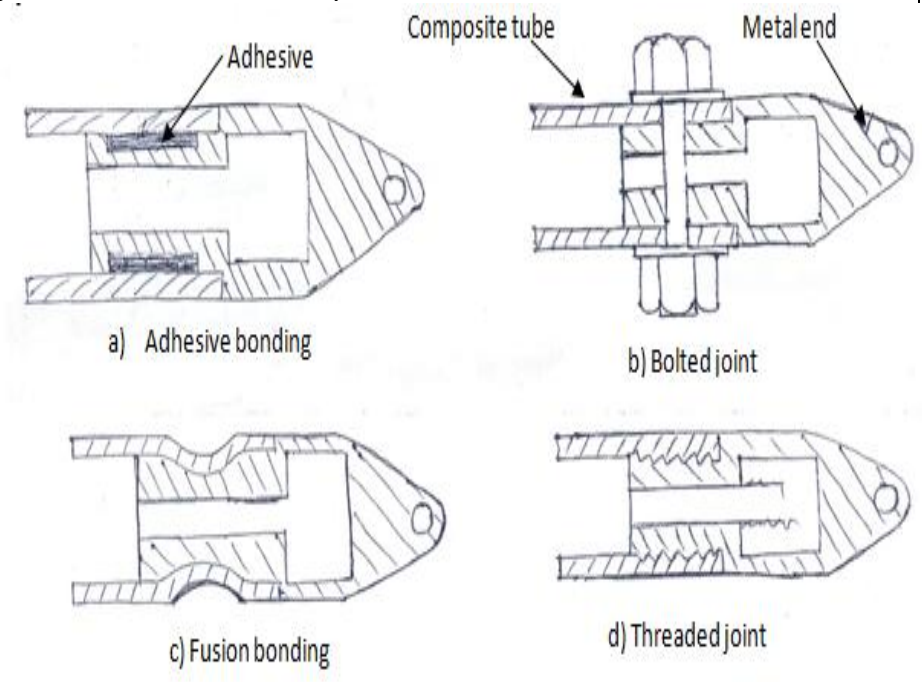
There are two types of joints used in the fabrication of composite products:

- Adhesive bonding
- Mechanical joints

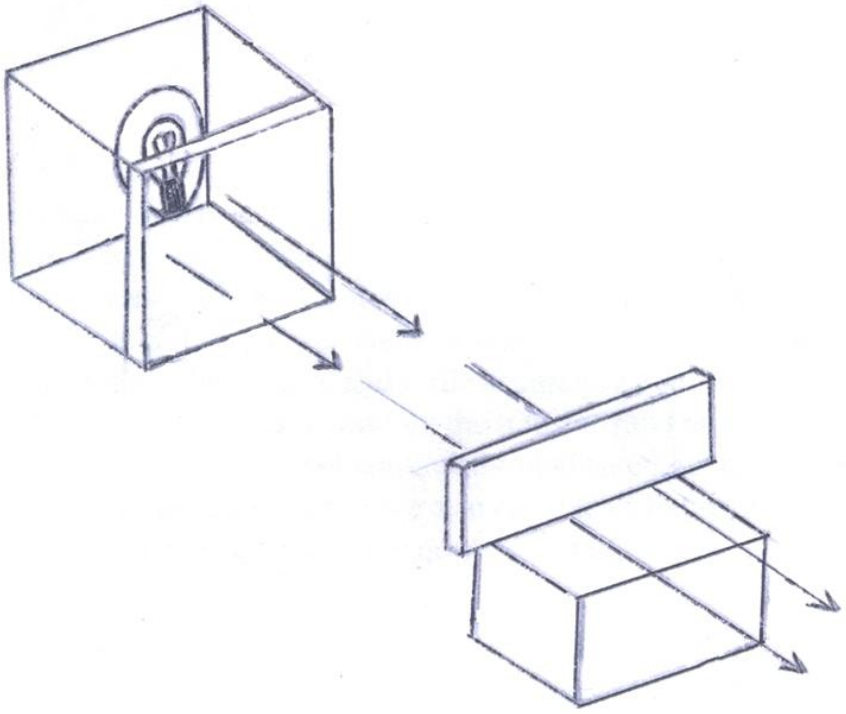
Adhesive bonding is the more common type of joint used in composites manufacturing.

In adhesive bonding, two substrate materials are joined by an adhesive. Mechanical joints for composites are similar to the mechanical joints of metals. In mechanical joints: rivets, bolts and / or screws are used to form the joints. Fusion bonding is also used for joining purposes. It is used to join thermoplastic parts by means of heat.

The figures below show an application in which a composite tube is

	joined with a metal end by various means  		
V	Need for surface coating: Some of the properties of engineering components sharply depend on the surface quality of the components. The properties largely affected by surface quality and type of surface are: Corrosion resistance, wear resistance, abrasion resistance, reflectivity, hardness, conductivity, etc. To achieve these properties, many times the surface of a component is coated or covered with another material, which changes the physical, mechanical and electrical properties of the component. The material at the surface provides a physical barrier between the environment and the surface of the component. Flame cleaning, Flame cleaning, also known as flame gouging, is the process of cleaning a structural steel surface by passing an intensely hot oxyacetylene flame over it. Mill scale and rust are removed by the reducing effect of the flame and the action of the heat, leaving the surface in a condition suitable for wire brushing and painting. There are many uses for flame cleaning rather than just to remove rust and mill scale. It is also used as a removal tool for paints, bad welds, burrs, mechanical wear (scraping, cuts, gouges and more) along with other surface imperfections. The process of flame cleaning is not anything new and does not require any extra equipment than what would be found in a typical metal shop. It is just an oxygen-fuel torch that is used parallel with the surface to melt and blow off any blemishes that the operator wants to eliminate. Shown in the diagram to the right, the surface is blasted with the	---~~4M~~ 2M (explan. of need) 2M (explan. of heat/flame method)	4M

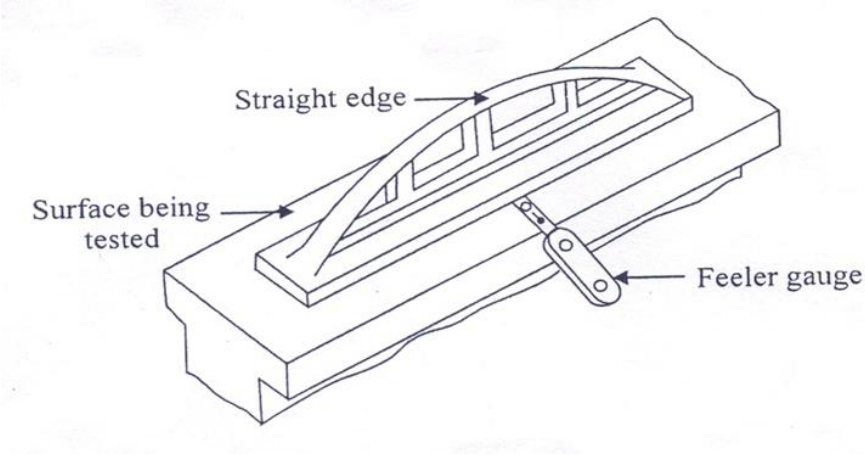
	oxygen-fuel torch across the surface versus the orthodox use of the flame as a cutting or gouging tool. Though the equipment is the same, the flame used in cleaning is drastically reduced to prevent excess removal of the surface. Various kinds of fuel can be run with the oxygen, for example acetylene.		
VI	A properly planned plant layout aims at achieving the following objectives: 1. To achieve economies in handling of raw materials, work in- progress and finished goods. 2. To reduce the quantum of work-in-progress. 3. To have most effective and optimum utilisation of available floor space. 4. To minimise bottlenecks and obstacles in various production processes thereby avoiding the accumulation of work at important points. 5. To introduce system of production control. 6. To ensure means of safety and provision of amenities to the workers. 7. To provide better quality products at lesser costs to the consumers. 8. To ensure loyalty of workers and improving their morale. 9. To minimise the possibility of accidents. 10. To provide for adequate storage and packing facilities. 11. To workout possibilities of future expansion of the plant. 12. To provide such a layout which permits meeting of competitive costs	4M (any 8)	4M
5.	**Attempt any FOUR** :		16
I	For checking the straightness, the straight edge is placed on the surface to be checked and the two are viewed against the light, which clearly indicates the straightness. If these two surfaces are perfectly straight then the gap between them will be negligible. The measurement of straightness is done by observing the colour of light due to interference caused by diffraction of light while passing through the small gap. If the colour of light is red then it indicates a gap of 0.0012 to 0.0017mm, while for blue light, the gap is approximately 0.0075mm.	4M (2 marks for explan.) (2 marks for diagm.)	4M



Use of straight edge with light source

OR

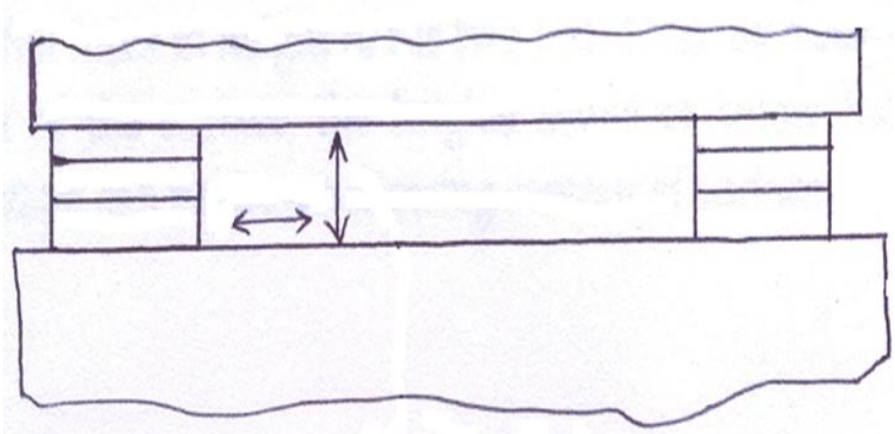
ii) For determining the straightness of engineering components in workshop by straight edge, it is placed against the work as shown in the figure below. The feeler gauges are then used to find any possible error.

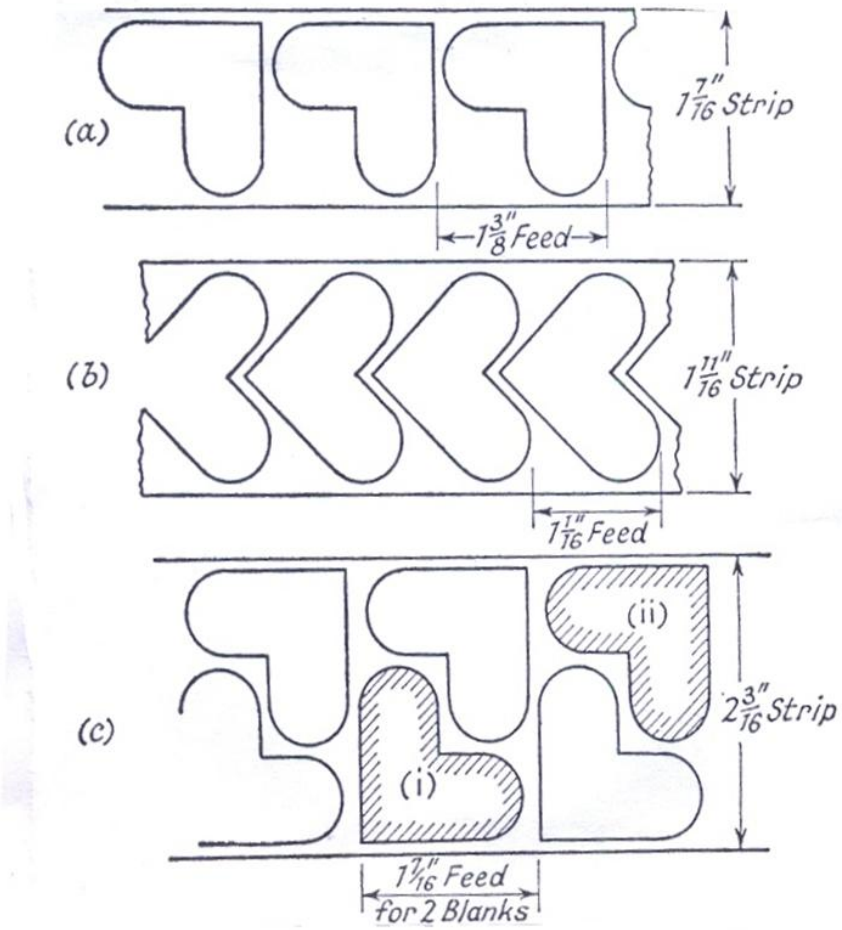
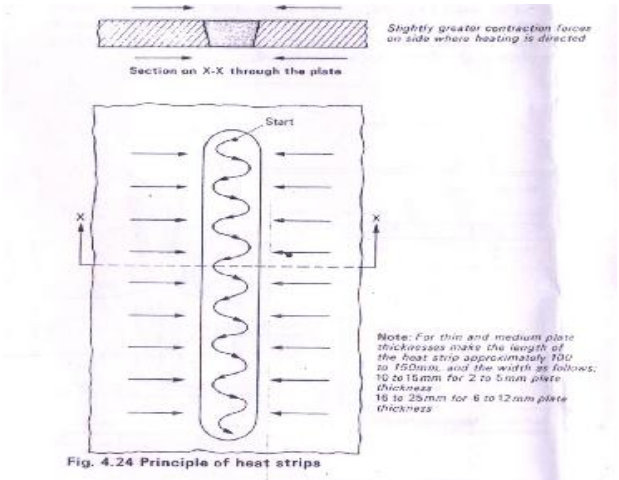


Use of straight edge with feeler gauge

OR

iii) A more accurate method is to support the straight edge on equal slip gauges at the correct points for minimum deflection and measure the

	uniformity of the space under the straight edge with slip gauges as shown in the Figure 3. below.  Use of straight edge with slip gauges		
II	Templates as a means to provide an economical arrangement of layout for press-work: Very often, when marking a full-size layout directly on to a sheet or plate, from information given on a drawing, it is almost impossible to anticipate exactly where to begin in order that the complete layout can be economically accommodated. Consequently, large-size layouts tackled in Templates as a means to provide an economical arrangement of layout for press-work: Very often, when marking a full-size layout directly on to a sheet or plate, from information given on a drawing, it is almost impossible to anticipate exactly where to begin in order that the complete layout can be economically accommodated. Consequently, large-size layouts tackled in this manner generally result in an extravagant waste of material.	4M (2 marks for explan.) (2 marks for diagm.)	4M

			
III	**Use of Heat Strips:-**  Fig. 4.24 Principle of heat strips	--2M--	

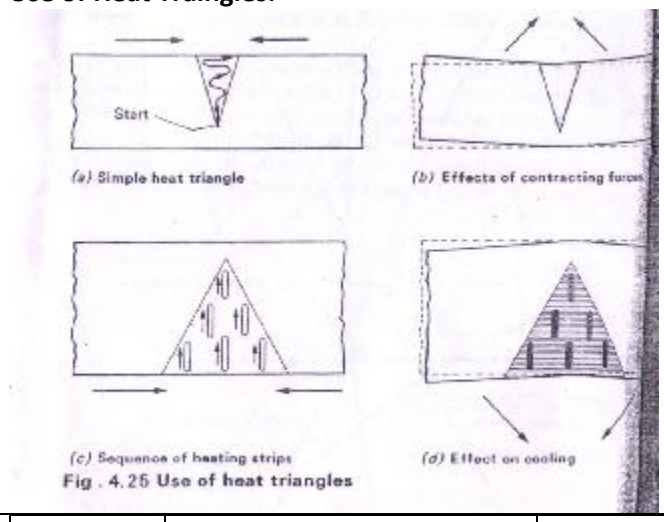
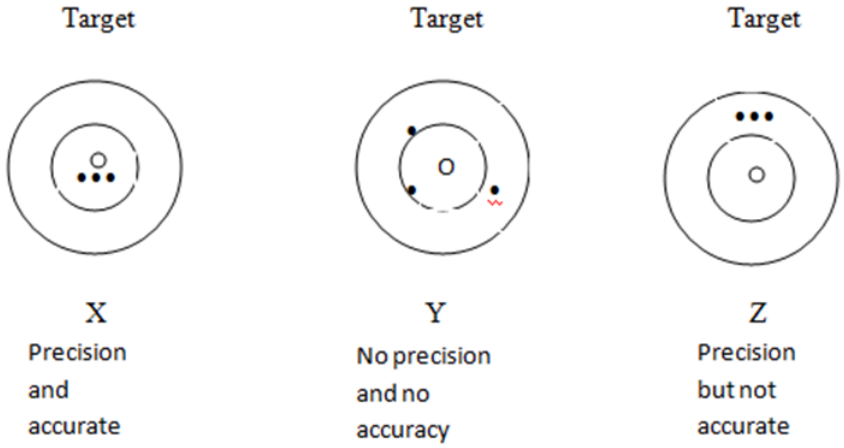
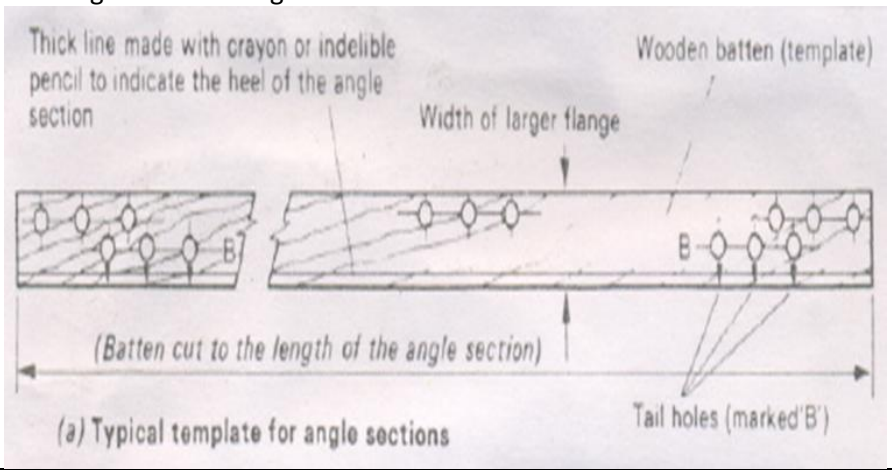
<table>
<tr><td></td><td>Use of Heat Traingles:-
 

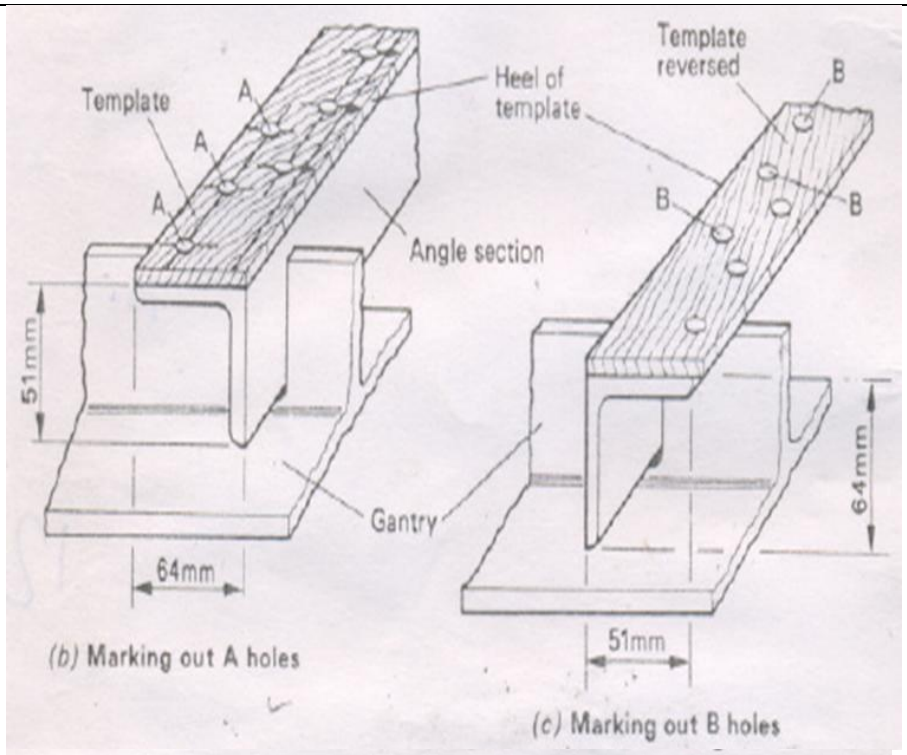
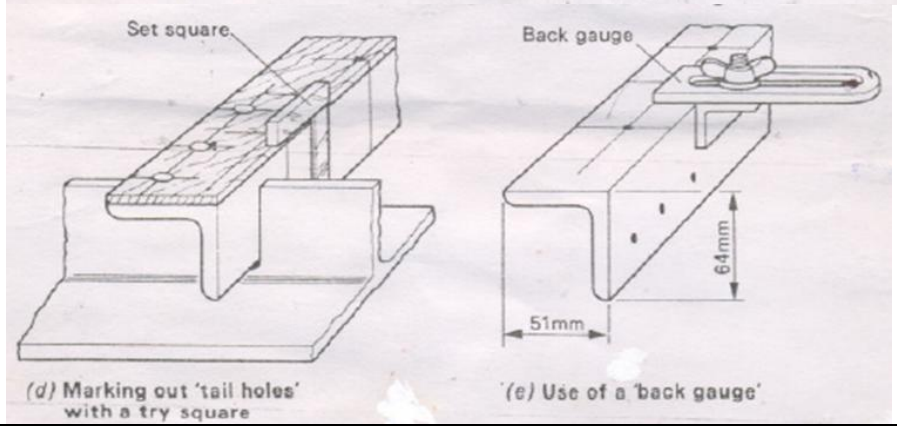
Fig . 4.25 Use of heat triangles</td><td>2M
(diagm. & explan.)

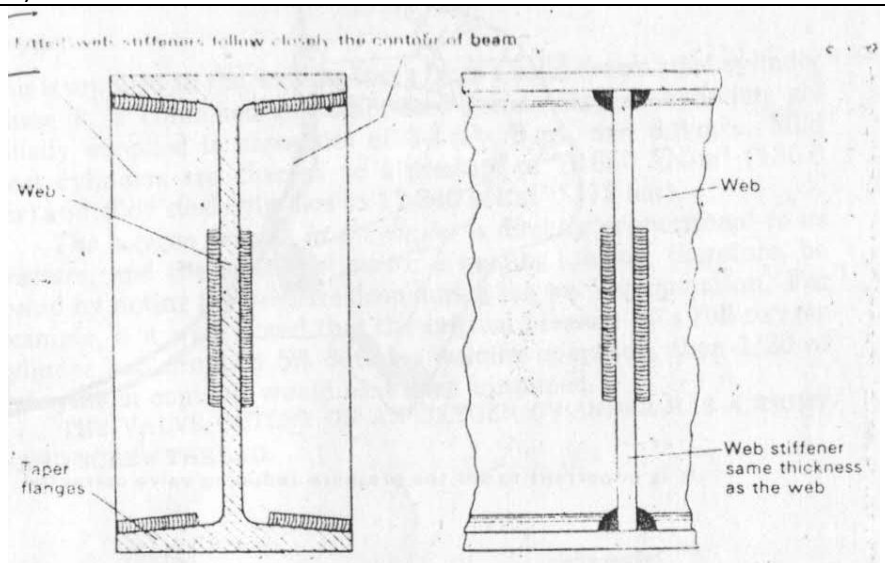
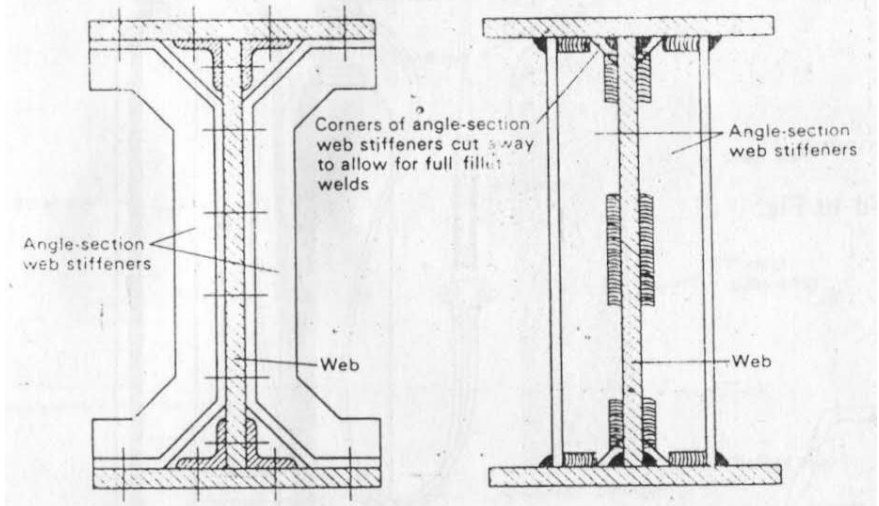
2M
(diagm. & explan.)</td><td>4M</td></tr>
<tr><td>IV</td><td><table>
<tr><td>SR NO</td><td>THERMOPLASTIC</td><td>THERMOSETTING PLASTIC</td></tr>
<tr><td>1</td><td>These resins do not undergoes any chemical changes when heated .</td><td>These undergoes permanent chemical changes when heated .</td></tr>
<tr><td>2</td><td>Becomes soft after heating and hard after cooling.</td><td>Cannot be resoftened after heating.</td></tr>
<tr><td>3</td><td>It can be reshaped</td><td>It cant be reshaped.</td></tr>
<tr><td>4</td><td>Two dimensional network of molecules</td><td>Three dimensional network of molecules.</td></tr>
<tr><td>5</td><td>Can be reused</td><td>Cannot reused.</td></tr>
<tr><td>6</td><td>Eg:- Acrylic, Nylons etc.</td><td>Eg:- phenolics, Epoxy resins etc.</td></tr>
</table></td><td>4m
(any 4)</td><td>4M</td></tr>
<tr><td>V</td><td>Pickling:-
Chemical metal cleaning process in which a strong inorganic acid (typically hydrochloric or sulfuric acid) is used at about 80°C to strip the surface of dirt, oil, rust, and scale. Usually, a small amount of citric acid is also added to the acid-water solution to serve as a buffering agent that retards metal etching
Oxides form naturally on stainless steel from many manufacturing processes such as soldering, welding, annealing and EDM to name a few. Pickling is the process of chemical removal of these oxides by means of a strong acid or base
Etching:-
Etching is the process of using strong acid or mordant to cut into the unprotected parts of a metal surface to create a design in intaglio in the metal (the original process—in modern manufacturing other chemicals may be used on other types of material). As an intaglio method of printmaking, it is, along with engraving, the most important technique for old master prints, and remains in wide use today.</td><td>2M

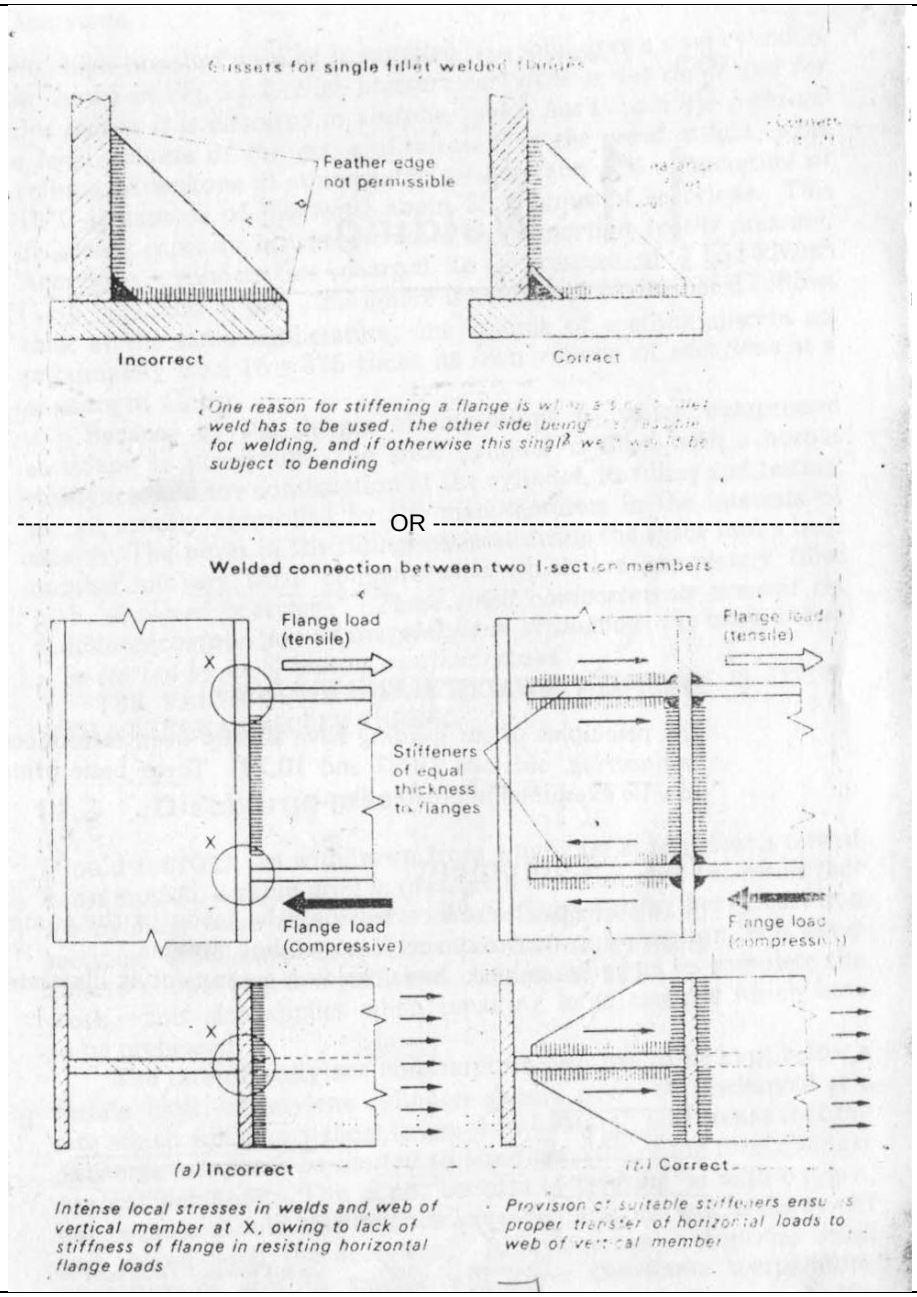
2M</td><td>4M</td></tr>
</table>

VI	Essentials of plant layout: An efficient factory layout is one that can be instrumental in achieving the following objectives; a) Proper and efficient utilization of available floor space b) To ensure that work proceeds from one point to another point without any delay c) Provide enough production capacity d) Reduce material handling cost e) Reduce hazards to personnel f) Utilize labor efficiently g) Increase employee morale h) Reduce accidents i) Provide for volume and product flexibility j) Provide ease of supervision and control k) Provide for employee safety and health l) Allow ease of maintenance m) Allow high machine or equipment utilization n) Improve productivity	4M (any 4)	4M
6.	**Attempt any FOUR :**		16
I	Consider three samples/shots and True value/center of target to highlight the difference between precision and accuracy  **Precision** is defined as the repeatability of a measuring process and is concerned with a process or a set of measurements and not a single measurement. In any set of measurements, the individual measurements are scattered about the mean and the precision tells us as to how well the various measurements performed by the same instrument on the same component agree with each other. **Accuracy** is defined as the agreement of the result of a measurement with the true value of the measured quantity where error is the difference between the mean of set of readings on same component and the true value i.e. Less is the error, more accurate is the instrument.	4M (2 marks for diagm.) (2 marks for explan.)	4M

<table>
<tr>
<td>II</td>
<td>
<table>
<tr><th>Characteristics</th><th>Line standards</th><th>End standards</th></tr>
<tr><td>Accuracy of measurement</td><td>Limited to + 0.2mm. For high accuracy, scales have to be used along with microscopes.</td><td>Highly accurate for measurement of close tolerances, up to + 0.001mm.</td></tr>
<tr><td>Time of measurement</td><td>Quick and easy.</td><td>Time consuming.</td></tr>
<tr><td>Effect of use</td><td>Scale markings are not subjected to wear but end of scale is worn. Thus, it may be difficult to assume zero of scale as datum.</td><td>Measuring faces get worn out. To take care of this, end pieces can be hardened. Built in datum is provided.</td></tr>
<tr><td>Other errors</td><td>Parallax errors can occur.</td><td>Improper wringing of slip gauge may introduce error.Change in laboratory temperature may lead to some errors.</td></tr>
<tr><td>Manufacture and cost of equipment</td><td>Simple and low.</td><td>Complex and high.</td></tr>
<tr><td>Examples</td><td>Yard, metre</td><td>Slip gauges, ends of of micrometer anvils, length bars, etc.</td></tr>
</table>
</td>
<td>4M
(ANY 4)</td>
<td>4M</td>
</tr>
<tr>
<td>III</td>
<td>Marking of holes in angle sections:
 
</td>
<td>4M
(2 marks for diagm.)
(2 marks for explan.)</td>
<td>4M</td>
</tr>
</table>

	 		
IV	Dynamics of plant layout: Plant layout is a dynamic rather than a static concept meaning thereby if once done if is not permanent in nature rather improvement or revision in the existing plant layout must be made by keeping a track with development of new machines or equipment, improvements in manufacturing process, changes in materials handling devices etc. But any revision in layout must be made only when the savings resulting from revision exceed the costs involved in such revision. Revision in plant layout may become necessary on account of the following examples: a) Increase in the output of the existing product b) Introduction of a new product and diversification c) Technological advancements in machinery, material, processes, product	4M	4M

	design, fuel etc. d) Deficiencies in the layout unnoticed by the layout engineer in the beginning. e) Etc.		
V	 Section of a beam showing fitted web stiffeners (welded)  Typical riveted plate girder Typical welded plate girder Web stiffeners OR	4M (2 marks for diagm.) (2 marks for explan.)	4M

			
VI	Dry processes of surface cleaning: i) Thermal degreasing: Work pieces soiled with oil are blow dried with hot air at a temperature of about 250^{o}C. This degreasing principle is based on the evaporation of oil by correspondingly applying energy. The oil vapors are subsequently condensed and separated from the laden air. Following processing, the oils can be reused in production (recycling rate up to 80%). OR ii) Vacuum thermal degreasing: Before heating the work pieces, the system is evacuated to less than 1mbar and the pressure then increased again with	4M	4M

	N_2. After heating in conjunction with extensive inerting, the oil is evaporated in a vacuum of approximately 10 mbar at a temperature of 150^oC to 200^oC. The oils are condensed and can be reused. OR iii) Degreasing with CO_2: Supercritical CO_2 has been used successfully for many years in the food and pharmaceutical industries for the purpose of solvent – free dry extraction. Work pieces are cleaned with super – critical CO_2 in high pressure systems at approximately 500 bar and an operating temperature of 190^oC		