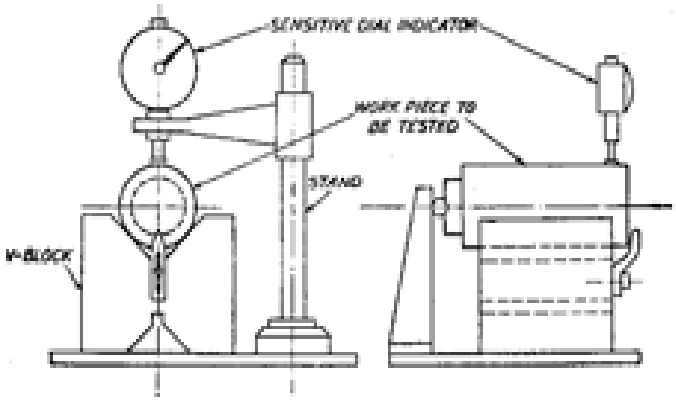
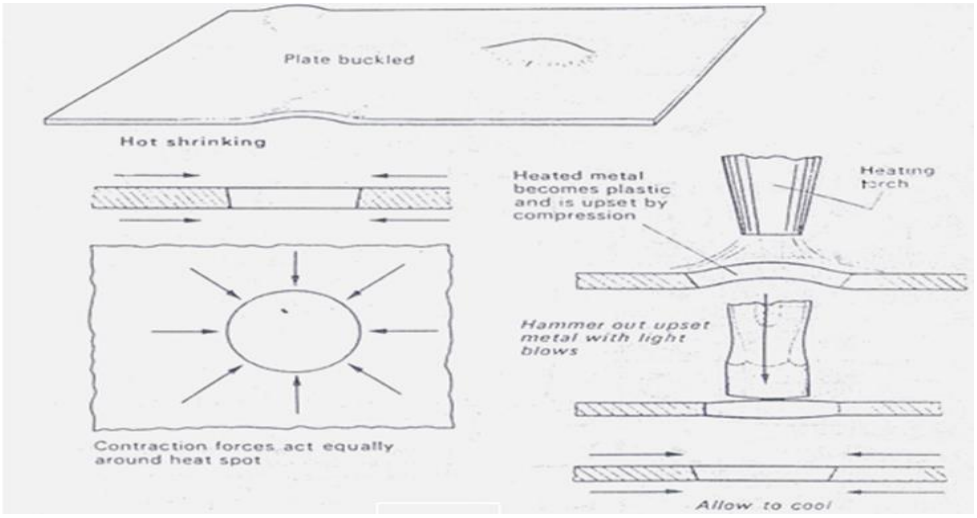
WINTER – 15 EXAMINATIONS

Subject Code: **17456** **Model Answer**

Important Instructions to examiners:

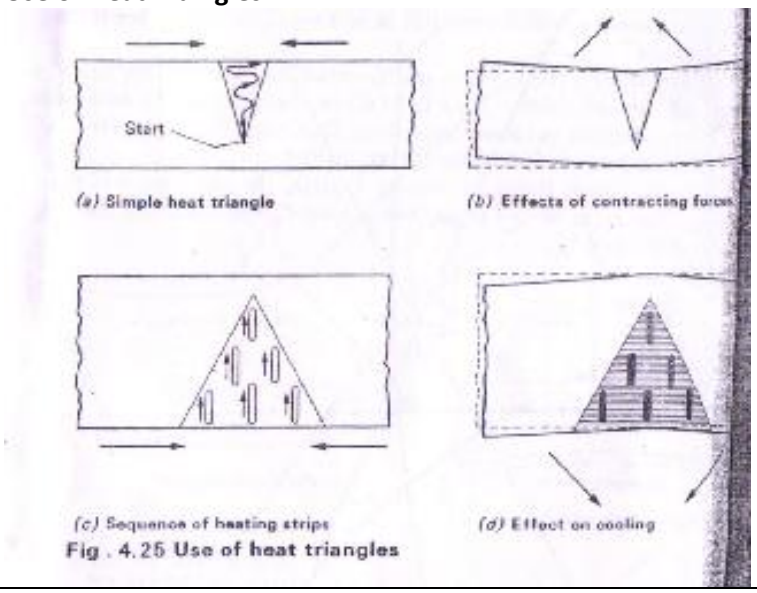
1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling 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.

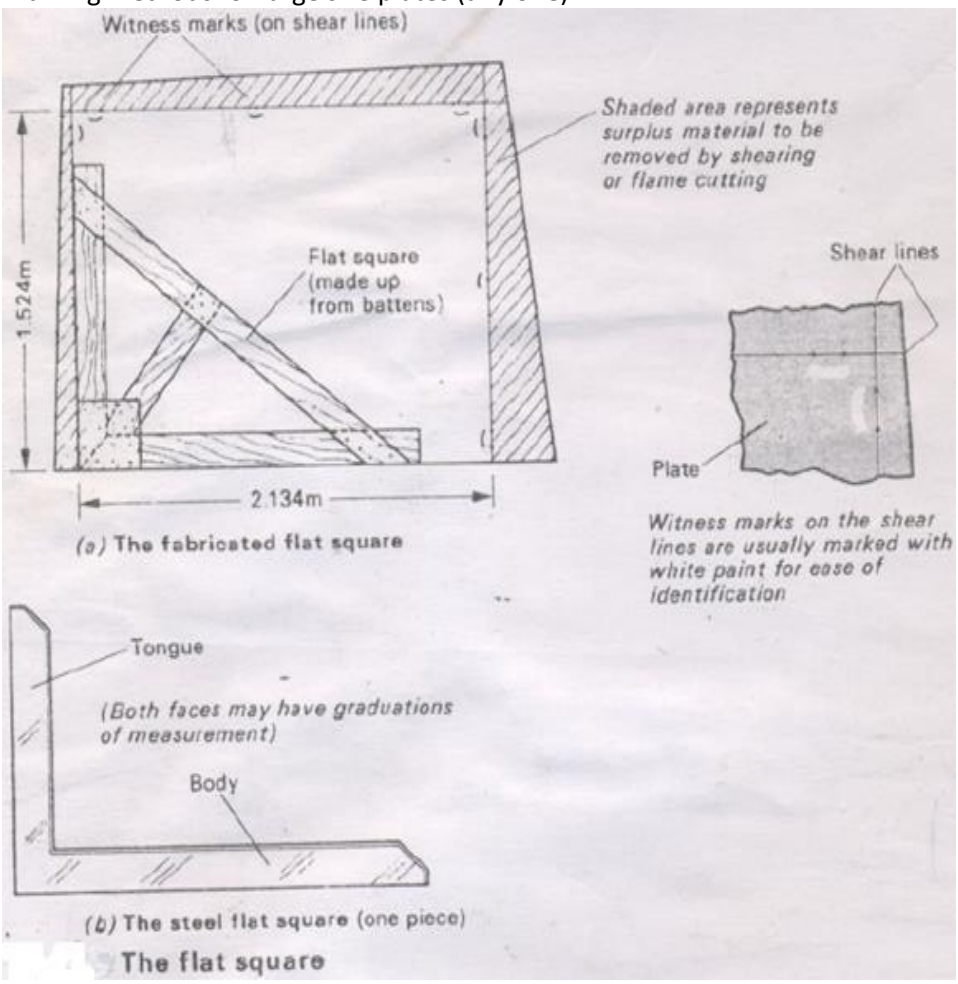
Q. NO.	MODEL ANSWER	MARKS	TOTAL
1.	**Attempt any five of the following**	**5*4**	**20**
a)	 As with the component manufacturing process, it is the level of precision required that will determine the measuring method and equipment to be used. In cases where roundness is not very critical, a simple technique is to place the part in a vee-block and rotate it in contact with a dial gauge. If the part is perfectly round the pointer of the gauge will not move. The 3 point method is greatly influenced by the spacing and "phase" of profile irregularities as well as the angle of the vee. Thus the results obtained may not accurately reflect how the component will function nor will they provide information useful for correction of the machine tool that produced the component.	2m 2m	**04**
b)	The figures below illustrate the principle of shrinking a thin plate at the places that are stretched.  •Hot shrinking •Use of heat strips •Use of heat triangles •Straightening simple sections by combination of heat strips and triangles	2m 1m	**04**

<table>
<tr><td></td><td>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.</td><td>1m</td><td rowspan="3">04

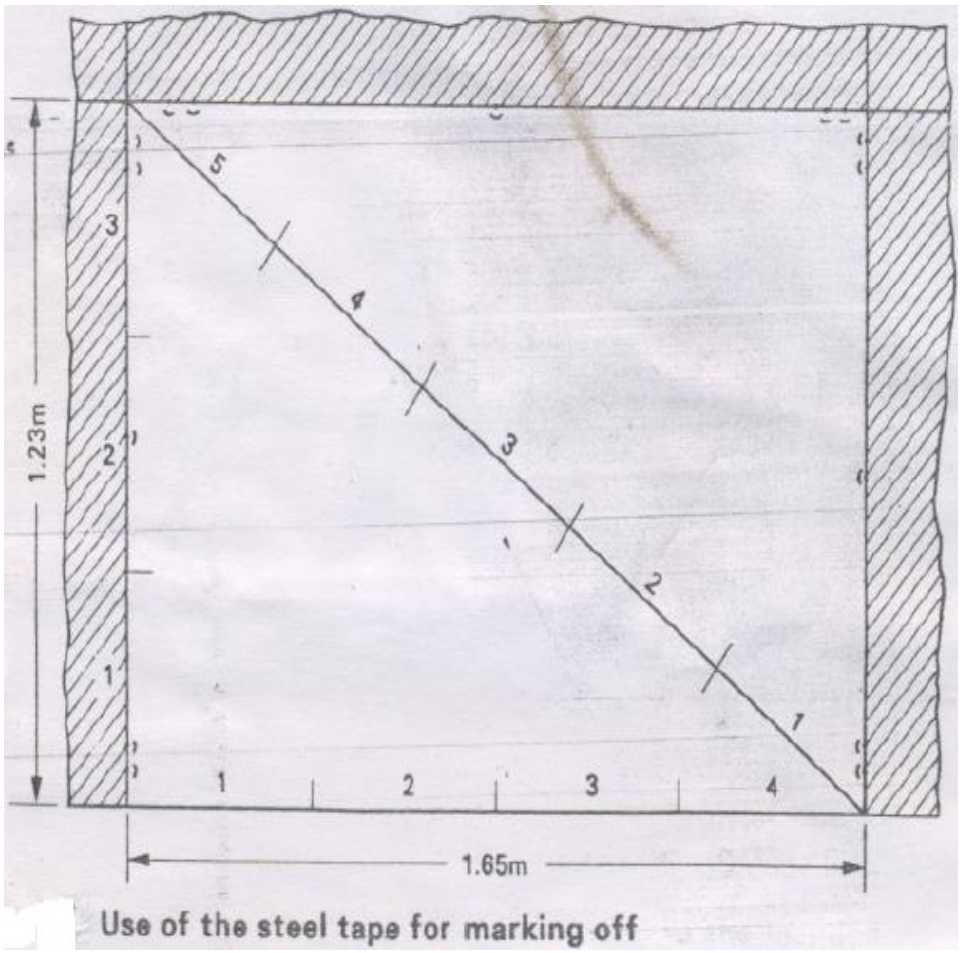
04</td></tr>
<tr><td>c)</td><td><table>
<tr><th>Characteristics</th><th>Line standards</th><th>End standards</th></tr>
<tr><td>Accuracy of measurement</td><td>Limited to + 0.2mm. For high accuracy, scales have to be used along with microscopes.</td><td>Highly accurate for measurement of close tolerances, 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>4 m
(any 4 points)</td></tr>
<tr><td>d)</td><td>Applications of composites:-
1)Automotive
Body panels in passenger cars as well as race cars are commonly made out of composite materials. Other applications include composite leaf springs for</td><td>4M
(Any 4)</td></tr>
</table>

	suspensions and composite drive shafts. 2) Aerospace applications: In aerospace industries some parts are pecise and need to be made by composite material. 3) Civil Engineering:- Some latest structure demand the use of composite material like bricks. 4) Rubber Composites:- High elastic polymer composites nowadays become very popular. 5) damping applications:- Composite materials nowadays used in high load damping applications.		
e)	The use of heat triangles for straightening thin angle and flat sections, and the use of 'triangles' of heat strips for the bending and straightening of plate and wide sections are as shown in figure. Simple heat triangles may be used as shown in fig.(a). This entails starting with the heating torch at the apex of the triangle and working towards the base with a gradually widening zig-zag movement. When allowed to cool, the base of the heat triangle will start to contract the most, and the contracting forces tend to cause the plate to bend, as shown in fig.(b). The resultant effects of using triangles of heat strips are exactly the same as for the simple heat triangles. Simple heat triangles are used for straightening of thin plate and light sections. Triangles of heat strips are preferred when bending or straightening thick plate and heavy sections. The order in which the heat strips are applied, in the triangle, is shown in fig.(c). Heating with the torch is commenced a short distance in from the edge of the plate, progressively heating from the outside inwards. **Use of Heat Traingles:-**  Fig . 4.25 Use of heat triangles	4 M (any 4)	**04**
f)	Tools used in Marking: Surface Plate Angle Plate Scriber	4 M	**04**

	Height gauge Tri square Protractor Punch Ball hammer Dividers or Compass		
g)	Marking methods for large size plates (any one):  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	4 M	**04**

cutting. Figure 2 shows how squareness may be checked.

OR



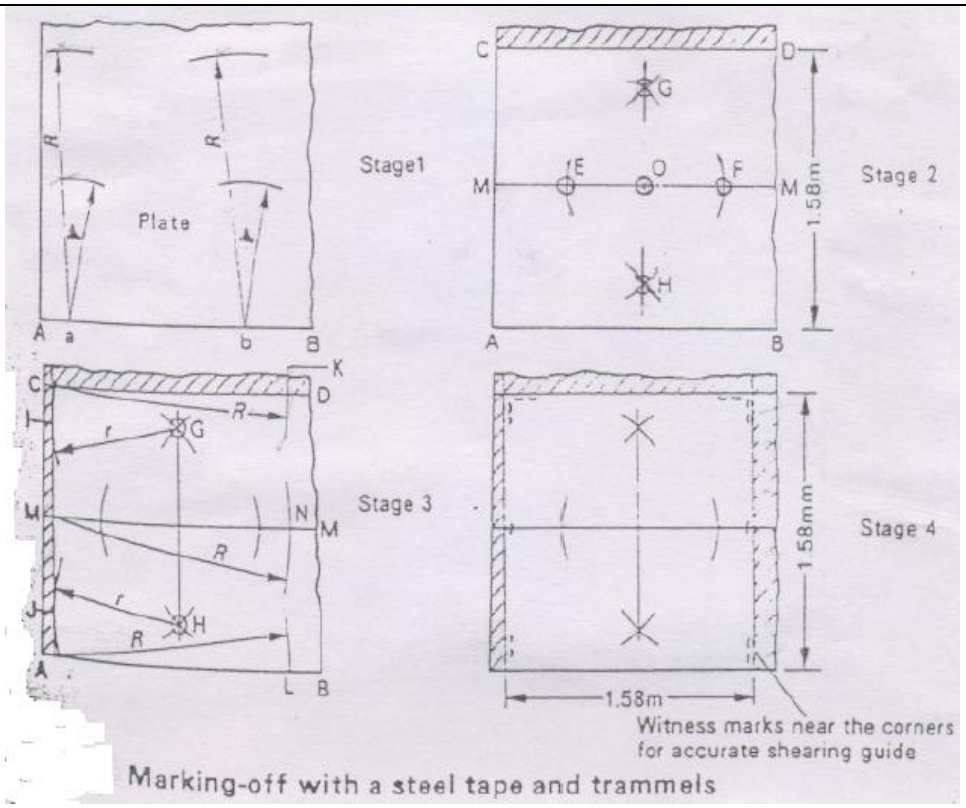
Use of the steel tape for marking off

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.

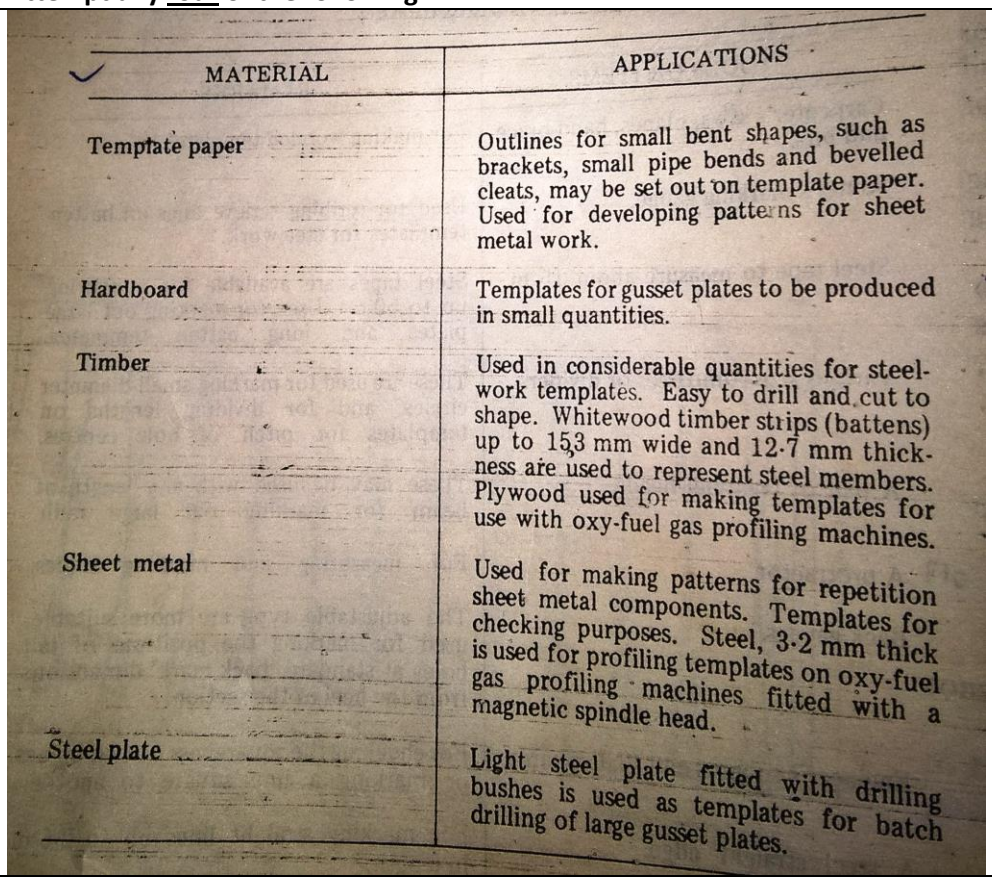
The points G, Hand O are used to check whether the edges of the plate are straight and parallel to this line of points, to enable use to be made of them.

Stage3;

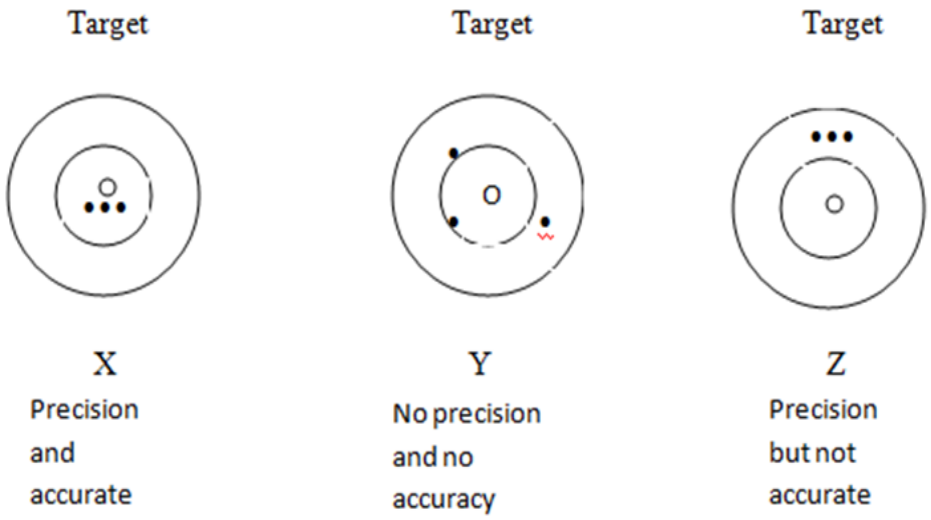
If both edges prove unsuitable for use, the trammels are set to radius r, and with centres G and H, arcs are struck to provide a suitable shearing margin at points I and J.

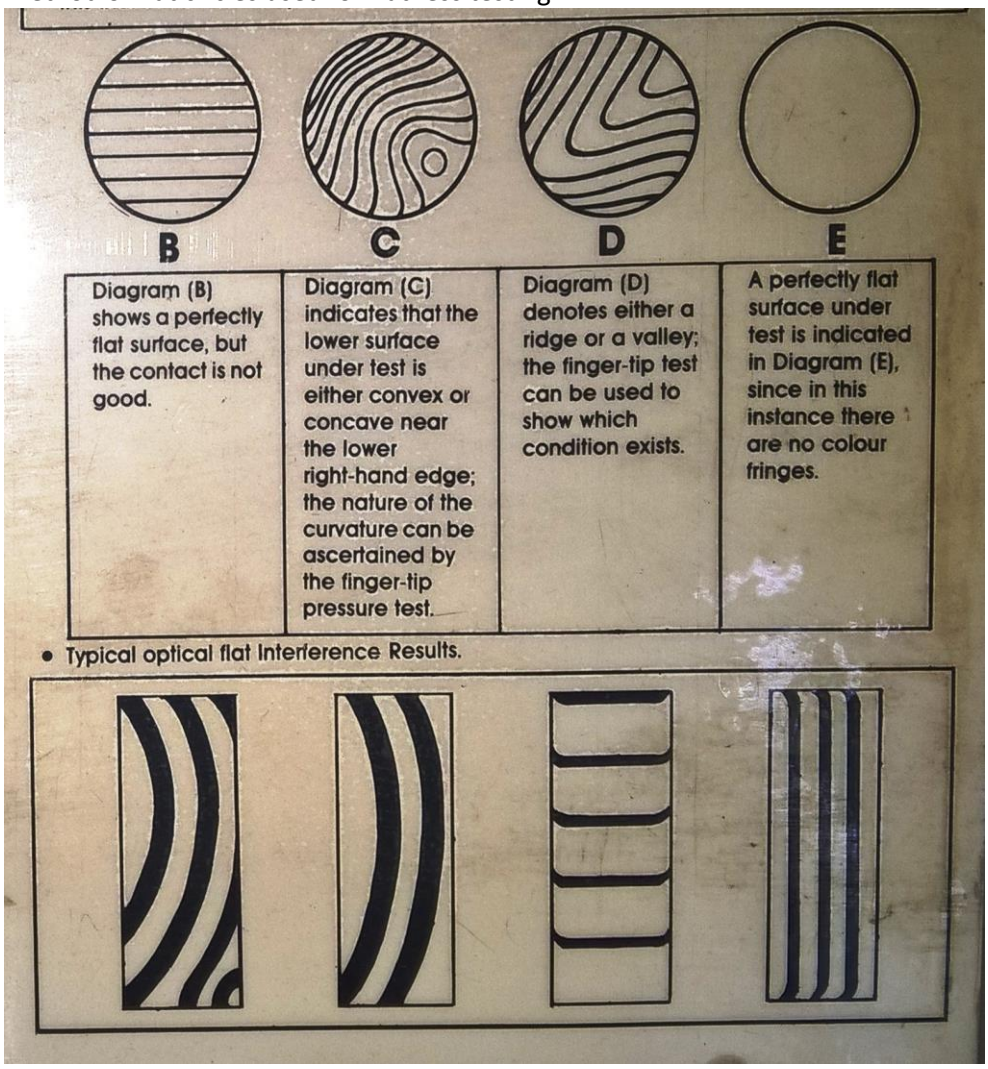
The end shear line is made with the chalk line held at a tangent to these arcs.

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		
h)	**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.	04 m for any one method	**04**
2.	**Attempt any <u>four</u> of the following**	**4*4**	**16**
a)		4 m (any 4) (1m for each)	**04**

MATERIAL	APPLICATIONS
Template paper	Outlines for small bent shapes, such as brackets, small pipe bends and bevelled cleats, may be set out on template paper. Used for developing patterns for sheet metal work.
Hardboard	Templates for gusset plates to be produced in small quantities.
Timber	Used in considerable quantities for steel-work templates. Easy to drill and cut to shape. Whitewood timber strips (battens) up to 153 mm wide and 12·7 mm thick-ness are used to represent steel members. Plywood used for making templates for use with oxy-fuel gas profiling machines.
Sheet metal	Used for making patterns for repetition sheet metal components. Templates for checking purposes. Steel, 3·2 mm thick is used for profiling templates on oxy-fuel gas profiling machines fitted with a magnetic spindle head.
Steel plate	Light steel plate fitted with drilling bushes is used as templates for batch drilling of large gusset plates.

b)	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.	2 M 1M 1M	**04**
c)	Different compositions of composites: i) Glass Fibre: Oxides of Calcium, Boron, Sodium, Aluminium and Iron ii) Boron Fibre: Boron Halide and hydrogen iii) Polyethylene Fibre: Carbon & Hydrogen iv) Oxide Fibre: Al_2o_3, B_2O_3, SiO_2 v) Tungsten Carbide: Tungsten oxide, Hydrogen vi) Silicon carbide: Silica & Carbon.	Any 04 (1m each)	**04**

d)	Method of flat circles used for flatness testing:  i) Cleaning of surface to ensure it free from oil, dirt, impurities, etc. ii) Once cleaning process is completed then put on the monochromatic light. iii) Place the object below monochromatic light to observe it with naked eyes. iv) Keep the optical flat surface over the object. v) Matching the fringe expression to know the nature of surface. The amount of inaccuracy of a surface tested by the optical flat method can readily be estimated by measuring the distance between the bands. For accurate measurements the distance between the colour fringes should be taken from the dark centre or from the edge of the red colour nearest the centre of the colour fringe. In order to determine whether the surface is convex or concave it may be pressed with the finger-tip at the centre of the rings. If the colour fringe moves away from the centre this indicates convexity, If they move in towards the centre, the surface is concave.	2m 2m	**04**

e	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	Any 08 (1/2 M Each)	**04**
f	Classification of methods of measurement: Depending upon the accuracy required and the amount of permissible error, the following methods of measurement are followed. **Direct method of measurement**. (Primary method) In this method the value of a quantity is obtained directly by comparing the unknown with the standard. It involves, no mathematical calculations to arrive at the results. For example, measurement of length by a graduated scale. The method is not very accurate because it depends on human insensitiveness in making judgement. **Indirect method of measurement**.(secondary Method) In this method several parameters (to which the quantity to be measured is linked with) are measured directly and then the value is determined by mathematical relationship. For example, measurement of density by measuring mass and geometrical dimensions. **Fundamental method of measurement**. Also known as the absolute method of measurement, it is based on the measurement of the base quantities used to define the quantity. For example, measuring a quantity directly in accordance with the definition of that quantity, or measuring a quantity indirectly by direct measurement of the quantities linked with the definition of the quantity to be measured. **Comparison method of measurement.** This method involves comparison with either a known value of the same quantity or another quantity which is function of the quantity to be measured. **Substitution method of measurement**. In this method, the quantity to be measured is measured by direct comparison on an indicating device by replacing the measuring quantity with some other known quantity which produces same effect on the indicating device. For example, determination of mass by Borda method.	4 M (Any 4)	**04**

Transposition method of measurement.
This is a method of measurement by direct comparison in which the value of the quantity to be measured is first balanced by an initial known value A of the same quantity ; next the value of the quantity to be measured is put in the place of that known value and is balanced again by a second known value B.
When the balance indicating device gives the same indication in both cases, the value of the quantity to be measured is VAB. For example, determination of a mass by means of a balance and known weights, using the Gauss double weighing method.

Differential or comparison method of measurement.
This method involves measuring the difference between the given quantity and a known master of near about the same value. For example, determination of diameter with master cylinder on a comparator.

Coincidence method of measurement.
In this differential method of measurement the very small difference between the given quantity and the reference is determined by the observation of the coincidence of scale marks. For example, measurement on vernier calipers.

Null method of measurement.
In this method the quantity to be measured is compared with a known source and the difference between these two is made zero.

Deflection method of measurement.
In this method, the value of the quantity is directly indicated by deflection of a pointer on a calibrated scale.

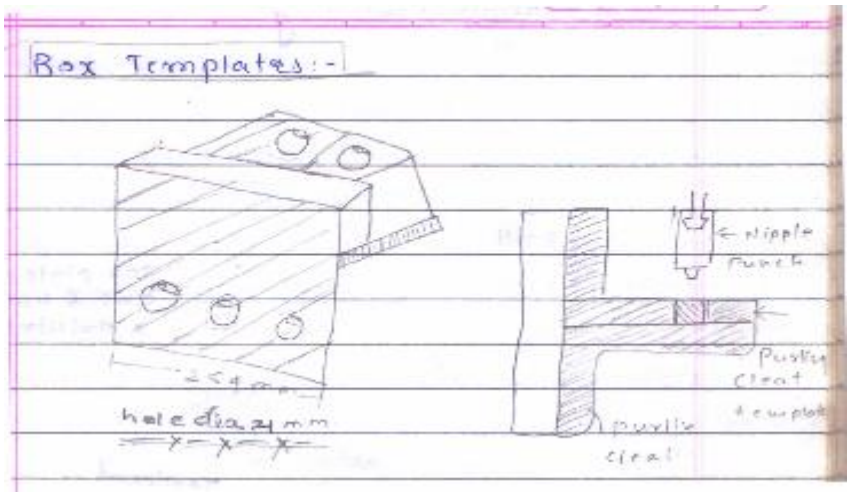
Interpolation method of measurement.
In this method, the given quantity is compared with two or more known value of near about same value ensuring at least one smaller and one bigger than the quantity to be measured and the readings interpolated.

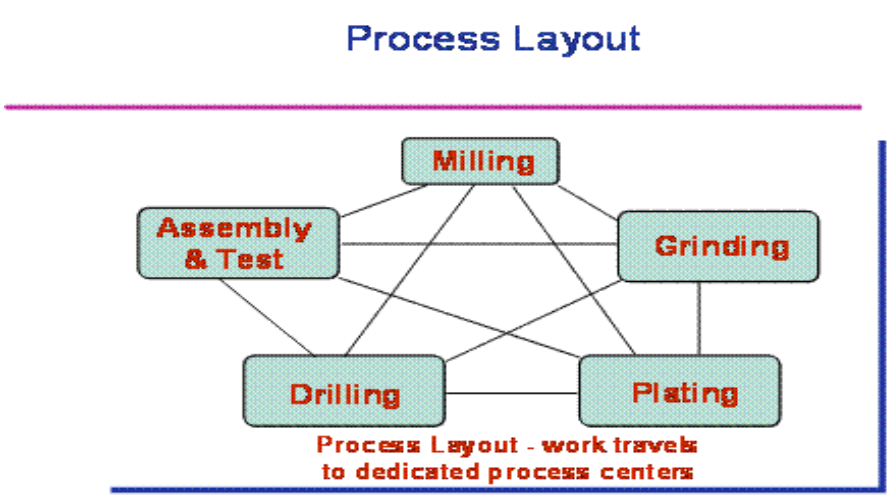
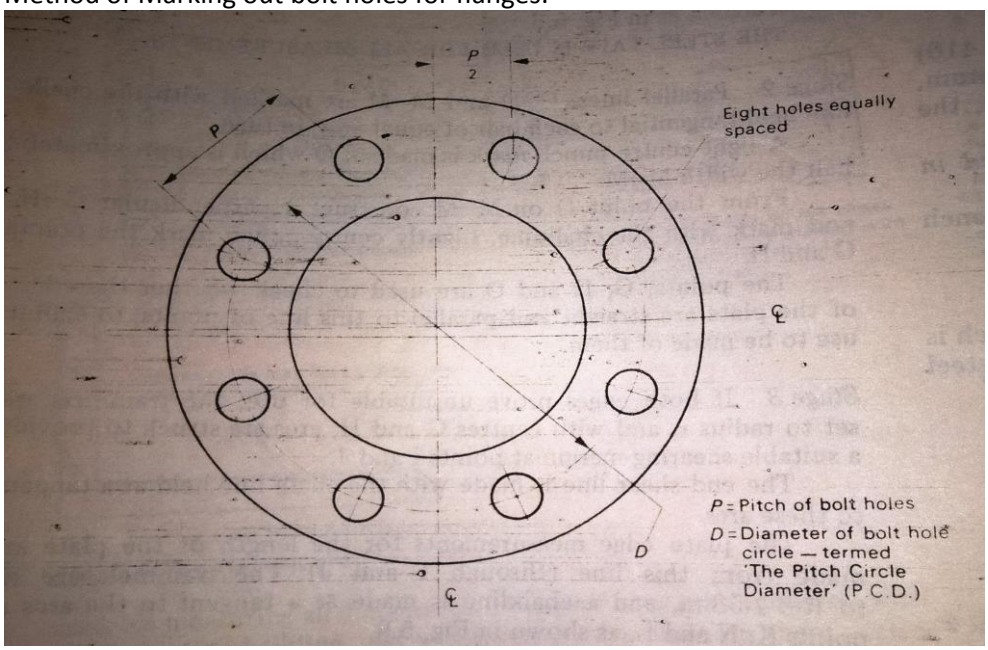
Extrapolation method of measurement.
In this method, the given quantity is compared with two or more known smaller values and extrapolating the reading.

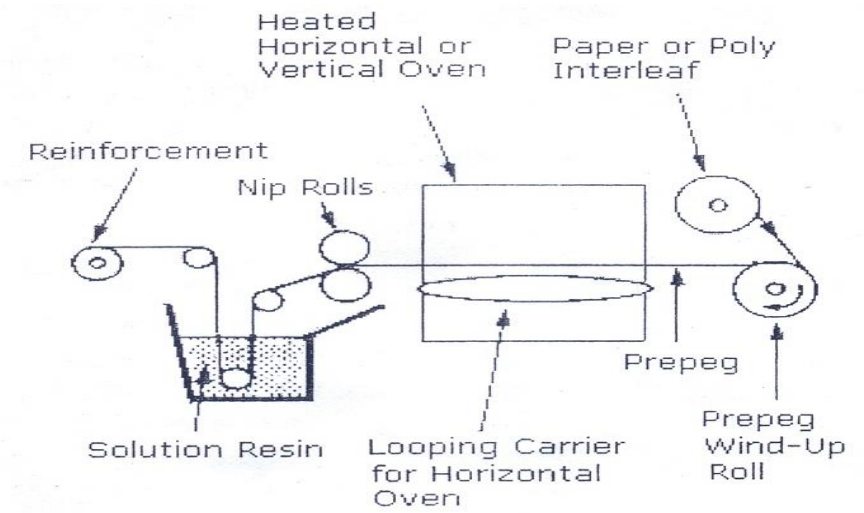
Complimentary method of measurement.
This is the method of measurement by comparison in which the value of the quantity to be measured is combined with a known value of the same quantity so adjusted that the sum of these two values is equal to predetermined comparison value.
For example, determination of the volume of a solid by liquid displacement.

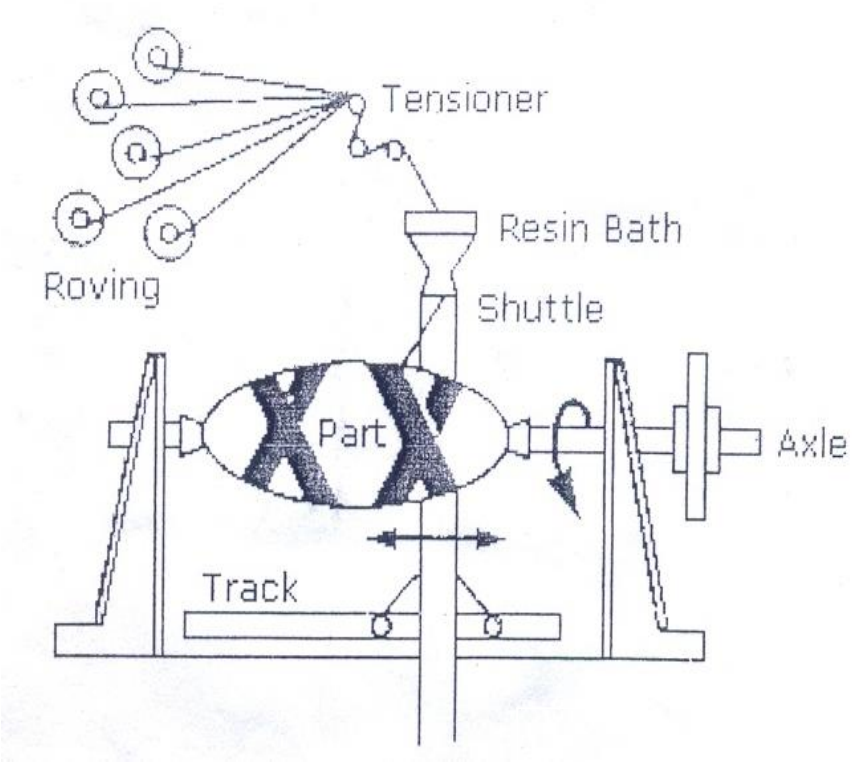
Composite method of measurement.
It involves the comparison of the actual contour of a component to be checked with its contours in maximum and minimum tolerable limits. This method provides for the checking of the cumulative errors of the interconnected elements of the component which are controlled through a combined tolerance. This method is most reliable to ensure inter-changeability and is usually effected through the use of composite “Go” gauges, for example, checking of the thread of a nut with a screw plug “GO” gauge.

Element method.
In this method, the several related dimensions are gauged individually, i.e. each component element is checked separately.
For example, in the case of thread, the pitch diameter, pitch, and flank angle are

	checked separately and then the virtual pitch diameter is calculated. It may be noted that value of virtual pitch diameter depends on the deviations of the above thread elements. The functioning of thread depends on virtual pitch diameter lying within the specified tolerable limits. In case of composite method, all the three elements need not be checked separately and is thus useful for checking the product parts. Element method is used for checking tools and for detecting the causes of rejects in the product. Contact and contactless methods of measurements. In contact methods of measurements, the measuring tip of the instrument actually touches the surface to be measured. In such cases, arrangements for constant contact pressure should be provided in order to prevent errors due to excess contact pressure. In contactless method of measurements, no contact is required. Such instruments include tool-maker's microscope and projection comparator, etc.		
3.	**Attempt any <u>four</u> of the following**	**4*4**	**16**
a)	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	04m	**04**
b	 These are made from wood & simply two flanged template fastened together. they are used for marking up longitudinally structural member. The hole positions are marked on the box template to standard dimensions as per the drawing & drilled. When marking OFF holes from a box template the nipple punch Is used.	2 M for Diag. 2 M (expln.)	**04**

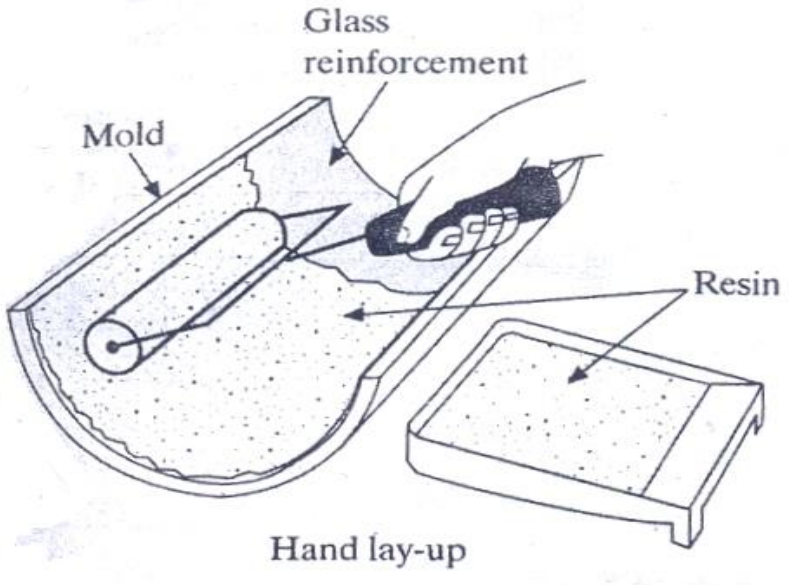
c	 In manufacturing engineering, **process layout** is a design for the floor plan of a plant which aims to improve efficiency by arranging equipment according to its function. The production line should ideally be designed to eliminate waste in material flows, inventory handling and management. In process layout, the work stations and machinery are not arranged according to a particular production sequence. Instead, there is an assembly of similar operations or similar machinery in each department. A common criticism of this layout is that the work can be monotonous for staff, especially if they are involved only in one stage of the process. This criticism can however be eliminated if the staff is rotated to different departments (involving different processes) thus developing a multi-skilled staff.	2M (dia) 2 M	**04**
d	Method of Marking out bolt holes for flanges: 	2 M	**04**

	The centre of the flange is plugged with a suitable piece of wood or piece of flat bar, which is 'tack-welded' in position to enable the centre of the flange to be located. On flanges up to about460mm in diameter horizontal and vertical centre lines may be marked with the aid of a height gauge in conjunction with an angle plate on a marking out table, and a pair of trammels. On very large diameter flanges, use is made of a large centre-square to locate the centre for the bolt hole circle. Having located the centre and marked the horizontal and vertical centre lines, the appropriate bolt circle is marked by means of trammels. The pitch is constant which has to be multiplied by the diameter of the bolt hole circle to obtain the required pitch.	2 M	
e	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.  **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.	1 M 3 M (any 1)	**04**



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.



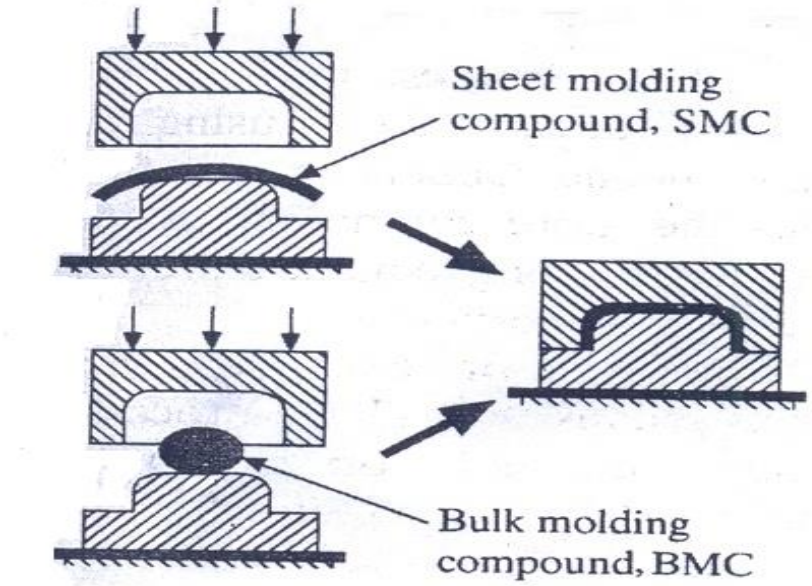
OR

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.

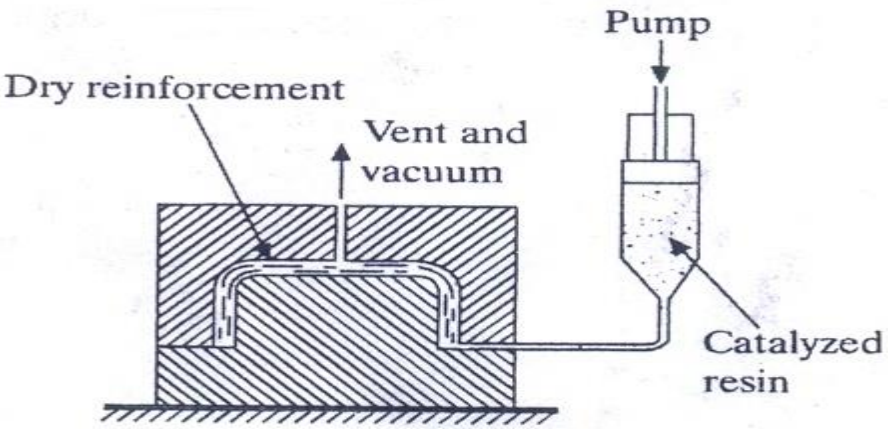
Both processes can be used for large mouldings such as automobile fenders.



Compression molding

OR

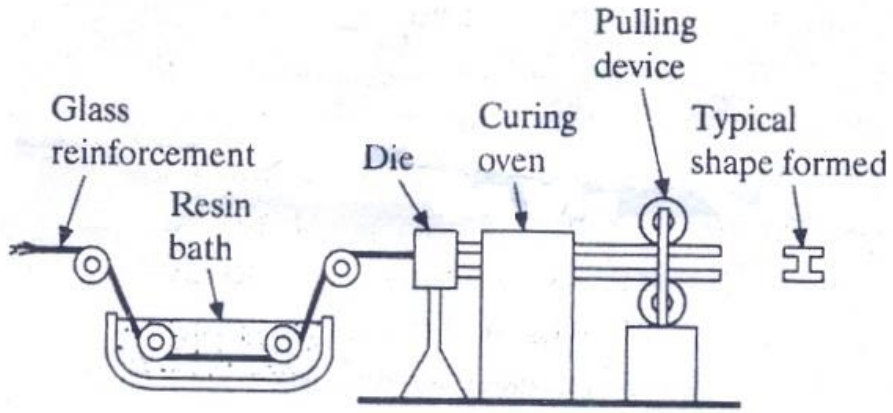
Resin transfer moulding --- This process has evolved as a way to speed up contact and to improve the part by having two finished surfaces instead of one. This process requires a close fitting mould. Glass reinforcement is cut and shaped to the desired thickness in the open mould. The mould is then closed 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

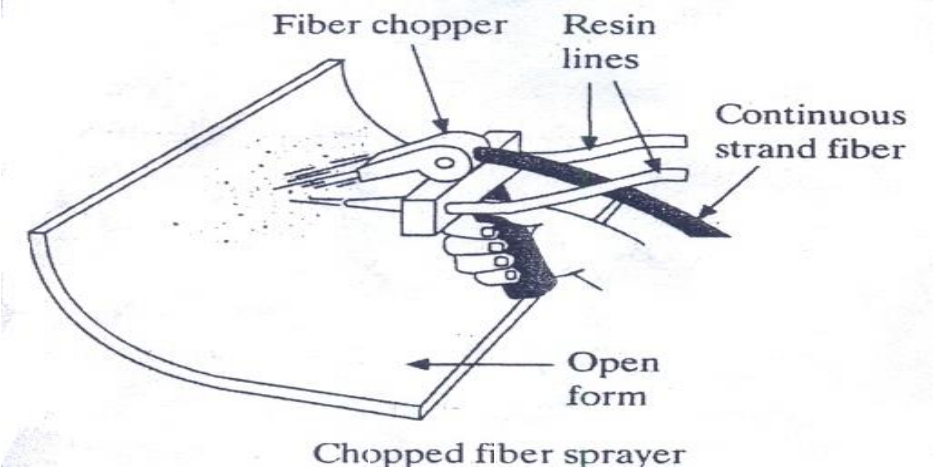
Continuous pultrusion --- It is a process for making glass-reinforced shapes that can be generated by pulling resin-impregnated glass strands through a die. The glass is pulled through a resin bath; it is shaped as it goes through a heated bath and the resin cross-links in the heated die and combined 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

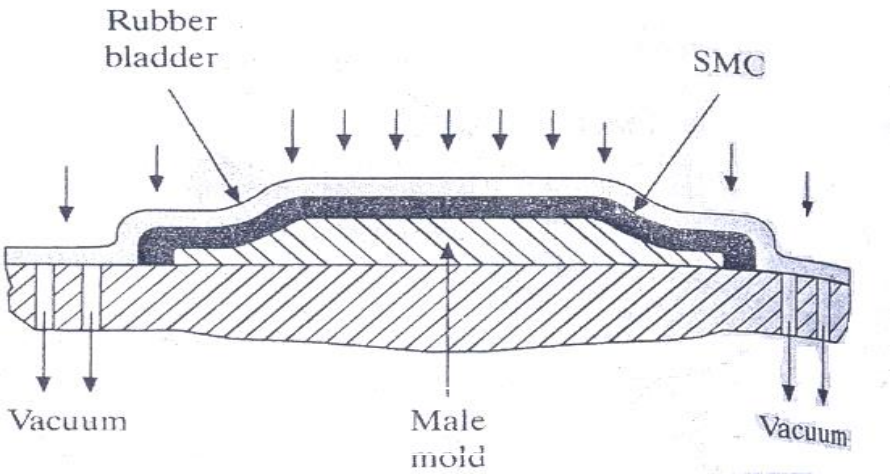
Chopped fibre spraying --- It performs the same job as hand lay-up, but it is much faster. Two component resins are mixed in a hand-held gun and sprayed at a mould surface. A chopper is incorporated in the gun. It chops continuous strands of glass into short lengths to act as reinforcement in the composites. 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

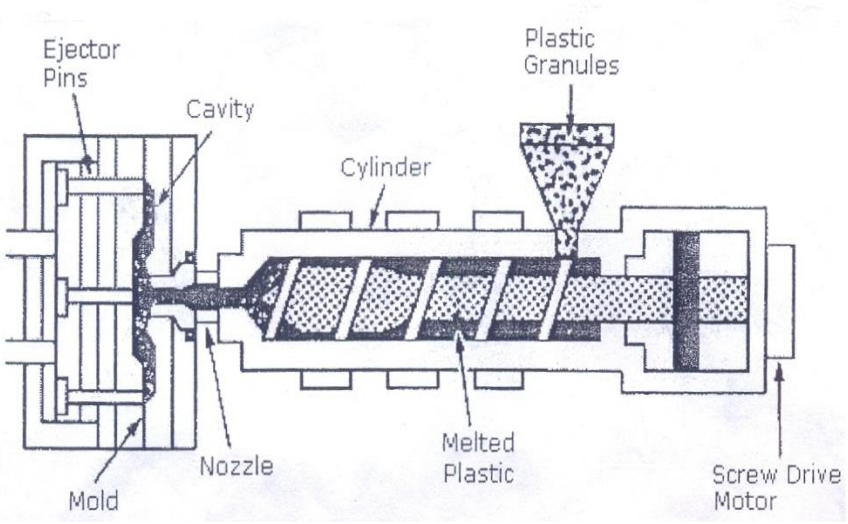
OR

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:

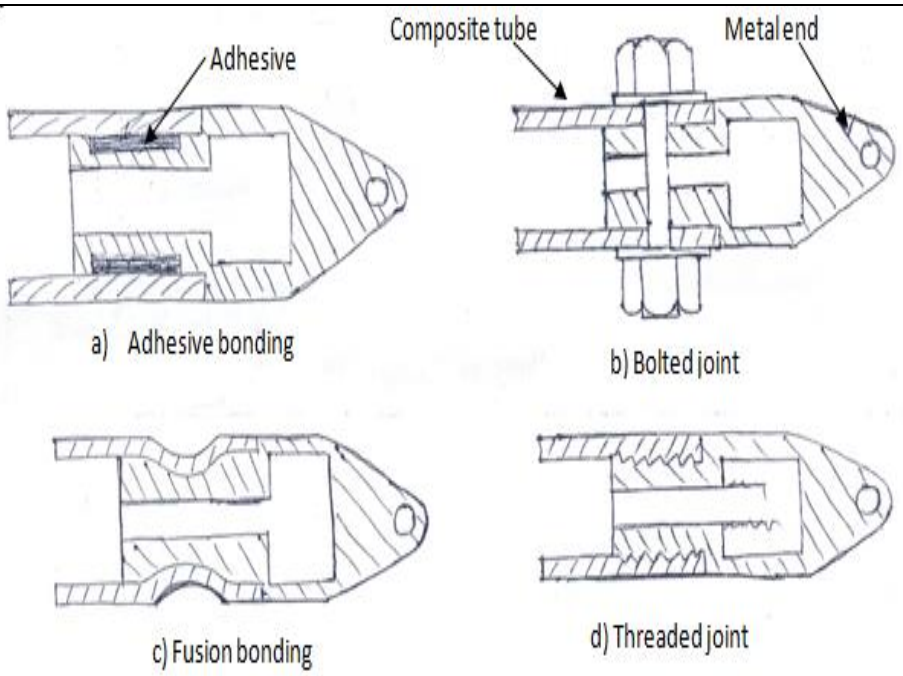
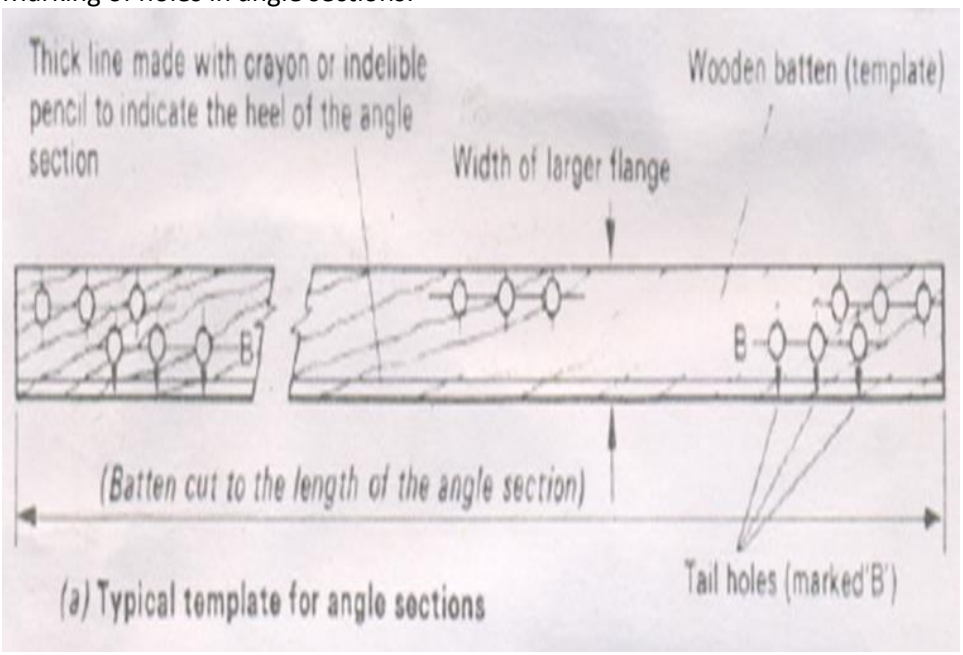
Adhesive bonding

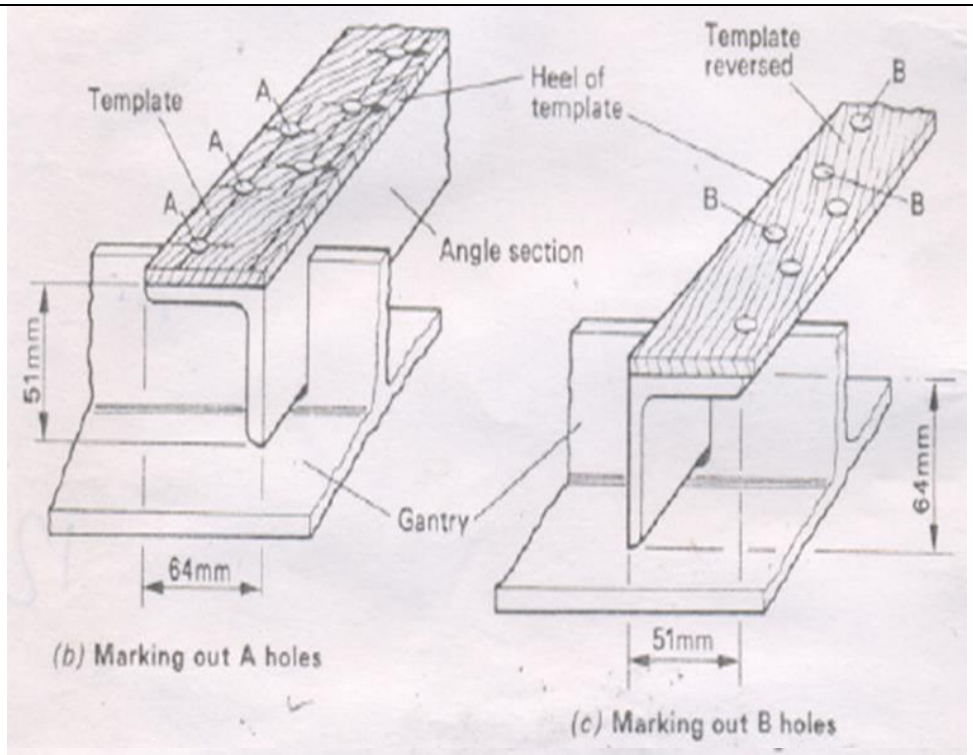
Mechanical joints

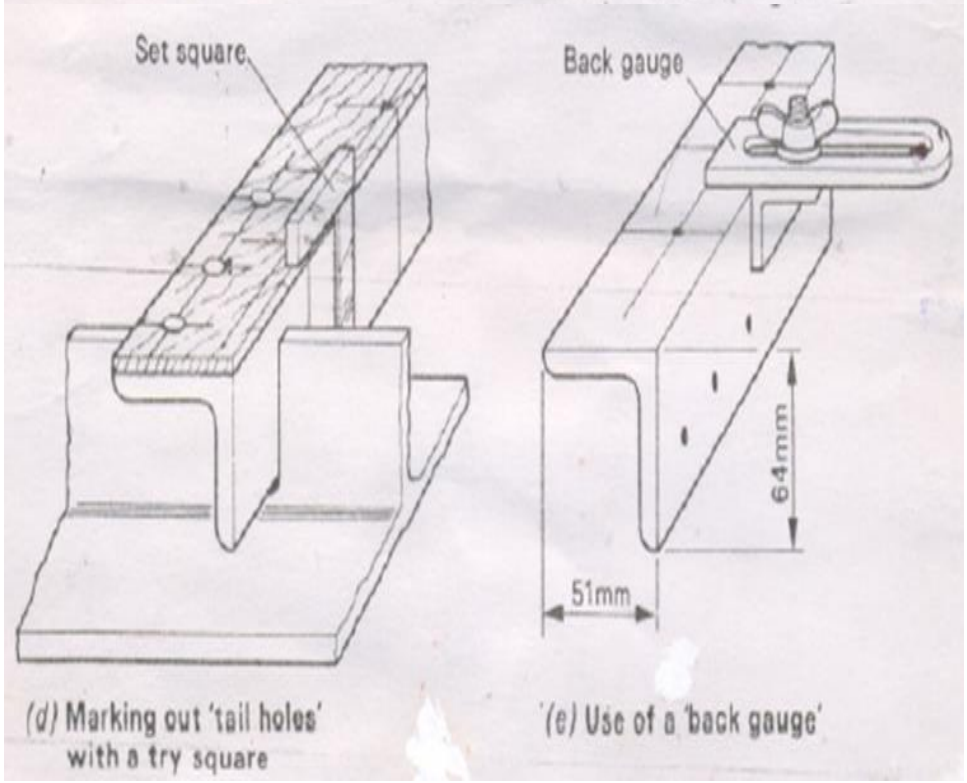
Adhesive bonding is the more common type of joint used in composites manufacturing.

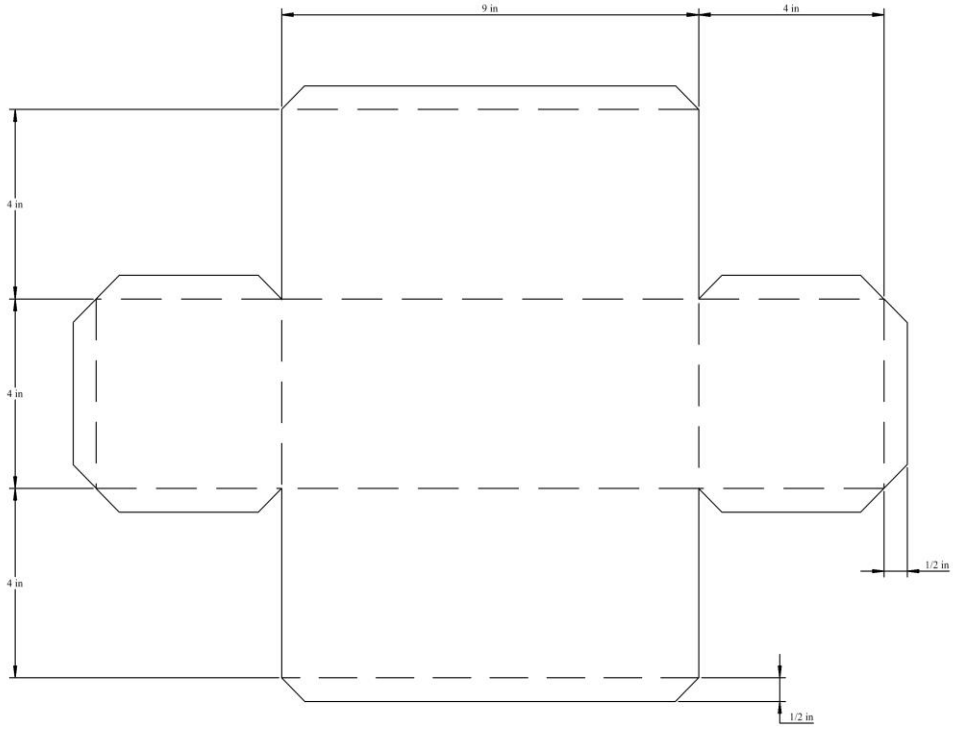
In adhesive bonding, two substrate materials are joined by an adhesive. Mechanical joints for composites are similar to the mechanical joints of metals. In mechanical joints: rivets, bolts and / or screws are used to form the joints. Fusion bonding is also used for joining purposes. It is used to join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

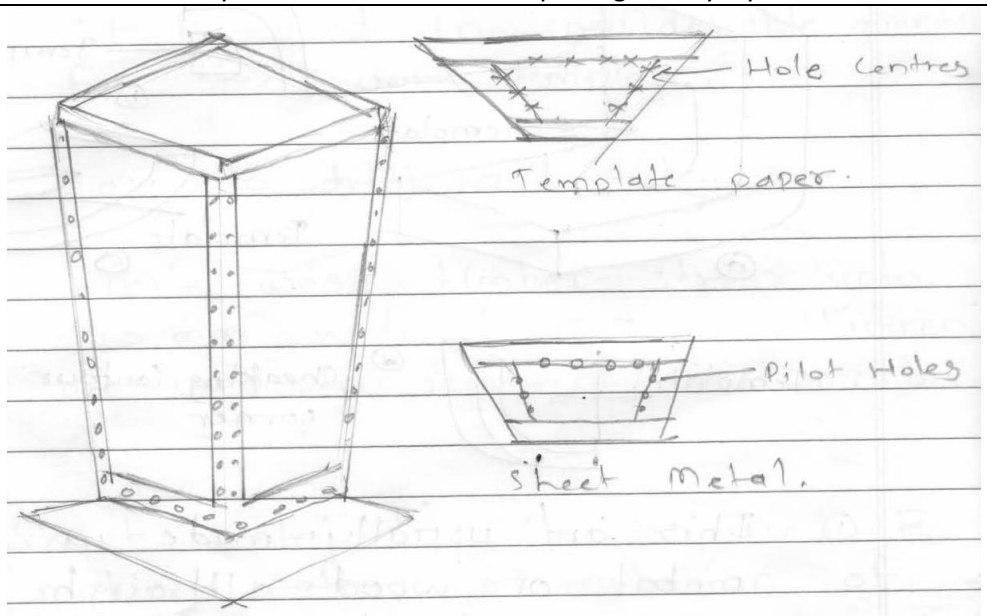
The figures below show an application in which a composite tube is joined with a metal end by various means

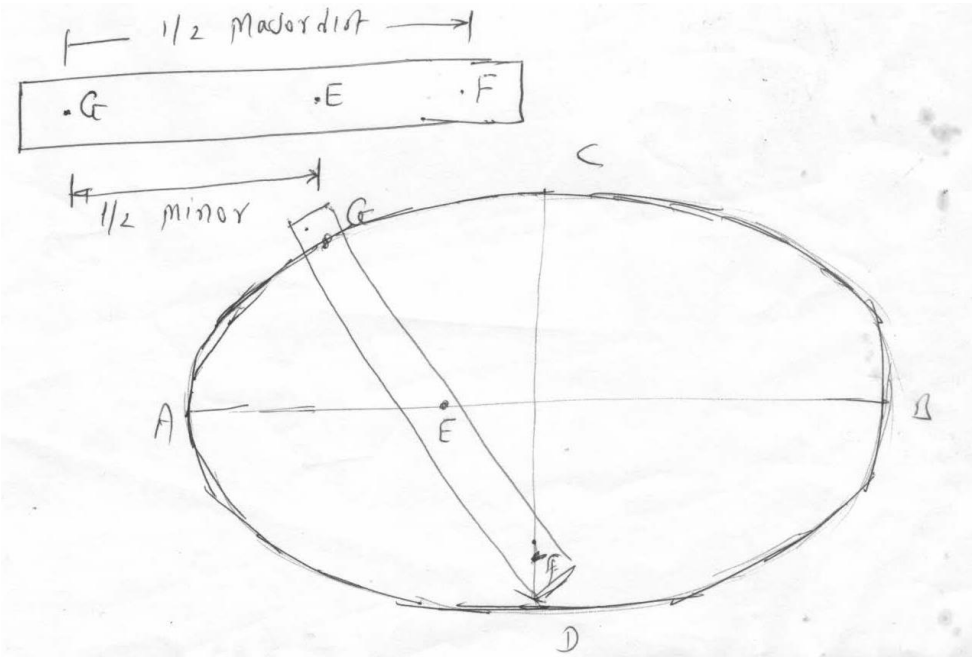
			
f	Marking of holes in angle sections: 	4m (Any 2)	**04**

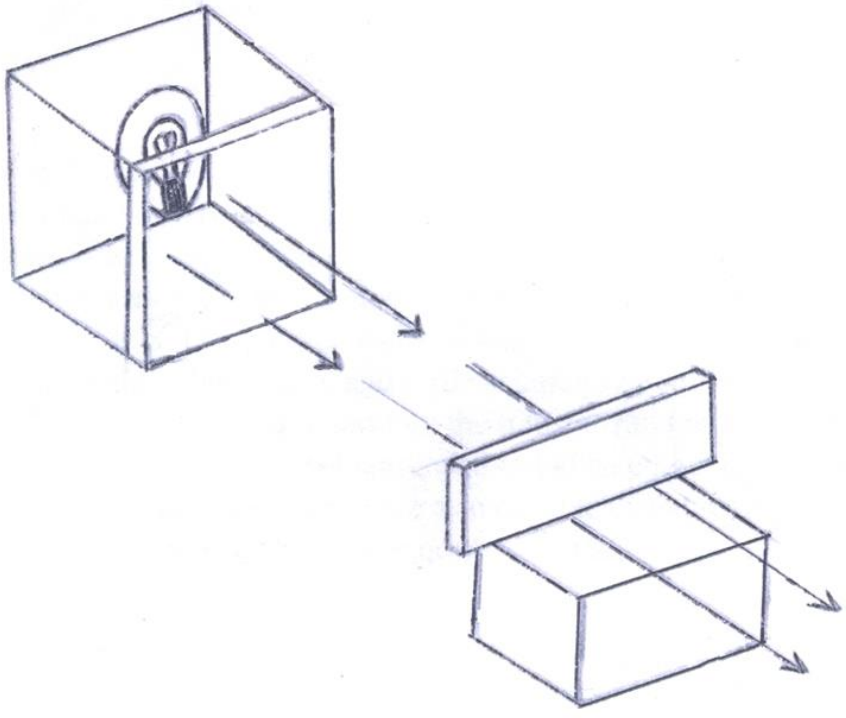

Template
A
A
A
Heel of template
Angle section
51mm
Gantry
64mm
(b) Marking out A holes
Template reversed
B
B
B
64mm
51mm
(c) Marking out B holes

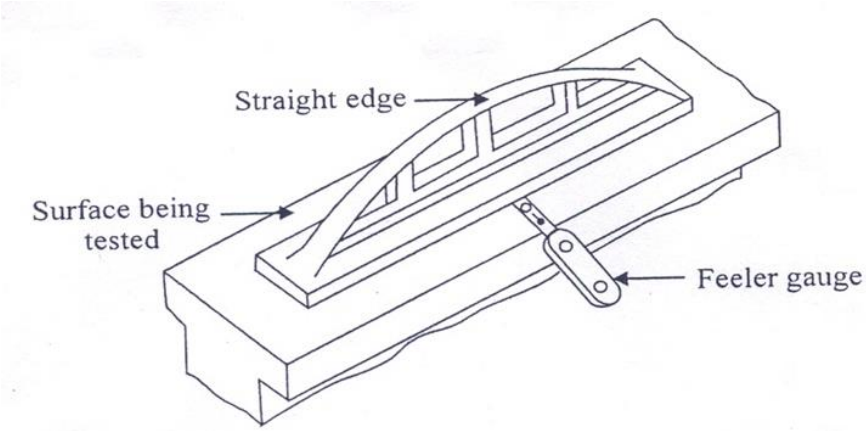
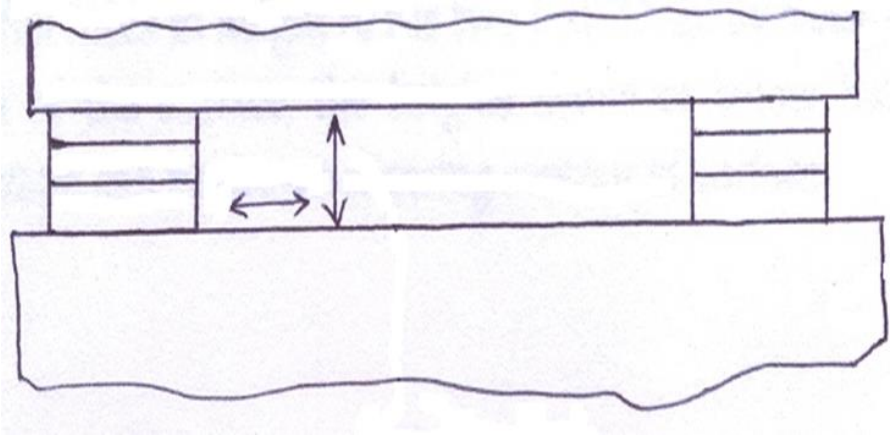

Set square
(d) Marking out 'tail holes' with a try square
Back gauge
64mm
51mm
(e) Use of a 'back gauge'

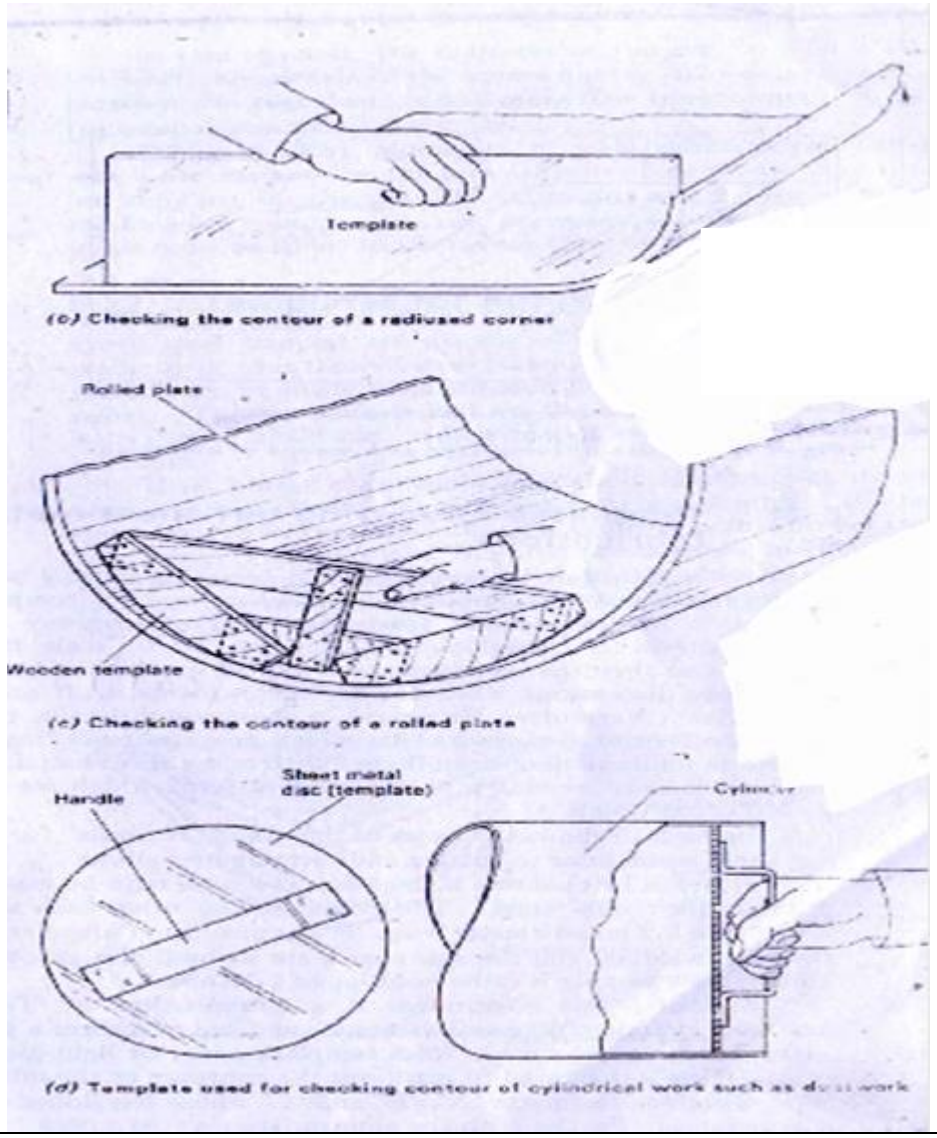
4.	Attempt any <u>two</u> of the following	2*8	16
a)	 Instruments Required for marking: -Scriber -Straight edge -Try square -Protractors -Dividers and trammels -Magnet Chalk line The operator should be able to find out the possible errors with direct eye. -When marking out a large plate, a CHALKLINE is employed for producing long straight lines. -The chalkline may be positioned at one end by means of a magnet -The line is then thoroughly 'chalked', either with ordinary chalk or French chalk. -The line is stretched and firmly held against the work in line with 'witness marks' previously made with a centre punch. -The line is then 'flicked' by lifting it vertically with finger and thumb and releasing it. -On release the line strikes the surface of the steel plate producing a truly straight chalk line in the required position. Beam Trammels and Tape measures are used for striking lines at 90^0 to each other, and for measuring distances accurately. A Knowledge of geometric constructions and arithmetic essential for marking out. Finally the chalk marked lines are scribbed out using scriber.	4 M 1 M 3 M	08

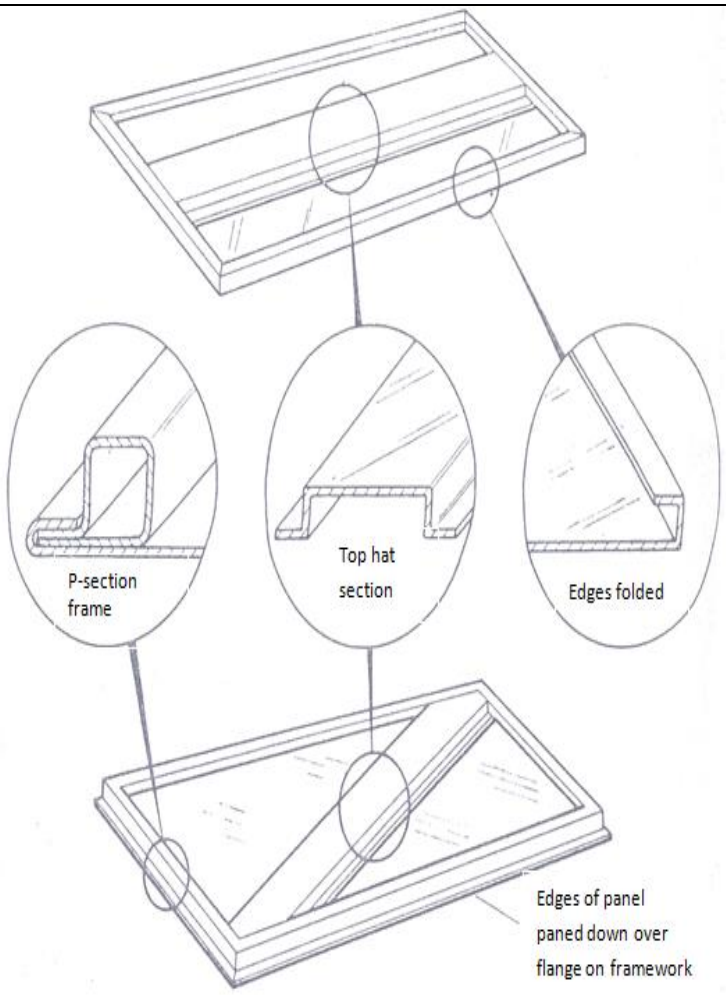
b)	Factors ınfluencıng layout: While deciding his factory or unit or establishment or store, a small-scale businessman should keep the following factors in mind: a) Factory building: The nature and size of the building determines the floor space available for layout. While designing the special requirments, 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 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.	3m 5m	**08**
c)	 Template for Happer Plate: Large steel hoppers are usually of riveted or welded construction made up of tapered steel plates. The templates for these hoppers are made from wooden patterns, sheet metal or	4 M	**08**

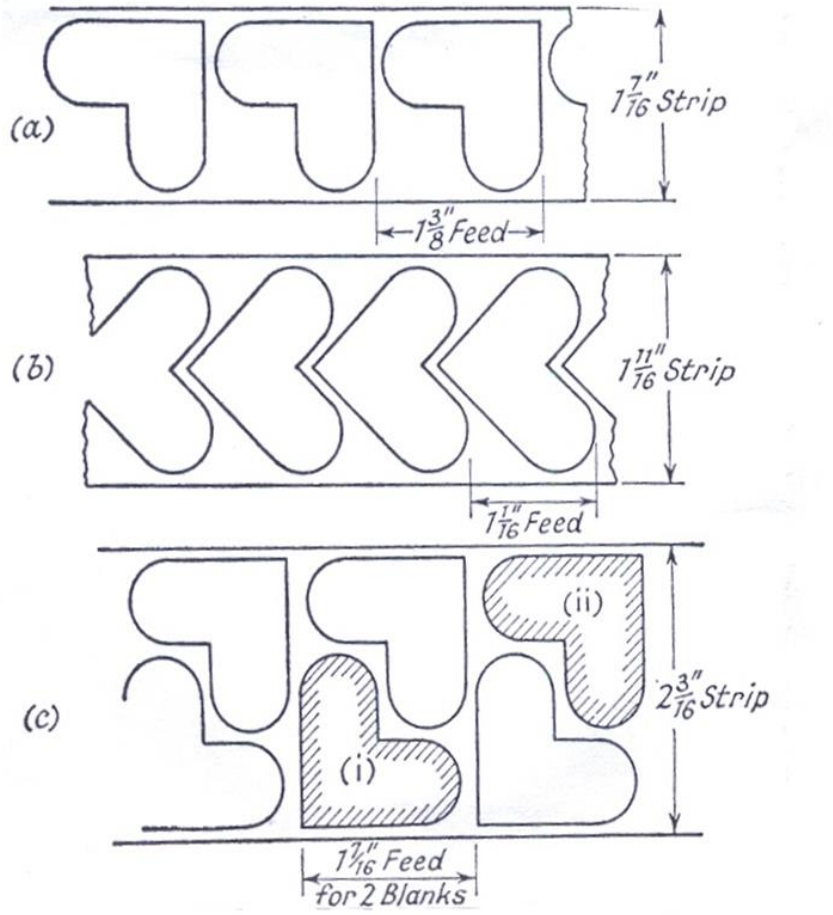
	template paper. The template is laid on the plate and outline marks with French chalk and witness mark arc center punch at a suitable position. Rivited holes are marked through the template with nipple punch when template paper is used, the holes are not provided in the paper template as in the case with wooden and metal template. The center of the hole position are marked on the paper and may be transferred on to the plate by center punching through the template.	4 M	
5.	**Attempt any <u>four</u> of the following**	**4*4**	**16**
a)	i) 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. ii) Another method of stiffening large sheet metal panels is to attach them to a rigid frame-work. The centre of the panel is stiffened by means of a diagonal top-hat section. iii)In case of internal stiffening on a panel of circular shapes, the stiffening 'top-hat' section are rolled to correct contour and attached externally. iv) When sheet metal is too thick to allow the edge to be wired the raw edge may be stiffened by attaching either flat-bar or 'D-shaped' bar. v) Welded angle frames are widely used as a means of stiffening and supporting rectangular ducts for high velocity systems. They also serve as a joining media when assembling sections together by bolting. vi) Simple angle frames of welded construction may be used as a means of supporting and stiffening the open ends of tanks or bins fabricated from sheet metal.	Any 4 (1 M for each)	**04**
b)	Elliptical Trammel Method 	2M (dia)	**04**

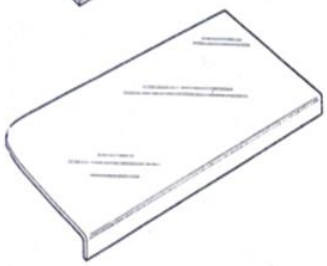
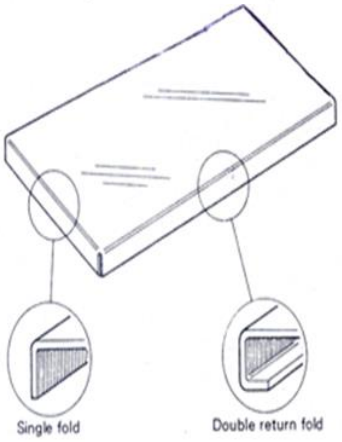
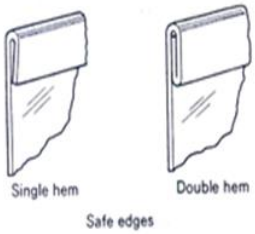
	The trammel method of ellipse construction involves plotting a series of pointer by using a strip of paper, cardboard, plastic and rotating the strip up and down and around horizontal and vertical axes. The stripes of length of paper or cardstock are a trammel. The trammel has 3marks, two representing the foci and one representing for ellipse circumference. Lay out horizontal (AB) and vertical (CD) axes that intersect at right angle. Determine the minor and major axes and the foci of the intended ellipse. On a strips or cardstock, lay off distance GE represntly half the length of the minor axis and GF represents half the length of major axis. Set the trammel on the drawing so that E is always traversing AB an F is moving along CD AB we move the trammel plot points at G which will always indicate the circumference of the ellipse.	2M	
c)	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.  Use of straight edge with light source **OR**	4 M (Any 1)	**04**

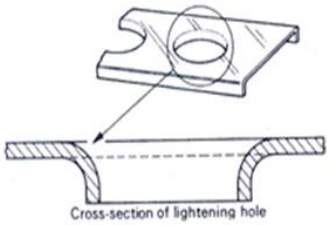
	ii) For determining the straightness of engineering components in workshop by straight edge, it is placed against the work as shown in the figure below. The feeler gauges are then used to find any possible error.  Use of straight edge with feeler gauge **OR** iii) A more accurate method is to support 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		
d)	Low temperature method for silicon surface cleaning: This method consists of wet chemical treatment to eliminate carbon contaminants on Si substrates, thin oxide film formation to protect the clean Si surface from contamination during processing before MBE growth, and desorption of the thin oxide film under UHV. The passivative oxide can be removed at temperatures below 800°C. It is confirmed that Si epitaxial growth can take place on substrates cleaned by this method and that high quality Si layers with dislocations of fewer than 100/cm^2 and high mobility comparable to good bulk materials are formed. Surface cleanliness, the nature of thin passivative oxide films, and cleaning processes are also studied by using such surface analytic methods as Auger electron spectroscopy, reflection high energy electron diffraction, and x-ray photoelectron spectroscopy.	4 M	**04**

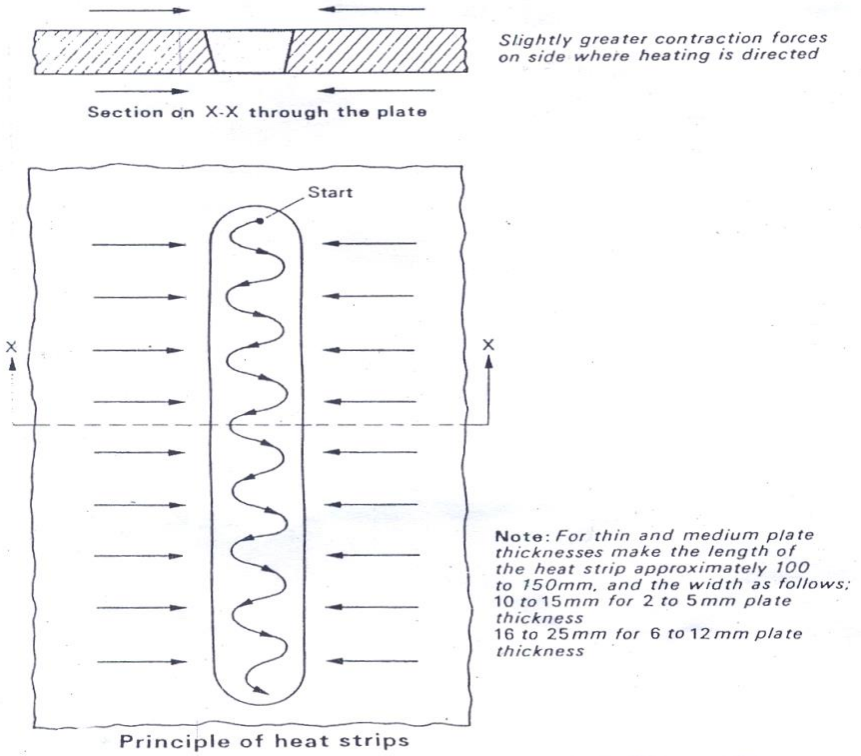
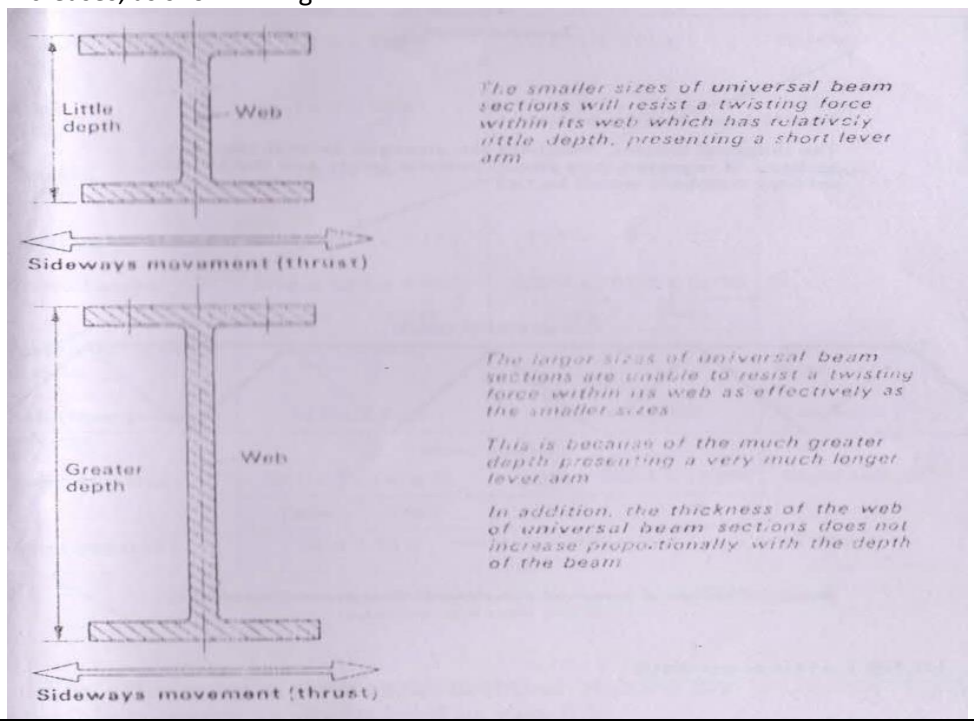
e	Template As a means of checking:- These are usually made up of sheet metal or wood sometimes template making paper may be used. Following fig. shows that the use of templates for checking  	2 M 2 M	**04**

f	 1)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. 2)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.	2M 2M	**04**
6.	**Attempt any <u>four</u> of the following**	**4*4**	**16**
a)	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	4 M (any four)	**04**

	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.  		
b)	Importance 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	4 M	**04**

	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		
c)	The following figures show the methods of stiffening sheet metal components;  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	4 M	**04**

	 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.		
d)	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 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^{o}C to 200^{o}C. 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^{o}C	4 M	**04**
e)	Use of heat strips: The figure below shows the use of heat strips for the 'hot straightening' and 'hot shrinking' of plate and wide sections. The shrinking forces will be approximately equal for both sides of the plate. The figure above shows the application of a heat strip which, upon cooling, causes the metal to become compressed, because the contraction forces come in at right angles to the strip. Heating is commenced at one end of the strip, making sure that the correct heat goes right through the plate (cherry red 750°C). The whole heating operation is a continuous one, employing a zigzag movement of the heating torch towards the opposite end. On cooling the plate will be shorter in length in the locally heated area. The length and width of a particular heat strip can be determined by the thickness of the plate. As a general guide: for thicknesses from about 10mm to 30mm, the width of the heat strip should be between 20mm and 30mm, the length of the heat strip between 130mm and 200mm.	4 M (any four)	**04**

			
f)	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 stifIcncrs, or gussets, increaseses as the depth of the beam increases, as shown in Fig. 	2 M 2 M	**04**