SUMMER-17 EXAMINATION

Model Answer Subject Code 17456

SUMMER – 17 EXAMINATIONS

Subject Title: Fabrication process **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.

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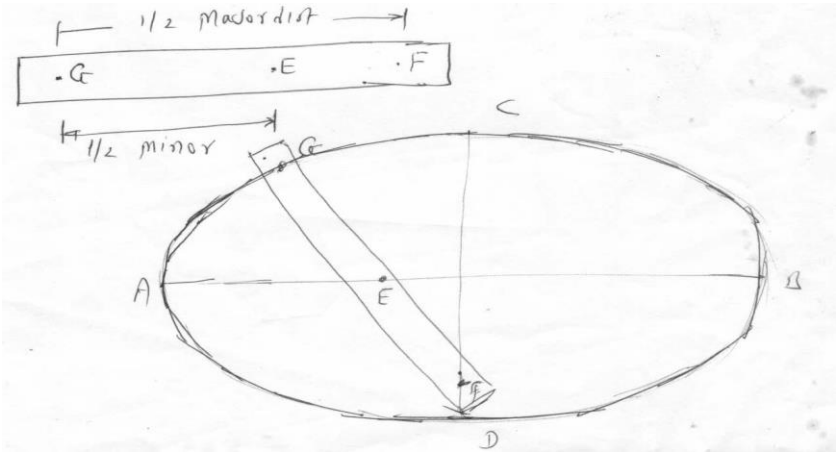
<table>
<tr><th>Q. NO.</th><th>MODEL ANSWER</th><th>MARKS</th><th>TOTAL</th></tr>
<tr><td>1.</td><td>Attempt any five of the following</td><td>5*4</td><td>20</td></tr>
<tr><td>a)</td><td>i) Accuracy:-
It is the closeness with which an instrument reading approaches the true value of the quantity being measured.
or
It is the degree of closeness to the true value.
ii) Precision:-
It is a measure of reproducibility of measurement. The difference between two successive or consecutive readings measured by instrument is known as precision.
iii) Repeatability:-
It is the ability of measurement process to give same value again and again when reading is taken by same observer & same instrument.
iv) Calibration:-
Calibration is the process of checking the dimensions & tolerance of the gauge or the accuracy of measurement by comparing it with a certified standard having higher accuracy.</td><td>4m (1m for each)</td><td>04</td></tr>
<tr><td>b)</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</td><td>Highly accurate for measurement of close tolerances, up to</td></tr></table></td><td>4m (ANY 4 POINTS)</td><td>04</td></tr>
</table>

		microscopes.	+ 0.001mm.					
	Time of measurement	Quick and easy.	Time consuming.					
	Effect of use	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.	Measuring faces get worn out. To take care of this, end pieces can be hardened. Built in datum is provided.					
	Other errors	Parallax errors can occur.	Improper wringing of slip gauge may introduce error. Change in laboratory temperature may lead to some errors.					
	Manufacture and cost of equipment	Simple and low.	Complex and high.					
	Examples	Yard, metre	Slip gauges, ends of of micrometer anvils.					

c) **1) By using an Elliptical trammel:-** 2m (dia) & 2m expainati on Of any 1 method **4M**



- The trammel method of ellipse construction involves plotting a

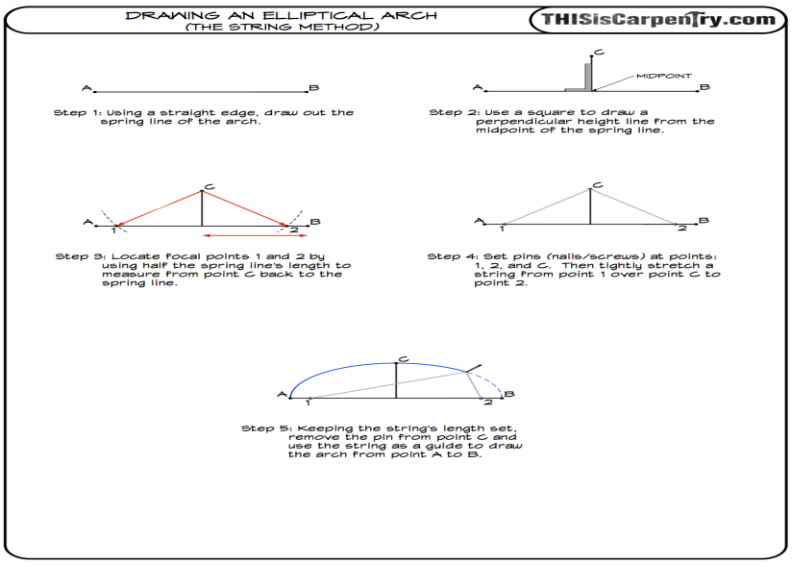
series of pointer by using a strip of paper, cardboard, plastic and rotating the strip up and down and around horizontal and vertical axes.

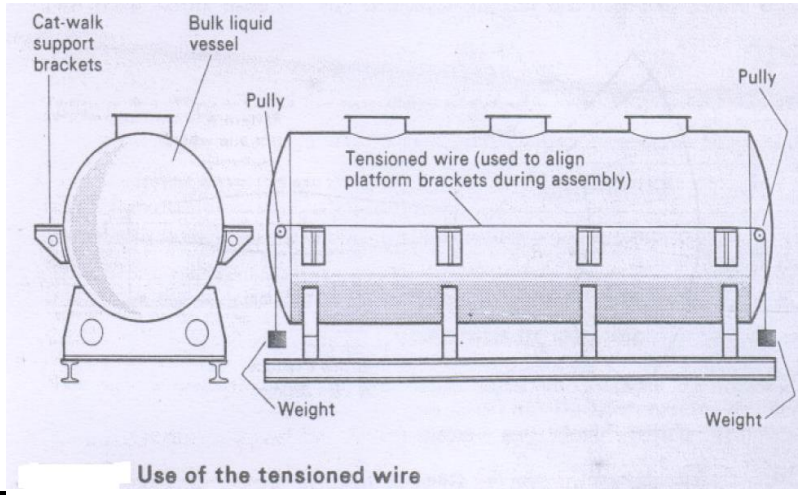
- The stripes of length of paper or cardstock are a trammel.
- The trammel has 3marks, two representing the foci and one representing for ellipse circumference.
- Lay out horizontal (AB) and vertical (CD) axes that intersect at right angle.
- Determine the minor and major axes and the foci of the intended ellipse.
- On a strips or cardstock, lay off distance GE representing 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.

2) **Shop Method of drawing of an Ellipse:-**

Fig shows the method of drawing an ellipse with the help of string; therefore it is called string method.

For this string method one should require Flat Square, measuring tape, string, nails, pins, pencil.



	Using a straight edge draw the desired length of ellipse which is equals to major axis. Use a flat square to draw minor axis. It should be perpendicular to the major axis & pass through center point. Locate focal points 1& 2 by using half the length of major axis. Fix pins, nails, screws at point 1 & 2 and a pencil at point C, and then tightly stretch a string around the three points and ends together. Keeping string length constant operate the pencil from point C and use the string as guide to draw the ellipse.		
d)	**Horizontal datum Alignment with the help of Tensioned Wire:-**  Use of the tensioned wire 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. The sufficient weights are being attached at both the ends to keep the wire in tension. Alternatively the wire may be secured by means of adjustable clamping devices. Fig shows the tensioned wire which is used to align platform brackets during assembly.	2m dia & 2m expainati on	**04**
e)	**Classification of composites:** Based on matrix material 1)Metal Matrix Composites (MMC): Metal Matrix Composites are	2 m (classific ation)	**04**

	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 composed of a ceramic matrix and embedded fibers of other ceramic material (dispersed phase). 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). **Applications:-** 1)AEROSPACE APPLICATIONS:- One of the primary requirements of aerospace structural materials is that they should have low density and, at the same time, should be very stiff and strong. 2) Automotive Engineering Feasibility studies were carried out, since early seventies, to explore the possibilities of using composites in the exterior body panels, frameworks/chassis, bumpers, drive shafts, suspension systems, wheels, steering wheel columns and instrument panels of automotive vehicles. 1) Civil Engineering:- Composite materials are most popularly used in civil engineering applications for construction like RCC. 2) Marine Applications:- Strong, stiff and light composites are also very attractive materials for marine applications. GFRPs are being used for the last 3-4 decades to build canoes, yachts, speed boats and other workboats. 3) Composites also have extensive uses in electrical and electronic systems. 4) Composites are, now-a-days, preferred to other materials in fabrication of several important sports accessories	2m (any 2)	
f)	<table><tr><th>Parameters</th><th>Manual straightening</th><th>Machine straightening</th></tr><tr><td>Cost</td><td>Less cost</td><td>High cost</td></tr></table>	4 m (any4)	**04**

	Time	More time	Less time		
	Ease of evaluation	Difficult to evaluate the job done	Easy to evaluate the job done		
	Labor wage	Difficult to fix the wage rate due to inconsistency in job performance	Easy to fix the wage rate as per specification of machine used in job performance		
	Quality of straightening	Poor	Good		
	Labor skill	Semi – skilled to skilled	Unskilled to semi – skilled		
	Etc.				

g) **Error:-** (02 m definition) **04**

it is difference between the measured value and the true value.

Absolute static error of a particular instrument is given by,

$$\delta A = Am - At$$

Sources Of Error:-

1) Human Error:-

- These class of error mainly covers human mistakes in reading instrument , recording and sometimes while calculating measurement results.
- The experiment or may misread the scale because of parallax error.
- The responsibility of mistakes lies with the experimenter.

2) **Systematic Error:-**

A) Instrumental error:-

- This error may occur due to inherent shortcomings in the instrument because of mechanical structure.
- Sometimes because of friction in the moving parts of instruments will give wrong reading
- Because of misuse of instrument.

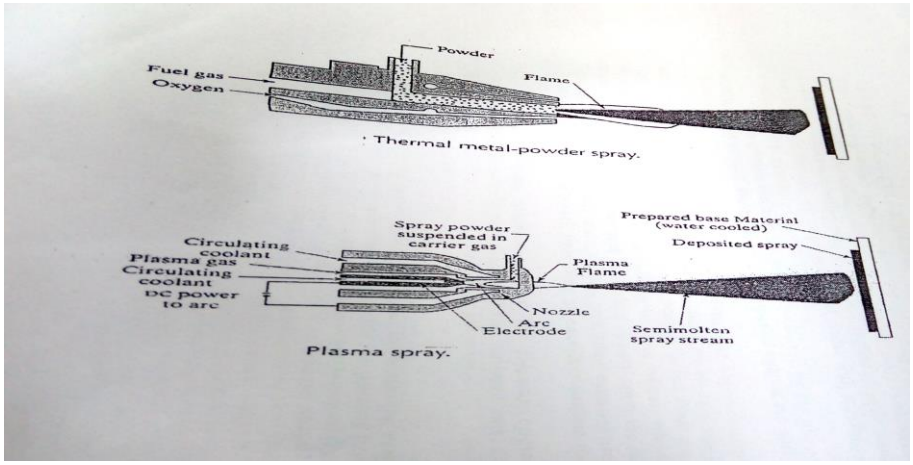
(2m any 2 sources)

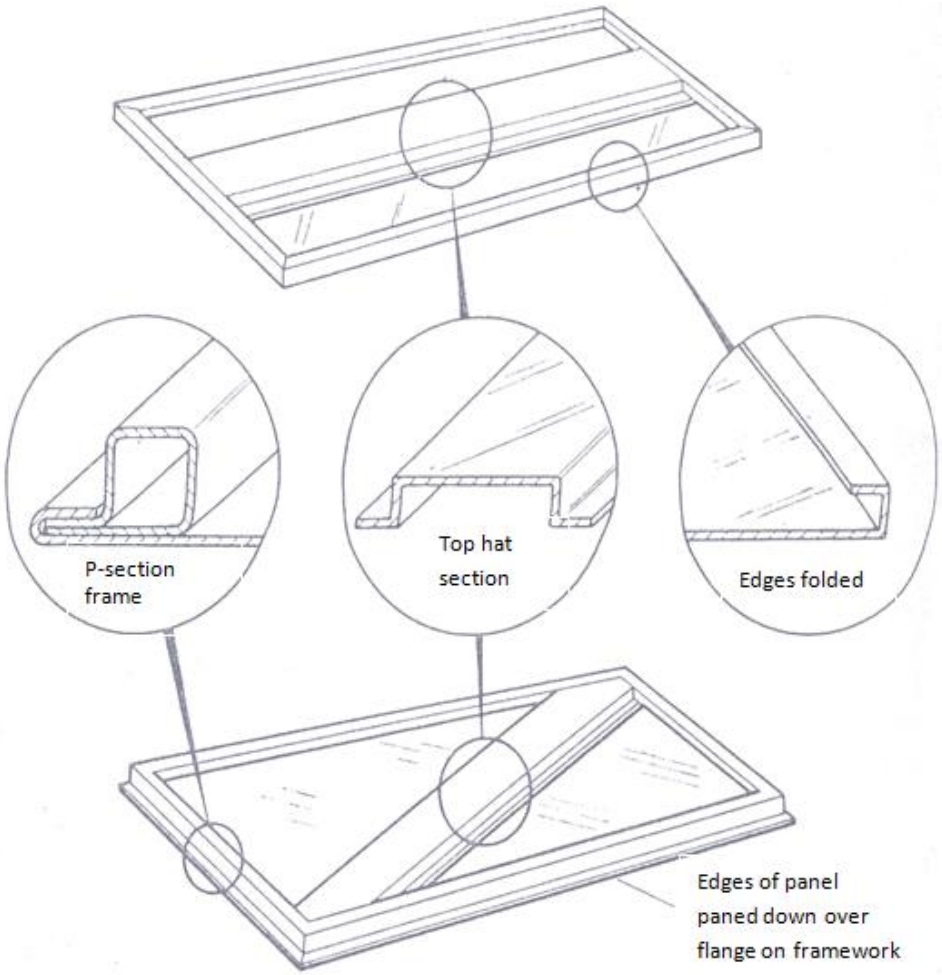
B) Environmental error:-

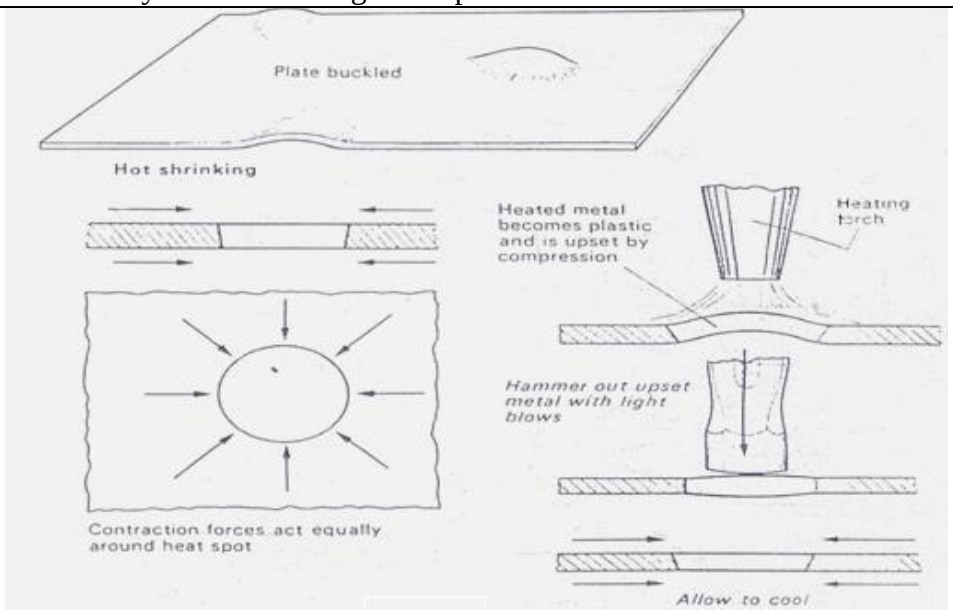
This error may be occurred due to surrounding conditions may be because of change in temperature, pressure, humidity, vibration or external magnetic or electrostatic field.

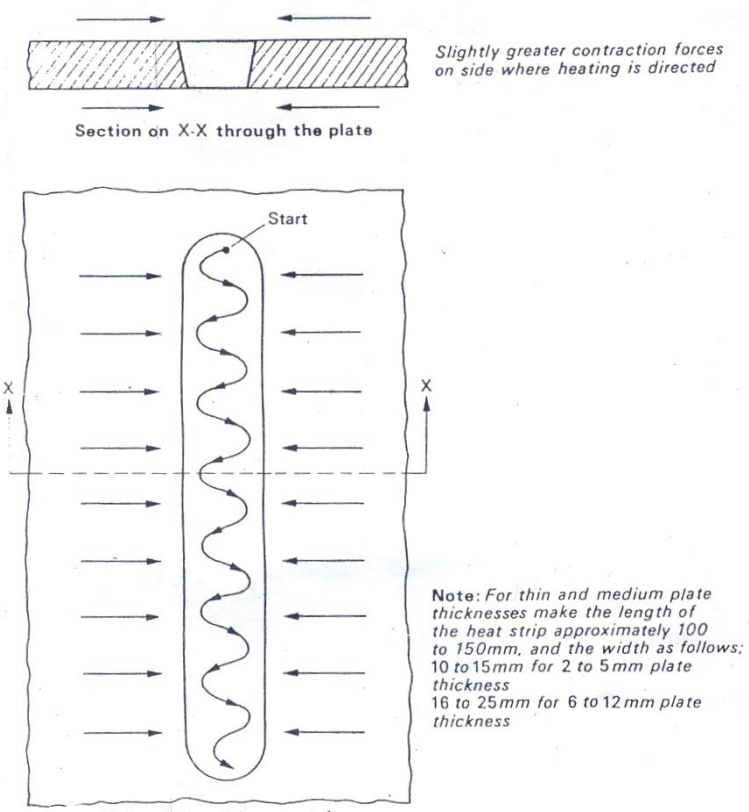
3) Random errors:-

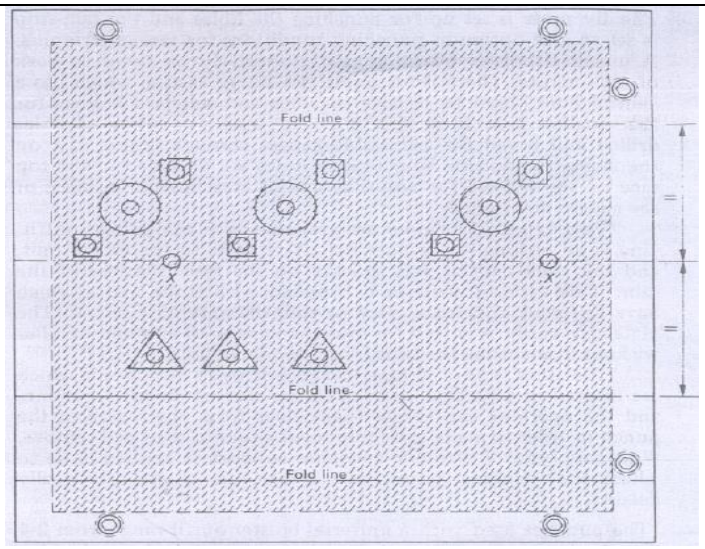
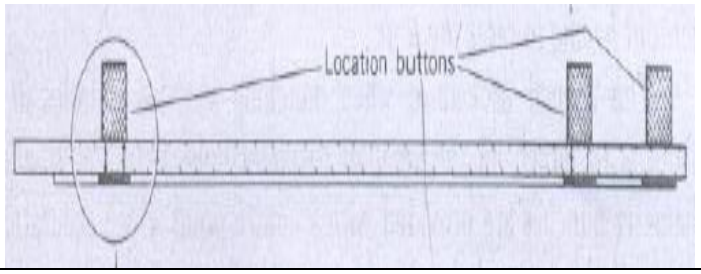
This error occurs randomly and specific cause of such error cannot be determined but sources of these types of errors are small variation in the position of setting standard and work piece

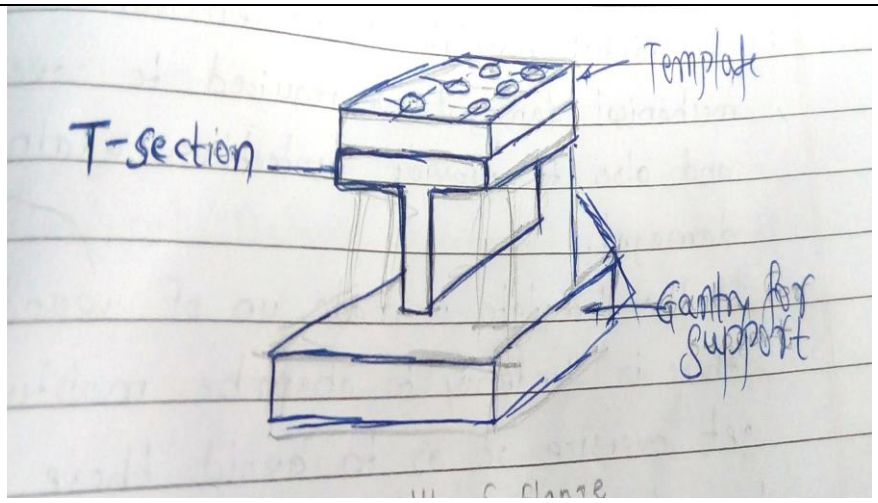
2.	Attempt any TWO of the following	2*8	16
a)	**Need for surface coating:** Some of the properties of engineering components sharply depend on the surface quality of the components. The properties largely affected by surface quality and type of surface are: Corrosion resistance, wear resistance, abrasion 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. **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. **Thermal Method:-**  **Working:-** In this method a metallic or nonmetallic material in the form of wire or powder is fed into heat source which melts the material and sprays it on to the surface of the work piece. The work piece does not melt like it does in hard facing. May be used to improve corrosion resistance, thermal resistance, wear resistance because both metal and ceramic based coatings may be applied. Generally the work piece needs to be roughened up before spraying to help with adhesion of sprayed material.	04 m (need of both) 2m diag 2m	**08**

b)	**Need Of stiffening:-** 1) To increase the strength to weight ratio of plate. 2) To increase the load carrying ability 3) To cut the sharp edges 4) For decorative purpose. The following figures show the methods of stiffening sheet metal components:-	04 m (needs)	**8M**
		2M (dia)	
	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 90^0 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	2m	

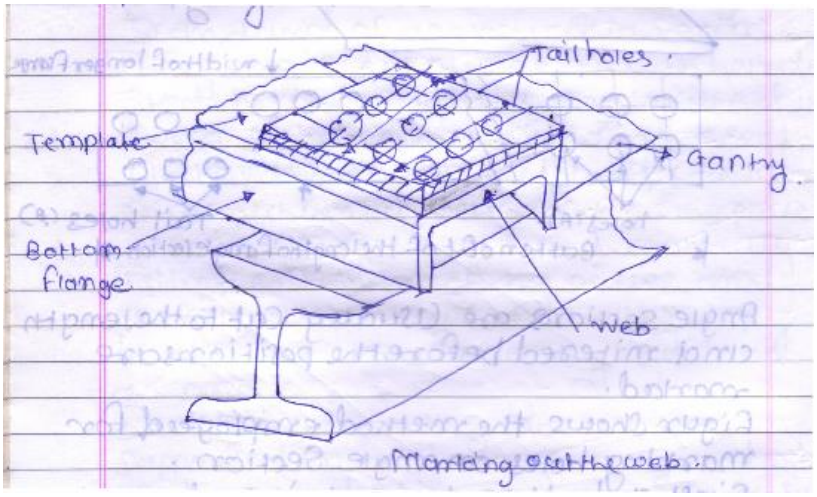
	stiffened by means of a diagonal top-hat section.		
c) i)	 It has been known that the application of heat can produce distortion. Heat can be used to advantage, for those same forces of expansion and contraction can be harnessed to remove distortion in plates or to straighten sections. The figures below 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.	2m dia 2m	**4m**
c) ii)	**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.	2m dia & 2m explaination	**4m**

			
3.	**Attempt any TWO of the following**	**8X2**	**16**
a) i)	**Marking of an Instrumental Panel:-** The sequence of operations for marking of holes may be as follows: A template is used to mark the positions of all the holes. Such a template is usually marked out on mild steel plate on a surface table using a Vernier height gauge and an angle plate. Small pilot holes are drilled, and once the template has been passed by inspection these are opened out with the correct size drill to suit the diameter of a nipple punch. The template is provided with location buttons to give an accurate location for the blanks. Figure below shows the template positioned over the blank ready for transferring the hole positions with a nipple punch. The use of such a template is a fool proof system which not only provides identical hole positions on each blank, but dispenses with the use of guides and locations having to be set up on the press.	02m (dia) & 02m explaination	**04**

	 		
ii)	**Template as a means of marking of holes in T- sections:-** • One bottom template is generally used to mark off hole position on both flange and web. • Before applying template center line representing half the thickness of stock is marked with French chalk on both ends of T-section. • The template with the instruction uppermost is laid on the surface of flange with the center line aligned with center line marked on T-section. • The holes are ben marked with the help of a nipple punch. • Once the hole are been marked the T-section will be tilted the web will be on uppermost position with the help of template mark of holes on web position.	2m dia & 2m explaination	**4m**



Template as a means of marking of holes in channel sections:-

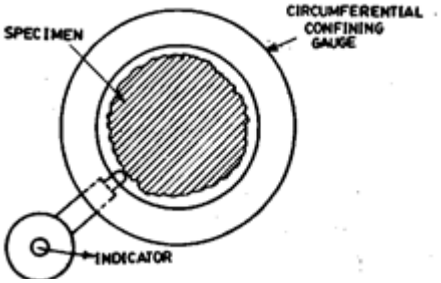
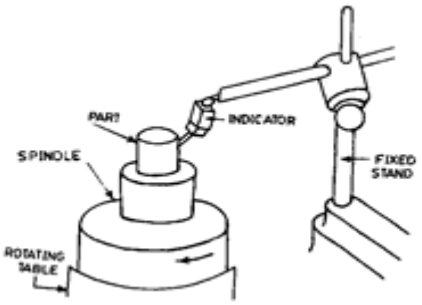


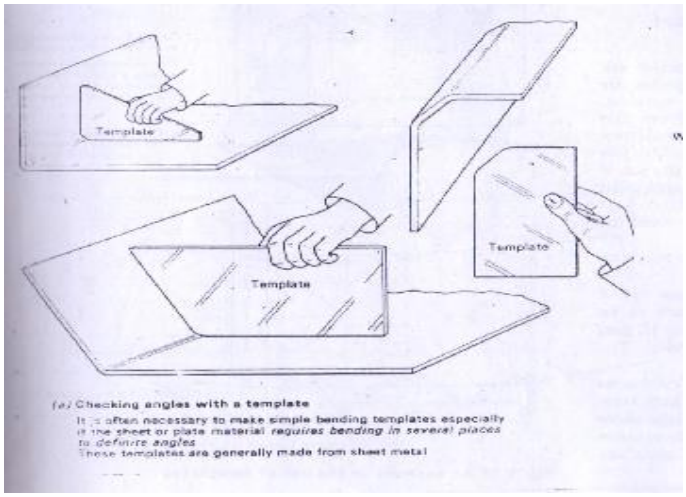
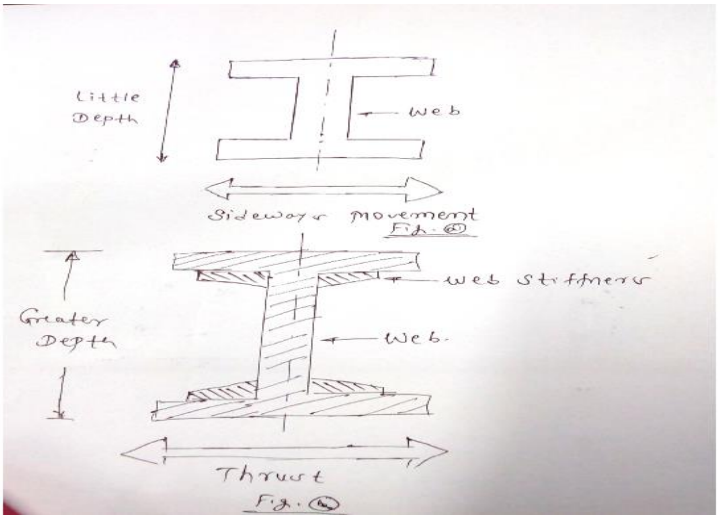
Channel sections are cut to the required length placed on a simple gantry with the web horizontal.

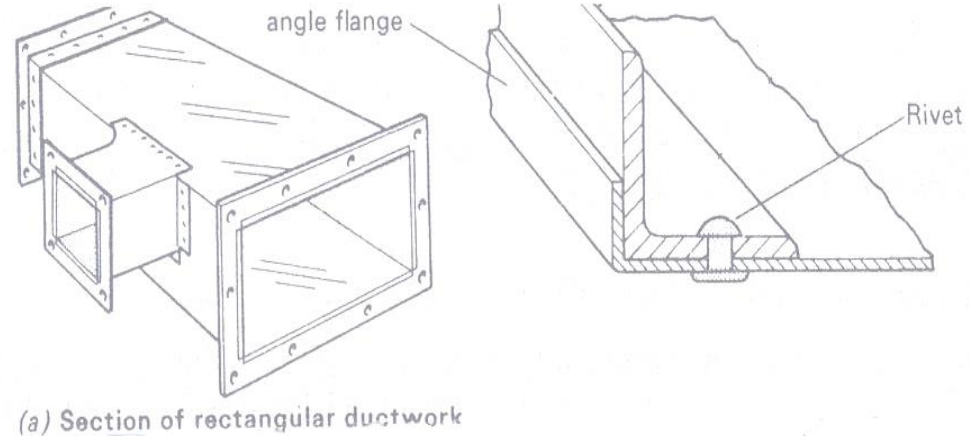
The wooden template is kept so that heel line of the template matches with the hill line of the channel sections at the uppermost portion and clamped into position.

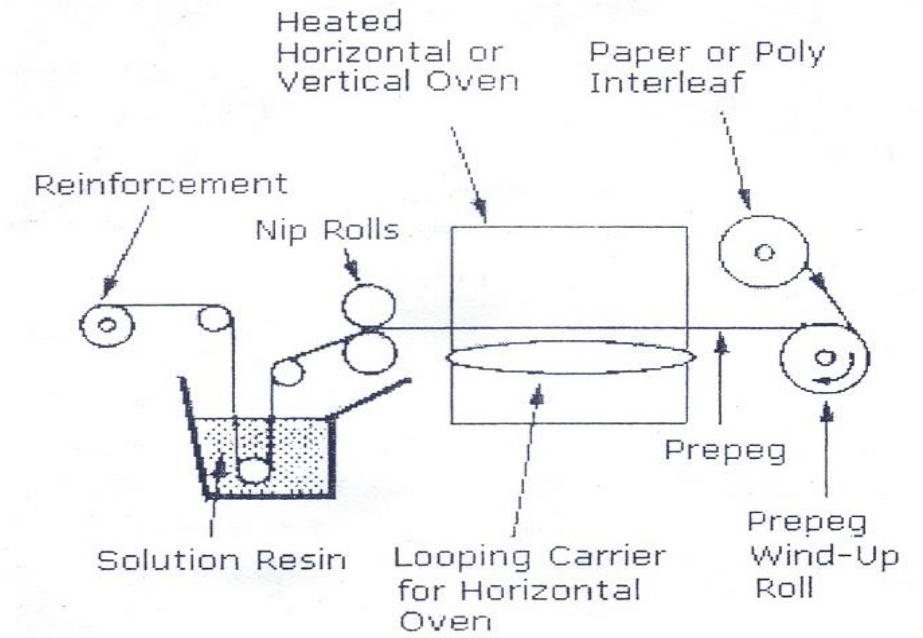
The hole position in the web are marked through the template with a nipple punch as shown in fig.

Afterward the channel section is tilted and the tail holes are marked with the help of template and a punch on the bottom flange and top flange.

b)	**i) Circumferential Confined gauge:-**  It is useful for inspection of roundness in production. Fig. shows the principle of this method. It is useful for inspection of roundness in production. This method requires highly accurate master for each size part to be measured. The clearance between part and gauge is critical to reliability. This technique does not allow for the measurement of other related geometric characteristics, such as concentricity, flatness of shoulders etc. **ii) Roundness Measuring machine:-**  Overhead spindle in which the part is fixed on a staging platform and the overhead spindle carrying the comparator rotates separately from the part. It can determine roundness as well as camming (circular flatness). The concentricity can be checked by extending the indicator from the spindle and thus the range of this check is limited. Flatness and squareness can be inspected by physically sliding the work piece past the indicator as is done on a surface plate.	4m for 1 method each	
c)	**Need Of Template:-** 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. Very often when marking large sized plate from the information given on a drawing it is almost impossible to judge exactly where to begin in order that the complete layout can be economically accommodated.	04 marks (any 4 needs)	**08**

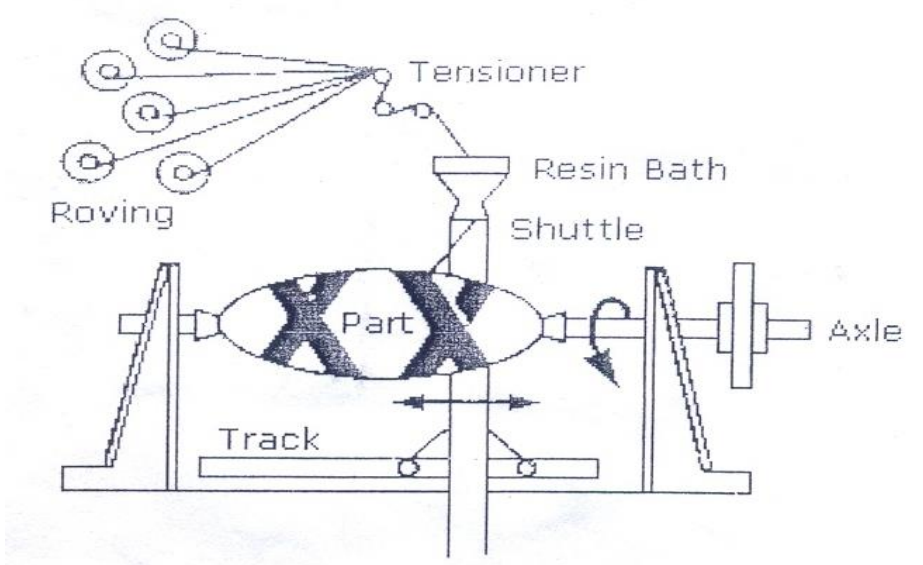
	•To act as a guide for cutting processes. •As a means of checking bend angles and contours during forming and rolling operations. **Template As a means of checking:-**  • These are usually made up of sheet metal or wood although for some applications template marking paper may be used. • Above fig shows the use of template for checking • In fig a, b & c template is used for checking the angles. • In fig d checking contour or radius corners template is used.	2m (dia) 02 marks	
4.	**Attempt any TWO of the following**	**2*8**	**16**
a)	Web Stiffners:-  	2m dia & 2m expainati on	**08**

	Description:- Above fig a shows that when the depth of I section is not much there is no chance of bending or twisting so stiffeners are not required. As the depth of I section i.e. the height of web increases the tendency of bending and twisting increases. So as to avoid this the web stiffeners are attached to strengthen the Section as shown in fig b. **Angle Stiffners:-**  (a) Section of rectangular ductwork 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 as shown in the figures above. The large sizes of square or rectangular ducting tend to drum as the air pressure passing through them varies. To overcome this drumming it is necessary to provide adequate stiffening to the walls of the duct. This may be achieved by use of swaging, but often a 'diamond-break' is used as stiffenrs.	**2m dia & 2m expainat ion**	
b)	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.	(2m Dia & 2m descripti on of any 2 each)	**08**



OR

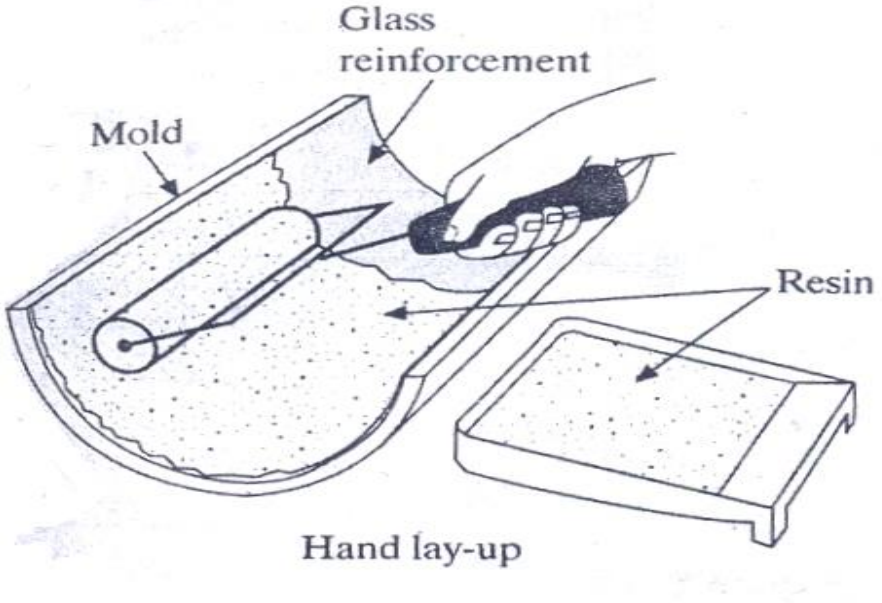
- Wet filament winding --- In this process, continuous fibre reinforcement materials are drawn through a container of resin mixture and formed onto a rotating mandrel to achieve the desired shape. After winding, the part is cured in an oven. This process can also be used as preimpregnated fibre tows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



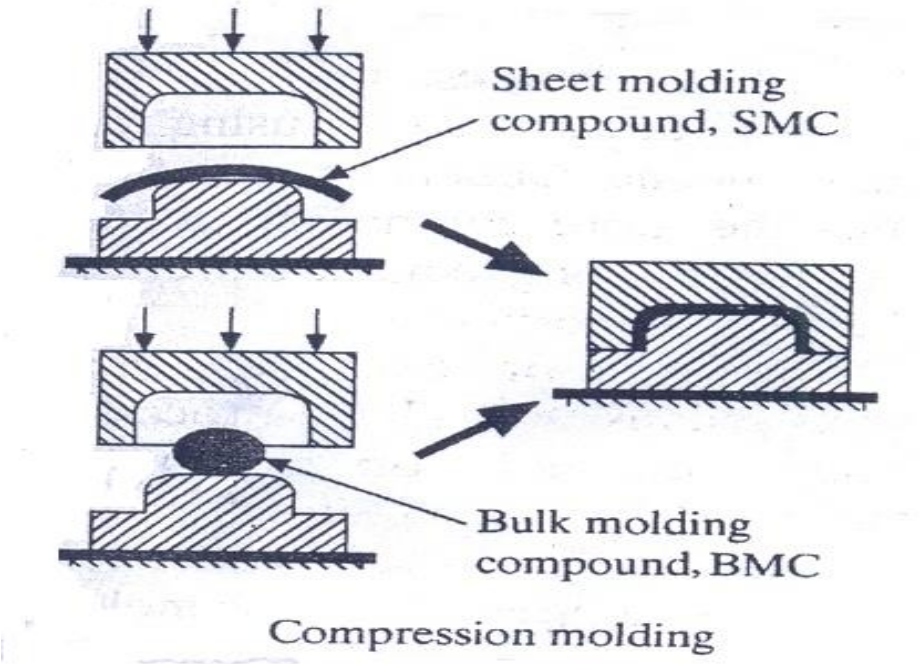
OR

- 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.

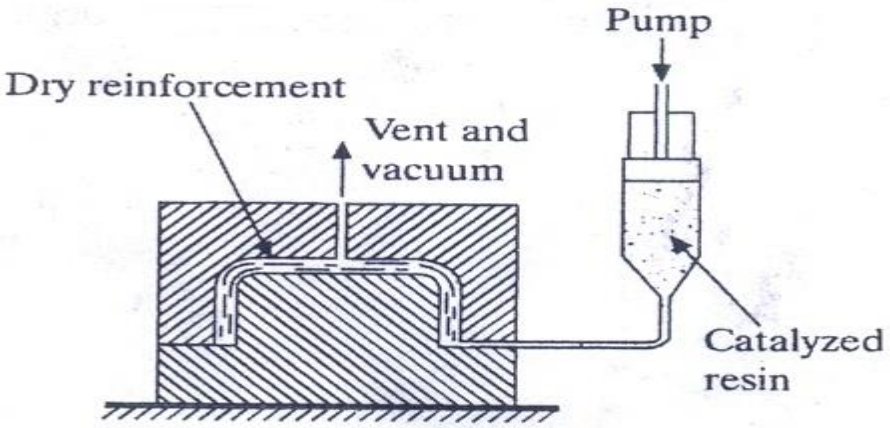
  Both processes can be used for large mouldings such as automobile fenders.



Compression molding

OR

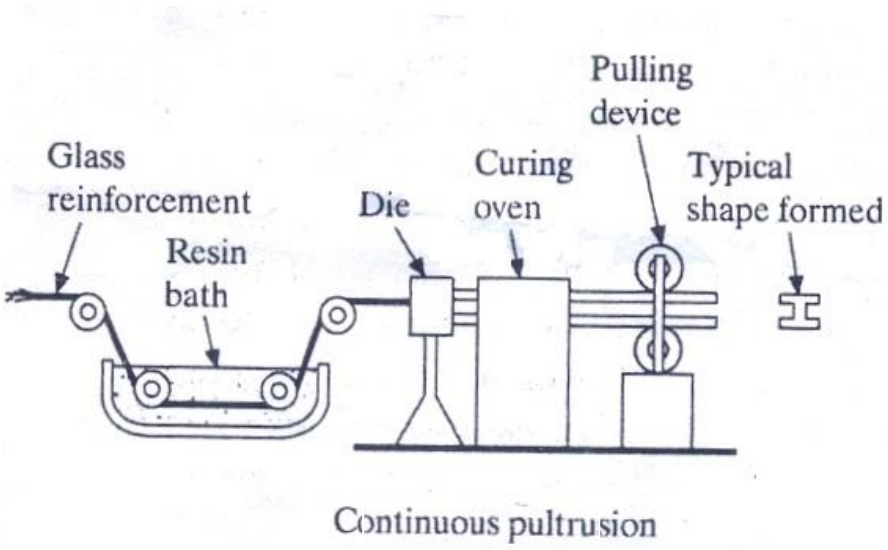
- Resin transfer moulding --- This process has evolved as a way to speed up contact and to improve the part by having two finished surfaces instead of one. This process requires a close fitting mould. Glass reinforcement is cut and shaped to the desired thickness in the open mould. The mould is then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

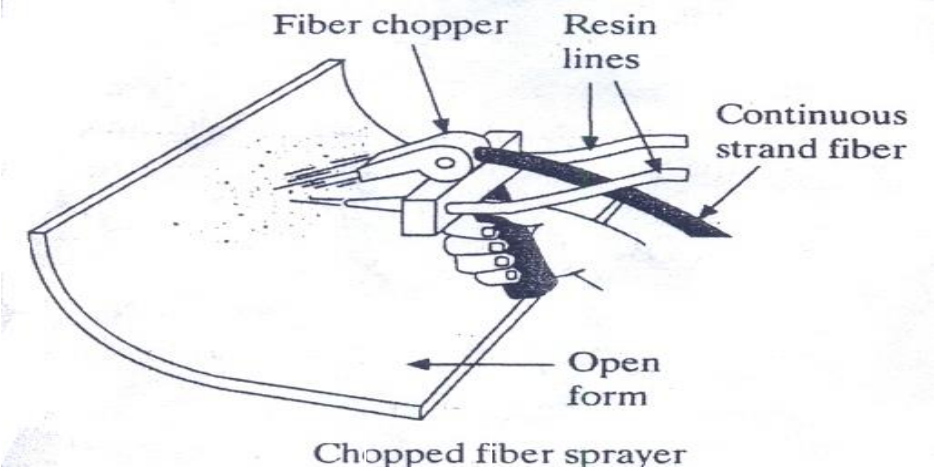
- Continuous pultrusion --- It is a process for making glass-reinforced shapes that can be generated by pulling resin-impregnated glass strands through a die. The glass is pulled through a resin bath; it is shaped as it goes through a heated bath and the resin cross-links in the heated die and combined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

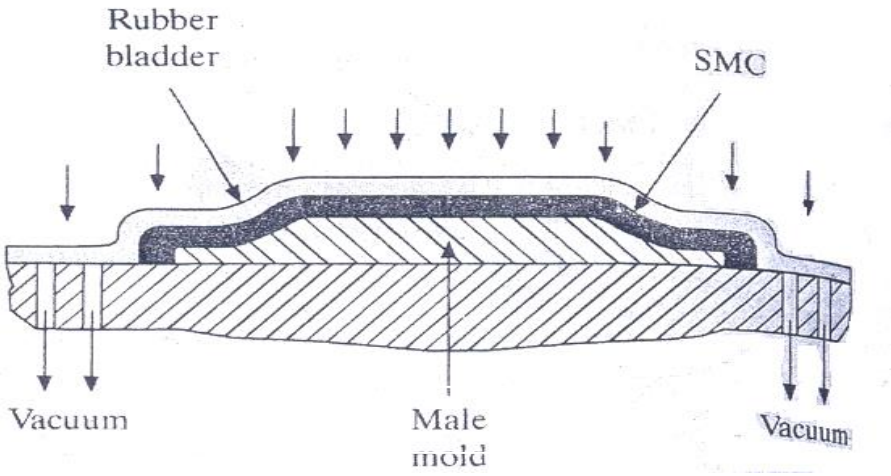
OR

- 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.



OR

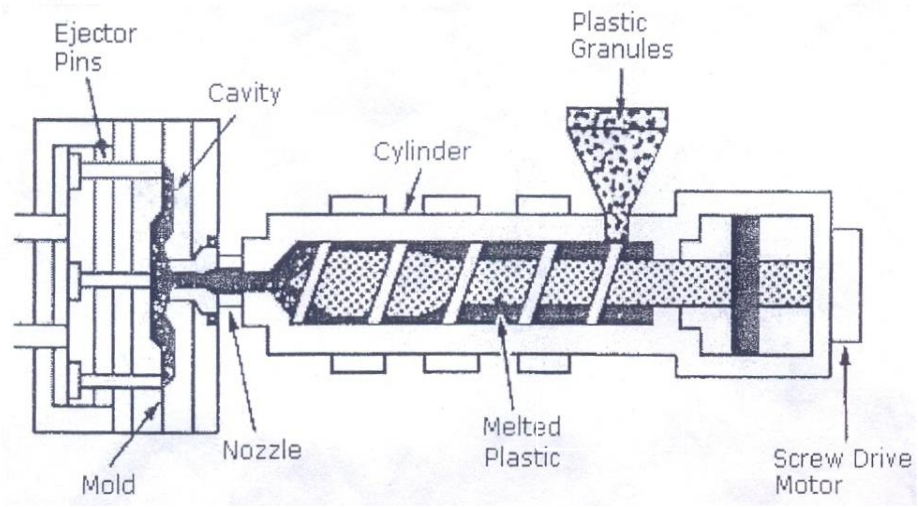
- Vacuum bag forming --- It is used to shape sheet moulding compounds to complex shapes. This process uses atmospheric pressure to do the forming, thus eliminating the high cost of matched metal moulds. It is possible to cure the SMC in the vacuum bag rig using temperature-resistant silicone rubbers 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.

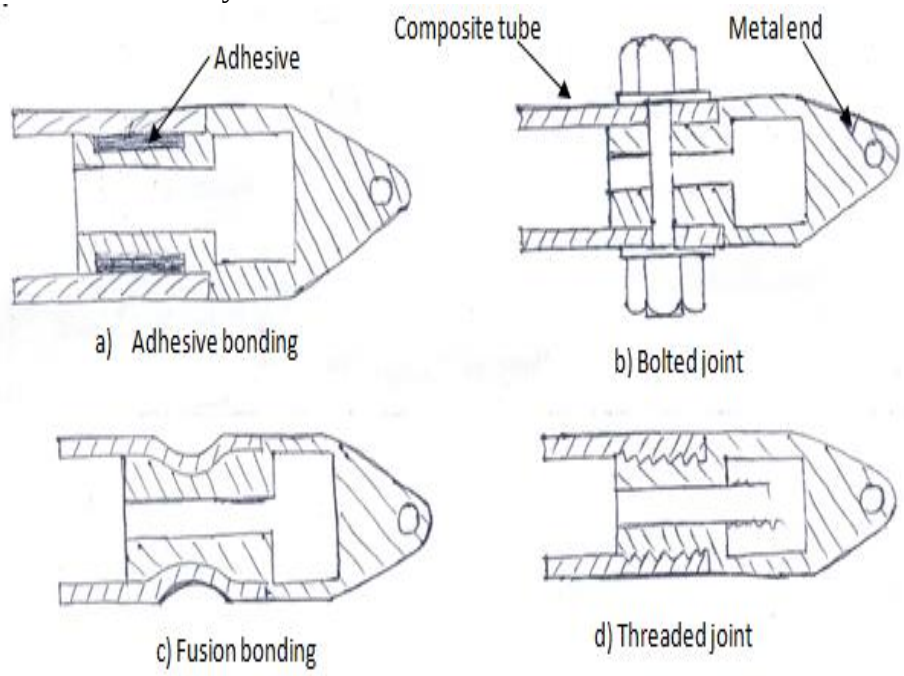
There are two types of joints used in the fabrication of composite products:

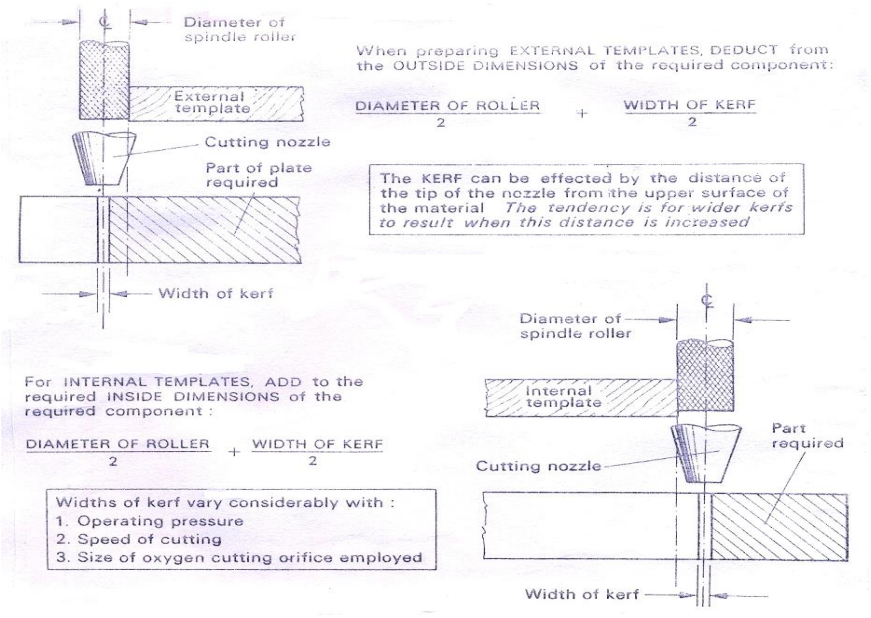
- Adhesive bonding
- Mechanical joints

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  		
c)	**Plant layout:-** It is the arrangement of physical facilities such as machinery, equipment, furniture etc. within the factory building in such a manner so as to have quickest flow of material at the lower cost and lower material handling. **Factors:-** 1) Factory building:- The nature & size of the building determines the floor space available for layout. 2) Nature of product:- Product layout is suitable for uniform products whereas process layout is suitable for custom made products. 3) Production processes:- In assembly line industries product layout is better. In job order process layout is desirable. 4) Type of machinery:- Special purpose machineries are used in product layout and general purpose machines are used in process layout. 5) Repair and maintenance:-machines should be so arranged so that there will be an adequate space available for repair and maintenance work. 6) Human needs:- Adequate arrangments should be made for clockrooms, washrooms, lockers, drinking waters, canteen etc. 7) Plant environment:- Haet, light, noise, ventilation and other aspects	02 M Definatio n 6m for any 6 factors.	**08**

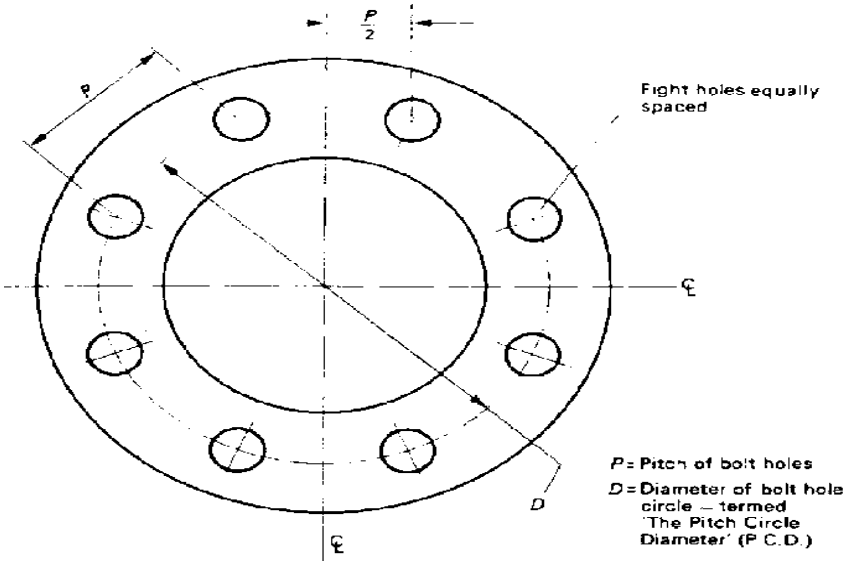
	should be duly considered. 8) Safety arrangements:- adequate safety arrangements should be made.		
5.	**Attempt any TWO of the following**	**8*2**	**16**
a)	Types Of Plant Layout:- 1) Product layout 2) Process layout 3) Fixed layout **For pressure vessel fabrication fixed layot is preferred.** **Justification:-** Pressure vessel fabrication requires a large space because size of the pressure vessel is more. The equipments , machinery, raw materilas, and labours are carried to a common place where fabrication is required to b done. We can divide the work in team. So that the work can be done fastly. One can fabricate different orders at a same time without changing the sequence and machineries. Different projects can be undertaken with the help of same layout. The jobs can be performed in accordance with the specifications given by the customers. It provides maximum flexibility for various changes in production processes and designs of the products.	03 marks 1m for selection 4m for justificati on	**08**
b)	 Suitable template may be manufactured from steel or light alloy, plywood, hardboard, wood depending upon the type or spindle head to be used.	02m (dia) 2m	**08**

	In general an external template is used when piece to be cut from the plate is component of system and an internal template when piece cut from the plate is not required for the component. Composite template may be used where the component to be cut as both external & internal profile. **Care & Storage of template:-** 1. To protect template from environmental or mechanical damage we require to take care and also to provide protection against damage. 2. If the template is made up of wood then there is tendency to absorb moisture and get oversize so as to avoid these we have to carefully store wooden template with the help of some suitable protection clothing. 3. If the template is made up of card board or hard board it should not get folded and preserved carefully to used for longer time. 4. When the metal template is used it has tendency to get corroded or rusted when comes in contact with some gases, moisture etc. so as to prevent some lubricants,oils,greace should be applied regularly on the surface of template. 5. Metal template has the tendency of elongation and contraction when it comes with contact with higher and lower temperature and hence template required to be stored suitable temp range.	4m	
c)	**Tools used in marking:-** 1. Surface Plate: - It provides perfectly flat i.e. true surface. 2. Angle Plate: - It assists in holding the work piece perpendicular to the table. 3. Scriber: - It is equivalent to pen or pencil. It literally scratches the metal surface living behind fine bright line. 4. Height Gauge: - Allow line to be scribed at a pre-set distance from the datum surface. 5. Tri Square: - To transfer 90^0 angle to the work piece. 6. Steel Tape: - It is used for linear measurement. 7. Protractor: - It is used for measuring angle. 8. Punch: - Used to create permanent mark. 9. Ball Peen hammer: - It is used in conjunction with the punch to	4m Any 4 tools	**08**

provide the striking blow required.

10. Divider or Compass: - It is used for drawing out circles or arc of any desired radius.

Methods Of Marking Out holes For flanges:-



2m dia

- Many fabrication such as boilers, chemical plant, pressure vessels incorporate the use of flanged inlet & outlet, pipes of various diameters are connected by means of flange.
- The flanges are welded and connections are made by bolting. 2m
- Fig shows a flange with 8 holes lies on circle which is known as pitch circle.
- Note that bolt holes never lie on the vertical center line because there is more chance of failure of the lowest bolt.
- The distance between adjacent holes is referred as pitch. If 8 holes are to be drilled on a pitch circle of 406 mm then pitch of adjacent holes may be calculated as follows:-
- The pitch distance of adjacent holes= PCD X constant for 8 holes
- To obtain the position of first hole divide pitch by 2 set the divider to these dimension and mark off from intersection of vertical center line and bolt circle.
- The reminder of the bolt hole center may now be located with the divider et as correct pitch.

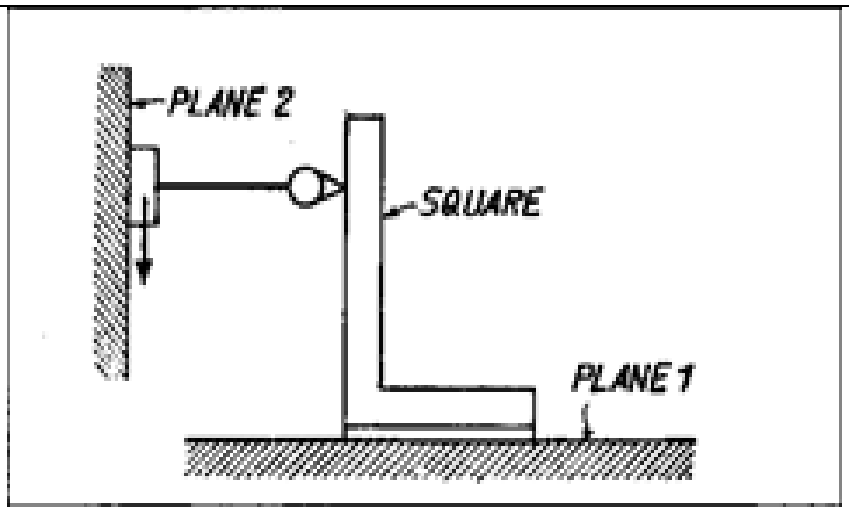
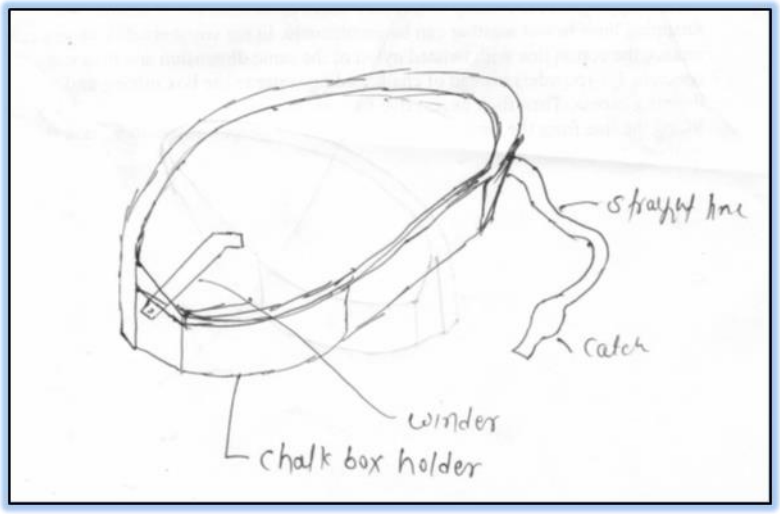
6.	Attempt any four of the following	4*4	16
a)	Chemical Cleaning (Removal of Oxide Scales and Surface Defects): Chemical cleaning is divided into two distinct groups: • Organic solvent based • Alkaline and acid aqueous method Emulsifiable Solvent and Emulsion Cleaning The component is either sprayed or immersed in an organic solvent which contains emulsifying agents. After comprehensive coverage, the component is rinsed with water to emulsify the solvent together with contaminating oil or grease. Another advantage is that treatment is usually at ambient temperature, although cleaning efficiency is directly related to physical agitation over the component surface during the water rinsing stage. **or** Alkaline and Acid Cleaners Alkaline cleaners are the most extensively used chemical cleaners for substrate pre-treatment, primarily on grounds of economics, safety, and resistance of steels to attack. They are also commonly used before metal undergoes conversion coating. The degree of alkalinity is known to effect phosphate conversion coatings (particularly zinc), with higher the pH, coarser the resulting crystal structure. In general, a finer structure is preferred for improved mechanical strength of the phosphating and gloss of the applied powder coating. Acid cleaners have a relatively restricted application, limited to mainly light rust removal. They are generally inefficient for oil and grease removal, and if the component is soiled as well as rusty, then acid cleaning is usually a follow-on to solvent or alkaline.	04 marks (any ONE)	**04**
b)	1) **Abrasive Blast Cleaning:-** **Abrasive blasting** is the operation of forcibly propelling a stream of abrasive material against a surface under high pressure to smooth a rough surface, roughen a smooth surface, shape a surface, or remove surface contaminants. A pressurized fluid, typically compressed air, or a centrifugal wheel is used to propel the blasting material (often called the *media*). There are several variants of the process, using various media; some are highly abrasive, whereas others are milder. The most abrasive are shot blasting (with metal shot) and sandblasting (with sand). Moderately abrasive variants include glass bead blasting (with glass beads) and media blasting with ground-up plastic stock or walnut shells and corncobs. A mild version is soda blasting (with baking soda) In addition, there are alternatives that are barely abrasive or nonabrasive,	04M Any 1	**04**

	such as ice blasting and dry-ice blasting. **OR** **2)TUMBLING:-** Tumbling, often is the least expensive process for removing rust and scale from metal parts. Parts configuration & size are the primary limitation for the process. Tumbling in dry abrasives is effective for removing rust and scale from small parts of simple shapes. However parts of complex shapes, with deep recess & other irregularities cannot be descaled uniformly by tumbling. It may require a several hours of tumbling, if the method is used. The addition of descaling compounds instead of deburring compounds will often decreases the tumbling time by 75 per cent. **OR** **1) Barrel Rolling:-** Barrel rolling and tumbling are quite similar operations, except that the barrel is loaded only to 40 to 60 percent capacity, while in tumbling a drum is generally packed nearly full. Abrasives such as cinders, slag, granite chips, and sharp sand are placed in the barrel with the work pieces, along with water or a dilute acid solution. Sometimes mineral matter or scrap punching are added to the wet rolling. As the barrel turns the mass rolls over and falls to the bottom of the barrel. This motion cuts down the surface of the parts.		
c)	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.	4m	**04**

d)

Sr. NO.	Direct Marking	Template Method
1	It is time consuming Process.	Time required is less as compared to direct method.
2	Repetitive measuring and marking-off of the same dimensions, where a number of identical parts or articles are required.	No need of repetitive measuring and marking off.
3	Wastage of material may takes place	avoid unnecessary wastage of material.
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.

04 m (any 4 points) **04**

e)	 When two surfaces are perfectly right angle to each other they are said to be having perfect Squareness. Fig. shows the method of testing with the help of engineers square and dial indicator. Squareness of two planes 1 & 2 is checked by placing a square on one plane then checking parallelism of second plane with the free arm of the square by sliding dial indicator which is mounted on second plane. If the two surfaces are perfectly square dial indicator does not show any deflection and if there is any deflection then the surfaces are not perfectly square to each other.	02 marks (dia) 2m	**04**
f)	 A chalk line is used to mark a straight line over a longer distance. It consists of a holder with chalk and a long string wound up	02 m dia) 2m	**04**

	inside the holder. The holder is filled with chalk usually red oxide or marking chalk. Following are the steps used for marking:- 1) Coat the string with chalk by shaking the holder. 2) Then work with assistant & stretch the string across the wall, floor, piece of wood or surface you are marking. 3) If we don't have partner one can hook up the string on the surface using the catch. 4) The line is now hooked tightly from starting position over the length to be marked. 4) Pull the line up from the surface release it; the chalk line will mark the straight line on the surface. 5) It is important to pull the line vertically to avoid the line being released at an offset angle.		