

MANUFACTURING PROCESS

PART-A

1. Give any two advantages of ultrasonic inspection test.

- i. High sensitivity and portability
- ii. Non hazardous operations

2. List the different types of comparators used for comparing the dimension with a standard.

- i. Mechanical comparators
- ii. Electrical comparators
- iii. Pneumatic comparators
- iv. Optical comparators

3. List any four properties required for good moulding sand

Porosity, Plasticity, Adhesiveness, Refractoriness

4. List any four major defects found in welded joints.

Weld crack, Under cut, Spatter, Slag inclusion

5. Mention any four physical properties of materials.

Density, Colour, Specific gravity, Viscosity

PART-B

1. Define the following mechanical properties:

- (1) Creep      (2) Fatigue failure      (3) Brittleness.

**Creep:** The slow and continuous deformation of a materials under steady load with time below elastic limit

**Fatigue failure:** It is the maximum stress at which failure may occur after a certain number of cyclic load application.

**Brittleness:** It is a property of breaking without much permanent distortion or deformation.

2. Explain the use of plug gauge, ring gauge and thread gauge.

**Plug gauge:** Used for checking inside diameter of an object. Standard type plug gauge is used to check one size only. GO-NO GO type is used to test limits of size of a hole.

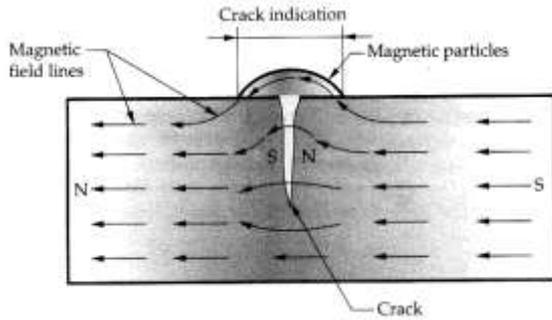
**Ring gauge:** Used for check the outside diameter of cylindrical parts.

**Thread gauge:** Used for checking pitch diameter of threads. Plug and ring thread gauges are available to check internal and external threads respectively.

3. Explain magnetic particle testing of materials.

Magnetic Particle Test is a non destructive testing, used to examine an object or material without damage or breaking. It is often required to verify the quality of a product. The product or specimen can use after the test. But test is conducted only for the component being magnetized.

The part to be tested is magnetized initially. Finely milled iron particles coated with a dye pigment are then applied to the specimen. These particles are attracted to magnetic flux leakage fields and will cluster to form an indication directly over the discontinuity. This indication can be visually detected under proper lighting conditions.



#### 4. Compare the characteristics of welding and soldering.

Welding	Soldering
Parts being joined by direct application of heat	Parts being joined by inserting low melting point metal between the surfaces being joined.
Welding gives much stronger joint	Weak joint
It requires very high temperature (above melting points)	It requires temperature below 450 <sup>0</sup> c.
Two metals are fused together	Solder melts and forms a bond between two surfaces.

#### 5. Differentiate between a comparator and a gauge.

**Comparator:** Comparators are one form of linear measurement device which is quick and more convenient for checking large number of identical dimensions. It will not show the actual dimension of the work piece. It gives only dimensional differences in relation to a basic dimension. A comparator has to compare the unknown dimensions of a part with some standard (Basic Size). These are commonly used for linear measurement in mass production.

Comparators of all types incorporate some kind of magnifying device. The magnifying device magnifies how much dimension deviates, plus or minus from the standard size.

**Gauge:** These are inspection tools used in production work to control the size and shape of the component. Gauges generally do not indicate actual dimension, but they check whether the part has been made within the specified limits of size. Gauges are two types, standard gauges and limit gauges. Standard gauges are made to nominal size of the part to be tested. Limit gauges are made to limit of the dimensions of the part to be tested.

#### 6. Explain pit moulding.

Moulding is the process by which making of desired cavity for casting with help of pattern.

In pit moulding, the mould is made in a pit, dug in a foundry floor. The walls and the bottom of the pit are usually reinforced with concrete and a layer of coke is laid on the bottom of the pit to enable easy escape of gas. The coke bed is connected to atmosphere through vent pipes which provide an outlet to the gases. The pit acts as drag (bottom box) of moulding box and a separate cope may be used. One box is generally required to complete the mould, runner, sprue, pouring basin and gates are cut in it. It is preferred for extremely large castings.

#### 7. Explain the use of runner and a riser in a gating system

**Runner:** It receives molten metal from sprue base, and distributes to the ingates, which carries metal to the mould.

**Riser:** It is a vertical passage through the cope. Its main function is to feed the molten metal into the casting to compensate for its shrinkage. It also serves to allow the air and gases to escape from mould and reveal the level of metal in the mould.

### PART-C

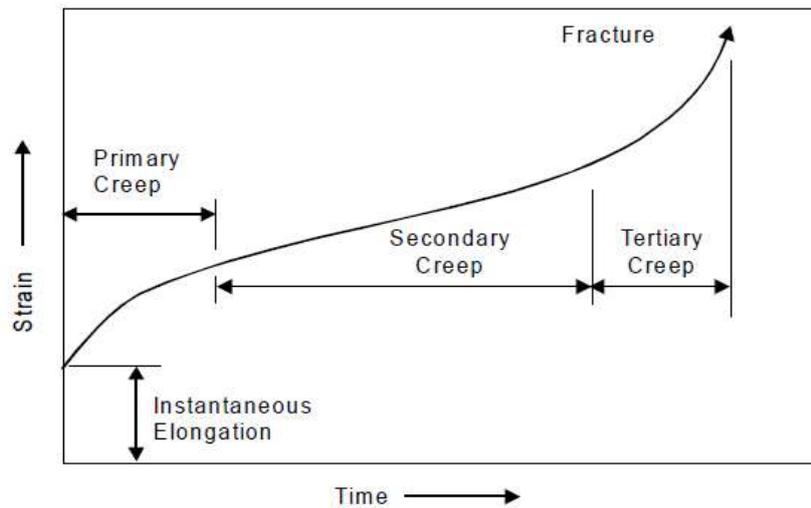
#### UNIT-I

#### (a) Explain the procedure for the creep test.

Creep is time dependent phenomena of metal failure at high constant stress and at high temperature.

- Test is carried out up to the failure of the test specimen.
- A specimen which is subjected to a constant load is placed in an electric furnace and is heated to a given temperature.
- The strain in the specimen is measured by an optical extensometer.
- Four or five specimens are tested at each temperature under different loads and elongation verses time curves (creep curve) are plotted for each specimen.

A creep curve for high temperature and long time creep is shown in Fig. The curve shows different portions of the primary secondary and tertiary creep which ends at fracture in metals.



Creep curve for high temperature and long time creep

(b) Explain the following terms:

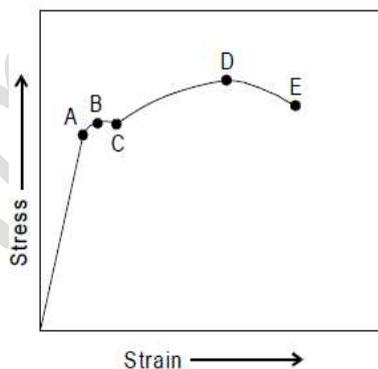
- (1) Elasticity (2) Endurance limit (3) Thermal conductivity

**Elasticity:** It is the ability of a material to regain its original shape and size after the removal of external load.

**Endurance limit:** It is the limit below which the fatigue life of a material is essentially infinite. Fatigue strength of a material is the maximum stress at which failure may occur after a certain number of cyclic load application.

**Thermal conductivity:** It is the ability of a material to conduct heat. In other terms, it is the quantity of heat transmitted through a unit thickness in a direction normal to a surface of unit area, due to a unit temperature gradient under steady state conditions.

(a) Draw a typical stress-strain diagram for ductile material and explain the terms elastic limit, yield point and breaking stress.



- A – Limit of proportionality  
 B – Elastic limit  
 C – Yield point  
 D – Maximum stress point  
 E – Breaking of fracture point

**Elastic limit:** It is the greatest stress that the metal can withstand without experiencing a permanent strain when load is removed.

**Yield point:** It is the minimum stress at which the specimen is deformed without an increase in load.

**Breaking stress:** It is the stress at which the specimen will fracture or failure.

(b) Differentiate between destructive testing and non-destructive testing. Name any four non-destructive tests.

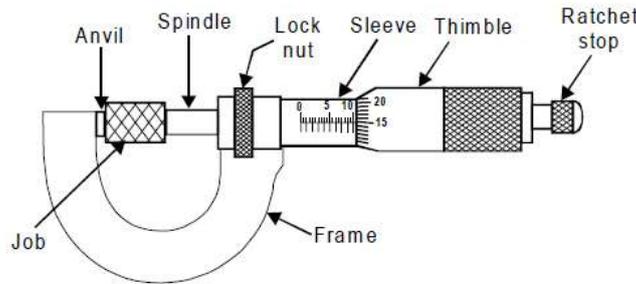
**Destructive testing:** Tests are carried out to the specimen's failure, in order to understand a specimen's structural behavior under different loads. It is most suitable and economical, for objects which will be mass produced. The specimen will not be used after test because of its failure.

**Non-Destructive testing:** Used to examine an object or material without damage or breaking. It is often required to verify the quality of a product. The product or specimen can use after the test.

**Non-destructive tests :** Magnetic particle testing, Dye penetrant test, Ultrasonic test , Radiographic test

**UNIT-II**

**(a) Sketch the figure of micrometer and label its parts. Mention its advantages and disadvantages in taking measurements.**



Advantages:

- ✓ Simple and easy measurements
- ✓ Measurements can be taken at a faster rate.
- ✓ Easy to handle.

Disadvantages:

- Only measure external sizes
- Limited range, only 25mm
- Cannot measure internal and depth

**(b) List the types of comparator. Give advantages of a mechanical comparator. Briefly explain the working of a dial indicator.**

- Mechanical comparators
  - ✓ Dial indicator Mechanical comparators
  - ✓ Reed type Mechanical comparators
  - ✓ Sigma Mechanical comparators
- Electrical comparators
- Pneumatic comparators
- Optical comparators

The **dial indicators** are also known as dial gauges. They are generally used for testing flatness of surfaces and parallelism of bars and rods. They are also used for testing the machine tools. They are available in both metric as well as in inches units. Inches dial indicator of 0.001" measuring accuracy is in commonly used. The commonly used metric dial indicator has an accuracy of 0.01 mm. Those having 0.001 mm accuracy are also available, however they are used in highly precision measurement work.

**(a) The divisions on the main scale of a vernier caliper are 0.5mm apart. The vernier has 100 divisions equal in length of 98 main scale divisions. What is the accuracy of the instrument?**

**Given,**

The vernier has 100 divisions equal in length of 98 main scale divisions.

main scale of a Vernier caliper = 0.5mm

Total number of vernier divisions = 100

98 main scale divisions =  $98 \times 0.5\text{mm} = 49\text{mm}$

So that  $1 \text{ v.s.d} = 49/100 = 0.49$

$$1 \text{ m.s.d} = 0.5 \text{ mm}$$

There for accuracy or least count =  $1 \text{ m.s.d} - 1 \text{ v.s.d}$

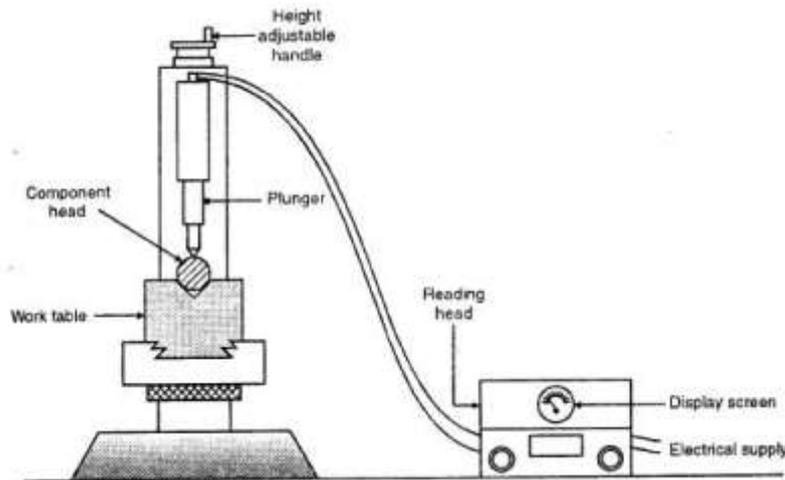
$$= 0.5 - 0.49 = 0.01 \text{ mm}$$

**(b) Explain the principle and working of an electrical comparator. Give its advantages and limitations.**

#### Electrical Comparators:

Electrical comparators have no moving parts. Thus a high degree of reliability is expected from these instruments. Generally there are two important applications of electrical comparators:

1. Used as measuring heads
2. Used for electrical gauging heads, to provide usual indication to check the dimensions within the limits laid down.



The first application is very important when there is a requirement for precise measurement for e.g. Checking or comparison of workshop slip gauges against inspection slip gauges. The second application is used to indicate with a green light if a dimension is within the limits. A red lamp indicates an undersized dimension; a yellow lamp indicates an oversize dimension. So the operator is not required to be aware of the actual tolerances on the dimension. After setting the instrument correctly, all that needs to be done is to place the component under the plunger of the gauging head. The signal lamps provide in standard positive indication of the acceptability of the dimension under test

#### Advantages:

1. Measuring units can be remote from indicating units.
2. Variable sensitivity which can be adjusted as per requirement.
3. No moving parts, hence it can retain accuracy over long periods.
4. Higher magnification is possible as compared to mechanical comparator.
5. Compact sizes of probes are available.
6. These are extremely sensitive

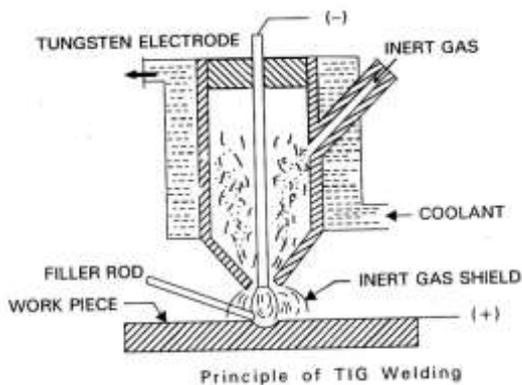
#### Disadvantages:

1. The accuracy of working of these comparators is likely to be affected due to temperature and humidity.
2. It is not a self-contained unit; it needs stabilized power supply for its operation.
3. Heating of coils can cause zero drifts and it may alter calibration.
4. It is more expensive than mechanical comparator.
5. Operation is difficult
6. Electric supply requires
7. Operating system is complex

### UNIT-III

**(a) Explain the principle and procedure of TIG welding with help of figure.**

In this process the heat necessary to melt the metal is provided by a very intense electric arc which is formed between a non-consumable tungsten electrode and metal work piece.



In this process a non-consumable tungsten electrode is used with an envelope of inert shielding gas around it. The shielding gas protects the tungsten electrode and the molten metal weld pool from the atmospheric contamination. The shielding gases generally used are argon, helium or their mixtures. TIG welding is specially used for aluminums and its alloys.

**(b) Explain the advantages and limitations of oxy acetylene welding.**

**Advantages:**

- ✓ Low capital cost
- ✓ High portability and convenience
- ✓ Flame is more easily controlled and can be used for all metals and alloys.
- ✓ Welding skills are relatively easy.
- ✓ Good weld quality.
- ✓ It is portable and is suitable for repair of fabrication work.

**Limitations:**

- Takes longer time to weld.
- Heat affected zone and distortion are longer.
- The gases are expensive and safety problem for handling and storage of these gases.
- Shielding provided by flame is not effective.
- Not suitable for joining heavy sections.

**(a) Compare the characteristics of AC welding and DC welding.**

Both the weldings are suitable for welding of all metals except for some non-ferrous metals which require a DC welding.

	<b>AC welding</b>	<b>DC welding.</b>
<b>Advantages</b>	<ul style="list-style-type: none"> <li>➤ Equipment is simple and cost is less.</li> <li>➤ No moving parts, so low maintenance cost,</li> <li>➤ No change of polarity when working with various types of electrodes.</li> </ul>	<ul style="list-style-type: none"> <li>➤ Can be used for ferrous and non-ferrous metals.</li> <li>➤ Stable arc, smoother welding facility of thin sheets.</li> <li>➤ Easy of operation, suitable for overhead welding</li> </ul>
<b>Limitations</b>	<ul style="list-style-type: none"> <li>➤ Not suitable for non- ferrous metals and thin sheets.</li> <li>➤ Electric shock is more intense.</li> </ul>	<ul style="list-style-type: none"> <li>➤ More expensive to purchase.</li> <li>➤ High maintenance cost</li> <li>➤ Troubles from arc blow.</li> </ul>

**(b) Define the following terms**

- (1) Fullering (2) Brazing (3) Upsetting (4) forging.**

**Fullering:** It is the process of increasing the length by necking the bar between two fullers.

**Brazing:** It is the process of joining metals by the use of filler metal (spelter) at above 450<sup>0</sup>c. Spelter is an alloy of copper and zinc.

**Upsetting:** It is the process of increasing the cross- sectional area at the expense of its length.

**Forging:** It is the process of shaping of a heated metal by hammering and pressing.

(a) Define pattern allowances. Why is it necessary? List pattern making allowances. Briefly explain any two.

Pattern allowance is defined as the size of pattern is slightly larger than the finished casting by an amount called allowance. It is necessary because allowance is must provided to get the required size of the casting as per our requirements.

**Pattern making allowances are;**

1. shrinkage allowance
2. machining or finishing allowance
3. taper or draft allowance
4. distortion allowance
5. shake or rapping allowance

**Shrinkage allowance:**

The pattern must be made oversize to compensate for contraction of liquid metal on cooling. This addition to the dimension of the pattern is known as shrinkage allowances.

**Machining or finishing allowance:**

The excess in the dimension of the casting (i.e. in the dimension of pattern) over the finished casting is called machining or finishing allowance.

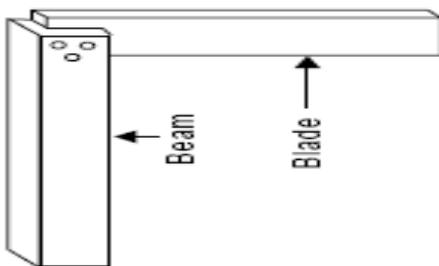
(b) List different making and measuring tools used in carpentry. Briefly explain the use of a try square.

**Measuring tools:**

- ✓ Steel rule
- ✓ Wooden folding rule
- ✓ Steel tape.

**Marking tools:**

- ✓ Straight edge
- ✓ Try square
- ✓ Marking gauge
- ✓ Divider



- ✓ Marking knife, etc..

**Try square:** Used for testing flatness of surface, marking parallel lines and also for marking and testing of right angles. It has a steel blade fitted at right angles in wooden or cast iron stock. It is available in various sizes ranging from 100mm to 300mm.

(a) Write short notes on:

- (1) Reaming                      (2) Seasoning

**(3) Venting****(4) Tapping**

**(1) Reaming:** It is the process of finishing a drilled hole to accurate size with a smooth finish.

**(2) Seasoning:** It is the controlled process of reducing the moisture content of the timber so that it is suitable for the environment and intended use.

**(3) Venting:** It is the process of making small holes in the sand of a mould by using vent rods.

**(4) Tapping:** It is the process of cutting internal threads with a tap.

**(b) Compare the characteristics of soft wood and hard wood. Explain different types of seasoning methods used.**

Sl.No.	Hard Wood	Soft Wood
1	It is dark in color	Its color is light
2	It is heavy in weight.	It is light in weight
3	Hard woods are harder and denser.	Soft woods are comparatively lighter
4	It has less resin content.	Few softwoods are resinous
5	It does not split quickly	It gets splitted quickly
6	It is difficult to work.	It is easy to work.
7	It's annual rings are close and often indistinct	Its annual rings are well spaced and quit distinct
8	It is slow growing.	It is fast growing.
9	It has good tensile and shear resistance.	It has good tensile resistance but is weak across the fibers.
10	It does not catch fire very soon	It catches fire very soon.

Seasoning is classified into two categories namely natural seasoning and artificial seasoning. **Natural seasoning** is carried out generally in air, or in water or in smoke. **Air seasoning** is the oldest method of drying timber and it depends entirely upon the free flow of air around the wood to evaporate moisture. In **water seasoning**, the timber barks are immersed in water for 15-20 days. During period, the flowing water drives away the sap of wood it. Timber is then taken out and dried in open air for about a month. **Artificial seasoning** is controlled by application of both heat and humidity which enables to reduce the moisture content quickly and accurately.