SECOND SEMESTER DIPLOMA EXAMINATION IN MECHANICAL ENGINEERING- OCTOBER, 2012

MANUFACTURING PROCESS

PART-A

1. List any four physical properties of materials.

Density, Colour, Specific gravity, Viscosity

2. Define least count of an instrument.

The least value that can be measured by using any measuring instrument known as least count.

3. What is meant by forging?

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

4. List the equipments required for arc welding.

Transformer, Generator, Rectifier

5. Write any four characteristics of good timber.

- ✓ Timber is free from knots, insects attack, excessive moisture, discoloration, twisted fibers, and free from any discoloration.
- ✓ It should possess straight fibers and high fire resistance.
- ✓ It should not split when nails are driven in it.
- ✓ It should not clog with the saw teeth during the sawing operation.

PART-B

1. Explain the terms thermal conductivity and thermal diffusivity.

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.

Thermal diffusivity: It is a material property which describes the rate at which heat flow through a material, typically measured in mm^2/s or in^2/hr.

2. What are the gauges? Explain the use of plug gauge.

Standard gauges: Dial gauge, feeler gauge, thread gauges, screw pitch gauge, wire gauge, plate gauge , etc.

Limit gauges: Plug gauge, ring gauge, Taper gauge, snap 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.

3. Enumerate the desirable characteristics of precision measuring instruments.

(a) High degree of sensitivity,

Sensitivity is defined with reference to the least change in the measured quantity which will cause an observable change in the instrument reading. In instrument design an attempt must be made that sensitivity remains constant throughout the range of measured quantity.

(b) High degree of accuracy

Accuracy is the degree of closeness to the true value. The measure of accuracy of an instrument
can be had by the amount of correction to be made to the instrument reading. The accuracy will be high, if calibration is proper and less wearing of parts takes place.

(c) Minimum inertia in the moving parts of mechanism.

The effect of inertia of moving parts is to make the instrument sluggish. All those instruments which depend on linkage and mechanical system, displacement of fluid, diaphragm etc. are subjected to disadvantages of inertia. Thus imperfect elasticity of the diaphragms and spring are causes of inertia in instruments.

(d) Must have freedom from variance.
Variance is defined as the range of variance in instrument readings obtained from repeated measurements of same quantity. It is inherent in the instrument and depends upon the
quality of instrument which in turn depends upon the quality of machines from which it is
manufactured and quality of workmanship.

4. Differentiate between upsetting and drawing down.

Upsetting is the process of increasing cross-sectional area at the expense of its length. It is achieved by heating the bar and striking the end with bar. Upsetting also known as 'jumping up'.

Drawing down is the process of decreasing the cross-sectional area with a corresponding increase in length of object. It is opposite to upsetting.

5. Compare Ac and DC arc welding.

	AC welding	**DC welding.**
Advantages	➢ Equipment is simple and cost is less. ➢ No moving parts, so low maintenance cost, ➢ No change of polarity when working with various types of electrodes.	➢ Can be used for ferrous and non-ferrous metals. ➢ Stable arc, smoother welding facility of thin sheets. ➢ Easy of operation, suitable for overhead welding
Limitations	➢ Not suitable for non- ferrous metals and thin sheets. ➢ Electric shock is more intense. ➢ Arc is unstable	➢ More expensive to purchase. ➢ High maintenance cost ➢ Troubles from arc blow.

6. Write short notes on chisels and gauges.

Chisel: It is widely used for cutting and chipping the work piece. It is made of high carbon steel or tool steel. It is in the form of a rod having cutting edge at one end, hexagonal or octagonal body and striking head at the other end. The size of a chisel is described by its length and width of edge. The angle of the cutting edge of the chisel is 35°-70°according to the metals to be cut.
Gauges: 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.

7. Explain scraper and scraping.

Scraping is the process of removing thin layer of materials to produce smooth surface by using scraper.
Scrapers are hand cutting tools used for removing metal from surfaces in form of thin slices or flakes to produce smooth and fine surfaces. Machined surfaces are not always perfectly true. If a very true surface is needed, the high spots must be located and removed. It is normally done with the help of a scraper. The scrapers are made in a variety of lengths from 100 mm upwards and in many shapes, depending upon the type of work to be done.

PART-C

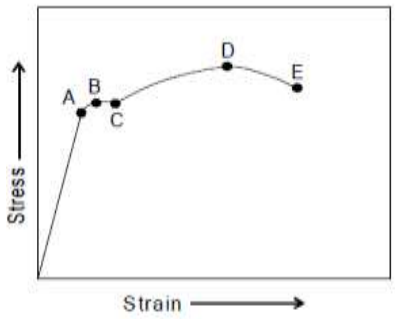
UNIT-I

(a) Differentiate between destructive testing and non-destructive test.

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. e.g.: Impact test, hardness test

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. e.g.: magnetic particle test, ultrasonic test

(b) Draw a typical stress-strain diagram for ductile material and explain the salient points.



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

Proportional limit: It is the stress at which the stress-strain curve deviates from linearity. Upto this point, stress is proportional to strain.

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**.**

Maximum stress point: It is the maximum stress, a material can withstand without fracture.

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

(a) Write short notes on:

(1) Strength (2) Brittleness (3) Stiffness (4) Toughness

(1) Strength: It is the ability of a material to withstand or support load without failure.

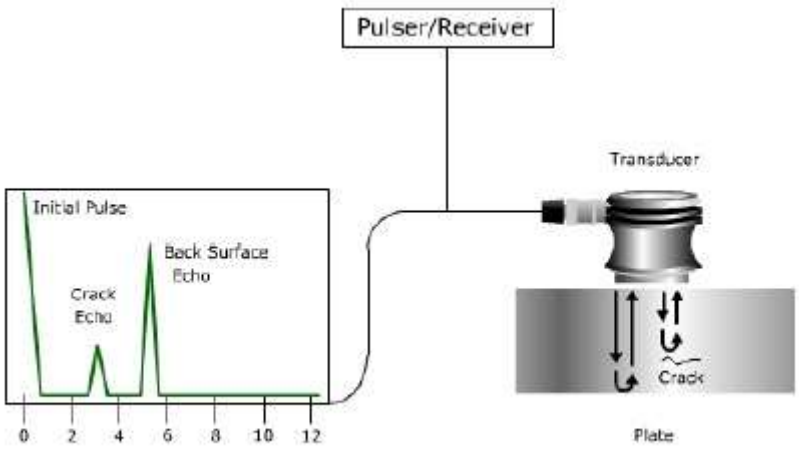
(2) Brittleness: It is a property of breaking without much permanent distortion or deformation.

(3) Stiffness: It is the ability of a material to resist elastic deformation or deflection. Higher the value of young's modulus, higher the stiffness.

(4) Toughness: It is the ability of a material to withstand shock or shear load. In other words, It is the ability of a material to withstand both plastic and elastic deformations.

(b) Explain ultrasonic test with suitable sketches.

Ultrasonic Testing (UT) uses high frequency sound waves (typically in the range between 0.5 and 15 MHz) to conduct examinations and make measurements. Besides its wide use in engineering applications (such as flaw detection/evaluation, dimensional measurements, material characterization), etc.



UT inspection system consists of several functional units, such as the pulser/receiver, transducer, and a display device. A pulser/receiver is an electronic device that can produce high voltage electrical pulses. Driven by the pulser, the transducer generates high frequency ultrasonic energy.
The sound energy is introduced and propagates through the materials in the form of waves. When there is a discontinuity(such as a crack) in the wave path, part of the energy will be reflected back from the flaw surface. The reflected wave signal is transformed into an electrical
signal by the transducer and is displayed on a screen. Knowing the velocity of the waves, travel time can be directly related to the distance that the signal traveled. From the signal, information about the reflector location, size, orientation and other features can sometimes be gained.

UNIT-II

(a) Write short notes on:

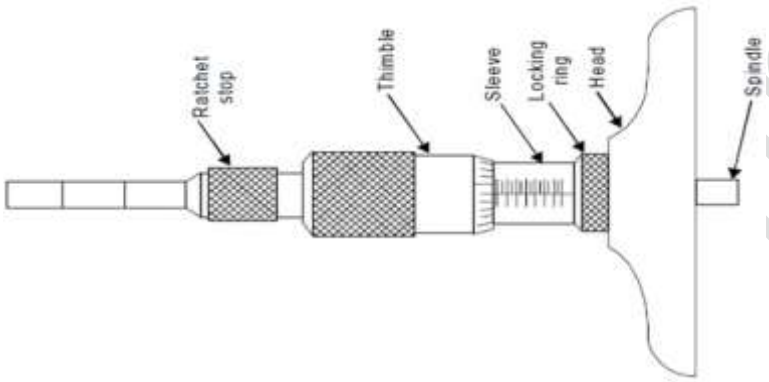
(1) Surface gauge (2) Ring gauge

Surface gauge: It provides a true flat surface for layout work and reference surface on which work may be mounted for inspection. Work pieces and accessories must be cleaned before being placed on the surface plate.

Ring gauge: It belongs to limit gauges. Used for check the outside diameter of cylindrical parts.

(b) Sketch and describe the working of a depth micrometer.

It is used to measure the depth of blind hole up to an accuracy of 0.01 mm. The screwed spindle moves and does the actual measurement. It is similar to outside micrometer, but depth increases as the spindle extends from the face. Therefore, the sleeve graduations are numbered in opposite directions.



To read depth micrometer
1. Note the number of divisions covered by thimble and multiplied by 0.5.
2. Note the division line on thimble which coincides with barrel (sleeve) mark. Multiply this number with 0.01

3. Add the two values to get the size.

(a) Describe the following:

(1) Screw pitch gauge (2) Telescopic gauge

(1) Screw pitch gauge: It is used to check the pitch of the screw. A set of gauges are provided in a holder, and one of which is in mesh with screw to be tested. The pitch of the screw is read directly on the gauges.

(2) Telescopic gauge: It is used to measure the size of hole or slot. The gauge consists of two rods or plungers which are attached to one end of a handle at right angles. One rod can slide the other fixed rod, and can be locked by screw.

While using, the rods are pressed closer to enter into the gap to be measured. After locking, the gauge is removed and the distance between face of rods is measured with outside micrometer.

(b) With a neat sketch, explain the working of a Vernier caliper.

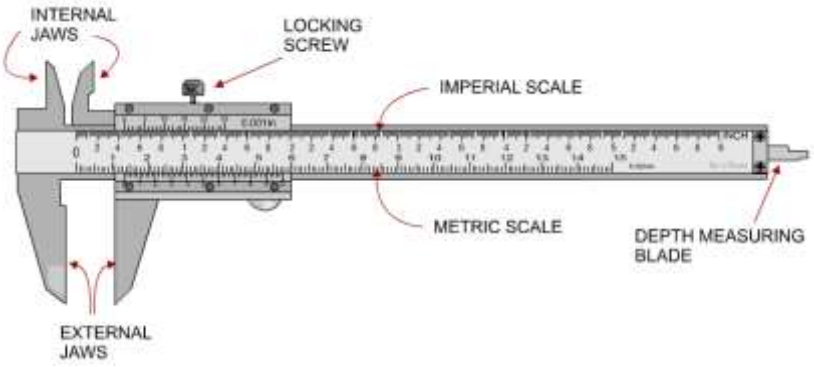


Fig. shows the Vernier caliper, which is commonly used to measure accurately
(1) Outside diameters of shafts,
(2) Thicknesses of various parts,
(3) Diameters of holes or rings and
(4) Internal dimensions of hollow jobs or articles.

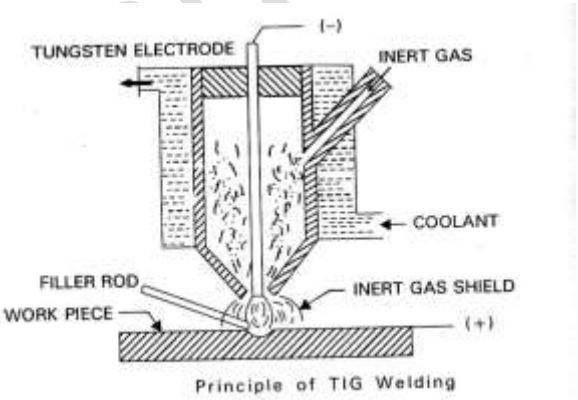
Working:

It works on the principle of vernier and can measure the dimensions to an accuracy of 0.02 mm. For making a measurement of external dimensions, the job is placed between the fixed and the movable jaws. The movable or the sliding jaw is moved until it almost contacts the job kept against the fixed jaw. The sliding jaw assembly of the vernier caliper that carries the fine adjustment screw should be clamped to the graduated beam with the help of adjustment clamp. The two jaws are then brought into contact with the job by moving the sliding jaw with the help of fine adjustment screw. The main slide assembly is then locked to the beam with help of clamp. The caliper is then carefully removed from the job to prevent springing the jaws and the reading is taken.

UNIT-III

(a) Describe the working of TIG welding with help of figure.

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.

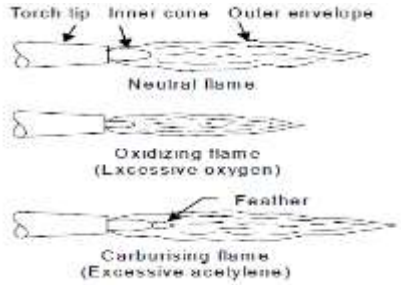


Principle of TIG Welding

(b) With help of sketches, explain different type of flames used in gas welding.

Oxidizing flame: It has an excess of oxygen over the acetylene. Its inner cone is shorter. It is used for welding brass and bronze and brazing of ferrous metals. It assures complete combustion and highest temperature, but has a tendency to oxidize metals being welded.

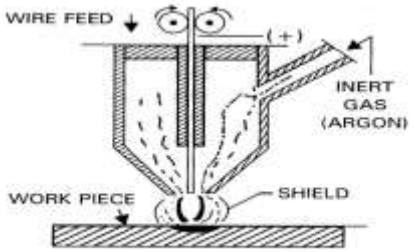
Neutral flame: It has equal quantities of oxygen and acetylene. It is most common flame used in welding processes. It has no tendency to react with material being weld



Reducing flame: It has an excess of acetylene over the oxygen. It has a longer inner cone, an intermediate feather and bluish outer flame. It is used for welding high carbon steel. The flame has carburizing effect on steel, causing hard, brittle and weak weld.

(a) Describe the working of MIG welding with help of sketch.

Metal inert gas arc welding (MIG) or more appropriately called as gas metal arc welding (GMAW) utilizes a consumable electrode and hence, the term metal appears in the title. Though gas tungsten arc welding (GTAW) can be used to weld all types of metals, it is more suitable for thin sheets. The consumable electrode is in the form of a wire reel which is fed at a constant rate, through the feed rollers.



The welding torch is connected to the gas supply cylinder which provides the necessary inert gas. The electrode and the work-piece are connected to the welding power supply. The power supplies are always of the constant voltage type only. The current from the welding machine is changed by the rate of feeding of the electrode wire. Normally DC arc welding machines are used for GMAW with electrode positive (DCRP). The DCRP increases the metal deposition rate and also provides for a stable arc and smooth electrode metal transfer.

(b) What do you understand by soldering and brazing? Describe the principle of each.

SOLDERING

Soldering is a method of joining similar or dissimilar metals by heating them to a suitable temperature and by means of a filler metal, called solder, having liquidus temperature not exceeding 450°C and below the solidus of the base material. Though soldering obtains a good joint between the two plates, the strength of the joint is limited by the strength of the filler metal used. Solders are essentially alloys of lead and tin.

BRAZING

Like soldering, brazing is a process of joining metals without melting the base metal. Filler material (alloy of zinc and copper called spelter) used for brazing has liquidus temperature above 450°C and below the solidus temperature of the base metal. The filler metal is drawn into the joint by means of capillary action (entering of fluid into tightly fitted surfaces). Brazing is a much widely used joining process in various industries because of its many advantages. Due to the higher melting point of the filler material, the joint strength is more than in soldering.

UNIT-IV

(a) Explain the common allowances provided on patterns.

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.

Taper or draft allowance:

The provision of taper on vertical face of the pattern (draft) to eliminate or reduce the tendency of mould to tear away the edges when the pattern is removed from mould.

Distortion allowance:

This allowance is applied to the castings of irregular shapes that are distorted in cooling because of metal shrinkage.

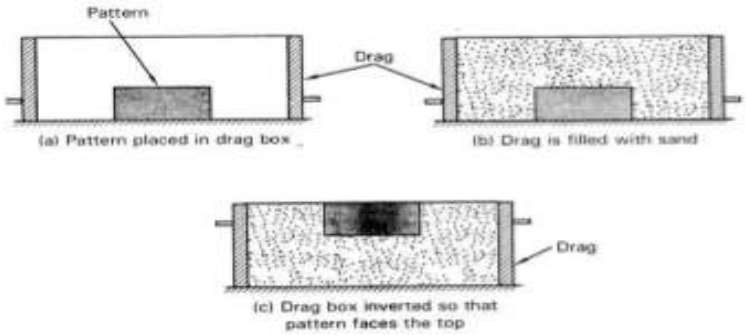
Shake or rapping allowance:

Due to rapping of the pattern in the mould, the size of the mould cavity increases slightly. A shake or rapping allowance shall be given to the pattern by making it smaller to compensate for rapping.

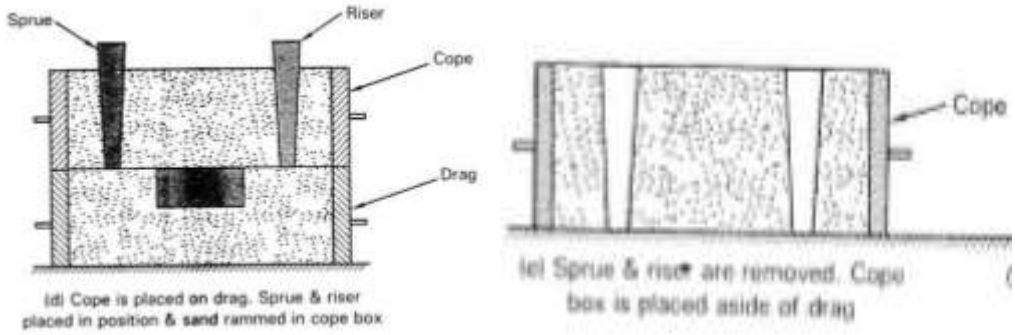
(b) Describe with sketches, the procedure of making green sand moulds by turn over method.

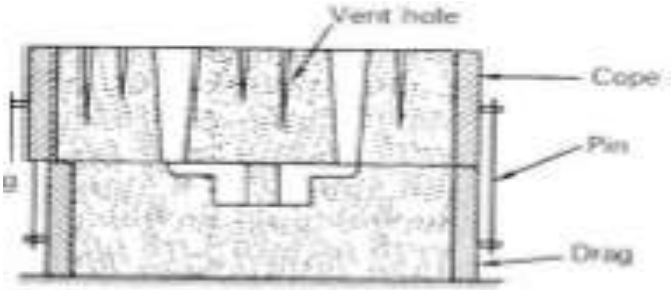
Procedure for green sand mould preparation by turn over method is as follows,

i. Suitable proportions of silica sand (85-92%), bentonite binder (6-12%), water (3-5%) and additives are mixed together to prepare the green sand mixture.
ii. The pattern is placed on a flat surface with the drag box enclosing it. Parting sand is sprinkled on the pattern surface to avoid green sand mixture sticking to the pattern.
iii. The drag box is filled with green sand mixture and rammed manually till its top surface. The drag box is now inverted so that the pattern faces the top. Parting sand is sprinkled over the mould surface of the drag box.



iv. The cope box is placed on top of the drag box and the sprue and riser pin are placed in suitable locations. The green sand mixture is rammed to the level of cope box.





Cope placed on drag & vent holes are made. Mould is ready for pouring

v. The sprue and the riser are removed from the mould. The cope box is lifted and placed aside, and the pattern in the drag box is withdrawn by rapping it carefully so as to avoid damage to the mould. Gates are cut using hand tools to provide passage for the flow of molten metal.

vi. The mould cavity is cleaned and finished. Cores, if any are placed in the mould to obtain a hollow cavity in the casting.

vii. The cope is now placed on the drag box and both are aligned with the help of pins. Vent holes are made to allow the free escape of gases from the mould during pouring. The mould is made ready for pouring.

(a) Write short notes on:

(1) Chipping **(2) Sawing**

(3) Draw filing **(4) Tapping**

(1) Chipping: It is the process of cutting unwanted metal with a cold chisel and a hammer. It is adapted when high accuracy is not required.

(2) Sawing: It is the process of cutting wood by using saw. The work should be gripped perfectly.

(3) Draw filing: It is used to produce a fine finish on a narrow surface. A smooth file is placed across the work and is then moved forward and backward.

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

(b) How files are classified? Name and explain the various types of files.

Files: The widely used hand cutting tool in workshops is the file. It is a hardened piece of high

grade steel with slanting rows of teeth.

Classification of Files

The files are classified on basis of type of cuts, grade and shapes. These are further sub classified as under

(A) Type of Cut

The most commonly used files according to cuts of teeth are

(*i*) Single, (*ii*) Double and, (*iii*) Rasp

(B) Grade of Cut

Files are cut with teeth of different grades. Those in general are

(*i*) Smooth, (*ii*) Second cut, (*iii*) Bastered, (*iv*) Rough

(C) Shape of File

Common shapes of files are having different cross sections, which cover most requirements.

Hand files

Hand files are commonly used for finishing surface work. Both faces of the file are double cut. Either both edges are single cut or one is uncut to provide a safe edge.

Flat files

Flat files are generally used for filing flat surfaces in fitting shop.

Triangular files

Triangular files are commonly used for filing corners between 60° and 90°. They are double cut on all faces.

Square files

Square files are commonly used for filing in corners in jobs. They are double cut on all sides and tapers.

Round files

Round files are generally used for opening out holes and rounding inside corners. Rough, bastard, second cut and smooth files under 15 cm in length are single cut.

Half round files

These files comprises of flat and half round sides. The flat side of half round file is used for general work and the half round side for filing concave surfaces. These files are double

cut on the flat side. The curved side is single cut, smooth or second cut.

Knife-edge files

These files are commonly used for cleaning out acute-angled corners. The two faces of these files are double cut, while the edge is single cut.

Pillar files

These files are used for finishing narrow slots. Both faces are double cut and either both edges are single cut or one is uncut to provide a safe edge of the file.

Needle files

Needle files are generally used for filling keys tooth wheels of clocks and other curved surfaces.

Mill files

Mill files are commonly used for filing half round recess and gullet of mill saw.