TED (15) - 3023

(Revision 2015)

THIRD SEMESTER DIPLOMA EXAMINATION IN MECHANICAL ENGINEERING/TECHNOLOGY

MANUFACTURING PROCESS – Answer key

Marks

PART A

I. 1) **Comparator**: Compare dimension of part with working standard; **Gauges:** Determine whether parts are made within specified limits. (1+1 = 2)

2) **Linear measuring instruments**: Steel rule, Caliper, Dividers, Micrometer, Vernier Caliper, Slip gauges, Height gauges etc. **Angular measuring instruments:** Eg. Vernier bevel protractor, sine bar, combination set etc. (½ x 4 = 2)

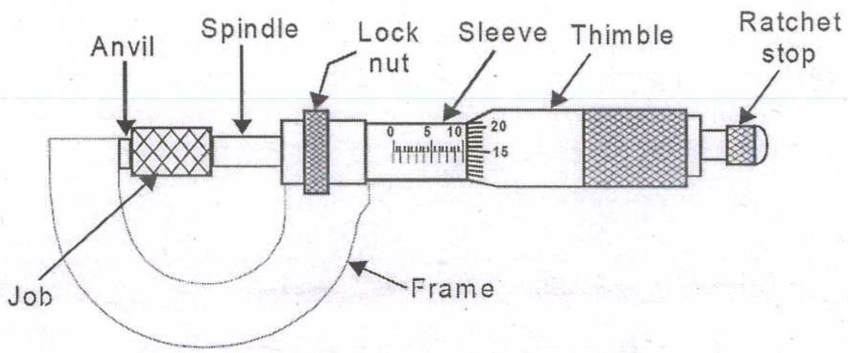
3) Protects weld pool from atmospheric contamination, Stabilize arc, Combine with impurities forming slag, Slow down cooling rate, Provide alloying elements, Good appearance ,Increase deposition and improve fluidity. (1+1=2)

4) Anvil, swage block, hand hammer & sledge hammer, tongs, chisels, swages, fullers, flatters, set hammer, punch and drift (½ x 4 = 2)

5) Fibre reinforced plastics (FRP) is a composite material made of a polymer matrix reinforced with fibres. (1x2=2)

PART B

II. 1)



- U frame consists of an anvil at one end,spindle, sleeve(barrel) and thimble on the opposite end
- Principle of working by nut and bolt assembly.Spindle is attached to the thimble and engages with a nut located within the barrel.Thimble is graduated into 50 divisions and marked 0-5-10…50.Barrel is graduated from 0 to 25 mm with 0.5 mm steps. Pitch of the micrometer is 0.5mm,i.e, in one rotation of the thimble the spindle advances by 0.5mm.Movement of one division of thimble= 0.5 x 1/50,Ie.Least Count = 0.01mm

(Fig. 3 + Exp. 3=6)

(1x6=6)

2)

PARAMETER	A.C WELDING	D.C WELDING
Efficiency	High compared to D.C	Low
Equipment cost	Low	High
Maintenance	Less	More
Rotating parts	No rotating parts. Noiseless operation	Rotating parts gives noise
Arc blow	No	Yes. Due to work piece magnetization
Stability of arc	Unstable	Stable
Electrode	Only coated Electrode	Both bare & coated
Polarity	Cannot be changed	Can be changed
Welding of thin section and nonferrous metals	Not suitable	Suitable

(1x6=6)

3)

Neutral flame: Equal amount of oxygen and Acetylene (1:1) .Flame temperature 3200^0C.It does not bring any chemical changes in the part being welded(neutral).Most used flame for welding MS, SS,Cu, Al etc and flame cutting.

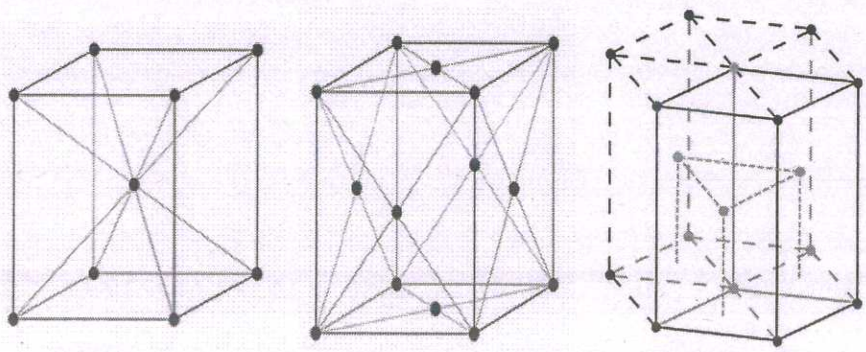
Oxidizing Flame: Excess of oxygen (1.5: 1).Burns with a loud noise.Temperature about 3300^0C.High temperature due to excess oxygen.Used for welding nonferrous alloys (Cu, Zn base alloys)

Carburizing flame: Excess of acetylene.Temperature about 3000^0C.Acetylene feather exist between the inner and outer cone. Used for welding high carbon steel and for surface hardening.

Neutral flame Oxidizing flame Carburizing flame

(2X3 =6)

4)

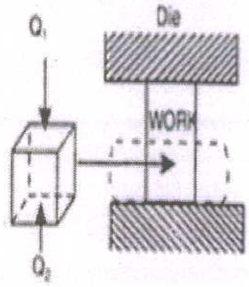


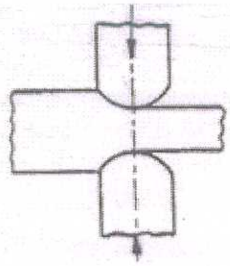
BCC FCC HCP

Body centered cubic (BCC): One atom at each corners and one at the centre of cube; **Face centered cubic (FCC):** Atoms are located at corners and at the centre of each cubic face. ; **Hexagonal close packed (HCP):** One atom at each corner of hexagon. One atom at centre of each hexagonal face (basal planes).3 atoms in the form of a triangle midway between 2 basal planes. (Exp.3 + Fig.3 =6)

5)

Upsetting: Process of increase the thickness or diameter of a material with reduction in its length; **Drawing Down**: Process of increasing the length of a bar and reduction in cross section





Upsetting Drawing down (3x2=6)

6)

a. **Permeability or Porosity**: Allows escape of gases and steam when molten metal is poured into it
b. **Refractoriness**: Ability to withstand high temperatures without fusion or any physical change
c. **Adhesiveness**: Adhering of sand to surface of moulding box for preparing cope and drag
d. **Cohesiveness**: Ability of sand particles to stick together
e. **Collapsibility:** Ability to automatically collapse after solidification of casting
f. **Plasticity or Flowability**: Sand flows during ramming to all portions of the moulding flask and packs around the pattern (1x6=6)

7)

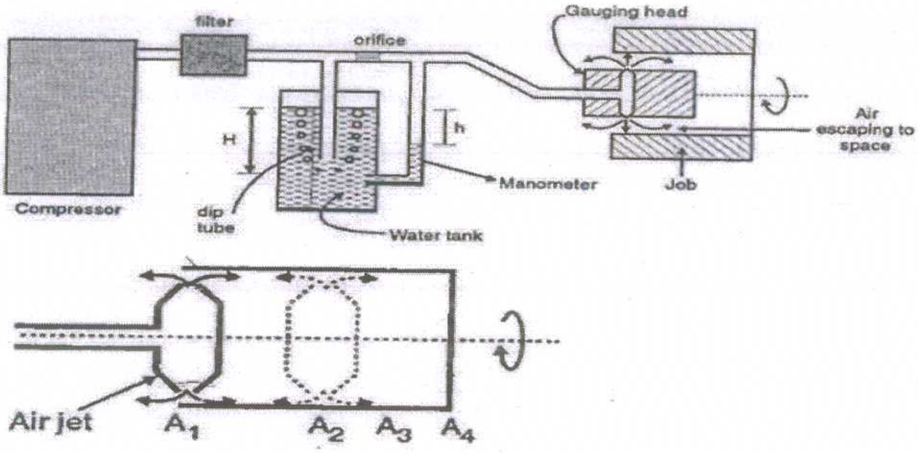
Runner: Passage provided in large castings through which molten metal is carried from sprue base to gates

Risers: Provide extra metal to compensate for the volumetric shrinkage, Allow mould gases to escape, Promotes directional solidification, Applies sufficient feeding pressure so that mould is completely filled (2+4=6)

PART C

III. a)

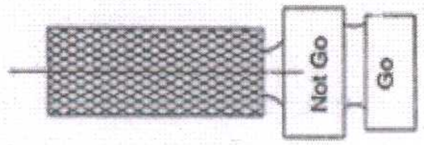
When there is no restriction to the escape of air through gauging head, the level of water in the manometer tube will coincide with that in the cylinder. If there is any restriction to escape of air, a back pressure will be induced in the circuit and level of water in the manometer tube will fall. Restriction to the escape of air depends upon the variation in the dimension to be measured which can be read from a scale provided with manometer.



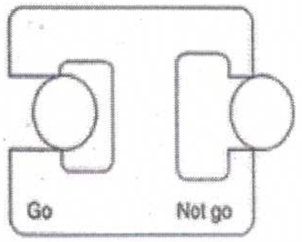
(Fig. 4+ Exp. 4=8)

b)

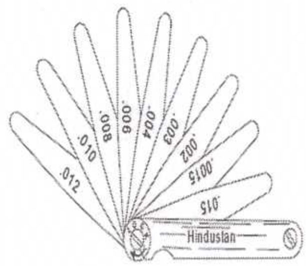
Plug Gauge: Check accuracy of holes
Snap Gauge: checking external dimensions such as diameter and thickness of a part.
Feeler Gauge: checking clearance between two mating parts



Plug gauge



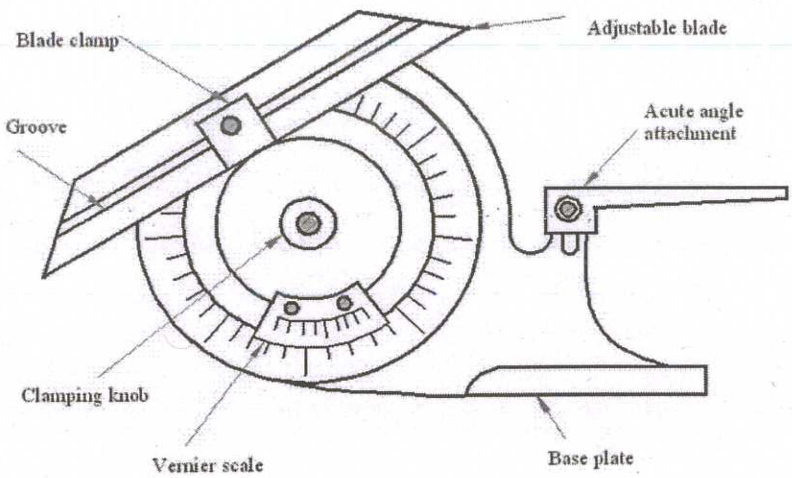
Snap Gauge



Feeler Gauge

(3x2=6)

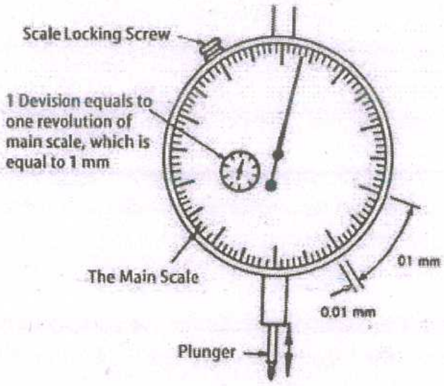
IV.a)



It consists of a base plate attached to the main body and an adjustable blade which is attached to a circular plate containing vernier scale. The adjustable blade along with circular plate containing vernier can rotate freely about the centre of the main scale and can be locked in any position. Main scale is divided in to four quadrants of 90 degree each(0° to 90°,90° to 0°,0° to 90° and 90° to 0°)Therefore each division on the main scale is 1° .12 divisions of the vernier occupy same space as 23° on the main scale. When zero of vernier scale coincide with zero of main scale, first division of vernier scale will be close to 2nd main scale division.

$LC = 2\ MSD - 1VSD = 2 - \frac{23}{12} = \frac{1}{12}^{\circ} = \frac{1}{12}^{\circ} \times 60 = 5'$ (Fig. 4 + Exp.4 =8)

b. Upward movement of the plunger is converted into rotary movement of the pointer .The dial is divided into 100 equal divisions.For 1mm linear travel of plunger, bigger arm turns through one complete revolution.So each division on the dial indicates a movement of .01 mm.The smaller arm register the number of full turns made by the bigger arm.



(Fig. 4 +Exp. 3 = 7)

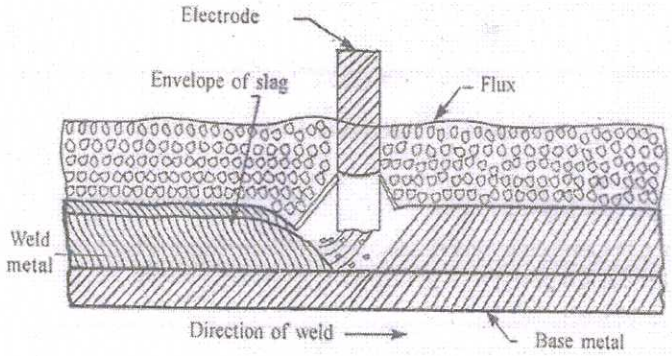
V. a)

Welding	Soldering	Brazing
Weld is made by application of heat with or without application of pressure and filler material	Joint is made by heat and a filler material whose melting temperature(450^{0}C) is lower than melting point of the metals to be joined	Joint is made by heat and filler material whose melting temperature is above 450^{0}C but less than melting point of the metals to be joined
Base metal also melt to form joint	Base metal do not melt to form joint	Base metal do not melt to form joint
Filler material (welding rod) is added to fill the joint	Soldering material(solder) is the filler material	Brazing material (spelter) is the filler material
Composition of filler material is same as base material	Composition different	Composition different
Strength of welded joint is higher than soldering and brazing	Least compared to welding and brazing	Strength higher than soldering but less than welding
Used for welding structural members	Used for connection in electronic instruments	Used for brazing fins of car radiator, heat exchanger, carbide tips on tools

(4x2 = 8)

b)

Arc is struck between a continuous, automatically fed consumable bare metal electrode and work piece under a heap of granular flux. The arc and molten weld pool is submerged under the flux and there is no sign of arc.The flux serves as a shield and protects the molten weld pool from atmospheric contamination.



(Fig. 4 +Exp. 3=7)

VI. a)

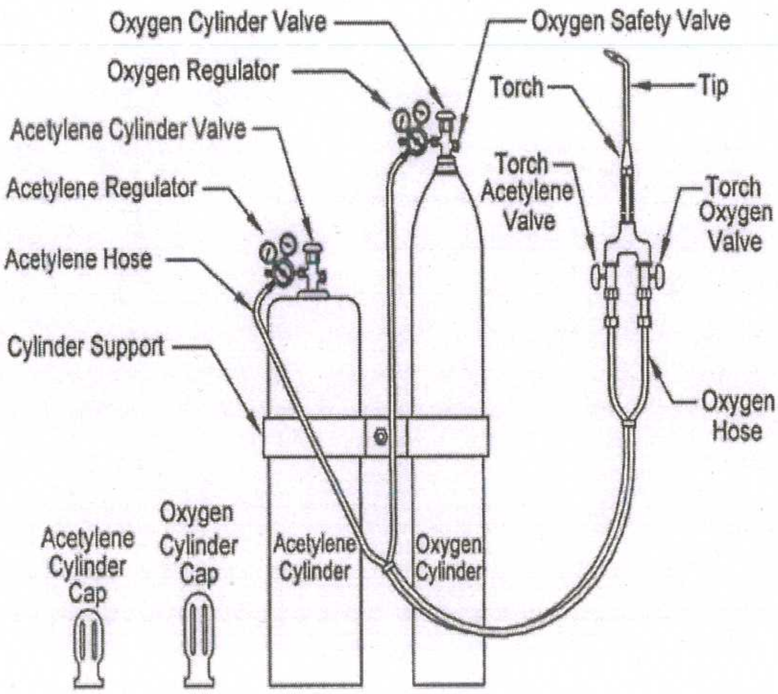
Advantages

Produces permanent joint,Equipment are cheap and portable,Large number of similar and dissimilar metals/alloys can be welded,Welding operation can be mechanized,Good weld is strong as base metal,Welding permits considerable freedom in design

Limitations: Welding results in residual stresses and distortion of work pieces, Edge preparation is necessary, Produces metallurgical changes and hence stress relief heat treatment is needed,Gives off harmful radiations, fumes and spatter,Skilled welder is essential for good welding

(1x4+1x4 =8)

b)



(Fig. 3 + Label 4=7)

VII. a)

Hot working	Cold Working
Working of metal above recrystallization temperature.	Working of metal below recrystallization temperature.
Less force is required for deformation	Bulk deformation is not possible
Equipment of lesser power needed	Large force is required for deformation
No residual stress	Heavier and powerful equipment needed
No strain hardening	Residual stress introduced
Grains are refined	Strain hardening occurs
Porosities and blow holes are eliminated	Grains are distorted
Metal is lost due to oxidation and scaling .Low surface finish	No loss of metal. Good surface finish
Handling is difficult due to higher temperature of working	Easier to handle cold parts
Low dimensional accuracy	High dimensional accuracy
Thin parts cannot be produced	Thin sections can be produced(.002 mm)
Metal is lost due to oxidation and scaling .Low surface finish	No loss of metal. Good surface finish

(1x8 = 8)

b)

Work hardening or Strain hardening

When material is cold worked, there will be an increase in dislocations which will interact with other moving dislocations. The interacting dislocations lead to decrease in their mobility and hence material get strengthened.

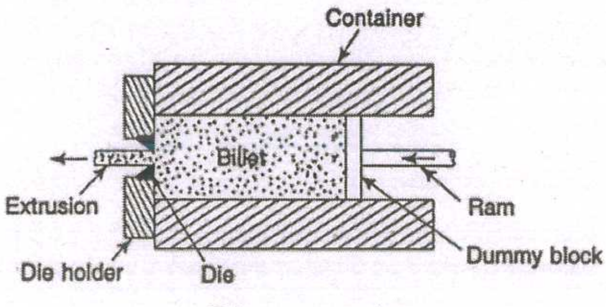
Solid Solution hardening

Strengthening and hardening of metals by alloying with impurity atoms to form substitutional or interstitial solid solution. This increases the force needed to move the dislocation and thus the strength get increased. (3 ½ x 2 = 7)

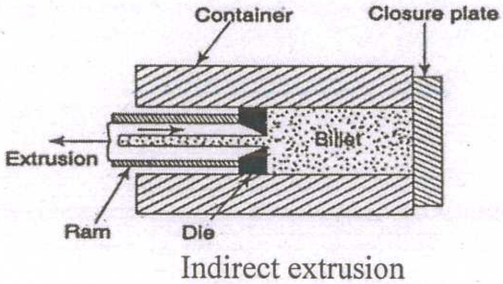
VIII. a)

Direct Extrusion or Forward Extrusion: Metals flows in the same direction as the movement of ram

Indirect Extrusion or Backward extrusion: Metal flows in the opposite direction to the movement of ram.



Direct extrusion

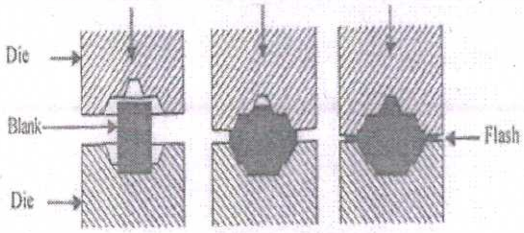


Indirect extrusion

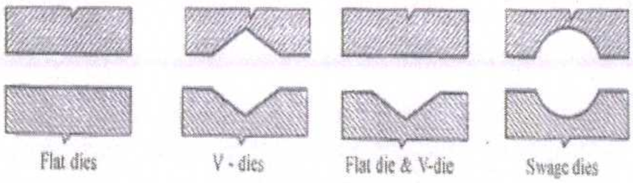
(Fig. 3 + Exp. 1) x 2 = 8

b)

1. Open die forging: Metal shaped between two flat dies or dies with grooves of simple shape
2. Closed (impression) die forging: Cavities or impression are cut in die blocks (top and bottom dies) in which metal are forced to takes its final shape and dimensions



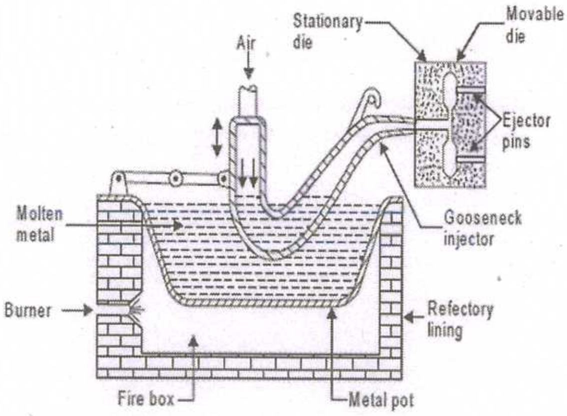
Closed die forging



Types of dies used in open die forging

(Fig 2.5+ Exp1)x2 = 7

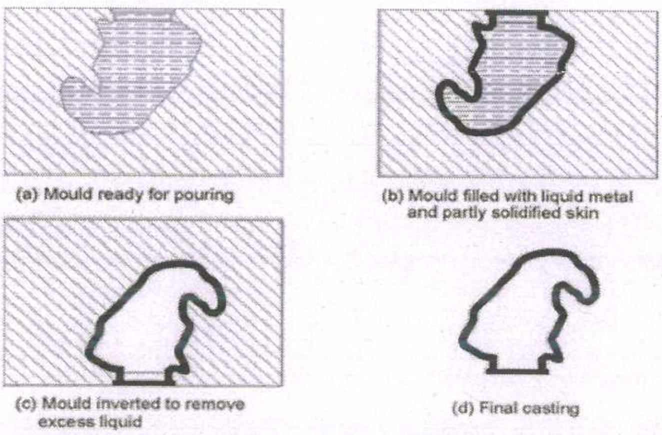
IX.a)



Molten metal is forced into the die cavity at a pressure of 30 to 45 bar. Provided with suitable mechanism to raise or lower the gooseneck. When gooseneck is lowered it receives the molten metal from the pot. Then it is raised and held in position against nozzle. Compressed air is blown in to the gooseneck which forces the metal to fill the die cavity. After solidification casting is ejected

(Fig 4.5 + Exp. 3.5 =8)

b)



Used to produce hollow parts without the use of cores. Molten metal is poured into the metallic mould .After desired thickness of solidified skin is obtained the mould is inverted and remaining liquid metal is poured out. Thickness of casting depends upon the time for which metal is allowed to retain in mould.

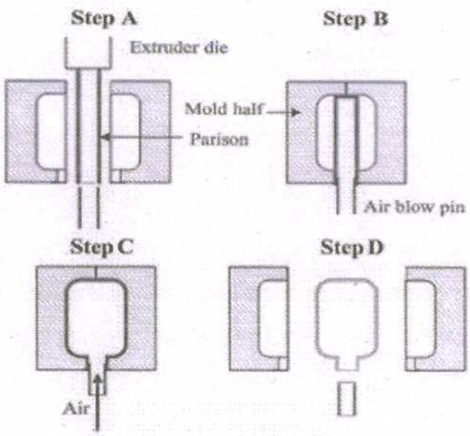
(Fig. 4 + Exp. 3=7)

X. a)

1. Shrinkage (contraction) allowance: To compensate for volumetric contraction during solidification of metal.
2. Draft or Taper allowance: Allowance given for easy removal of pattern from sand without damaging mould cavity.
3. Machining allowance: Allowance given to provide compensation during machining to remove surface roughness and other imperfections from casting.
4. Distortion (camber) allowance: For casting having irregular shape or uneven thickness, the contraction is not uniform throughout; will tend to wrap or distort during cooling. Distortion can be practically eliminated by constructing the pattern initially distorted in opposite direction.
5. Shake or rapping allowance: When pattern is rapped or shaked before it is withdrawn, the mould cavity is slightly enlarged. A negative allowance is provided by making the pattern slightly smaller in size to compensate for this.

(Listing 2.5 +Exp. 5.5=8)

b)



First, a parison, or length of polymer tubing, is extruded. Parison is placed in a two-piece mold having the desired shape. The tube is inflated so that it takes the shape of the mold cavity. Mold is opened to remove the solidified part.

(Fig. 4 +Exp. 3=7)