278

April-24 Version A

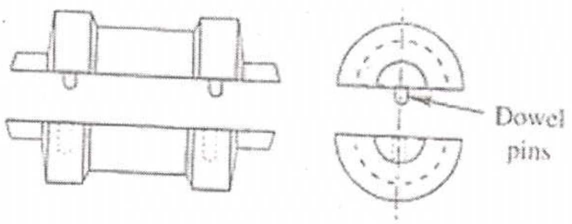
Pageno - 16

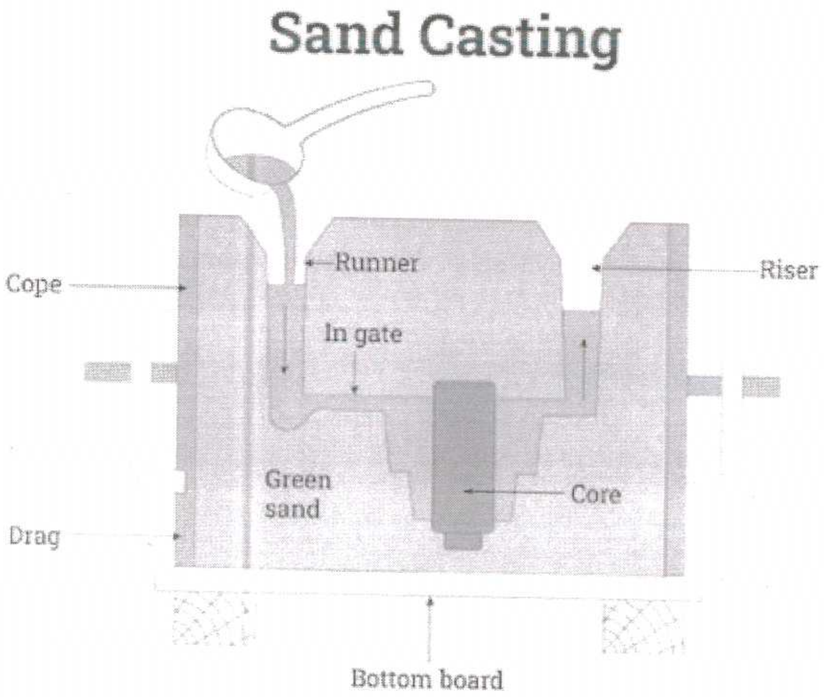
SCORING INDICATOR

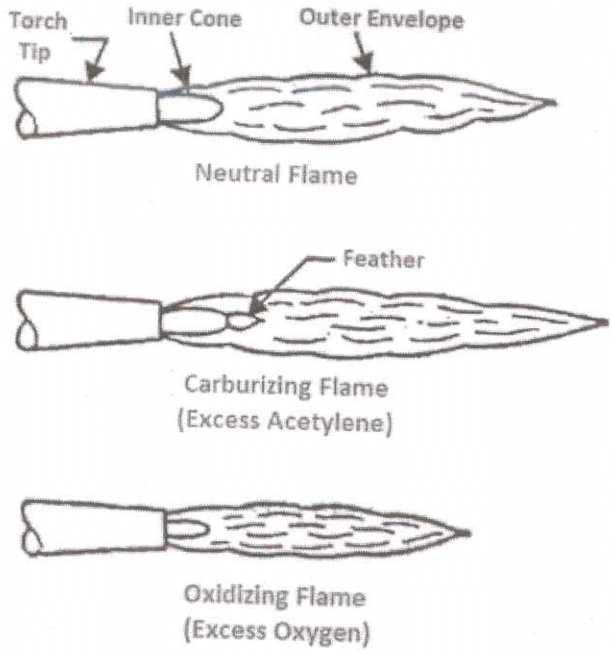
COURSE NAME :

COURSE CODE : QID : A

Q No	Scoring Indicators	Split score	Sub Total	Total score
	PART A			9
I. 1	**Define the hardness of material** ➢ Ability of the material to withstand wear and tear is known as hardness		1	
I. 2	**Define gating system** ➢ All channels or passageways through which the molten metal is delivered to the mould cavity is called gating system		1	
I. 3	**Define recrystallization temperature** ➢ Recrystallization is defined as the process in which grains of a crystal structure come in a new structure or new crystal shape ➢ The temperature at which recrystallization is taking place is known as recrystallization temperature		1	
I. 4	**Name the different process of powder metallurgy** ➢ Powder manufacturing (Any 2) ➢ Mixing and blending ➢ Compacting ➢ Sintering		1	
I. 5	**Write the difference between soldering and brazing** ➢ The only difference between soldering and brazing is the temperature at which each process takes place. ➢ Soldering takes place at a temperature below 840°F (450°C), and brazing occurs at a temperature above 840°F (450°C)		1	
I. 6	**What are the functions of flux** (Any 2) ➢ Assist arc striking and stability ➢ To form a slag that will protect and shape the weld bead ➢ To form a gas shield to protect the molten filler metal being projected across the arc gap		1	

	➢ To react with the weld pool to provide clean high quality weld metal with the desired properties ➢ To deoxidise the weld pool ➢ To provide deoxidants			
I. 7	**Name different type of welded joints** ➢ Butt joint welding. ➢ Tee joint welding. ➢ Corner joint welding. ➢ Lap joint welding. ➢ Edge joint welding (Any 2)		1	
I. 8	**Name any ~~four~~ 2 press working operation** 1. Shearing Operation 2. Cutting-Off Operation 3. Parting Operation 4. Blanking Operation 5. Punching Operation 6. Notching Operation (Any 2)		1	
I. 9	**What are the types of hammer used in smithy** ➢ Ball peen hammer ➢ Cross peen hammer ➢ Straight peen hammer ➢ Sledge hammer ➢ Set hammer (Any 2)		1	
	PART B			24
II. 1	**What are the advantages of casting** ➢ Casting can produce very complex geometry parts with internal Cavities. ➢ It can be used to make small (few hundred grams) to very large size part (thousand of kilograms). ➢ .Any intricate shape can be Produced. ➢ Any Material can be cast ferrous & non-ferrous. ➢ It is economical,with very little wastage: the extra metal in each casting is re-mental and re-used. ➢ Certain metals & alloys are produced only by castings.		3	
II. 2	**Write short notes on Split pattern** 		3	

	➢ These patterns are split along the parting plane (which may be flat or irregular surface) to facilitate the extraction of the pattern out of the mould before the pouring operation. ➢ For a more complex casting, the pattern may be split in more than two parts	Figure=1 mark Explanation=2 marks		
II. 3	**Draw the schematic diagram of sand casting process**  	3	3	
II. 4	**Mention any three application of powder metallurgy** ➢ To produce a porous product and Babbitt bearing for automobiles. ➢ To produce oil pump gears for automobiles. ➢ Used for production of cutting tools, wire drawing dies and deep drawing dies. ➢ To produce refractory metal composites	1 mark each	3	
II. 5	**Define hot working process and name different hot working operations** Mechanical working carried out above recrystallization temperature is known as hot working operations		3	

<table>
<tr><td></td><td>Different hot working operations are
1. Hot rolling.
2. Hot spinning.
3. Extrusion.
4. Forging.
5. Drawing.
6. Rotary piercing.</td><td>Definitio n = 1mark Name of operation s =2 marks</td><td></td><td></td><td></td></tr>
<tr><td>II. 6</td><td>Draw the schematic diagram of different oxy acetylene flames


Oxy-acetylene Gas Flame</td><td>1 mark each</td><td>3</td><td></td><td></td></tr>
<tr><td>II. 7</td><td>Describe resistance welding
➢ Resistance Welding is a welding process, in which work pieces are welded due to a combination of a pressure applied to them and a localized heat generated by a high electric current flowing through the contact area of the weld.
➢ Heat produced by the current is sufficient for local melting of the work piece at the contact point and formation of small weld pool ("nugget").
➢ The molten metal is then solidifies under a pressure and joins the pieces.
➢ Time of the process and values of the pressure and flowing current, required for formation of reliable joint, are determined by dimensions of the electrodes and the work piece metal type.</td><td>3</td><td>3</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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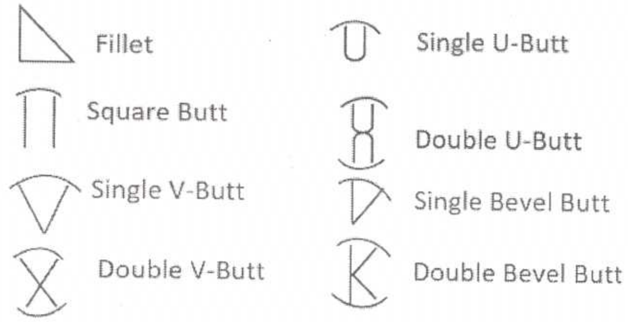
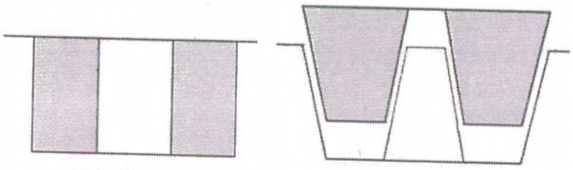
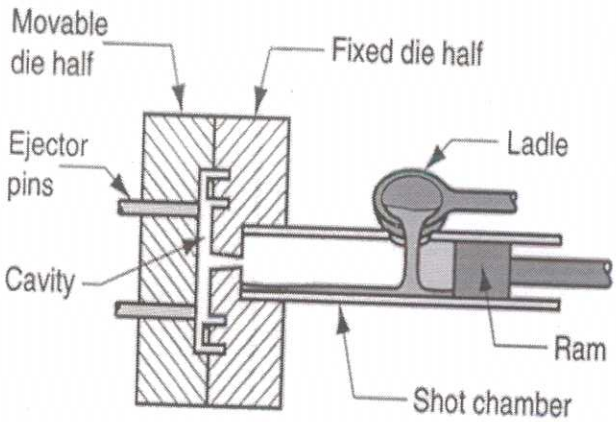
II. 8	**Draw any six welding symbol**  	0.5 mark each	3	
II.9	**Differentiate between hot chisel and cold chisels used in smithy shop** **Hot chisel** ➢ Hot chisel chisel is thinner in section with a slightly convex cutting edge of included angle of 30 ° **Cold chisel** ➢ The cold chisel is forged thick and cutting edge is hardened and tempered with an included angle of about 60°	1.5 marks each	3	
II.10	**State the functions of fullers ,flatters and swage block** **Fuller** ➢ They are used for necking down, shouldering and for making grooves in hot metal **Flatters** ➢ It is used fro leveling and finishing after drawing out or any other forging operation **Swage block** ➢ It is used for squaring sizing, heading, bending and forming operation	1 mark each	3	
	PART C			42
III. 1	**Name the allowances generally given to a pattern and explain each allowances** Allowances are given on pattern to compensate any structural or dimensional change that will happen during casting **1.Shrinkage or contraction allowance:** ➢ The various metals used for casting contract after solidification in the mould.			

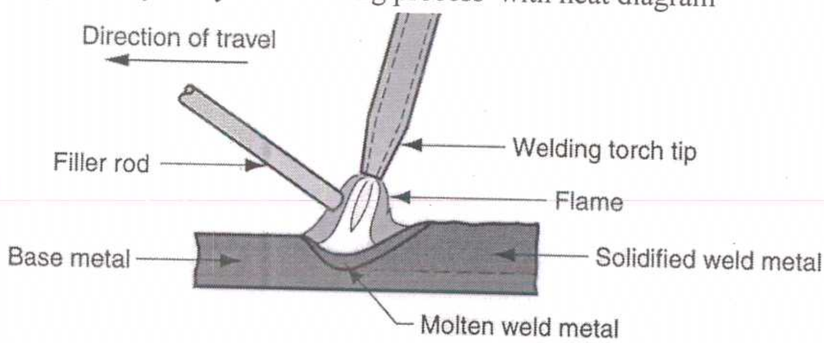
	➢ Allowances provided on pattern material to compensate contraction is known as shrinkage allowances ➢ Since the contraction is different for different materials, therefore it will also differ with the form or type of metal **2. Draft allowance** ➢ It is a taper which is given to all the vertical walls of the pattern for easy and clean withdraw of the pattern from the sand without damaging the mould cavity.  **3. Finish or machining allowance** ➢ The allowance is provided on the pattern if the casting is to be machined. **4. Distortion or camber allowance** ➢ This allowance is provided on patterns used for casting of such design in which the contraction is not uniform throughout. **5.Rapping or shaking allowance** ➢ This allowance is provided in the pattern to compensate for the rapping of mould because the pattern is to be rapped before removing it from the mould.`	Explanation 5 marks Figure =2 marks	7	7
III. 2	**What are the properties of good molding sand? Explain each properties in detail.** **1 Adhesiveness** ➢ Adhesiveness is a property of molding sand to get the stick or adhere to foreign material such as sticking of molding sand with the inner wall of molding box. **2 Cohesiveness** ➢ Cohesiveness is property of molding sand by virtue which the sand grain particles interact and attract each other within the molding box . **3 Collapsibility** ➢ After the molten metal in the mould gets solidified, the sand mould must be collapsible so that free contraction of the metal occurs and this would naturally avoid the tearing or cracking of the contracting metal. ➢ In absence of collapsibility property the contraction of the metal is hindered by the mold and thus results in			

	tears and cracks in the casting. This property is highly required in cores. **4 Dry strength** ➢ As soon as the molten metal is poured into the mould, the moisture in the sand layer adjacent to the hot metal gets evaporated and this dry sand layer must have sufficient strength to its shape in order to avoid erosion of mould wall during the flow of molten metal. ➢ The dry strength also prevents the enlargement of mould cavity cause by the metallostatic pressure of the liquid metal **5 Flowability or plasticity** ➢ Flowability or plasticity is the ability of the sand to get compacted and behave like a fluid. It will flow uniformly to all portions of pattern when rammed and distribute the ramming pressure evenly all around in all directions. **6 Green strength** ➢ Sand with moisture is green sand and its property to retain shape of mould is green strength **7 Permeability** ➢ Permeability is also termed as porosity of the molding sand in order to allow the escape of any air, gases or moisture present or generated in the mould when the molten metal is poured into it. ➢ All these gaseous generated during pouring and solidification process must escape otherwise the casting becomes defective. ➢ The extent of ramming of the sand directly affects the permeability of the mould. ➢ Permeability of mold can be further increased by venting using vent rods. **8 Refractoriness** ➢ Refractoriness is defined as the ability of molding sand to withstand high temperatures without breaking down or fusing thus facilitating to get sound casting.	1 mark each	7	7
III. 3	**Explain the mechanical properties associated with engineering materials** ➢ **Strength** It is the property of a material which opposes the deformation or breakdown of material in presence of external forces or load.			

	➢ **Toughness** It is the ability of a material to absorb the energy and gets plastically deformed without fracturing. ➢ **Hardness** It is the ability of a material to resist to permanent shape change due to external stress. There are various measure of hardness – Scratch Hardness, Indentation Hardness ➢ **Brittleness** Brittleness of a material indicates that how easily it gets fractured when it is subjected to a force or load. ➢ **Malleability** Malleability is a property of solid materials which indicates that how easily a material gets deformed under compressive stress. ➢ **Ductility** Ductility is a property of a solid material which indicates that how easily a material gets deformed under tensile stress.	One mark each	7	7
III. 4	**What are the common materials used for pattern making. Explain each material and also mention advantages and disadvantages of each** __Wood__ It is the most __common__ material used for pattern making because of the following __Advantages__: (i) It is cheap and available in abundance. (ii) It can be easily shaped into different forms and intricate designs. (iii) Its manipulation is easy because of lightness in weight. iv) Good surface finish can be easily obtained by only planning and sanding. __Disadvantages__ (i) It wears out quickly due to its low resistance to sand abrasion. (ii) It is very susceptible to moisture, which may lead to its warping or splitting. ➢ (iii) Its life, owing to the above reasons, is short as compared to other pattern materials. __Metals :__ ➢ Metals are used with advantage, as pattern material, only when the number of castings to be made is very high and a closer dimensional accuracy is desired.			

	Advantages 1. They have a much longer life than wooden patterns and eliminate the inherent disadvantages of wood to a great extent. 2. 2.High dimensional accuracy 3. Does not absorb moisture and do not change their shape and size. **Disadvantages:** (i) They are costlier than wood and, therefore, cannot be used with advantage, where a smaller number of castings is to be made. (ii) Most of them are very heavy and in case of large castings the weight of the pattern always poses a problem in its manipulation. (iv) A large number of them have a tendency to get rusted **Plaster of parris** ➢ Plaster of parris or Gypsum is used in making small patterns and core boxes involving intricate shapes and closer dimensional control **Advantages:** ➢ Plaster of Paris or gypsum cement is advantageously used as a pattern material since it can be easily casted into intricate shapes and can be easily worked also. **Disadvantages :** ➢ A marked feature of this cement is that contrary to the action of metals, it expands on being solidified. **Plastics :** ➢ The plastics used as pattern materials are thermosetting resins. ➢ For making the pattern, first the moulds are made, usually from plaster of Paris. ➢ The resin is then poured into these moulds and the two heated. At a specific temperature, the resin solidifies to give the plastic pattern. **Advantages** 1.Lightness in weight. 2. High strength. 3. High resistance to wear. 4. High resistance to corrosion due to moisture. 5. Fine surface finish. **Wax :** ➢ Wax patterns are exclusively used in investment casting. ➢ For this a die or metal mould is made in two halves into which the heated wax is poured.	One mark each	7	7

	➢ The die is kept cool by circulating water around it. As the wax sets on cooling, the die parts are separated and the wax pattern taken out			
III. 5	**Sketch and describe cold chamber die casting process**  ➢ Cold chamber die casting is a type of die casting that is used for alloys with high melting temperatures ➢ As a contrast from hot chamber die casting here melting unit is separate . ➢ Molten metal is ladled from the furnace into the shot chamber through a pouring hole ➢ The plunger forces metal through the shot chamber into the die at pressures ranging from 2,000 and 20,000 psi. ➢ The plunger holds the pressure and retracts after solidification.	Figure = 4 marks Explanation = 3 marks	7	7
III. 6	**What is powder metallurgy?. Describe the basic steps in powder metallurgy** ➢ Powder metallurgy is a manufacturing process that produces precision and highly accurate parts by pressing powdered metals and alloys into a rigid die under extreme pressure **Four Basic Steps of Powder Metallurgy** **Powder Preparation** ➢ Properties of products produced using powder metallurgy are dependent on the characteristics and properties of the powder. ➢ One of the processes used to produce powder for powder metallurgy is melt atomization.			

	➢ In this process, liquid metal is broken into tiny droplets that cool and solidify into minute particles. **Mixing and Blending** ➢ In the mixing and blending process, powders are combined with other powders, binders, and lubricants to ensure the final part has the necessary characteristics. ➢ Blending and mixing can be completed wet or dry depending on the type of powder metallurgy process and the requirements of the part. **Compacting** ➢ Compacting involves pressing and compressing the powder mixture into the desired shape or die. ➢ When done properly, compacting reduces potential voids and significantly increases the density of the product. ➢ The compressed and pressured form is referred to as a green compact, an indication that the part was formed by compacting. **Sintering** ➢ Though the green compact has been stressed and pressed at extreme pressure, it is not strong enough to be used. ➢ In order to produce a permanent bond between the metal particles, the green compact is sintered or heated at high temperature. ➢ In essence, sintering produces the final usable product or part.	Definition 2 marks Steps 4 marks	7	7
III. 7	Explain oxy acetylene welding process with neat diagram  ➢ **Oxyacetylene Welding** is a <u>Gas Welding</u> process using a combustion mixture of acetylene (C_2H_2) and oxygen (O_2) for producing gas welding flame. ➢ Filler rod is used when an additional supply of metal to weld is required. <u>Shielding flux</u> may be used if protection of weld pool is necessary ➢ Oxyacetylene flame has a temperature of about 6000°F (3300°C). Combustion of acetylene proceeds in two stages: 1. Inner core of the flame. $C2H2 + O2 = 2CO + H2$	Figure = 4 marks Explanation = 3 marks	7	7

2. Outer envelope of the flame: $CO + H2 + O2 = CO2 + H2O$

III. 8

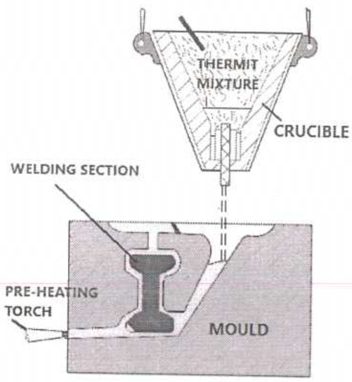
Compare between welding soldering and brazing

Welding	Brazing	Soldering
Base metal fused	Base metal doesn't fused	Base metal doesn't fused
High Temp , High power	Low Temp , Low power	Low Temp , Low power
High distortion	Low distortion	No distortion
High stresses in joints	Low stresses in joints	Low stresses in joints
Mictrostucture of base metal change	Base Metal Microstructure no change	Base Metal Microstructure no change
Dissimilar metals difficult to join	Dissimilar metal easy to join	Dissimilar metal easy to join
Thin sheet difficult to weld	Thin sheet can be joined	Thin sheet can be joined
High strength of joints	Low strength of joints	Low strength of joints
Tensile strength > 200 MPa	Tensile strength 100~150 Mpa	Tensile strength <75MPa

One mark each | 7 | 7

III. 9

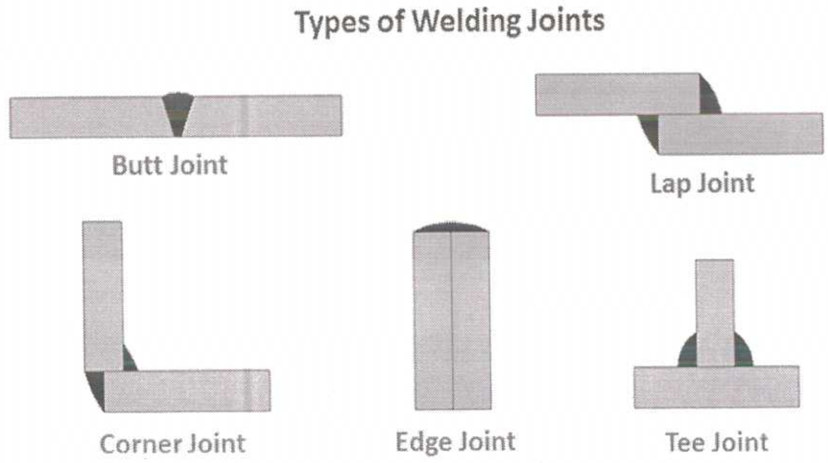
Describe Thermit welding and Mention its advantages and disadvantages



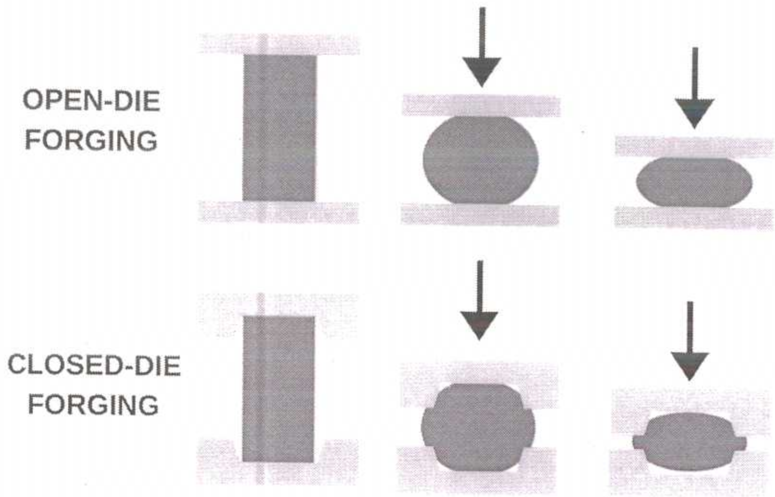
- **Thermit Welding** is a welding process utilizing heat generated by exothermic chemical reaction between a mixture of a metal oxide and aluminum powder.
- The proportion of Aluminium oxide to iron powder is 3:1
- The combustion reaction products (iron and aluminum oxide) heat up to 4500°F (2500°C). Liquid iron fills the sand (or ceramic) mold built around the welded parts, the slag (aluminum oxide), floating up , is then removed from the weld surface.

  $8Al + Fe_3O_4 = 9Fe + 4Al_2O_3 + heat$
- Thermit Welding is used for repair of steel casings and forgings,for joining railroad rails, steel wires and steel pipes, for joining large cast and forged parts

Figure = 4 marks
Explanation = 3 marks | 7 | 7

III. 10	**With diagrams explain types of joints in Arc welding**  **Butt Joint** ➢ The joint which is formed by placing the ends of two parts together is called butt joint **Corner Joint** ➢ The joint formed by placing the corner of two parts at right angle is called corner joint (see fig above). Two parts which is going to be weld with corner joint forms the shape of L **T-Joint** ➢ The joint which is made by intersecting two parts at right angle (i.e at 90 degree) and one part lie at the centre of the other. **Lap Joint** ➢ The lap joint is formed when the two parts are placed one over another and than welded (see fig above). It may one sided or double sided. ➢ This types of welding joints are mostly used to join two pieces with different thickness. **Edge Joint** ➢ The joint formed by welding the edges of two parts together are called edge joint. This joint is used where the edges of two sheets are adjacent and are approximately parallel planes at the point of welding	Figure = 4 marks Explanation= 3 marks	7	7
III. 11	**Explain different forging operations** **1. Cutting Operation** To make small of long metal rods and plates is known as cutting. This can be done both in cold or hot condition			

	2. Upsetting Operation This operation applied to increase the cross-sectional area of the stock over the length extension. The offsetting force is used in a direction parallel to the long axis to achieve the length, for example, the development of the bolt head. **3. Drawing Out Operation** To increase metals length is called Drawing out. The metal is heated and the hammer is struck at the beak of the anvil. **4. Jumping Operation** To shorten and thicken a piece of metal after heating it is called jumping or upsetting. By jumping the length of the metal can be reduced to almost half **5.Bending Operation** To turn or bend a piece of metal in round or angular form is called "bending". This has been shown in the figure below. Round rings etc. are made through this operation. **6.Punching Operation** The hole is made in hot metal with the help of a punch. For punching, the job is first placed on the punch hole of the anvil or a nut etc., and the hole is made with punch	One mark each	7	7
III. 12	**Explain open die forging and closed die forging** **Open-Die Forging** ➢ Open die forging is the art of shaping metal by hammering or pressing it between flat or simple contour dies, while manipulating the hot work-piece between each stroke of the equipment. ➢ Since the metal tends to flow equally in all directions away from the high point of pressure, and is not physically confined by a cavity in a die, the process is termed to be "open die forging" as opposed to "closed" or "impression die" forging. **Closed-Die Forging** ➢ In a closed-die (also called impression-die) process, the dies allow for excess material to be used and the material is forced to certain areas between the dies. ➢ This excess material is called flash. The flash that is extruded between the dies can be costly and, therefore, needs to be minimized.			

	➢ However, flash has a vital use in that without this relief area, the pressure in the cavity could become too high. This could result in the reduction of die life or even the catastrophic failure of the die for forge machine component. ➢ Our die design engineers control the flash area design in such a way as to aid and enhance the flow of the metal. This metal then fills the die impression to maximizing die strength and lifetime.  	Figure = 4 mark Explanation = 3 marks	7	7

BLUE PRINT

Mark Distribution

Module	Hr / Module	hi / $\sum$Hi) * 123	TYPE OF QUESTIONS							
			PART A		PART B		PART C		TOTAL	
			No of Questions	Marks	No of Questions	Marks	No of Questions	Marks	No of Questions	Marks
I	11	32	2	2	3	9	4	28	**9**	**39**
II	10	29	2	2	2	6	2	14	**6**	**22**
III	12	34	3	3	3	9	4	28	**10**	**40**
IV	10	28	2	2	2	6	2	14	**6**	**22**
Total	**43**	**123**	**9**	**9**	**10**	**30**	**12**	**84**	**31**	**123**

Cognitive Level Wise Question Analysis

Mark Distribution

Cognitive Level	% Marks	Marks	TYPE OF QUESTIONS							
			PART A		PART B		PART C		TOTAL	
			No of Questions	Marks	No of Questions	Marks	No of Questions	Marks	No of Questions	Marks
R	20	23	7	7	3	9	1	7	**11**	**23**
U	80	100	2	2	7	21	11	77	**20**	**100**
A	0	0	0	0	0	0	0	0	**0**	**0**
Total	**100**	**123**	**9**	**9**	**10**	**30**	**12**	**84**	**31**	**123**