



**DEPARTMENT OF MECHANICAL ENGINEERING
ME 3393 MANUFACTURING PROCESS
UNIT- I METAL CASTING PROCESSES**

PART A (2 MARKS)**1. State any four types of patterns. (Nov/Dec 2019)**

- a. Single piece or solid pattern
- b. Two piece pattern
- c. Loose piece pattern
- d. Cope and Drag pattern
- e. Gated pattern

2. Write the requirements of good pattern. (Nov/Dec 2017)

- a. Cheap and readily available
- b. Light in mass
- c. Have high strength
- d. Should not react with moisture

3. What is the function of core (April/May 2019)

- a. Core provides a means of forming the main internal cavity for hollow castings.
- b. Core provides external undercut feature
- c. Core can be inserted to obtain deep recesses in the casting.

4. What are all the functions of core prints. (Nov/Dec 2018)

- a. Core prints are basically extra projections provided on the pattern
- b. They form the core seats in the mould when the pattern is embedded in the sand for mold making
- c. Core seats are provided to support all the type of core.

5. Mention the specific advantages of CO2 moulding process. (Nov/Dec 2019)

- a. Gives strength and hardness to core
- b. Process cost is less
- c. It saves time on heating

6. Define AFS grain- fineness number. (April/May 2018)

It is defined as the ratio between the total products and total percentage of sand retained on pan and each sieve. $\text{AFS grain fineness number} = \frac{\text{sum of products}}{\text{total sum of the \% of sand retained on pan and each sieve.}}$


7. Classify moulding Machines. (April/May 2017)

- a. Squeezer Machine
- b. Jolt Machine
- c. Sliding machine
- d. Pattern draw machine

8. Define mould and loam moulding. (Nov 2013, May 2016)

When the pattern is removed, a cavity corresponding to the shape of the pattern remains in the sand which is known as mould or mould cavity. In this, a rough structure of component is made by hand using bricks and loam sand. The sand used is known as loam sand or loam mortar.

9. Define pattern. List the allowances of pattern. (May 2014)

Pattern is defined as a model or replica of the object to be cast. A pattern exactly resembles the casting to be made except for the various allowances.

The following allowances are provided on the pattern :

- Shrinkage or contraction allowance
- Machining allowance
- Draft or taper allowance
- Distortion allowance
- Rapping or shake allowance

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10. Explain in short shell moulding. (Dec 2014)

Shell moulding is suitable for thin walled articles. It consists of making a mould that has two or more thin shell like parts consisting of thermosetting resin bonded sand.

11. Explain the term fettling. (Dec 2009)

Fettling is the name given to cover all those operations which help the casting to give a good appearance. It includes the removal of cores, sand, gates, risers, runners and other unwanted projections from the casting.

PART – B & C

1. How are the patterns classified? Describe any two types with sketches and state the uses of each of the. (Nov/Dec 2016)
2. Enumerate the casting defects and suggest suitable remedies. (Nov/Dec 2016)
3. Explain the properties required for moulding sand? Explain the preparation of moulding sand process. (April/May 2015), (Nov/Dec 2016)
4. Explain any one type of centrifugal casting. Name any five casting defects and explain the remedies. (April/May 2015)
5. Briefly explain the carbon dioxide CO₂ moulding process and state two important merits and demerits. (May/June 2006)



6. Explain the Centrifugal casting process (May/June 2007)
7. List any eight casting defects, their causes and remedies (April/May 2017, 2008)
8. Give the sequence of step in pressure die casting process. (Nov/Dec 2018)
9. Describe the operation of a cupola furnace for melting cast iron. (Nov/Dec 2009)

UNIT – II METAL JOINING PROCESS

PART A (2 MARKS)

1. **List out any four arc welding equipment. (May 2016)**

Ans: The most commonly used equipments for arc welding are as follows:

- (a) A.C or D.C. machine
- (b) Wire brush
- (c) Cables and connectors
- (d) Ear thing clamps
- (e) Chipping hammer

2. **Define resistance welding process. (May 2006, May 2017)**

Ans: Resistance welding is a process where coalescence is produced by the heat obtained from resistance offered by the workpiece to the flow of electric current in a circuit of which the workpiece is a part and by the application of pressure.

3. **What is the purpose of flux? (May 2019)**

Ans:
 1) It acts as shield to weld.
 2) To prevent atmospheric reaction of molten metal with atmosphere.

4. **How can slag inclusions in welding be avoided? (May 2018)**

Ans: Avoid multi layer welding

- a. Reduce arc length
- b. Increase electrode angle
- c. Avoid using large electrode

5. **How does brazing differ from braze welding? (Dec 2018)**

Brazing	Braze Welding
The filler alloy is fed to one or more points in the assembly and it is drawn into the rest of the joint by capillary action.	The filler alloy is deposited directly at the point where it is desired.

6. **Name the types of flames.**

The generated flames are classified into following three types



- a. Neutral flame (Acetylene and oxygen in equal proportion)
 - b. Oxidizing flame (Excess of oxygen)
 - c. Reducing flame or carburizing flame (Excess of acetylene)

- 7. Explain the function of flux in welding.(May 2008, 2016, Nov 2013, 2014)**
 While welding, if the metal is heated in air then the oxygen from air combines with the metal to form oxides. This results in poor quality, low weld strength hence, to avoid this difficulty a **flux** is employed during welding. It prevents the oxidation of molten metal.

- 8. Write about special feature of flux cored welding. (Dec 17)**
 The electrode is **flux cored** i.e. flux is contained within the hollow electrode. The flux cored electrode is coiled and supplied to the arc as a continuous wire. The flux inside the wire provides the necessary shielding of the weld pool.

- 9. What is adhesive bonding? (Nov 2013)**
 Adhesive bonding is the process of joining materials by using adhesives. The term adhesive includes substances such as glues, cements and other bonding agents.
 Main steps in adhesive bonding are

(1) Surface Preparation	(2) Applying the primer
(3) Applying the adhesive	(4) Assembling adhesive coated components
(5) Curing the assembly	(6) Testing of the joints

- 10. What is thermit welding? (Nov 2012, 2013)**
 Thermit welding is a fusion welding process that makes use of the intense heat produced when a mixture containing iron oxide and powdered aluminium is ignited. It reduces iron oxide to thermit steel and slag.

- 11. Give the applications of gas welding. (May 2019)**
 Gas welding is most widely used for the following purposes:
 - a. Joining thin materials.
 - b. Joining most ferrous and non-ferrous metals.
 - c. In automobile and aircraft industries.
 - d. In sheet metal fabricating plant.

- 12. Define weld ability. (April 2018)**
 Weld ability is defined as the capacity of a material to be welded under fabrication conditions imposed in a specific and suitably designed structure and to perform satisfactorily in the intended service.

PART – B & C

1. What is a soldering flux? What different types of soldering fluxes are used?



(Nov/Dec2016)

2. Explain the spot welding process (May 2016)
3. Explain the Arc welding process and its positions (May 2014, 2015)
4. Explain the submerged arc welding process (May 2016, 2017, 2013, Nov 2015)
5. Explain the gas (Oxy Acetylene) welding process (Nov 2012, May 2010, 2015)
6. Explain the electron beam welding process with a neat sketch and the merits, limitations and applications.(May 2019)
7. Explain the features of neutral, reducing and oxidizing flames. Why is a reducing flame so called?
11. Explain the TIG and MIG system of welding. Give the applications of each. (Nov 2009, 2012)
12. Explain the types of resistance welding process giving the equipment parameters controlled and the applications. (Nov 2019, May 2014)
13. Sketch the different types of weld defects and mention how they occur. (Nov 2013)

UNIT III – METAL FORMING PROCESSES

PART A (2 MARKS)

1. What are the four major drawbacks of hot working? (May 2016)

- As hot working is carried out at high temperatures, a rapid oxidation or scale formation takes place on the metal surface which leads to poor surface finish and loss of metal.
- Due to the loss of carbon from the surface of the steel piece being worked, the surface layer loses its strength.
- This weakening of the surface layer may give rise to fatigue crack which results in failure of the part.
- Close tolerance cannot be obtained.

Hot working involves excessive expenditure on account of high tooling cost

2. What is impact extrusion? (May 2017)

The raw material is in slug form which have been turned from a bar or punched from a strip. By using punch and dies, the operation is performed. The slug is placed in the die and struck fromtop by the punch opareting at high pressure and speed.

3. What is meant by cold spinning and Hot Spinning? (May 2018)

It is the operation of shaping very thin metals by pressing against a form while it is rotating , It is carried out at room temperature.

It is the process of making circular cross section or a dish or head from circular heavy plates by spinningsheet metal.

**4. Compare hot and cold working. (May 2019)**

S. No.	Hot working	Cold working
1.	Hot working is carried out above the recrystallisation temperature but below the melting point, hence deformation of metal and recovery takes place simultaneously.	Cold working is carried out below the recrystallisation temperature and as such there is not appreciable recovery of metal.
2.	During the process, residual stresses are not developed in the metal.	During the process, residual stresses are developed in the metal.
3.	Because of higher deformation temperature used, the stress required for deformation is less.	The stress required to cause deformation is much higher.

5. Define the term extrusion ratio. (Nov 2011)

It is defined as the ratio of the cross section area of the straight billet to the final crosssectional area of the extruded section.

6. What is the purpose of rolling? (May 2018)

The main purpose of rolling is to convert larger sections such as ingots into smaller sections, which can be used directly in as rolled state or stock for working through other process.

7. What are the types of rolling mills?(Nov19)

According to the number and arrangement of the rolls, rolling mills are classified as follows:

- | | |
|---------------------------|----------------------------|
| a. Two-high rolling mill | 2. Three-high rolling mill |
| 3. Four-high rolling mill | 4. Tandem rolling mill |
| 5. Cluster rolling mill | 6. Planetary rolling mill |

8. What is the purpose of rolling ? (Nov2017)

The main purpose of rolling is to convert larger sections such as ingots into smaller sections, which can be used directly in as rolled state or stock for working through other process.

9. Which extrusion requires less force and define it. (May 2016)

As compared to direct extrusion, less total force is required in indirect extrusion.

In this type, the ram or plunger used is hollow and as it presses the billet against the back wall of the closed chamber, the metal is extruded back into the plunger.

10. What are the disadvantages of forging processes? (Dec. 2009)

- Complicated shapes cannot be produced.



- Generally used for large parts.
- Because of cost of dies, process is costly.

11. How are seamless tubes produced? (May 2008)

Seamless tubing is a popular and economical raw stock for machining because it saves drilling and boring of parts. The piercing machine consists of two tapered rolls, called as **piercing rolls**.

12. Define swaging. (May 2015)

Rotary swaging is a process of reducing the cross-sectional shape of bars, rods, tubes or wires by a large number of impacting blows with one or more pairs of opposed dies.

PART – B & C

- (i) Classify the types of rolling mills and sketch them. (May 2016, Nov 2019, 2014)
- (ii) Explain forging operations. (Nov 2012, 2013)
- List out the various forging defects (May 2006, 2015)
- Describe the indirect extrusion process for solid and hollow work piece and hydrostatic extrusion process (May 2006, 2010, Nov 2013)
- Explain hot working and cold working process (May 2013, Nov 2014)
- Explain briefly with neat sketch, direct and indirect extrusion process. (May 2008, 2015, 2016, Nov 2014)
- What is shape rolling? Mention the products of shape rolling and explain the production of any one of these products with sketch (Nov 2012)
- Distinguish between wire drawing and tube drawing. (Nov 2009, May 2010)
- (i) Classify the types of rolling mills and sketch them. (May 2016, Nov 2019, 2014)
- (ii) Explain forging operations.

UNIT IV – SHEET METAL PROCESSES
PART A (2 MARKS)
1 What is punching operation? (May 2019)

Ans : It is the cutting operation with the help of which various shaped holes are produced in the sheet metal. It is similar to blanking; only the main difference is that, the hole is the desired product and the material punched out to form a hole is considered as a waste.

2 What is super plastic forming operation? (Nov 2018)



Ans: Superplastic forming is a metalworking process for forming sheet metal. It works upon the theory of superplasticity, which means that a material can elongate beyond 100% of its original size.

3 What is press brake? (Nov 2017)

Ans: Press brake (bending brake) is an open frame press used for bending, cutting and forming. Generally, it handles long workpieces in the form of strips. Usually press brake have long dies and suitable and suitable for making long straight line bends.

4 Define hydro forming process. (May 2016)

Ans : Hydro forming is a process which can be carried out in two ways:

1) Hydro - mechanical forming

2) Electro - hydraulic forming Hydro - mechanical forming: In this method , the blank is placed over the punch whose shape is similar to inner of the final workpiece.

Electro - hydraulic forming : This method involves the conversion of electrical energy into mechanical energy in a liquid medium. Electric spark in a liquid produces shock waves and pressures which can be used for metal forming.

5 Give the difference between punching and blanking. (May 2015)

Ans:

Blanking : It is the cutting operation of a flat metal sheet. The article punched out is known as blank.

Blank is the required product of the operation and the metal left behind is considered as a waste.

Punching: It is similar to blanking; only the main difference is that, the hole is the desired product and the material punched out to form a hole is considered as a waste.

6 How is hydro forming is similar to rubber forming ? (Nov 2017)

Ans : In both the sheet metal working processes sheet metal is pressed between a die and rubber block.

Under pressure, the rubber and sheet metal are driven into the die and conform to its shape by forming the part.

7 What do you mean by minimum bend radius? (Nov 2013)

Ans: It is the radius of curvature on the inside surface of the bend. If the bend radius is too small, then cracking of a material on the outer tensile surface takes place. To prevent any damage to punch and die, the bend radius should not be less than 0.8mm.

8 Define limiting drawing ratio. (May 2018)

Ans : It is the ratio of finished shell diameter (d) to the radius of bottom corner (r).

**9 Define Embossing. (Dec2015)**

Ans : With the help of this operation, specific shapes or figures are produced on the sheet metal.

It is used for decorative purpose or giving details like names, trade marks, specifications, etc. On the sheet metal.

10. What are the factors affecting shearing operation? (May 2018)

Shape and material of punch Die, speed of punching, lubrication Clearance between punch & die.

11. Define Blanking. (May 2016)

A finite shape of sheet metal is removed and blocked by shearing the entire contour using a die and a punch. The portion removed, which is the required part is called as blank and the operation is called as blanking.

12. What is meant by Dimpling. (Nov 2013)

First hole is punched and then it is expanded into a flange. Flange may be produced by piercing with a sharp punch when the bend angle is less than 90° , as in fittings with conical ends. This process is also called as **FLAIRING**.

PART – B & C

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1. Explain principle of magnetic pulse forming? (May 2016, 2010, 2018)
2. Describe the electro hydraulic process? (May 2006, 2008, Nov 2012)
3. What is drawing operation? Explain with neat sketch (May 2006)
4. Describe the various test methods used in sheet metal forming (May 2008)
5. Explain in details the working principles and applications of any two special forming (May 2008)
6. Explain the super plastic forming process. (May 2017, 2013)
7. (i) Explain the rubber pad forming? (May 2016, Nov 2014)
- (ii) Discuss the characteristics of metal and its importance to sheet metal forming.
8. Name and describe the common bending operations. (Nov 2012, 2008, May 2010)
9. What is an explosive forming? Explain with the sketches? (Nov 2018)
10. (i) Write short notes on hydro forming. (Nov 2009, May 2010, 2016)
- (ii) Explain with a neat sketch the principle of stretch forming. (Nov 2009, 2014)
- (iii) Explain the principle of metal spinning process. (May 2006, Nov 2019)



UNIT V – MANUFACTURE OF PLASTIC COMPONENTS

1 What are the characteristic of thermoplastics ? (May 2016)

Thermoplastics polymers soften when heated and harden, when cooled. These types of polymers are soft and ductile. They have low melting temperature and can be repeatedly moulded and remoulded to the required shapes.

2 List out the material for processing of plastics?

The following mentioned are the various polymer additives used in practice:

- (1) Filler material (2) Plasticizers (3) Stabilizers
- (4) colorants (5) Flame retardants (6) Reinforcements
- (7) Lubricants.

3 List the advantage of cold forming of plastics? (MAY 2015)

ADVANTAGES:

- Cold forming can be carried out at room temperature
- It is used to produce filament and fibres
- It is a simple process.

4 What is film blowing? (May 2017)

In this process a heated doughy paste of plastic compound is passed through a series of hot rollers, where it is squeezed into the form of thin sheet of uniform thickness. It is used for making plastic sheets and films.

5 What are the types of plastics ? (May 2019)

Polymers are classified in two major categories:

- o Thermoplastic polymers (Soften when heated and harden when cooled)
- o Thermosetting polymers (Soften when heated and permanently hardened when cooled).

6 What is compression moulding? (May 2018)

The main objective is to melt the material due to compression.

7 Name the parts made by rotational moulding. (Dec. 2019)

Ans: Rotational moulding process is mostly used for the production of toys in P.V.C like horse, boats, etc. Larger containers upto 20 m³ capacity, fuel tanks of automobile are made from polythene and nylon. This process is also used for production of large drums, boat hulls, buckets, housings and carrying cases.

8 What is parison ? (Dec.2018)

Ans: Blow moulding consists of extrusion of the heated tubular plastic piece



called as parison which is transferred to the two piece mold.

9 Define degree of polymerization. (Dec. 2017)

Ans: It is the number of repetitive units present in one molecule of a polymer.

$$\text{Degree of polymerisation} = \frac{\text{Molecular weight of a polymer}}{\text{Molecular weight of a single monomer}}$$

10 Write the two types of Injection Moulding.

1. Ram Or plunger type injection moulding
2. Screw type Injection Moulding

11 Define Polymer

Polymers are long chain molecules and are formed by polymerization process, linking and crosslinking a particular building block called monomer, a unit cell.

12 Define Plastics.

Plastic is defined as the organic polymer which can be moulded into any required shape with the help of heat and pressure.

PART – B & C

1. Sketch and explain the injection molding process for plastics. (May 2007, 2008, 2015, Nov 2009)
2. Discuss the advantage and application of compression and transfer molding process. (May 2007, 2015)
3. Describe thermoforming and transfer molding process. (May 2008)
4. Illustrate with suitable sketch the blow molding process for producing plastics serving bottles. (May 2013, 2015, Nov 2008)
5. Explain the process of compression moulding with neat diagram (May 2016)
6. Give the sequence of operation in transfer molding for thermosetting plastic process. (May 2008)
7. Describe the thermoforming process and thermosetting plastics. (Nov 2018, 2019)
8. Describe the various properties of plastics. (Nov 2019)
9. Why is screw injection molding machine better than a ram type injection molding machine. (Nov 2017)