MECHANICAL ENGINEERING SCIENCE (UE25ME141A/B)

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MECHANICAL ENGINEERING SCIENCE

UNIT 3 – Manufacturing Techniques and Metal Joining Processes

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INTRODUCTION TO MANUFACTURING PROCESSES

- Manufacturing can be broadly defined as **the process of converting raw materials into finished products.**

- A detailed understanding of the manufacturing processes is essential for every engineer. This helps them appreciate the **capabilities, advantages and also the limitations of the various manufacturing processes**.

- This in turn helps in the proper design of any product required by them. Firstly, they would be able to assess the **manufacturing feasibility** of their designs. Secondly, they may also find out that there is **more than one process available for manufacturing** a particular product.

- Keeping this in mind, they can make a **proper choice of the process** which would require the **lowest manufacturing cost** and would deliver the product of **desired quality**.

CLASSIFICATION OF MANUFACTURING PROCESSES

- The various processes used in manufacturing are classified into the following five groups –

1) ***Primary shaping processes*** – Casting, Forming such as rolling, extrusion, forging etc.,

2) ***Machining processes*** – The machining operations are performed on castings, rollings and forgings etc. in order to obtain the desired accuracy and shape. Ex – Turning, Drilling, Milling, Planing etc.

3) ***Surface finishing processes*** – These processes are used effectively to provide a good surface finish to the metal surface of the product. Ex – Buffing, Lapping, Honing, Anodising, Electroplating etc.

4) ***Joining processes*** – These processes are used for joining two or more pieces of metal parts. Ex – Welding, Soldering, Brazing etc.

5) ***Processes affecting change in properties-*** These processes are used to impart certain specific properties to the metal part for specific conditions of use. Ex – Heat treatment, shot peening etc.

METAL CASTING PROCESS

- Casting is one of the earliest metal shaping methods known to human being.

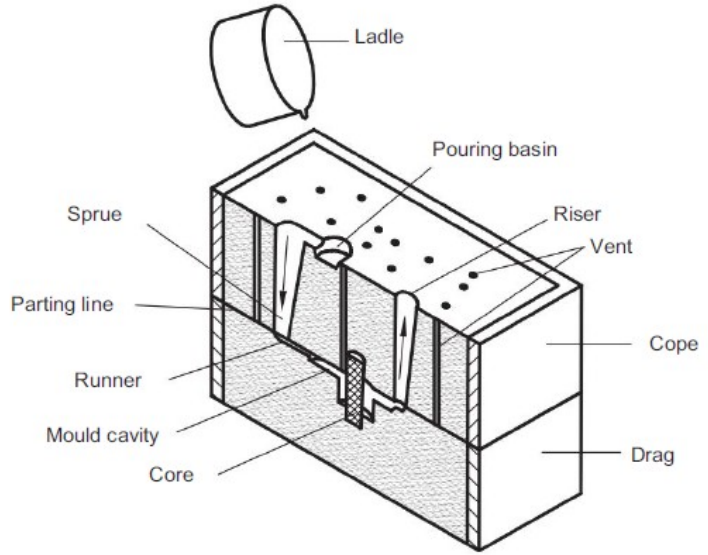
- It generally means pouring molten metal into a refractory **mould** with a cavity of the shape to be made and allowing it to solidify. When solidified, the desired metal object is taken out from the refractory mould either by breaking the mould or taking the mould apart. The solidified object is called **casting**. This process is also called **founding**.

- The principal process among these is **sand casting** where sand is used as the refractory material.

- Some of the other casting processes for specialised needs are as follows:
  - Shell Mould Casting
  - Precision Investment Casting
  - Plaster Mould Casting
  - Permanent Mould Casting
  - Die Casting
  - Centrifugal Casting

CASTING TERMS

- ***Flask*** - A moulding flask is one which holds the sand mould intact. Depending upon the position of the flask in the mould structure, it is referred to by various names such as drag, cope and cheek.
- ***Drag*** - Lower moulding flask.
- ***Cope*** - Upper moulding flask.
- ***Pattern*** - Pattern is a replica of the final object to be made with some modifications. The mould cavity is made with the help of the pattern.
- ***Parting line*** - This is the dividing line between the two moulding flasks that makes up the sand mould. In split pattern it is also the dividing line between the two halves of the pattern.



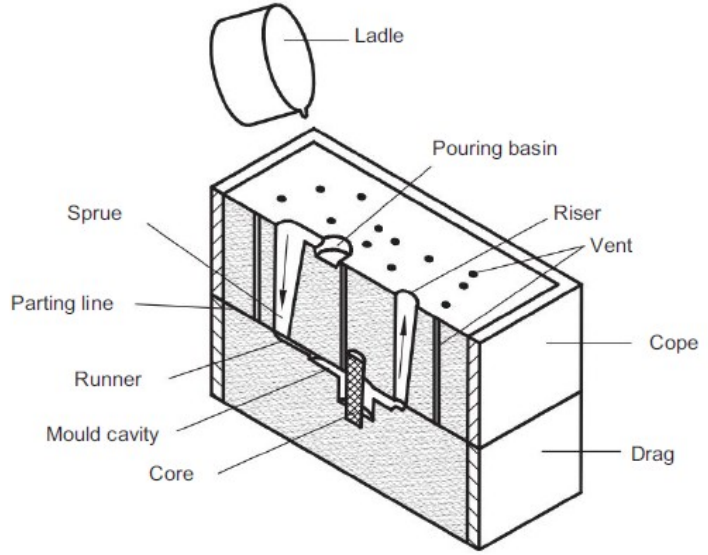
CASTING TERMS

- ***Bottom board*** - This is a board which is normally made of wood and is used at the start of the mould making. The pattern is first kept on the bottom board, sand is sprinkled on it and then the ramming is done in the drag.

- ***Facing sand*** - The small amount of carbonaceous material sprinkled on the inner surface of the moulding cavity to give better surface finish to the castings.

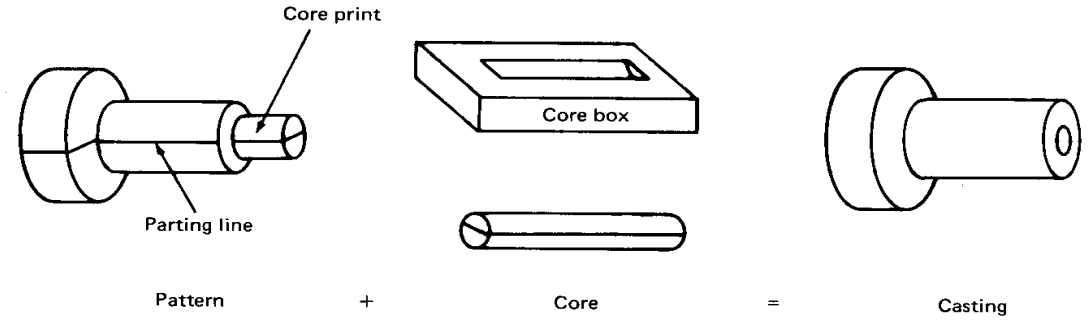
- ***Moulding sand*** - It is the freshly prepared refractory material used for making the mould cavity. It is a mixture of silica, clay and moisture in appropriate proportions to get the desired results and it surrounds the pattern while making the mould.

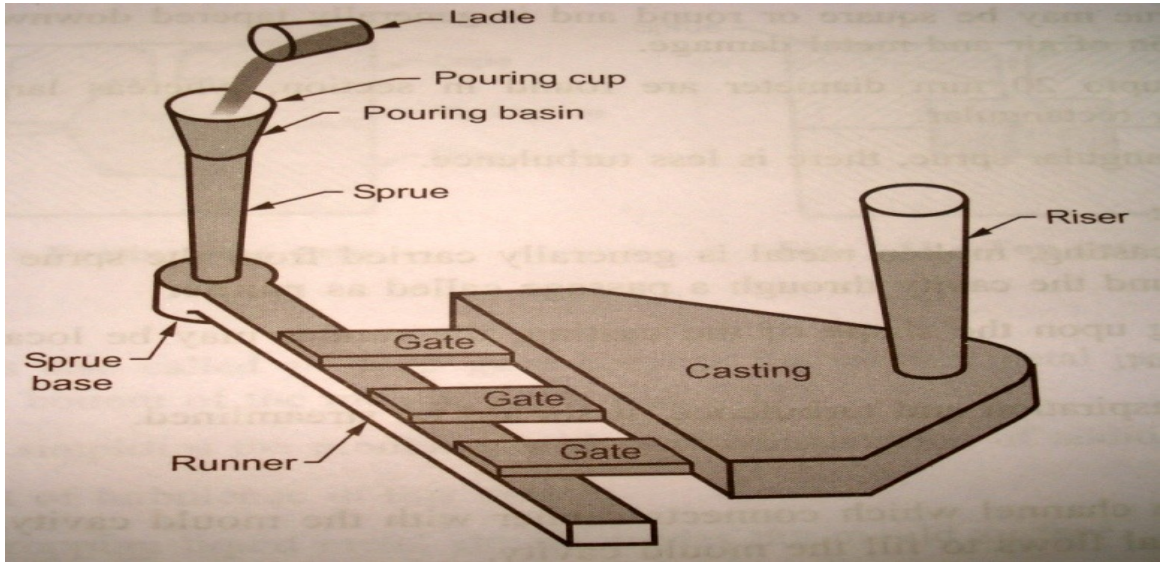
- ***Backing sand*** - It is what constitutes most of the refractory material found in the mould. This is made up of used and burnt sand.



CASTING TERMS

- ***Core*** **-** It is used for making hollow cavities in castings.
- ***Pouring basin*** **-** A small funnel shaped cavity at the top of the mould into which the molten metal is poured.
- ***Sprue*** **-** The passage through which the molten metal from the pouring basin reaches the mould cavity. In many cases it controls the flow of metal into the mould.
- ***Runner*** - The passageways in the parting plane through which molten metal flow is regulated before they reach the mould cavity.
- ***Gate*** - The actual entry point through which molten metal enters mould cavity.





CASTING TERMS

- ***Riser*** - It is a reservoir of molten metal provided in the casting so that hot metal can flow back into the mould cavity when there is a reduction in volume of metal due to solidification.