



**SNS COLLEGE OF TECHNOLOGY**

(An autonomous institution)



## *Department of Mechanical Engineering*

### **Unit – III**

## **Topic Basics of Foundry**

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# Manufacturing Process





# Manufacturing Process

- Manufacturing can be defined as the process of converting raw materials (and information such as specifications) into a usable form of products.
- The process of manufacturing mainly encompasses
  - (a) Product design**
  - (b) Raw material selection, and**
  - (c) Sequence of operations (processes) through which the product will be manufactured.**





# Manufacturing Process



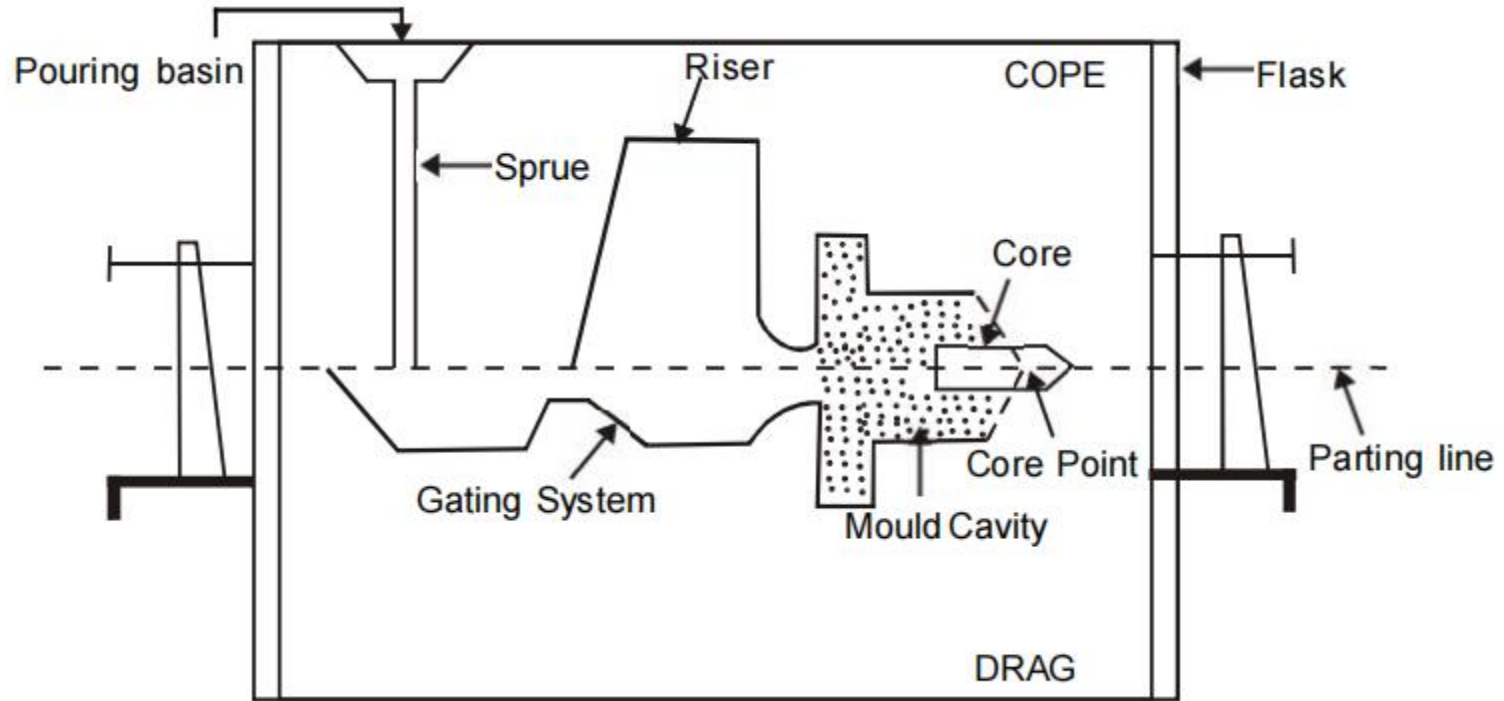


# Casting

- The process of metal casting involves **pouring of molten metal into a mould**, which is a cavity formed in some moulding material such as sand.
- The mould cavity exactly **resembles in shape and size** with the product to be made.
- After pouring, the molten metal is **allowed to freeze there**, taking up the shape of the mould cavity and the product is thus cast, is called a casting



# Casting







# Casting



## Flask

- ❖ A moulding flask is one **which holds the sand mould intact**.
- ❖ Depending on the position of the flask in the mould structure, it is referred to as drag, cope and cheek.
- ❖ It is generally made up of **wood** for temporary use or of metal for long term use.

## Drag

- ❖ **Lower moulding flask.**

## Cope

- ❖ **Upper moulding flask.**

## Cheek

- ❖ **Intermediate moulding flask** used in three piece moulding.

## Parting line

- ❖ This is the dividing line between the two moulding flasks that makes up the sand mould.

## Core

- ❖ It is used for making **hollow cavities in castings**.



# Casting



## 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.

## Runner

- ❖ The **passage ways** 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.

## Chaplet

- ❖ Chaplets are used to **support cores inside the mould cavity** to take care of its own weight and overcome the metallostatic forces.





# Casting



## Chill

- ❖ Chills are **metallic objects** which are placed in the moulds to **increase the rate of cooling of castings** to provide uniform or desired cooling rate.

## Riser

- ❖ It is the **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.

## Core print

- ❖ An impression in the form of a recess is made in the mould with the help of a projection suitably placed on the pattern, for supporting the cores in the mould cavity.
- ❖ This projection is known as a core print.



# Steps in Casting

The whole process of producing casting may be classified in to five steps as follows :

## Pattern making

- The pattern is an exact fascimile or replica of the article to be cast.
- The patterns are **designed and prepared as per the drawing.**

## Moulding and core making

- The moulds are prepared in **either sand or similar materials** with the help of patterns so that a cavity of the designed shape is produced.
- To obtain hollow portions, cores are prepared separately in core boxes.
- The moulds and cores are then baked to impart strength and finally assembled for pouring.
- Moulding can be done **either manually or by machines** depending on the output required. Provision of gates and risers are also made for flow of molten metal.



# Steps in Casting



## Melting & casting

- Correct composition of **molten metal is melted** in a suitable surface and poured into the moulds. The moulds are then **allowed to cool down for the metal to solidify**.
- The castings are finally extracted by breaking the moulds.

## Fettling

- The castings as obtained after solidification **carry unwanted projections**.
- Also sand particles tend to adhere to the surface of castings.
- The castings are therefore sent to fettling section when the **projections are cut off and surface cleaned for further work**.
- The casting may also need **heat treatment** depending on the specific properties required.

## Testing & Inspection

- Finally, before the casting is despatched from foundry, it is **tested and inspected** to ensure that it is flawless and confirms to the specifications desired.





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#### **Topic**

### **Foundry(Types of Pattern)**

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# Pattern

- Pattern may be defined as a **model or replica** of the object to be cast.
- Only variation according to dimension between casting and pattern are the various allowances.
- Sand is packed around the pattern and after its removal mould cavity is formed in which molten metal is poured to form final cast product.



# Casting



## Types of Pattern

- ❖ Single piece/ one piece pattern (solid pattern)
- ❖ Split/ Two piece pattern
- ❖ Loose piece pattern
- ❖ Match plate pattern
- ❖ Cope and Drag pattern
- ❖ Sweep pattern
- ❖ Gated pattern
- ❖ Skeleton pattern
- ❖ Follow board pattern



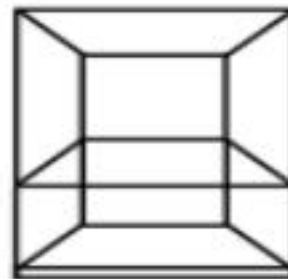


# Casting



## Singlepiece Pattern

- Simplest pattern and inexpensive
- Made out of **one piece** and does not contain loose pieces or joints.
- Large size single castings are manufactured.
- Moulding operations are manual and so much time is required.
- Generally small numbers of castings are produced.
- Material used are wood or metal (depend on quantity of production)
- Stuffing box of steam engine.**



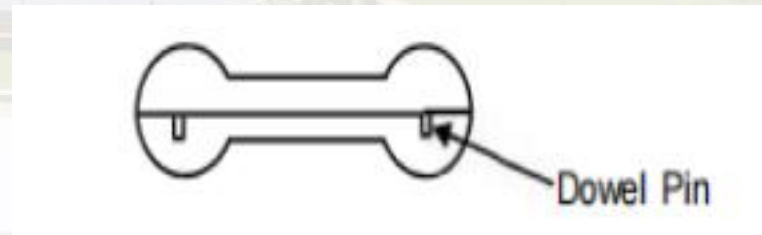


# Casting



## Split Pattern

- Castings of **complicated shape can not be prepared in single piece** because of some difficulties like withdrawing the pattern from the mould, etc.
- Upper part kept on cope and lower part in drag of mould.
- Alignment is maintained by using dowel pins. (i.e., parting line for both pattern and
- mould are same)
- Taps, water stopcocks**



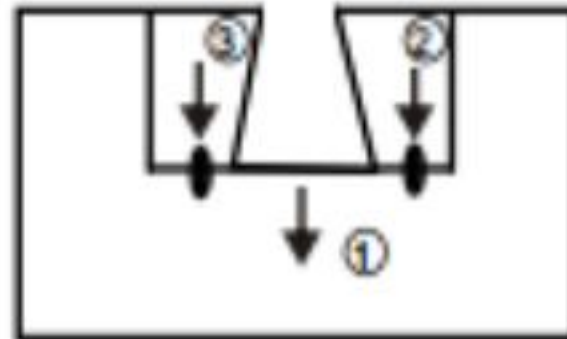


# Casting



## Loose Piece Pattern

- Why Loose Pieces ?
- Some **patterns can not be removed after putting them in moulding sand.** So for removing them, they are made of loose pieces.
- Loose pieces are attached to the main body by lower pins.
- Main body drawn out first and then loose pieces.
- Moulding needs more time.
- Provides errors





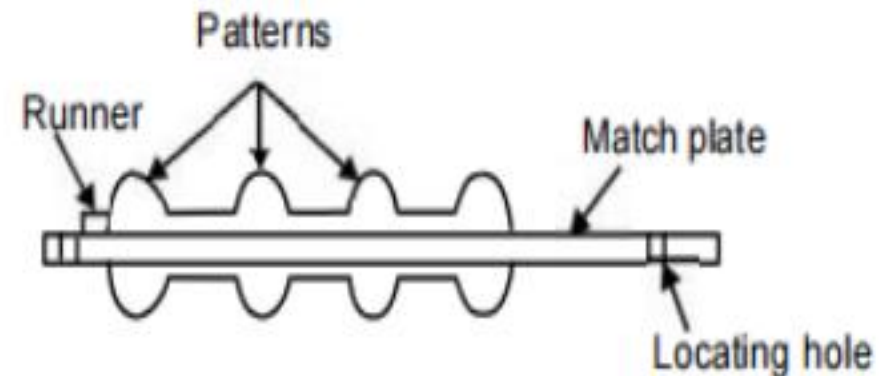


# Casting



## Match Plate Pattern

- It has a match plate on both side of which number of split patterns are fastened.
- Pattern of different size and shape can be fitted to a match plate.
- Match plate is clamped with drag by locator holes.
- Runner and gates are attached to the pattern assembly.
- After ramming the whole assembly is removed.
- Cope and drag fitted together-forms mould.
- Material - Aluminium normally used because of light weight and cheap in cost.
- Small castings are made in large scale.
- Piston rings and IC engines.**



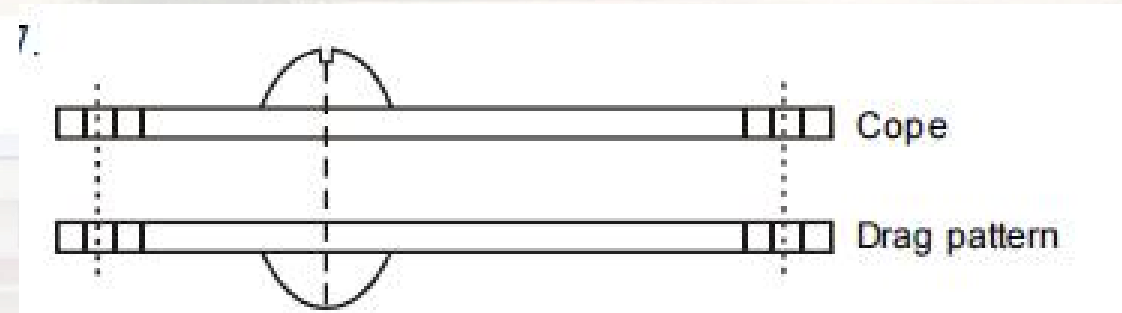


# Casting



## Cope and Drag Pattern

- One kind of split pattern.
- Difference is that in this gating and risering system attached to both the halves using separate metal/wooden plate.
- Both the cope and drag parts of the final mould can be produced separately and assembled finally.
- Used for heavy castings inconvenient to handle.**



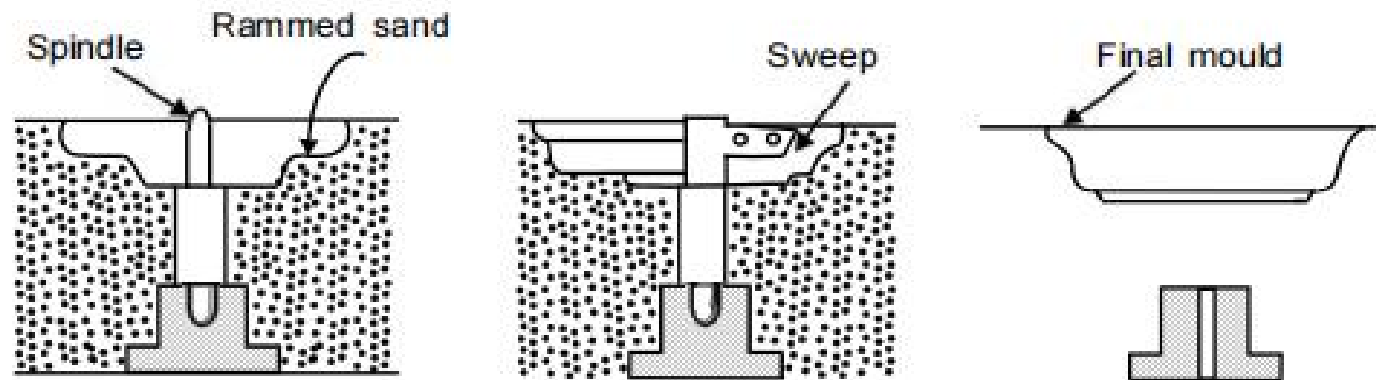


# Casting



## Sweep Pattern

- ❑ It is a form made on a wooden board which sweeps the shape of the casting around the post/spindle.
- ❑ It eliminates need of 3D pattern.
- ❑ Used for producing **large castings of circular section and symmetrical shapes**
- ❑ **Large bells etc.**





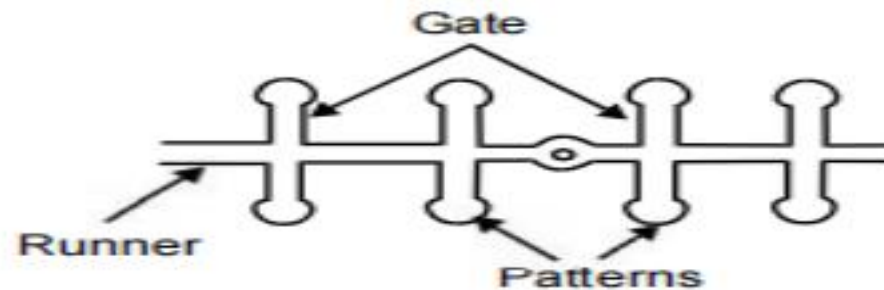


# Casting



## Gated Pattern

- Improvement of simple pattern
- Gating and runner system is a part of pattern.
- Productivity increases by eliminating preparation of gating system manually.
- For producing small size castings for **mass production**



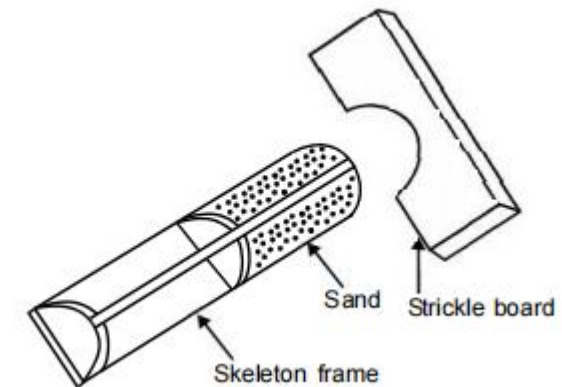


# Casting



## Skeleton Pattern

- This pattern is the skeleton of desired shape.
- Skeleton is made from wooden strips.
- Strickle board is used after ramming to remove extra sand.
- If object is symmetrical, then two halves can be moulded by using same pattern and
- finally moulds assembled before pouring.
- Large castings in small numbers.
- Turbine blades, water pipes, chutes, L - bends, etc.**





# Thankyou