

# Metal Casting - Web course

## COURSE OUTLINE

This course is an elective subject for manufacturing students. The subject comprises a little wider and deeper on the manufacturing techniques by casting process. It covers bigger spectrum for manufacture products by the casting techniques with require attributes specify for certain purpose such as intricacy, features detail, soundness and others. Among topics or issues include in this course are liquid metals, solidification, molding material, casting design, production techniques, Metal melting & treatment, and casting quality & evaluation.

**Contents:** Casting problems, Survey and scope; Solidification; Pure metals and alloys; Solidification of actual castings, Riser; riser design, risering curves, NRL method, feeding distance, risering of complex castings. Gating; system and their characteristics; Types of gates and design consideration, Pattern design consideration, and testing; Various molding processes, Gases in metals, Fluidity of metals, Casting defects, Casting quality measurement.

## COURSE DETAIL

Sl. No	Topic	Hours
1.	<b>Introduction:</b> The features of casting problem; a survey and scope of foundry industry.	3
2.	<b>Solidification:</b> Solidification of pure metals and alloys; nucleation and growth in alloys; solidification of actual castings; progressive and directional solidification; centreline feeding resistance; rate of solidification; Chvorinov's Rule, electrical analog of solidification problem.	5
3.	<b>Risering:</b> Riser design; risering curves;	3



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## Mechanical Engineering

### Pre-requisites:

- Understanding of basic concept of Metal Casting.
- UG course on Basic Manufacturing Processes.

### Additional Reading:

- Metals Handbook-Metal Casting, ASM.

### Coordinators:

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	NRL method of riser design; feeding distance; risering of complex casting; risering of alloy other than steel; recent developments e.g. riser design by the application of geometrical programming.	
4.	<b>Gating:</b> Gating systems and their characteristics; the effects of gates on aspiration; turbulence and dross trap; recent trends.	2
5.	<b>Patterns:</b> Pattern design; recent developments in pattern design; materials and construction.	8
6.	<b>Molding and Core Making Processes:</b> Review and critical comparison of various established processes; recent developments e.g. low pressure and ferrous die casting; high pressure molding; full mold process; flaskless molding, hot and cold box molding; ceramic shell molding; Vprocess; continuous casting; squeeze and pressed casting; Nishiyama process; shaw process; Anitoch process etc.	4
7.	<b>Melting:</b> Selection and control of melting furnaces; moiling, refining and pouring; recent trends in cupola design.	2
8.	<b>Fluidity:</b> Measurement of fluidity; effects of various parameters on fluidity.	3
9.	<b>Internal Stresses, Defects and Surface Finish:</b> Residual stresses; hot tears and cracks in castings; stress relief; defects and their causes and remedies; various parameters affecting surface finish and related defects e.g. rough Casting, sand bumon sand bumon and metal penetration; facing and washes; mold wall movement; vapor transpol1 zones; expansion scabbing etc.	2
10.	<b>Testing of Sand:</b> Recent developments	1

	e.g. mulling index; moldability index; compactability; deformability.	
11.	<b>Casting Design Considerations:</b> Review of casting design; recent trends.	1
12.	<b>Gases in Metal:</b> Methods of elimination and control of dissolved gases in castings.	3
13.	<b>Inspection and Quality Control:</b> Review of xray and gamma ray radiography; magnetic particle; penetrant and ultrasonic inspections; use of statistical quality control in foundry.	3

**References:**

1. Fundamentals of Metal casting, Flinn, Addison Wesley.
2. Principles of Metal casting, Heine, Loper & Rosenthal, McGraw Hill.
3. Product Design and Process Engineering Practice, Niebel & Draper, Salmon & Simons, McGraw Hill Foundry, Issac Pitaman.