

METAL CASTING AND WELDING
B.E, III/IV Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME35 A /45A	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- To provide detailed information about the moulding processes.
- To provide knowledge of various casting process in manufacturing.
- To impart knowledge of various joining process used in manufacturing.
- To provide adequate knowledge of quality test methods conducted on welded and casted components.

Module - 1

INTRODUCTION & BASIC MATERIALS USED IN FOUNDRY

Introduction: Definition, Classification of manufacturing processes. Metals cast in the foundry-classification, factors that determine the selection of a casting alloy.

Introduction to casting process & steps involved. Patterns: Definition, classification, materials used for pattern, various pattern allowances and their importance.

Sand molding: Types of base sand, requirement of base sand. Binder, Additives definition, need and types

Preparation of sand molds: Molding machines- Jolt type, squeeze type and Sand slinger. Study of important molding process: Green sand, core sand, dry sand, sweep mold, CO₂ mold, shell mold, investment mold, plaster mold, cement bonded mold. Cores: Definition, need, types. Method of making cores, concept of gating (top, bottom, parting line, horn gate) and risering (open, blind) Functions and types

Module - 2

MELTING & METAL MOLD CASTING METHODS

Melting furnaces: Classification of furnaces, Gas fired pit furnace, Resistance furnace, Coreless induction furnace, electric arc furnace, constructional features & working principle of cupola furnace.

Casting using metal molds: Gravity die casting, pressure die casting, centrifugal casting, squeeze casting, slush casting, thixocasting, and continuous casting processes

Module - 3

SOLIDIFICATION & NON FERROUS FOUNDRY PRACTICE

Solidification: Definition, Nucleation, solidification variables, Directional solidification-need and methods. Degasification in liquid metals-Sources of gas, degasification methods.

Fettling and cleaning of castings: Basic steps involved. Sand Casting defects- causes, features and remedies. Advantages & limitations of casting process

Nonferrous foundry practice: Aluminum castings - Advantages, limitations, melting of aluminum using lift-out type crucible furnace. Hardeners used, drossing, gas absorption, fluxing and flushing, grain refining, pouring temperature. Stir casting set up, procedure, uses, advantages and limitations.

Module - 4

WELDING PROCESS

Welding process: Definition, Principles, Classification, Application, Advantages & limitations of welding. Arc welding: Principle, Metal arc welding (MAW), Flux Shielded Metal Arc Welding (FSMAW), Inert Gas Welding (TIG & MIG) Submerged Arc Welding (SAW) and Atomic Hydrogen Welding (AHW).

Special type of welding: Resistance welding principles, Seam welding, Butt welding, Spot welding and Projection welding. Friction welding, Explosive welding, Thermit welding, Laser welding and electron beam welding.

Module - 5

SOLDERING , BRAZING AND METALLURGICAL ASPECTS IN WELDING

Structure of welds, Formation of different zones during welding, Heat Affected Zone (HAZ), Parameters affecting HAZ. Effect of carbon content on structure and properties of steel, Shrinkage in welds & Residual stresses, Concept of electrodes, filler rod and fluxes. Welding defects- Detection, causes & remedy.

Soldering, brazing, gas welding: Soldering, Brazing, Gas Welding: Principle, oxy-Acetylene welding, oxy-hydrogen welding, air-acetylene welding, Gas cutting, powder cutting.

Inspection methods: Methods used for inspection of casting and welding. Visual, magnetic particle, fluorescent particle, ultrasonic. Radiography, eddy current, holography methods of inspection.

Course outcomes:

- Describe the casting process, preparation of Green, Core, dry sand molds and Sweep, Shell, Investment and plaster molds.
- Explain the Pattern, Core, Gating, Riser system and Jolt, Squeeze, Sand Slinger Molding Machines.
- Compare the Gas fired pit, Resistance, Coreless, Electrical and Cupola Metal Furnaces.
- Compare the Gravity, Pressure die, Centrifugal, Squeeze, slush and Continuous Metal mold castings.
- Explain the Solidification process and Casting of Non-Ferrous Metals.
- Describe the Metal Arc, TIG, MIG, Submerged and Atomic Hydrogen Welding processes used in manufacturing.
- Explain the Resistance spot, Seam, Butt, Projection, Friction, Explosive, Thermit, Laser and Electron Beam Special type of welding process used in manufacturing.
- Describe the Metallurgical aspects in Welding and inspection methods for the quality assurance of components made of casting and joining process.

TEXT BOOKS:

1. "Manufacturing Process-I", Dr.K.Radhakrishna, Sapna Book House, 5th Revised Edition 2009.
2. "Manufacturing & Technology": Foundry Forming and Welding, P.N.Rao, 3rd Ed., Tata McGraw Hill, 2003.

REFERENCE BOOKS

1. "Process and Materials of Manufacturing", Roy A Lindberg, 4th Ed. Pearson Edu. 2006.
2. "Manufacturing Technology", Serop Kalpakjian, Steven R. Schmid, Pearson Education Asia, 5th Ed. 2006.
3. "Principles of metal casting", Richard W. Heine, Carl R. Loper Jr., Philip C. Rosenthal, Tata McGraw Hill Education Private Limited Ed. 1976.

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