Course Syllabus

Iron Metalcasting 101

Course Code	CEUs
3-110	0.6 CEUs

Course Introduction

This is an introductory course covering the major cast iron families. Topics include basic metallurgy, mechanical and physical properties, example applications for each iron type, common alloying elements and their effects, iron melting and treatment methods, compatible casting/molding processes, and heat treatment options.

Learning Outcomes

At the end of this course, participants should be able to:

1. Describe the fundamental metallurgical features and solidification process of cast irons
2. Explain the classification systems for each of the 5 basic types of cast iron.
3. How chemistry and processing determine the type and grade of iron.
4. Discuss the mechanical and physical properties of each type cast iron.
5. Describe important inspection/test methods for determining quality during and after casting.
6. Describe how different alloy and tramp elements affect the properties of cast iron.
7. Describe the basic melting practices and related technologies for cast iron.
8. Compare iron casting and molding processes.
9. Understand heat treatment of cast irons and how that affects mechanical properties and cost.
10. Apply safety procedures to the daily work environment in a metalcasting facility.

Lesson Outline

- Module 1: Introduction
- Module 2: Overview of Iron and its Alloys
  - Lesson 1: Characteristics of Iron, the Element
  - Lesson 2: The Range of Ferrous Alloys
  - Lesson 3: Cast Iron Key Characteristics and Applications
- Module 3: Basic Cast Iron Metallurgy and Processing
  - Lesson 1: Basics of the Fe-C System
  - Lesson 2: Solidification in the Cast Iron Range
  - Lesson 3: Eutectic Solidification, Graphite and Iron Carbide
  - Lesson 4: Matrix Formation, Pearlite and Ferrite
  - Lesson 5: Cast Iron Microstructures
  - Lesson 6: Foundry Processing vs. Type of Cast Iron
- Module 4: Properties, Classification Systems, and Testing
  - Lesson 1: Key Mechanical Properties and Classification Systems
  - Lesson 2: Physical Properties
  - Lesson 3: Quality Testing During and After Processing
- Module 5: Effects of Alloy Elements
  - Lesson 1: Key Alloy Elements and Their Purposes
  - Lesson 2: Common Tramp Elements and Their Effects
- Module 6: Commercial Applications and Alloy Selection
  - Lesson 1: Applications for Each Type of Cast Iron
  - Lesson 2: Material Selection and Trade-offs
- Module 7: Cast Iron Melting Technology
  - Lesson 1: Types of Melting Furnaces

- Lesson 2: Overview of Melting Practices
  - Lesson 3: Holding Furnaces
- Module 8: Primary Molding Processes for Cast Irons
  - Lesson 1: Sand Casting and Molding Terminology
  - Lesson 2: Investment Casting
  - Lesson 3: Lost Foam Casting
  - Lesson 4: Coldbox Process
- Module 9: Heat Treatment Overview
  - Lesson 1: Residual Stress Relief
  - Lesson 2: Annealing and Ferritizing
  - Lesson 3: Normalizing
  - Lesson 4: Dissolution of Iron Carbides
  - Lesson 5: Quench & Temper Process
  - Lesson 6: Austempering (ADI)
- Module 10: Safety Overview & Wrap-Up
  - Lesson 1: Safety Hazards in the Foundry
  - Lesson 2: Personal Protection
  - Wrap-Up

Instructional Methods:

- Facilitator led discussion
- Q & A sessions
- Group activities
- Case studies
- Videos
- Individual problem solving

Assessment Methods:

No formal assessment will take place in this course; however, attendees will participate in informal activities such as knowledge check and Q&A sessions with the facilitator to verify that learning outcomes are being met. Assessment of successful achievement of learning outcomes must be included throughout the course in order to meet the ANSI/IACET 1-2013 standard for continuing education programs and for CEUs to be awarded.

Attendee Requirements to Earn CEUs:

1. Present at least 6 hours of the total 6.5 hours of instructional time (90%), which does not include meals or breaks.
2. Active participation (can include asking questions, communicating with other attendees during and taking part in group activities, providing responses during whole class or group discussions).
3. Successful achievement of learning outcomes.

Who Should Attend?

The target audience for this course consists of individuals responsible for:

- Foundry production and management
- Process control
- Quality assurance
- Buying from casting suppliers
- Designing/engineering cast components
- Production and/or sales of supplies and services to the industry
- New employees or anyone new to iron casting