



# Welding Metallurgy I

## WELDENG 7101

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**Credit Hours:**

3.00 - 3.00

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**Course Levels:**

Graduate (5000-8000 level)

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**Course Components:**

Lecture

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**Course Description:**

Application of physical metallurgy principles to nonequilibrium thermo-mechanical conditions associated with welding in structural alloys and focus on carbon steels.

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**Prerequisites and Co-requisites:**

Prereq: Grad standing, or permission of instructor.

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**Course Goals / Objectives:**

- Understand fundamental concepts of welding/joining metallurgy
  - Understanding of regions of fusion and solid-state welds, weld solidification, HAZ phenomena, weld defects, and weldability testing
  - Basic understanding of the nature of iron and its allotropic form
  - Understanding the effects of alloying elements on the solid state transformation of iron alloys (steels)
  - Understanding of heat treatment of carbon and low-alloy steels and the effect of welding thermal cycles on structure and properties of steels in the heat-affected-zone and weld metal
  - Understanding of welding procedures, steel and filler metal classification systems, and post-weld heat treatments
  - Understanding of weldability and weldability testing
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**Course Topics:**

- Introduction to Welding Metallurgy
  - Regions of a Weld in Fusion and Solid-State Weld
  - Weld Solidification Principles
  - Fusion Zone
  - Unmixed-Zone and Partially Melted Zone
  - Heat-Affected-Zone
  - Classification of Defects and Discontinuities
  - Weldability
  - Weldability Testing
  - Introduction to Steels
  - Steel Making and Processing
  - Physical Metallurgy of Steels
  - Weld Microstructure Evolution
  - Consumables and Selection
  - Welding Fume
  - Weldability of Steels (General)
  - Hydrogen Cracking
  - Post-weld Heat Treatment and High-Temperature Properties of Steel Welds
  - Fracture and Fatigue Behavior
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**Designation:**

Elective