



THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Welding Metallurgy I

WELDENG 4101

Credit Hours:

4.00

Course Levels:

Undergraduate (1000-5000 level)

Course Components:

Lecture

Lab

Course Description:

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

Prerequisites and Co-requisites:

Prereq: MatScEn 2251 and 3141, and enrollment as a WeldEng-BS or MatSEng-BS major; or permission of instructor.

Course Goals / Objectives:

- First part of the course introduces the fundamental concepts of welding/joining metallurgy. This will build upon physical metallurgy principles from prerequisite MSE courses
 - Topics presented include regions of fusion and solid-state welds, weld solidification, HAZ phenomena, weld defects, and weldability testing
 - This course provides the foundation for the second part of the class, as well as, subsequent required and elective courses to be offered in related welding/joining metallurgy courses
 - This second part of the course will provide basic understanding of the nature of iron and its allotropic form. In addition, the effect of alloying elements on the solid state transformation of iron alloys (steels) will be discussed
 - Heat treatment of carbon and low-alloy steels is discussed and related to the effect of welding thermal cycles on resulting structure and properties of steels in the heat-affected-zone and weld metal
 - in the third part of the course, welding procedures, steel and filler metal classification systems, and post-weld heat treatments are described. Weldability and weldability testing are discussed
 - Major emphasis is placed on the toughness characteristics of steel weldments and the influence of hydrogen in producing HAZ and weld metal cracks
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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:

Required