

# WELDENG 7021 (Approved): Solid-State Welding/Joining

## Course Description

The welding and Joining of materials in the solid state with emphasis on physical processes and metallurgical principles.

**Prior Course Number:** 701

**Transcript Abbreviation:** SS Weld Proc

**Grading Plan:** Letter Grade

**Course Deliveries:** Classroom

**Course Levels:** Graduate

**Student Ranks:** Masters, Doctoral

**Course Offerings:** Spring

**Flex Scheduled Course:** Never

**Course Frequency:** Every Year

**Course Length:** 14 Week

**Credits:** 3.0

**Repeatable:** No

**Time Distribution:** 3.0 hr Lec

**Expected out-of-class hours per week:** 6.0

**Graded Component:** Lecture

**Credit by Examination:** No

**Admission Condition:** No

**Off Campus:** Never

**Campus Locations:** Columbus

**Prerequisites and Co-requisites:** Prereq: Graduate Standing and 4001 or 7001, 4002 or 7002, 4101 or 7101, 4102 or 7102 or permission of instructor.

**Exclusions:** Not open to students with credit for 701 or 4021.

**Cross-Listings:**

**Course Rationale:** Existing course.

**The course is required for this unit's degrees, majors, and/or minors:** No

**The course is a GEC:** No

**The course is an elective (for this or other units) or is a service course for other units:** Yes

**Subject/CIP Code:** 14.9999

**Subsidy Level:** Doctoral Course

## Programs

Abbreviation	Description
WELDENG	Welding Engineering

## General Information

This is a graduate level course that will be taught at the same time as 4021. Lecture content will be the same as 4021, but graduate students will be expected to read 2-3 research papers and provide presentations in the class on those papers.

## Course Goals

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Understanding of solid state welding process through exploration of processes and scientific and engineering principles that govern the processes.
Understand how the physical laws affect the observed phenomenon in solid state welding processes.
Understand material compatibility and phenomenon that affect compatibility.

## Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Mechanisms of Solid State Welding I	4.0							
Thermo-mechanical Processing of Metals and Alloys (Low to High Strain Rates)	3.0							
Cold and Pressure Welding	2.0							
Roll Bonding	2.0							
Flash Butt Welding	3.0							
Friction Welding	3.0							
Friction Stir Welding	5.0							
Ultrasonic Welding	3.0							
Explosive (Impact) Welding	3.0							
Magnetic Pulse (Impact) Welding	2.0							
Deformation / Resistance Welding	2.0							
Material Changes during Solid-State Joining and Its Impact	2.0							
Diffusion Based Joining Processes (includes transient liquid phase bonding)	4.0							
Meso-, Micro- and Nano-Scale Welding	2.0							
Computational Tools for Solid-State Joining	2.0							

## Grades

Aspect	Percent
Homework	15%
Proposal / Presentation	25%
Mid Term	25%
Final Exam	35%

## Representative Textbooks and Other Course Materials

Title	Author
<i>Class Notes and Research Papers to be provided during the class</i>	
<i>ASM and AWS Handbooks on Welding</i>	

## ABET-EAC Criterion 3 Outcomes

Course Contribution	College Outcome
***	a An ability to apply knowledge of mathematics, science, and engineering.
**	b An ability to design and conduct experiments, as well as to analyze and interpret data.
*	c An ability to design a system, component, or process to meet desired needs.
**	d An ability to function on multi-disciplinary teams.

Course Contribution		College Outcome
**	e	An ability to identify, formulate, and solve engineering problems.
*	f	An understanding of professional and ethical responsibility.
**	g	An ability to communicate effectively.
*	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.
*	i	A recognition of the need for, and an ability to engage in life-long learning.
*	j	A knowledge of contemporary issues.
***	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

## WELDENG ABET-EAC Criterion 9 Program Criteria Outcomes

Course Contribution		Program Outcome
***	l	an ability to select and design welding materials, processes and inspection techniques based on application, fabrication and service conditions
***	m	an ability to develop welding procedures that specify materials, processes and inspection requirements
**	n	an ability to design welded structures and components to meet application requirements

### Additional Notes or Comments

Solid-State Joining Process Literature is Expanding at Rapid Scale; We need 3 credit hours to do the justice to the field and also in graduate level

**Prepared by:** Sudarsanam Babu