# WELDENG 7240 (Approved): Fitness-for-Service of Welded Structures

## Course Description

The interrelationship of design, fabrication, nondestructive evaluation, fracture mechanics, and reliability concepts in establishing the overall fitness-for-purpose of welded structures.

**Prior Course Number:** 740
**Transcript Abbreviation:** Fitness-for-Servic
**Grading Plan:** Letter Grade
**Course Deliveries:** Classroom
**Course Levels:** Graduate
**Student Ranks:** Masters, Doctoral
**Course Offerings:** Autumn
**Flex Scheduled Course:** Never
**Course Frequency:** Every Year
**Course Length:** 14 Week
**Credits:** 2.0
**Repeatable:** No
**Time Distribution:** 2.0 hr Lec
**Expected out-of-class hours per week:** 4.0
**Graded Component:** Lecture
**Credit by Examination:** No
**Admission Condition:** No
**Off Campus:** Never
**Campus Locations:** Columbus
**Prerequisites and Co-requisites:** Prereq: Graduate Standing and 620 or 4201 or permission of instructor.
**Exclusions:** Not open to students with credit for 740 or 4240.
**Cross-Listings:**

**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 WE4240. Lecture content will be the same as 4240, but graduate students will be required to submit a term project that may include a detailed design, a computer simulation or detailed review of research papers.

## Course Goals

Understand basic fitness-forservice concenpts.

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| Ability to analyze and apply fracture mechanics design concepts to welded structures. |
| Ability to analyze and apply fatigue life prediction methods to welded structures. |
| Ability to apply fitness-for-service methods and standards for design of new and for life-assessment of in-service welded structures. |

## Course Topics

| Topic | Lec | Rec | Lab | Cli | IS | Sem | FE | Wor |
|---|---|---|---|---|---|---|---|---|
| Introduction to fitness-for-service and root causes of weld failure. | 4.0 | | | | | | | |
| Fracture mechanics for brittle fracture. | 3.0 | | | | | | | |
| Fracture mechanics for ductile fracture. | 4.0 | | | | | | | |
| Fracture toughness testing. | 3.0 | | | | | | | |
| Fatigue crack initiation and propagation. | 3.0 | | | | | | | |
| Fatigue and fracture of welded components. | 3.0 | | | | | | | |
| Fracture and fatigue control. | 3.0 | | | | | | | |
| Fitness-for-service assessment procedures and standards. | 3.0 | | | | | | | |
| Case studies. | 2.0 | | | | | | | |

## Grades

| Aspect | Percent |
|---|---|
| Homework and quizzes | 20% |
| Mid-Term | 25% |
| Final exam | 30% |
| Term project | 25% |

## Representative Textbooks and Other Course Materials

| Title | Author |
|---|---|
| *Fracture and Fatigue Control in Structures: Applications of Fracture Mechanics* | J.M. Barsom and S.T. Rolf |

## 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. |
| *** | 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. |

| Course Contribution | | College Outcome |
|---|---|---|
| *** | 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 |

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