THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Engineering Analysis for Design and Simulation

WELDENG 4201

Credit Hours:
4.00

Course Levels:
Undergraduate (1000-5000 level)

Course Components:
Lecture
Lab

Course Description:
Fundamentals of engineering analysis of heat flow, thermal and residual stresses, and fracture and fatigue with applications to design and simulation in welding and manufacturing.

Prerequisites and Co-requisites:
Prereq: 2001 or 3001; and Math 2177, or 2255, or 2415, or 2174; and MechEng 2040 or 2020; and Engr 1221 or 1281H; and enrollment in WeldEng major; or permission of instructor.

Course Goals / Objectives:
- Obtain fundamental understanding of heat flow including heat conduction with moving heat sources
- Obtain basic understanding of causes for and development of thermal stresses, residual stresses and distrotion
- Obtain basic understanding of linear elastic fracture mechanics including ability to apply fracture criteria
- Obtain basic understanding of high cycle fatigue, effect of mean stress using Goodman diagram, and life prediction for a variety of structures inculing welded structures
- Ability to analyze and design simple welded joints
- Obtain basic understanding of and ability to apply finite difference and finite element modeling to simple heat flow, stress analysis and fracture mechanics problems

Course Topics:

- Introduction to heat flow including steady state conduction.
- Finite difference and finite element modeling of heat flow.
- Heat flow with moving heat sources including Cooling rates and peak temperature equations.
- Introduction to thermal stresses, residual stresses and distortion.
- Three-bar analogy analysis for residual stresses and distrotion.
- Residual stress measurement, stress relieving, and distortion analysis.
- Introduction to fracture mechanics, stress intensity factors and fracture toughness.
- Introduction to high cycle fatigue, Goodman diagaram, and fatigue of welded structures.
- Welded joint analysis and design.
- Matlab programming and application to heat flow and finite difference modeling.
- Abaqus modeling of steady state and transient heat flow.
- Ababqus analysis of elastic, thermo-elastic and thermo-elastic-plastic problems.
- Abaqus analysis of fracture.

Designation:

Required