Binghamton University, SUNY
Department of Mechanical Engineering
Summer 2018

Course: ME-417 Introduction to Finite Element Method 3 Semester Credit Hours
Instructor: Mahdi Farahikia
Class Time: On-Line
Room: On-Line
Office: On-Line
Office Hours: TBD (Or By Appointment)
Email: mfarahi1@binghamton.edu


Course Description:
This course will cover the fundamentals of Finite Element Method through typical mechanical engineering examples. Stiffness method will be introduced for the solution procedure. Knowledge of a programming language (Matlab or Python are preferred) will be very helpful. Fundamentals of using ANSYS APDL for engineering simulations will be covered. “Why”, “what” and “how” are the questions that will be answered for each necessary step during a typical analysis. Hands-on exercises will allow students to practice using ANSYS APDL for engineering analysis. Proper modeling and meshing techniques, and extraction and interpretation of the results (derived from simulations) will be taught.

Course Objectives:
The course is intended to provide students with the necessary fundamental knowledge about implementation of Finite Element Method and ANSYS APDL for engineering analysis. After completing the course successfully, the students should be able to:

1. Write computer Finite Element Method codes to solve basic engineering problems
2. Understand the reason behind every step in implementing ANSYS APDL for engineering analysis and find solutions to new challenges by using the help documentation efficiently.
3. Demonstrate capability to model and analyze engineering problems using ANSYS APDL.
4. Extract, interpret and present results professionally.

Topics:

- Fundamentals of FEM
  - Stiffness method
  - Truss analysis
  - Beam analysis
  - Rigid plane frame analysis
  - 1-D Fluid flow/Heat transfer analysis
- Fundamentals of ANSYS APDL
  - Element type selection
Material definition
Modeling and meshing
Boundary condition and load definition
Analysis type and solution
Post-processing

Grading Scale:

- Participation in Discussion: 15%
- Assignment: 25%
- Midterm Exam: 30%
- Final Exam: 30%

Course Grading Procedure:

- A: 96 - 100
- A-: 91 - 95
- B+: 86 - 90
- B: 81 - 85
- B-: 76 - 80
- C+: 71 - 75
- C: 66 - 70
- C-: 61 - 65
- D: 55 - 60
- F: below 55

Calendar of the Semester:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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| One: May 29 – June 3 | Stiffness Method  
                   | Introduction to ANSYS APDL and Finite Element Method                 |
| Two: June 4 – June 10 | Truss Analysis  
                       | Solving Truss Problems using ANSYS APDL                             |
| Three: June 11 – June 17 | Beam Analysis  
                       | Solving Beam Problems using ANSYS APDL                              |
| Four: June 18 – June 24 | Hands-on ANSYS APDL Exercises:  
                       | Element Type Selection, Modeling, Meshing, Boundary Condition Setup |
| Five: June 25 – July 1  | Review & Midterm Exam                                                |
| Six: July 2 – July 8  | Frame Analysis  
<pre><code>                   | Solving Frame Problems using ANSYS APDL                             |
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<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Seven: July 9 – July 15</td>
<td>1-D Fluid Flow/Heat Transfer Analysis</td>
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<td>Solving 1-D Heat Transfer Problems in ANSYS APDL</td>
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<td>Eight: July 16 – July 22</td>
<td>Hands-on ANSYS APDL Exercise:</td>
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<td>Solution Setup, Post-processing</td>
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<td>Nine: July 23 – July 30</td>
<td>Review of ANSYS APDL through Examples</td>
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<td>Ten: July 31 – August 3</td>
<td>Final Exam</td>
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