Syllabus ENGR 4103/5103 (Finite Element Analysis)

Instructor:

Dr. Morshed Khandaker
Assistant Professor
Department of Engineering and Physics
405-974-5935
Office Howell Hall 221H
mkhandaker@uco.edu

Course Schedule:

Class meets TR, 5:50 pm - 7:00 pm, in Howell Hall 100.

Office Hours:

M-F 1:00 p.m – 2:00 p.m. or by appointment.

Course Website:

http://learn.uco.edu/

Course Catalog Description:

This course provides an introduction to the finite element method, from an engineering rather than a purely mathematical point of view. This course introduces approximate solution methods, the RITZ method, interpolation, isoparametric finite elements, displacement-based bending elements, and applications for elasticity problems. The course includes the development of stand-alone finite element computer codes and the application of commercial finite element software packages to analyze solid and structural mechanics problems.

Course Prerequisites:

ENGR 2143, ENGR 3703, and concurrent enrollment PHY 3883.

Course Purpose:

The purpose for this course is to equip the students with a fundamental understanding of the physical laws governing the response of engineering systems to forces. Also, students will develop a logical, orderly, and systematic approach to the modeling and solution of engineering problems in statics.
Expected Learning Outcomes:

Upon completion of the course, students will be able to:

- Understand the mathematical and physical principles underlying the Finite Element Method (FEM) as applied to solid mechanics.
- Be able to create his/her own FEM computer programs.
- Be able to analyze more complex problems (in solid mechanics or thermal analysis) using commercial FEM software such as ANSYS.
- Demonstrate the ability to design a component using FEM analysis.
- Make clear and effective technical presentations, both in terms of form as well as content, of his/her work.
- Write clear technical reports describing his/her work.
- Understand the importance of analysis and design, using the FEM, in the broader context of engineering practice.

Topics Covered:

- Equations in Solid Mechanics
- One-dimensional elements (C0 continuity)
- Two-dimensional (triangular, quadrilateral and curved) elements
- Axisymmetric problems
- Three dimensional stress analysis
- One-dimensional elements (C1 continuity)
- Two-dimensional elements (C1 continuity)

Assessment Methods:

- Homework Assignments – 35%,
- Quizzes – 10%,
- Project – 20%,
- Midterm Exam – 15%,
- Final Exam – 20%

Text:


Reference:


Grading:

Course Numerical Grade Course Letter
Grade

- >=89.5 A
- 79.5-89.4 B
- 69.5-79.4 C
- 59.5-69.4 D
- <=59.4 F

**Relation to Engineering Physics Program Outcomes:**

<table>
<thead>
<tr>
<th></th>
<th>Ability to apply mathematics, science, and engineering principles.</th>
<th>None</th>
<th>Low</th>
<th>High</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td>Homework, Exams, Quiz</td>
</tr>
<tr>
<td>b</td>
<td>Ability to design and conduct experiments, analyze and interpret data</td>
<td>x</td>
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<tr>
<td>c</td>
<td>Ability to design a system, component, or process to meet desired needs</td>
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<td>x</td>
<td></td>
<td>Homework, Project</td>
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<td>d</td>
<td>Ability to function on multidisciplinary teams.</td>
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<tr>
<td>e</td>
<td>Ability to identify, formulate, and solve engineering problems.</td>
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<td></td>
<td>x</td>
<td>Homework, Exams, Quiz</td>
</tr>
<tr>
<td>f</td>
<td>Understanding of professional and ethical responsibility.</td>
<td>x</td>
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<tr>
<td>g1</td>
<td>Ability to communicate effectively-Oral</td>
<td></td>
<td>x</td>
<td></td>
<td>Project</td>
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<tr>
<td>g2</td>
<td>Ability to communicate effectively-Written</td>
<td></td>
<td></td>
<td>x</td>
<td>Project</td>
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<tr>
<td>h</td>
<td>The broad education necessary to understand the impact of engineering solutions in a global and societal context</td>
<td>x</td>
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<td>i</td>
<td>Recognition of the need for and an ability to engage in life-long learning.</td>
<td>x</td>
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<tr>
<td>j</td>
<td>Knowledge of contemporary issues.</td>
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<td>k</td>
<td>Ability to use techniques, skills, and modern engineering tools necessary for engineering practice.</td>
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<td>x</td>
<td>Homework, Project</td>
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<tr>
<td>l</td>
<td>Ability to work professionally in both thermal and mechanical systems areas including the design and realization of such systems</td>
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<td>x</td>
<td></td>
<td>Homework, Project</td>
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**Contribution of the course to the professional component**

<table>
<thead>
<tr>
<th></th>
<th>None</th>
<th>Low</th>
<th>High</th>
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<tbody>
<tr>
<td>General Education</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td></td>
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<td>x</td>
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</tbody>
</table>
Basic Sciences | x |
Laboratory Experience | x |
Engineering Science | x |
Engineering Design | x |

**Class Policies:**

- No makeup homework, exam unless sever health issue for which proper doctors note has to be submitted.
- No test scores or homework grades will be dropped.
- All students are expected to come to class alert and ready to participate. Sleeping, reading newspapers, and doing homework for other classes are not allowed during class. Students are expected to assist in maintaining a classroom environment that is conducive to learning. Inappropriate behavior in the classroom shall result, minimally, in a request to leave the class.
- It is the aim of the faculty of University of Central Oklahoma to foster a spirit of complete honesty and a high standard of integrity. The attempt of students to present as their own any work that they have not honestly performed is regarded by the faculty and administration as a serious offense and renders the offenders liable to serious consequences, possibly suspension.
- Students with disabilities who need special accommodations must make their requests by contacting the Assistant Director of Disability Support Services, Ms. Kimberly Fields at (405) 974-2549. The DSS Office is located in the Nigh University Center, Room 309.