Colorado State University

MECH-301A-L01: Engineering Design III: Finite Element Analysis

Dr. McGilvray reserves the right to make changes to this syllabus at any time throughout the semester.

General Course Description [1 credit – (1 – 2 - 0)]:

∴ This class supports the Mechanical Engineering program's learning objectives by educating you (the student) in relevant computational analytic tools (i.e., finite element analysis (FEA) software tools) that will be used throughout your undergraduate education, and very likely, within your career as an engineer.

∴ Upon successful completion of this course you will be able to:

1) Utilize a FEA programs to analyze mechanical structures for deformation, stress and strain.
2) Apply engineering principles when using FEA programs to evaluate the *in silico* predictions / results.

Instructor:

∴ Dr. Kirk McGilvray
∴ *Email:* Kirk.McGilvray@colostate.edu
∴ *Office:* Engr. 106A
∴ *Office Hours:* By Appointment

Textbook:

- *None*

Graduate Teaching Assistances (GTAs):

∴ Will be announced, and email addresses will be distributed, within the Course Information Module

Class Website (https://canvas.colostate.edu/)

∴ The Canvas website will be used for homework assignments, instructional material, and announcements.

∴ ***GTAs should be your first point of contact for questions about homework, lab work, and grading concerns***.

∴ **DO NOT email through Canvas**, send emails directly to your GTAs or Kirk.McGilvray@colostate.edu.

Class Schedule:

SYLLABUS *
100 Total Possible Points Available
*Subject to change at the discretion of Dr. McGilvray

Download; Watch; Lab Work; Upload

MECH 301A FEA	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7	WEEK 8
MOD 1: Introduction to Finite Element Analysis								
MECH 301A Lecture Notes (Fillable PDF Packet)								
Student Sorting Numbers								
Syllabus Review and Class Introduction (2 Min. 26 Sec.)								
Introduction to Finite Element Analysis (37 Min. 52 Sec.)								
Introduction to Abaqus (Lab 1a: 26 Min. 39 Sec.) Deliverables: N = 1; 1 pnt.								
Getting SolidWork Parts into Abaqus (Lab 1b: 3 Min. 03 Sec.) Deliverables: N = 1; 1 pnt.								
Underwater Project Box Analysis (Lab 1c: 31 Min. 12 Sec.) Deliverables: N = 2; 2 pnts.								
MOD 2:Linear Elasticity and Failure Theories								
Homework ONE: Available								
Linear Elasticity and Failure Theories (46 Min. 12 Sec.)								
Failure Theory Analysis (Lab 2a: 44 Min. 53 Sec.) Deliverables: N = 4; 4 pnts.								
MOD 3: Mesh Convergence								
FEA Calculation Basics and Mesh Convergence (17 Min. 55 Sec.)								
Element Types and Mesh Control (34 Min. 19 Sec.)								
Mesh Convergence (Lab 3a: 38 Min. 01 Sec.) Deliverables: N = 4; 4 pnts.								
MOD 4: Contact and Frequency Analysis								
Homework ONE Deliverables: N = 1 packet Due: Wednesday of Week 4 at 12AM:Midnight								
Homework TWO: Available								
Axissymmetic Modleing, Contact and Boundary Conditions (39 Min. 02 Sec.)								
Frequency Analysis - Eigenvalues (Lab 4a: 15 Min. 17 Sec.) Deliverables: N = 4; 4 pnts.								
MOD 5: Validation								
Validation (28 Min. 50 Sec.)								
Adaptive Mesh Refinement (Lab 5a: 26 Min. 03 Sec.) Deliverables: N=4; 4 pnts.								
MOD 6: Structural FEA Review								
Homework TWO Deliverables: N = 1 packet; 12.5 pnts. Due: Wednesday of Week 6 at 12AM:Midnight								
Structural Finite Element Review (22 Min. 38 Sec.)								
Topology Optimization (Lab 6a: TBD Min. TBD Sec.) Deliverables: N = 4; 4 pnts.								
MOD 7: Final Written Exam								
FEA Lab Practicium Review (Lab 7a: TBD Min. TBD Sec.) Deliverables: N = 1; 1 pnt.								
Written Final Exam (60 Min. 00 Sec.) Deliverables: N = 1 packet; 25 pnts.								
MOD 8: Lab Practicum								
Lab Practicum (120 Min. 0 Sec.) Deliverables: N = 1 packet; 25. pnts.								

Class Policies:

∴ You are responsible for your learning. Take advantage of all resources to achieve the course objectives. Be sure you have made a serious attempt at your own solutions before contacting GTAs for assistance on

homework. Also, be sure to pay close attention to the tutorials in the lab sections. It is your responsibility to understand and apply the procedures used in the tutorials. Any material in the tutorials may be on the written or lab exam.

Absence Policy:

∴ Arrangements may be made ahead of time for University excused absences (only). Please notify Dr. McGilvray prior to assuming your absence is excused.

NOTE: The *Students Rights and Responsibilities* section of the *University General Catalog* provides general policies of conduct. Particularly important is the subsection on ***Academic Integrity***. The policies below provide additional specific guidelines on this course. Violation of ***Academic Integrity*** will result in severe and adverse penalties, including at a minimum, a loss of credit (including the possibility of negative credit) for the assignment(s) in question. There will be NO tolerance for any form of cheating.

I. Course Grading:

Homework	*25%*
Laboratory Assignments	*25%*
FEA Lab Practicum	*25%*
FEA Written Exam	*25%*

- Any disagreement with HW, LW, or Exam grading must be settled **within one week** after the graded material is returned. **No exceptions will be made.**

∴ Grading will be assigned according to the following fixed grade scale.

- No individual extra credit work will be offered to improve grades.
- Grades will not be 'rounded'.

A +	100.00% - 96.67%
A	< 96.67% - 93.33%
A -	< 93.33% - 90.00%
B +	< 90.00% - 86.67%
B	< 86.67% - 83.33%
B -	< 83.33% - 80.00%
C +	< 80.00% - 76.67%
C +	< 76.67% - 70.00%
D	< 70.00% - 60.00%
F	< 60.00% - 0.00%

II. General and Homework:

- You may work on homework individually or in a small group ($n \leq 4$). To enhance your learning experience, I encourage you to work in groups. If you do, I recommend the following approach:
  - Try to work the problems individually first, then compare your approaches and results with your group members, then work the problem together to settle on the correct approach and final answers.
  - *DO NOT* divide the problems up within your group – every person should work every problem.

- Homework is given to ensure that you understand and can correctly apply course material. These are the cornerstones of the educational process. Academic misconduct eliminates the educational discovery process (the "aha" moment) necessary in understanding. This will reflect on exams.
- **Each student will need to submit their own HW solutions.**
  - Submitted HW assignments should be original work. Copying solutions and/or answers from any source (solution manuals, internet sources, current students, past students, course files, etc.) is plagiarism and is prohibited. Unauthorized possession or distribution of such material is also prohibited.
  - Each HW problem should begin on a new page with the following info at the top:
    - 1st) Your full name, and
    - 2nd) Student sorting number (to be assigned via Canvas (*https://canvas.colostate.edu/)* – this will help the graders input grades and sort HWs for return).
- Homework will be assigned via Canvas (*https://canvas.colostate.edu/)*
- ***Homework must be submitted by 12PM (midnight) the day it is due.***
  - Homework will be turned in via Canvas (*https://canvas.colostate.edu/)*
  - Late work will not be accepted without penalty (e.g., 1 - 30 minutes late: -5%; 30 - 60 minutes late -10%; a few hours late: -50%; more than a day late: -100%).
  - Homework solutions will be posted via Canvas (*https://canvas.colostate.edu/)*

- ***Laboratory work***
  - Only attend your assigned laboratory section. Attendance is not required, but strongly encouraged as this will be the appropriate time to get help from GTAs.
  - Lab work is not homework, and in principle you should turn in your finished lab work at the end of your lab session.
    - However, **lab work is due Sunday at 12PM (midnight) on the week it was assigned**.
      - Each student will need to submit their own lab work solutions
      - **Due dates and times will not be extended for extraneous problems**, such as computer problems, internet problems, etc., that occurred after your lab session.
  - Put your finished lab work in a folder. Name the folder with your lab section number (LS), student sorting number, last name, first name, and lab work number:
    - For example: LS0_McGilvray_K_000_MOD0_Results.TIF
    - Drop the folder in the drop-box (classes.engr.colostate.edu T:\MECH\MECH301\drop-box). **If the folder name is not correct or the folder is not organized as required, there will be significant penalties in grading**.
    - There can be more than one item turned in for each lab assignment, however all of the items may not be graded.

III. Exams

∴ Examinations will be administered during your lab section.

- Make-up exams will be given only in extreme, unanticipated, and unavoidable circumstances.
- ***Any form of cheating of on any examination will result in severe penalties (i.e., an 'F' in the course).***

∴ At CSU the Resources for Disabled Students (RDS) provides support (including support on exams) for students with both permanent and temporary limitations and chronic illness/health conditions (physical and mental health). Limitations include, but are not limited to, mobility, hearing, seeing, and learning. Chronic illness/health conditions include, but are not limited to, depression, diabetes, epilepsy, celiac, and concussion.

IV. Harassment-Free Academic Environment

The faculty of the Mechanical Engineering department are committed to providing open and honest environments for our intellectual pursuits. Any action in a group situation (whether or not in relation to race, color, religion, sex, national orientation, age, disability, or sexual orientation) resulting in the **perception** of an intimidation, harassing, retaliatory, hostile or offensive environment is a violation of our education community's obligation to provide an open, safe, conductive learning environments and will not be tolerated. Any perception of harassment will be reported to the CSU Office of Equal Opportunity which is tasked by the state to investigate incidences of this nature.

I hope you have a great semester and enjoy this class. ***Best of luck!***

Regards,
Kirk C. McGilvray, Ph.D.
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