CALIFORNIA STATE UNIVERSITY SACRAMENTO
The Department of Mechanical Engineering

ME173 – INTRODUCTION TO FINITE ELEMENT ANALYSIS

SYLLABUS

DESIGNATION: Mechanical Design and Mechatronic Systems

INSTRUCTOR: Prof. José J. Granda
Riverside 5002, 916- 278-5711
Email: grandajj@ecs.csus.edu

OFFICE HOURS: 2:00 p.m.- 3:00 p.m. T, TH or by appointment

TIME: 12:00 – 1:15 p.m.

PLACE: Riverside 4001

TECHNOLOGY USED: Exchanges of materials will all be electronic. Notes, assignments, etc.

WEB PAGE.- Course documents will be posted on the instructor's web site or on the Web CT
site.

OBJECTIVES: **It** is an introductory course in Finite Element Analysis for the solution of
design problems. While the emphasis will be on fundamentals, the use of the computer to solve
engineering problems is essential. A final project using the software used in class or other finite
element programs used by students is required. Lecture three hours.

PREREQUISITES: E110   UNITS: 3.0

TEXT: APPLIED FINITE ELEMENT ANALYSIS by   Larry J. Segerlind , John
Wiley and Sons, Inc (second edition)

Software Documentation
REFERENCES: Finite Element Analysis and Design. Kim, Shankar Wiley, 2009

**KNOWLEDGE, SKILLS, AND ABILITIES STUDENTS SHOULD HAVE BEFORE
ENTERING THIS COURSE:**   Communicate technical information accurately and concisely –
both orally and in writing, use analysis, computer software, word processors, etc., to define and
develop solutions to technical problems. The skills learned in dynamics courses are a good basis. .
The student will be expected to study the assigned reading assignments and homework following the
schedule. Students are responsible for ALL material presented in class. This includes any
announcements, due dates, changes or clarifications made in class. The instructor and the materials
available to you will be your guidance, but the real learning process takes place on your own going

over examples in class and in communication with the instructor.

KNOWLEDGE, SKILLS, AND ABILITIES STUDENTS GAIN FROM THIS COURSE:
The objective of this course is to provide the student with the necessary skills to understand and use the Finite Element Modeling technique for designing parts and complete assemblies.

After taking this class students will be able to:
1) To solve problems involving the basic concepts of finite elements for static and dynamics finite element problems.
2) To use the computer and generate Finite Element Models in two and three dimensional.
3) To use two and three dimensional Solidworks models and transform them in Finite element models.
3) To perform computer simulations using the Finite Element Modeling technique to study stress, strain. Deformations and loading conditions.
4) Understand the concepts of Finite Elements for one, two and three dimensions.

IMPACT ON SUBSEQUENT COURSES IN CURRICULUM: For those enrolled students, who have not yet participated in the capstone design course, provides a foundation for modeling and simulation of the subsequent course topics of ME190, ME191.   For students who want to learn more about automatic control, this class is an excellent basis for ME114.

ABET CRITERIA 2000 OUTCOMES ACHIEVED: This course contributes to the following EC2000 Criterion 3 outcomes and those specific to the EAC accredited _ program.

Outcome		Outcome	
a. An ability to apply knowledge of mathematics, science, and engineering	√	g. An ability to communicate effectively	√
b. An ability to design and conduct experiments, as well as to analyze and interpret data		h. The broad education necessary to understand the impact of engineering solutions in a global/societal context	√
c. An ability to design a system, component, or process to meet desired needs	√	i. A recognition of the need for and an ability to engage in life-long learning	
d. An ability to function on multi-disciplinary team	√	j. A knowledge of contemporary issues	√
e. An ability to identify, formulate, and solve engineering problems	√	k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	√
f. An understanding of professional and ethical responsibility	√	l. Begin list of any other outcomes unique to the program.	

ABET PROGRAM CRITERIA OUTCOMES ACHIEVED: Program criteria outcomes are unique to each degree program and are to be compiled from the program criteria given for each degree program and listed in bullet format below.

Criterion		Criterion		Criterion	
A. Aerodynamics		G. Orbital Mechanics		M. Preliminary/Conceptual Design	√
B. Aerospace Materials		H. Space Environment		N. Other Design Content	√
C. Structures		I Attitude Determination and Control		O. Professionalism	√
D. Propulsion		J. Telecommunications		P. Computer Usage	√
E. Flight Mechanics		K. Space Structures			
F. Stability and Control	√	L. Rocket Propulsion			

COMPUTER USAGE: Computers are used for writing reports (WORD) and presentations (PowerPoint).   Spreadsheets are used as appropriate in doing multiple trade studies. Computational tools such as PATRAN, NASTRAN, ADAMS.

CLASS FORMAT: This course follows a lecture format. Assignments will be both individual and group. Groups will be approximately 4 people, and pre-assigned by the instructor. Students are responsible for reading the assigned material prior to the scheduled class. Class participation is required and part of the course grading. Students are encouraged to actively participate and to ask questions freely. Students will be expected to present their work periodically.

COURSE GRADING:

> Quizzes/Exams 40%
> Homework Assignments 10%
> Lab assignments 30%
> Individual Project 10%
> Final Exam 10%
> _____
> 100%

Exams and assignments will be graded balancing the procedure used and the correctness of your answer on an equal basis. Presentation and organization of your assignments will also be considered in grading. Midterm exams and final will be closed book exams. It is important that students realize they are responsible for the reading assignments, readings specified in this outline and reading the lab manual. That material can be on an exam. Students should not rely only on the lectures in class or lab but also on the readings.

Exams and assignments will be graded balancing the procedure used and the correctness of your answer on an equal basis. Presentation and organization of your assignments will also be considered in grading. There will be Quizzes approximately one to two weeks apart, including the last week of class. Quizzes and final exam will be closed book exams. If there is a discrepancy in

grading, you have two weeks from the date you received it to bring up for discussion. After that period grades are final. Projects are due on the last day of class. Work turned in after the deadlines will not be computed in your final grade.

HOMEWORK, COMPUTER ASSIGNMENTS POLICY:
Assignments are issued each week and students work is due in one week unless otherwise noted in the accompanying class schedule. Assignments are due at the start of class on the due date. Late assignments may be accepted, but at a loss of 20% of the grade per 24 hours late. Homework assignments will be returned to students post grading. There will be reading homework and computer assignments. Students are responsible for ALL material presented in class. This includes any announcements, changes, clarifications on assignments, or due dates. It is expected that the assignments will be completed and turned in before or on the specified deadlines. There will be no make up tests except in cases of confirmed and documented illness or emergency.

As the semester goes on and you realize "things" are not going well for you in this class or you become frustrated with the computer, be aware of the policy on drops and incomplete. To drop the class you must meet deadlines and an incomplete is rarely granted and can not be used to "bail out" of the class.

EXAMINATIONS:
There will be quizzes and exams. These will be announced to cover specific modules of the course.   The final exam will be administered in accordance with the University scheduled time. Make-up exams require the permission of the instructor prior to the day of the exam.

ATTENDANCE:
Regular attendance is expected. Note that a portion of your grade is based on class participation and self-initiative. Professional contribution is a goal of this course.

SCHEDULE / CRITICAL DATES:

- Last Day of Official Adds/Drops
- Holidays
- Last Drop Day for Possible Refund
- Mid-Term Exam
- Spring Break
- Last Drop Day (with Approval)
- Final Book Reports Due
- Final Exam

Other important dates are available from the University Academic Calendar web site.

SPECIAL NOTES:

Students with Disabilities: The California State University provides upon request appropriate academic adjustments for qualified students with disabilities. For more information, contact the Office of the Dean of Students or the College of Engineering Director of Students with Disabilities.

Class Web Sites and Student Privacy: Web-based, password-protected class sites are associated with all academic courses taught at The University. Syllabi, handouts, assignments and other resources are types of information that may be available within these sites. Site activities could include exchanging e-mail, engaging in class discussions and chats, and exchanging files. In addition, electronic class rosters will be a component of the sites. Students who do not want their names included in these electronic class rosters must restrict their directory information in the Office of the Registrar.

EVALUATION:
The Measurement and Evaluation Center forms for the College of Engineering will be used during the last week of class to evaluate the course and the instructor.

UNIVERSITY POLICY ON INDIVIDUAL WORK
    CSUS is a high level educational institution and therefore a professional environment should exist. However discipline problems or attempts to disrupt any aspect of the course, or influence other students to do the same.

    The assignments are supposed to be individual unless assigned as a group.   Copying assignments or exams will at the very least, result in zeroes assigned to ALL involved. It is the Mechanical Engineering Department's policy to remove from the major students who copy an exam or to expel them from the university. Copying or deleting unauthorized disk files will have the same effect. Logging onto somebody else's account is not permitted. Students are expected to answer questions on any of the work they hand-in.

    Students are encouraged to make constructive suggestions to the instructor about any aspect of the course. Please feel welcome to come and see me. Students are encouraged also to suggest projects, particular engineering problems or research topics of interest to the whole class.

INSTRUCTOR RESERVES THE RIGHT TO REVISE SCHEDULE AS NECESSARY
COURSE CONTENTS

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WEEK	TOPICS	READINGS	ASSIGNMENTS
1	The Finite Element Method One-Dimensional finite elements	Chapter 1,2	
2	Weighting Functions. Integral Evaluations.	Chapter 3	
3	Elément Matrices.	Chapter 4	
4	Two-Dimensional elements.	Chapter 5	
5	Coordinate Systems ** MIDTERM 1 **	Chapter 6	
6	Two-dimensional field equations. Differential equations. Element matrices.	Chapter 7	
7	Torsion of noncircular sections	Chapter 8	
8	Continuation from previous week		
9	Point Sources and Sinks.	Chapter 9	
10	Fluid mechanics problems.	Chapter 10	
11	Continuation from previous week		
12	Heat transfer problems.	Chapter 11	
13	Continuation from previous week		
14	Structural and Solid mechanics Problems. Axial force members. ** MIDTERM 2 **	Chapter 17	
15	Continuation from previous week		
16	** FINAL EXAMS **		