

CE 529a Finite Element Analysis (3)

2016 Summer Semester — **Tentative** Course Syllabus

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|------------------------|--|----------------------|---------|
| Lecture | Tuesday, Thursday | 6:40p.m. to 9:20p.m. | OHE 120 |
| Professor | Dr. A. Niaz, P.E. | | |
| Email | Niaz@usc.edu | | |
| Textbook • Required | D.L. Logan, " A First Course in the Finite Element Method ," CL-Engineering, Sixth Edition, 2016 , ISBN-13: 978-1-305-63511-1. | | |
| References | <ol style="list-style-type: none"> 1. S.S. Rao, "<i>The Finite Element Method in Engineering</i>," Butterworth-Heinemann, Elsevier Inc., Fifth Edition, 2010, ISBN-13: 978-1856176613. 2. R. Cook, D. Malkus, M. Plesha, and R. Witt, "Concepts and Applications of Finite Element Analysis," 4th Edition, 2002, Wiley." 3. J. Fish, and T. Belytschko, "A First Course in Finite Elements," 1st Edition, 2007, Wiley, ISBN: 978-0-470-03580-1, Paperback. 4. K. Huebner, D. Dewhirst, D. Smith, and T. Byrom, "The Finite Element Method for Engineers," 4th Edition, 2001, Wiley-Interscience." 5. K-J. Bathe, "Finite Element Procedures," Prentice-Hall, Englewood Cliffs, 1995. 6. M.A. Crisfield, "Non-Linear Finite Element Analysis of Solids and Structures," Vol. II, John Wiley & Sons; 1st edition, 1997. | | |
| Course Description | Typical engineering problems discussed on a physical basis. Setup and solution of problems by means of the existing mathematical tools. | | |
| Course Objectives | To achieve fundamental understanding of the subject of finite element analysis and apply it to diverse problems in Aerospace, Civil, and Mechanical Engineering. | | |
| Learning Objectives | <p>Variational Models</p> <ol style="list-style-type: none"> 1. Calculus of variations 2. Constraints – Lagrange’s multiplier 3. Constraints – Penalty 4. Galerkin’s method. <p>Continuum Finite Elements</p> <ol style="list-style-type: none"> 1. 1-D interpolation methods 2. 2-D interpolation methods – rectangles and triangles 3. 3-D interpolation methods – hexahedron, tetrahedron, prism <p>Isoparametric Elements</p> <ol style="list-style-type: none"> 1. Mappings – physical system and natural coordinate system 2. Numerical integration – Gauss’ quadrature <p>Numerical Implementation</p> <p>Elasticity Problems</p> <ol style="list-style-type: none"> 1. Plane stress and plane strain 2. Stress calculation 3. Incompressible problems 4. Pressure, enforced displacement, and thermal loading <p>Axisymmetric Elasticity Problems</p> <p>Plate Problems</p> <p>Dynamic Problems</p> <p>Shell Problems</p> <p>Introduction to Nonlinear Finite Element Analysis?</p> | | |

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| Policies on: | | | | | | | | | | | |
|---|--|----------|------|--------------|------|---------|------|------------|------|-------|-------|
| Exams | <ul style="list-style-type: none">• Closed book.• Only one sheet of 8.5" x 11" paper (two pages) of formulae allowed.• Calculator.• Students must turn in questions sheets with their answer sheets at the end of each exam. | | | | | | | | | | |
| Homework | Homework problems assigning and delivery are as indicated on the class calendar ; unless otherwise instructed . In addition, homework delivery needs to be no later than 6:40 P.M. in Los Angeles time, CA, USA, on the day of delivery. | | | | | | | | | | |
| Late work | Not to be accepted. | | | | | | | | | | |
| Make-up work | No make-up on any examinations. | | | | | | | | | | |
| Incomplete work | To be graded accordingly. | | | | | | | | | | |
| Extra credit | No current plan for extra credit. | | | | | | | | | | |
| Final grade scheme is based on percentages of graded coursework | <table><tbody><tr><td>Homework</td><td>20 %</td></tr><tr><td>Midterm Exam</td><td>20 %</td></tr><tr><td>Project</td><td>20 %</td></tr><tr><td>Final Exam</td><td>40 %</td></tr><tr><td>Total</td><td>100 %</td></tr></tbody></table> | Homework | 20 % | Midterm Exam | 20 % | Project | 20 % | Final Exam | 40 % | Total | 100 % |
| Homework | 20 % | | | | | | | | | | |
| Midterm Exam | 20 % | | | | | | | | | | |
| Project | 20 % | | | | | | | | | | |
| Final Exam | 40 % | | | | | | | | | | |
| Total | 100 % | | | | | | | | | | |

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Lectures and Class Calendar

| Session | Date | Topic | Textbook Reading Assignments | Assignments | |
|-----------|--------------|--|---|----------------------|-----------------------|
| | | | | Assignment | Delivery |
| 1 | 19-May | Introduction to The Finite Element Method | Chapter 1, Section 2.6, Section 3., 3.1, 3.10, 3.11 | HW 1 | |
| 2 | 24-May | Variational Principles/ Project Discussion | Chapter 1, Section 2.6, Section 3, 3.1, 3.10, 3.11 | HW 2/ Project | |
| 3 | 26-May | Direct Method of Calculus of Variation, Galerkin's method, Constraints | Section 3.12, 3.13, Section 4., 4.1, 4.2, 4.7, 4.8 | HW 3 | HW1, HW 2 |
| 4 | 31-May | Continuum Elements Part I: Isoparametric Elements, numerical Integration/ Project Discussion | Section 3.2, Section 4.4, Section 6., 6.1, 6.6, Section 10., 10.1, 10.2, 10.3, 10.4, 10.5 | HW 4 | HW 3 |
| 5 | 2-Jun | Continuum Elements Part I: Isoparametric Elements, numerical Integration/ Project Discussion | Chapter 10 | HW 5 | HW 4 |
| 6 | 7-Jun | Midterm Exam (90 min) | | | |
| 7 | 9-Jun | Static Condensation, Performance of Elasticity Elements, Stress Calculations, Barlow's points , Continuum Elements Part II, Substructure | Section 4.6, Section 7.5, Section 5.6, Chapter 10 | HW 6 | HW 5 |
| 8 | 14-Jun | Continuum Elements Part II | Section 6.1, 6.2, 6.3, 6.4, Chapter 8, Chapter 11 | HW 7 | HW 6 |
| 9 | 18-Jun | Axisymmetric Elasticity Problems / Plate Problems | Chapter 9 | HW 8 & HW 9 | HW 7 |
| 10 | 21-Jun | Plate Problems | Chapter 12 | HW10 | HW 8 & HW 9 |
| 11 | 23-Jun | Dynamics Problems / Project Delivery | Chapter 16 | HW 11 | HW 10/ Project |
| 12 | 28-Jun | Free Vibration Analysis | Chapter 16 | HW 12 | HW11 |
| 13 | 30-Jun | Shell Problems | | | HW12 |
| 14 | 5-Jul | Final Exam (120 min) | | | |

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STATEMENT ON ACADEMIC INTEGRITY

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own.

All students are expected to understand and abide by these principles. *SCampus*, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A:

<http://www.usc.edu/dept/publications/SCAMPUS/gov/>

Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at:

<http://www.usc.edu/student-affairs/SJACS/>

The Viterbi Honor Council presents the following honor code:

Engineering enables and empowers our ambitions and is integral to our identities. In the Viterbi community, accountability is reflected in all our endeavors.

Engineering + Integrity.
Engineering + Responsibility.
Engineering + Community.
Think good. Do better. Be great.

These are the pillars we stand upon as we address the challenges of society and enrich lives.

STATEMENT FOR STUDENTS WITH DISABILITIES

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible.

DSP Contact Information

Location: STU 301
Hours open: 8:30 a.m. until 5:00 p.m., Monday — Friday
Phone number: (213) 740-0776