CE 402
Course Syllabus

Spring 2013
Part I Course Organization
Spring 2013

CE 402  COMPUTER METHODS IN ENGINEERING

Instructor:  S.F. Masri; KAP 206A; email: masri@usc.edu

Office Hours:  Monday/Wednesday: 3:30 - 5:30 pm
Telephone:  740-0602; 740-0603

Teaching Assistant:  (Discussion Session) Miguel Hernandez Garcia
Telephone:  213-740-0575; email: miguelrh@usc.edu
T.A. Office Hours:  (KAP 239) M 1:00-2:00 p.m., T 2:00-3:30 p.m., W 1:00-2:00 p.m.

Class No.  29638R
TTime & Place: Lecture  2:00 - 3:15 p.m. MW; MHP 105
Time & Place: Discussion  5:00 - 5:50 p.m. W; KAP 144

Textbook:  “Numerical Methods for Engineers” (Sixth Ed.)
by:  S.C. Chapra & R.P. Canale (McGraw-Hill)

Prerequisite:  CE 108: “Introduction to Computer Methods in Civil Engineering”
            MATH 245: “Mathematics of Physics and Engineering”

Final Exam:  Wednesday, 08-MAY-2013, 2:00-4:00 p.m.

Grades:  Homework/Midterm/Final:  20%/30%/50%
Remarks:  About 10 homework projects will be assigned

   Late Homework will not be accepted.
   No make-up on any examinations.

***************  COURSE OUTLINE  ***************

1.  Introduction - Course Overview; Flowcharts
2.  Software Tools - Mathematical Computation Software (Fortran, C, Matlab, Mathematica)
3.  Solution of Nonlinear Algebraic Equations
4.  Solution of Sets of Equations (Linear and nonlinear)
5.  Optimization
6.  Interpolation
7.  Numerical Differentiation
8.  Numerical Integration
9.  Monte Carlo Techniques
10. Numerical Solution of Ordinary Differential Equations
11. Boundary-Value Problems and Characteristic-Value Problems
12. Curve-fitting and Approximation of Functions
Part II  Detailed Course Objectives
## Course Information, Textbook, and Supplementary Materials

### Course Description:
Fundamentals of analog and digital computers; simulation of nonlinear physical systems; numerical analysis and solution of engineering problems.

### Required for:
BSCE, BSCE Structural, and BSCE Building Science

### Prerequisites:
- CE 108 Introduction to Computer Methods in Civil Engineering
- MATH 245 Mathematics of Physics and Engineering I

### Co-Requisite:
none

### Required Textbook:

### Reference:
none

## Topics Covered

<table>
<thead>
<tr>
<th>Topics Covered</th>
<th>Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algorithms for solving linear and nonlinear algebraic equations, numerical interpolation, differentiation and integration</td>
<td>14. To create computer programs for solving linear and nonlinear algebraic equations 15. To create computer programs for numerical interpolation, differentiation and integration</td>
</tr>
<tr>
<td>Algorithms for Monte Carlo Techniques, Curve-fitting and approximation of functions</td>
<td>16. To create computer programs for solving the Monte Carlo techniques 17. To create computer programs for Curve-fitting &amp; approximation of functions</td>
</tr>
<tr>
<td>Solutions of ordinary differential equations and boundary and characteristic value problems</td>
<td>18. To create computer programs for finding the solutions of ordinary differential equations. 19. To create computer programs for solving boundary and characteristic-value problems</td>
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Lecture and Lab Schedule

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sessions per Week</td>
<td>Sessions per Week</td>
</tr>
<tr>
<td>Duration per Session</td>
<td>Duration per Session</td>
</tr>
<tr>
<td>2</td>
<td>n/a</td>
</tr>
<tr>
<td>1.5 hours</td>
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Contribution of Course to Meeting the Professional Component

Engineering Topics
In this class, students will learn the computer methods used in civil engineering; basic experimental methods as a companion means of analysis applied in solving real word structural problems; algorithms for solving linear and nonlinear algebraic equations, numerical interpolation, differentiation and integration; algorithms for Monte Carlo Techniques, Curve-fitting and approximation of functions; and solutions of ordinary differential equations and boundary and characteristic value problems.

Relation of Course Objectives to Program Outcomes
The Civil Engineering program is designed to teach beyond the technical content of the curriculum and prepare the students to utilize what they learn in a professional setting.

This course contributes to the program outcomes as outlined in the adjacent table.

<table>
<thead>
<tr>
<th>Course Contribution to Program Outcomes (a-k)</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. An ability to apply knowledge of mathematics, science, and engineering.</td>
<td>✓</td>
</tr>
<tr>
<td>e. An ability to identify, formulate and solve engineering problems.</td>
<td>✓</td>
</tr>
<tr>
<td>k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.</td>
<td>✓</td>
</tr>
</tbody>
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Prepared by: Dr. Sami F. Masri
Professor of Civil Engineering

Semester: Spring 2013