**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

<table>
<thead>
<tr>
<th>Topics Covered</th>
<th>Learning Outcomes</th>
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</thead>
</table>
| Computer methods used in civil engineering; basic experimental methods as a companion means of analysis applied in solving real word engineering and structural problems | Students will have learned:  
1. Procedural languages such as FORTRAN; Flowcharts  
2. To solve nonlinear algebraic equations  
3. To solve sets of equations (linear and nonlinear)  
4. Interpolation  
5. Numerical differentiation  
6. Numerical integration  
7. Monte Carlo techniques  
8. Numerical solutions of ordinary differential equations  
9. Solution of boundary-value problems and characteristic-value problems  
10. Curve-fitting and approximation of functions  
11. Development of numerical algorithms for a given set of instructions or procedures  
12. Creation of flow-charts as illustrations of numerical algorithms  
13. Translation of flow-charts into executable computer programs  
14. Application of computer algebra programs for symbolic manipulation  
15. To create computer programs for solving linear and nonlinear algebraic equations  
16. To create computer programs for numerical interpolation, differentiation and integration |
| Algorithms for solving linear and nonlinear algebraic equations, numerical interpolation, differentiation and integration |  
17. To create computer programs for applying Monte Carlo techniques for simulating random phenomena  
18. To create computer programs for Curve-fitting & approximation of functions |

| Algorithms for Monte Carlo Techniques, Curve-fitting and approximation of functions |  
17. To create computer programs for applying Monte Carlo techniques for simulating random phenomena  
18. To create computer programs for Curve-fitting & approximation of functions |
Topics Covered | Learning Outcomes
--- | ---
20. To create computer programs for solving boundary and characteristic-value problems

### CE 402

**Computer Methods in Engineering**  
3 Units

**Lecture and Lab Schedule**

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sessions per Week</td>
<td>Duration per Session</td>
</tr>
<tr>
<td>2</td>
<td>1.5 hours</td>
</tr>
</tbody>
</table>

### 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>
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</thead>
<tbody>
<tr>
<td>i. Recognition of the need for, and an ability to engage in lifelong learning.</td>
<td></td>
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<tr>
<td>k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.</td>
<td>✔</td>
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</tbody>
</table>

**Prepared by:**  
Dr. Sami F. Masri  
Professor of Civil Engineering

**Date:**  
Fall 2014