1. **Course number and name:** CSCI 4610 (4410) Numerical Analysis

2. **Credits and contact hours:** 3 credit, 3 contact

3. **Instructor’s or course coordinator’s name:** Hong Zhang, PhD

   a. **Other supplemental materials:** None

5. **Specific course information**
   a. **Brief description of the content of the course (Catalog Description)**
      Introductory numerical analysis and scientific computation. Computer arithmetic, numerical error, polynomial interpolation, systems of linear equations, iterative methods for nonlinear equations, least squares approximation, numerical and integration.
   b. **Prerequisites:** A minimum grade of "C" in MATH 2242 and CSCI 1301.
   c. **Indicate whether a required, elective, or selected elective course in the program**
      Elective course for BS-CS.

6. **Specific goals for the course**
   a. **Specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.**

<table>
<thead>
<tr>
<th>Course Learning Outcomes</th>
<th>Student Outcomes</th>
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</thead>
<tbody>
<tr>
<td>demonstrate understanding of computational algorithms developed for solving systems of equations, determining roots and performing integration</td>
<td>1a</td>
</tr>
<tr>
<td>perform basic programming of selected algorithms</td>
<td>1a, 1c</td>
</tr>
<tr>
<td>execute mathematical proofs of certain theorems associated with computational algorithms</td>
<td>1a</td>
</tr>
<tr>
<td>analyze problems related to numerical integration and interpolation using assigned commercial software</td>
<td>1b, 1i</td>
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<tr>
<td>solve and be able to explain the approach and the solution to project-level queries that require a numerical analysis type assessment.</td>
<td>1a, 1b, 1c, 2a</td>
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</tbody>
</table>

b. **Student Outcomes:**
   - 1a: An ability to apply knowledge of computing and mathematics appropriate to the discipline
   - 1b: An ability to analyze a problem, and identify and define the
computing requirements appropriate to its solution
• 1c: An ability to design, implement and evaluate a computer-based system, process, component, or program to meet desired needs
• 1i: An ability to use current techniques, skills, and tools necessary for computing practice
• 2a: An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices

7. Brief list of topics to be covered

• Overview of constructive approach to mathematics;
• numerical issues: error analysis, rates of convergence;
• equation solving in 1-dimension: bisection method, functional iteration, Newton’s method;
• polynomial interpolation;
• numerical differentiation;
• numerical integration;
• numerical ordinary differential equations;
• overview of numerical linear algebra.