



**The Hashemite University**  
**Faculty of Engineering**  
**Course Syllabus**  
**Department of Allied Engineering**  
**Sciences (DAES)**



|  |                    |                             |           |
|--|--------------------|-----------------------------|-----------|
| <b>Course Title:</b>                     | Numerical Analysis | <b>Course Number:</b>       | 110402303 |
| <b>Designation:</b>                      | Compulsory         | <b>Prerequisite(s):</b>     | 101203    |
| <b>Instructor:</b>                       |                    | <b>Instructor's e-mail:</b> |           |
| <b>Office Hours:</b><br>Required Course: |                    |                             |           |

**Course Description (catalog):** Basic principles of numerical analysis and methods for solving different engineering problems: error analysis, solution of linear and nonlinear algebraic equations, regression and interpolating polynomials, numerical differentiation and integration, numerical solution of ordinary and partial differential equations.

**Textbook(s) and/or Other Supplementary Materials:**

*Numerical Methods for Engineers* by Chapra, S.C. and Canale, R.P., McGraw-Hill, 7<sup>th</sup> edition.

**References:**

*Applied Numerical Analysis* by Curtis F. Gerald and Patrick O. Wheatley, Addison-Wesley, 6<sup>th</sup> edition.

*An Introduction to Numerical Methods and Analysis* by James F. Epperson, Wiley, 2001.

**Major Topics Covered:**

| Topic   | # Weeks   | # of contact hours |
|---|-----------|--------------------|
| MATLAB Basics   | 2         | 6                  |
| Error Analysis: Approximations and Round-Off Errors   | 1         | 3                  |
| Error Analysis: Truncation Errors and the Taylor Series                                       | 1         | 3                  |
| Roots of Equations: Bracketing and Open Methods   | 2         | 6                  |
| Linear Algebraic Equations: Gauss Elimination, LU Decomposition and Special Matrices          | 2         | 6                  |
| Curve Fitting: Least Squares Regressions and Interpolation                                    | 2         | 6                  |
| Numerical Differentiation and Integration Formulas  | 2         | 6                  |
| Ordinary Differential Equations: Runge-Kutta Methods, boundary value and eigenvalue problems. | 3         | 9                  |
| <b>Total</b>  | <b>15</b> | <b>45</b>          |

\*Contact hours include lectures, quizzes and exams

**Specific Outcomes of Instruction (Course Learning Outcomes):**

After completing the course, the student will be able to:

**CLO 1:** Explain and define the meaning of numerical techniques. (1)

**CLO 2:** Evaluate and compare the accuracy of different numerical solution methods. (1, 5)

**CLO 3:** Demonstrate the fundamentals of numerical methods for: Root of equations, solving systems of linear equations, Data interpretation by curve fitting and interpolation, numerical differentiation, and integration. (1, 5)

**CLO 4:** Manipulate numerical solutions for 1<sup>st</sup> and 2<sup>nd</sup> order differential equations. (1, 5)

**Student Outcomes (SO) Addressed by the Course:**

| #   | Outcome Description  | Contribution |
|---|--|--------------|
| <b>General Engineering Student Outcomes</b> |  |              |
| (1)   | an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics  | H            |
| (2)   | an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors                   |              |
| (3)   | an ability to communicate effectively with a range of audiences  |              |
| (4)   | an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts |              |
| (5)   | an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives   | M            |
| (6)   | an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions  |              |
| (7)   | an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.  |              |
| <b>H=High, M= Medium, L=Low</b>             |  |              |

**Grading Plan:**

|  |           |
|--|-----------|
| Mid Exam                               | 30 Points |
| MATLAB based course work               | 20 Points |
| Participation, attendance, and absence | 10 points |
| Final exam                             | 40 Points |