# ME 350, Programming and Numerical Methods 

Mechanical and Materials Engineering Department
Winter 2017
Portland State University

ME 350 is a required course for the BSME program, and it is typically taken in the third year. The primary goal is to provide mechanical engineering majors with a basic knowledge of numerical methods including: root-finding, elementary numerical linear algebra, solving systems of linear equations, curve fitting, and numerical solution to ordinary differential equations. Matlab is the software environment used for implementation and application of these numerical methods. The numerical techniques learned in this course enable students to work with mathematical models of technology and systems. Homework and projects in other courses in the BSME curriculum require the mathematical and numerical skills obtained in ME 350.

## Prerequisites

Admission to upper division MCECS Program, EAS 101 or ME 121, Math 256

## Course Content

The list of class topics is given on the public web site for the course, http://web.cecs.pdx.edu/~gerry/class/ME350.

## Instructor

Instructor: Gerald Recktenwald, Associate Professor, Mechanical Engineering Department Engineering Building Suite, Room 402C, 725-4296, gerry@pdx.edu
Web site for the course: http://web.cecs.pdx.edu/~gerry/class/ME350
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## Required Textbook

Essential MATLAB for Engineerings and Scientists, 6th ed., Brian H. Hahn and Daniel T. Valentine, 20178, Academic Press, ISBN 978-0-08-100877-5
or Essential MATLAB for Engineerings and Scientists, 5th ed., Brian H. Hahn and Daniel T. Valentine, 2013, Academic Press, ISBN 978-0-12-394398-9

New and used copies of the book are available at the PSU bookstore. The 6th edition is preferred, but the 5th edition will be fine.

## Policies

Homework is due in a D2L dropbox, 5 minutes before the beginning of class on the due date.
The final exam will be comprehensive. Quizzes are administered on-line. There are no make-up quizzes, but the lowest quiz score will be dropped.
Students are expected to submit in homework assignments, lab worksheets, quizzes and projects that are substantially the result of their own work. Study groups, discussion of assignments among students, collective brainstorming for solutions, and sharing of advice are encouraged. Copying of assignments, computer files, graphs, or other means of duplicating
material that is turned in for grading is forbidden. Students must not discuss quizzes while the quiz is active on-line. Cheating on any assignment (quizzes, homeworks lab assignments and exams) will result in a zero grade for the assignment.
If you have a disability and are in need of academic accommodations, please notify me (G. Recktenwald) immediately to arrange needed supports. If you need information about disabilities, please contact the Disability Resource Center, 116 Smith Memorial Student Union, 503-725-4150 or via the web at http://www.pdx.edu/drc/.

## Learning Objectives

The Learning Objectives are skills that you should obtain by the end of class. If you can do all of the following activities very well, then you will likely get an "A" grade.
> The ability to write programs in Matlab that involve loops, logical block constructs (if...else), plotting, and simple file input/output. The ability to write programs that evaluate and plot analytical functions.
> The ability to use an understanding of machine precision and roundoff errors to write Matlab code for correctly testing convergence of iterative sequences.
$>$ The ability to transform an engineering equation involving one unknown into the canonical root-finding form: $f(x)=0$. The ability to apply MATLAB programs for finding the zeros of a function of one variable.
> The ability to manually perform addition, subtraction, and multiplication operations on vectors and matrices. The ability to manually compute vector norms. The ability to use all of these linear algebra operations in Matlab programs.
> The ability to set up and solve linear systems of equations. using MatLaB's backslash operator. The ability to interpret the condition number of coefficient matrix for a linear system of equations. The ability to compute and interpret the residual of a linear system of equations.
$>$ The ability to manually apply Euler's method, Heun's method, and the fourth order Runge-Kutta method to advance a single ordinary differential equation for one or two steps of the independent variable. The ability to use Matlab programs to obtain numerical solutions to ordinary differential equations.

## Grading

Cumulative grades will be based on the following weights:

|  | Percentage <br> of Total | Comments |
| :--- | :---: | :--- |
| Lategory worksheets | 15 | Mostly yes/no did you complete the work- <br> sheet? Drop the lowest lab score |
| Homework | 15 | Drop the lowest 2 homework scores |
| Midterm project | 15 | Work in groups of 2 |
| Quizzes | 25 | Via D2L. Drop the lowest quiz score. |
| Final exam | 30 |  |
|  | 100 |  |

