# Syllabus MTH 656, Spring 2016

**Course Name:** Numerical Analysis  
**Course Number:** MTH 656  
**Faculty:** Nathan Gibson  
**Contact Info:** Mathematics Department, Kidd 056, (541) 737-4894, gibsonn@oregonstate.edu  
**Course Credits:** 3  
**Course Location:** Corvallis Campus, MWF 13:00-13:50  
**Course Catalog Description:** Advanced topics in numerical analysis, including the numerical solution of inverse problems. All courses used to satisfy MTH prerequisites must be completed with C- or better. Solid undergraduate advanced calculus and linear algebra are the prerequisites. Prior computing experience is not required but students will be expected to grow in their computational and theoretical abilities. This class is the third in a year-long sequence MTH 654-656, but classes in this sequence can be taken independently. (Please contact the instructor with questions.)

**Prerequisites:**
This course is concerned with the numerical solution of inverse problems, including numerical optimization of cost functionals. Specific topics covered in the course will include ill-posedness and regularization, image de-noising, numerical optimization methods (including convergence analysis, implementation concerns, and dealing with noisy functionals), maximum likelihood estimation, parameter identification, sensitivity analysis, uncertainty quantification, discrete optimal control, and constrained optimization. The course will provide an introduction to optimization theory, a working understanding of several numerical solution methods, and MATLAB sample solutions to examples of applications.

**Course Content:**
A successful student will be able to
- Formulate a well-posed problem based on a question about quantities of interest in a model
- Analyze the appropriateness of particular methods for given problems including

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appraising accuracy and computational efficiency

- Apply learned methods to new problems and discuss the results

Evaluation of Student Performance:

A student's grade will be determined by three homework assignments, which will consist of a mixture of analytical problems and numerical computations using MATLAB. Problems will reinforce theoretical and computational concepts from lecture. Additionally, the student will complete an individual term project on a topic chosen by the student, but which demonstrates techniques discussed in the course. Students must submit a typed (less than or equal to two pages) research proposal, including questions to be investigated midway through the course. The final report must be typeset and a presentation will be given to the class. Each of the above assignments will count equally toward the final grade.

Learning Resources:

Required Text: "Computational Methods for Inverse Problems" by Curtis R. Vogel, SIAM. Optional Text: "Iterative Methods for Optimization" by C. T. Kelley, SIAM.

Statement Regarding Students with Disabilities:

Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at http://ds.oregonstate.edu. DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.

Link to Statement of Expectations for Student Conduct:

http://studentlife.oregonstate.edu/studentconduct/offenses-0