MATH 685-001/OR 681-001
Fall 2017

Numerical Analysis

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ABOUT THE COURSE

It is well-known that the use of numerical methods for the analysis, simulation, and design of engineering processes and industrial systems has been increasing at a rapid rate. Therefore, this course is intended to better prepare future engineers and computational scientists (as well as to assist practicing engineers and computational scientists), in understanding the fundamentals of numerical methods, especially their application, limitations, and potentials. This course is designed as an introductory course in computational techniques for solving problems from science and engineering with emphasis on applications. The course will cover the classical fundamental topics in numerical methods such as, approximation, numerical integration, numerical linear algebra, solution of nonlinear algebraic systems and solution of ordinary and partial differential equations. The viewpoint will be modern, with connections made between each topic and a variety of applications. By the end of the course, the student should not only be familiar, but more confident, in effectively using numerical tools to solve problems in their own field of interest.

- Lectures: M (7:20 pm - 10:00 pm)

- Venue: Exploratory Hall - 4107

INSTRUCTOR

Dr. Padmanabhan Seshaiyer

- Office:MATH 4453, Exploratory Hall

- Office Hours: M Th (3:00 pm - 4:30 pm) and by appointment

- E-mail: pseshaiy@gmu.edu

PREREQUISITES

Sufficient recall of advanced calculus, undergraduate linear algebra, differential equations and computer literacy.

EXPECTED LEARNING OUTCOMES

In this course, the emphasis will be to apply well-known numerical techniques to solve engineering problems and evaluate the results. The objective will be to train students to understand why the

methods work, what type of errors to expect, and when an application might lead to difficulties. In particular, the students will become proficient in:

1. Understanding the theoretical and practical aspects of the use of numerical methods

2. Implementing numerical methods for a variety of multidisciplinary applications

3. Establishing the limitations, advantages, and disadvantages of numerical methods

The expected learning outcomes for the course will be assessed through: Exams, homeworks, in-class activities and class discussions. Problem-based learning will be an integral part of the course.

ABOUT MATLAB

The software package MATLAB will be used for scientific computation, analysis and presentation of data. MATLAB is an interactive programming language for general scientific and technical computation with powerful graphics and library functions.

- Introduction to the MATLAB problem solving environment

- Accessing MATLAB

    o MATLAB is available on the Mason academic research system. You can access it using the program SSH terminal .

    o Alternatively you can use the Virtual Computing Lab .

    o There are computer Labs in Innovations Hall, the Johnson Center, and the Field House. For hours of operation of these labs and other locations see Academic Computing Labs Page .

- Connecting to MATLAB

    o **Two options for Windows Users**

        ▪ Use SSH

            ▪ Download Secure Shell from the mason website: https://itservices.gmu.edu/downloads

            ▪ Once you have it installed, open the program.

            ▪ SSH has both an FTP(Yellow Icon) and a Terminal(White Icon). Open the Terminal.

            ▪ From the SSH client window, click on the 'Quick Connect' button.

            ▪ In the Host Name Box type mason.gmu.edu and your user name.

            ▪ Press Connect and you will be prompted to enter your password.

            ▪ To begin your Matlab session, at the mason prompt type matlab and press enter.

- Use Virtual Computing Lab.

    - After clicking on New Reservation choose from drop down menu: Matlab 2013a. Click here for PC instructions

- **Two options for Mac Users**

    - Use Terminal App

        - In Applications/Utilities open the terminal program.

        - At the command prompt, type : **ssh username@mason.gmu.edu**

        - After you press enter you will be prompted to enter your password.

        - To begin your Matlab session, at the mason prompt type **matlab** and press enter.

    - Use Virtual Computing Lab

        - After clicking on New Reservation choose from drop down menu: Matlab 2013a Click here for Mac instructions.

COURSE EVALUATION

Evaluation for the course will be based on the following criteria:

Homework	30%
Computer Projects	30%
Midterm Exam	15%
Final Exam and Project	25%
TOTAL	100%

- There will be four homework assignments during the semester each worth 7.5%. There will also be computer projects which is worth 30%. These items should be written up and handed in on time to receive full credit as they add towards 60 % of the total grade.

- There will be one midsemester exam and one comprehensive final exam in this course. There will also be a final group project.

- The **Final Exam** will be on **Monday, Dec 18, 2017** from **7:30 PM - 10:15 PM** and will be comprehensive.

- Make-up exams may be possible only in the case of documented emergencies.

COURSE OUTLINE

Problem-based learning (both in and out of class) will be an integral part of the course. The primary reference will be "Classical and Modern Numerical Analysis", by A. Ackleh, E. Allen, R. Kearfott and P. Seshaiyer. Lecture notes will also be provided by the instructor that will be posted on the course website on a regular basis.

HOMEWORK

COMPUTER PROJECT

ACADEMIC INTEGRITY

All students will be expected to abide by the Honor Code: **Student members of the George Mason University community pledge not to cheat, plagiarize, steal, or lie in matters related to academic work**
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DISABILITY ACCOMODATION

Any student who, because of a disability, may require some special arrangements in order to meet course requirements should contact the instructor as soon as possible to make such accommodations as may be necessary.