Department of Mathematics, Oklahoma State University

Math 5580, Fall 2018

Case Studies in Applied Mathematics

Time: Tuesday & Thursday, 9:00 AM – 10:15 AM in MS 428

Instructor: Mahdi Asgari
Office: MS 525
E-mail: asgari@math.okstate.edu
Tel: 744-6718
Office Hours: Tuesday 2:00–3:00 PM at MLSC, Thursday 8:00–9:00 AM in MS 525, and by appointment (or just knock on the door to see if I am available).

Course Objectives: This course provides students with the opportunity to solve realistic mathematical problems *independently*, to discuss and present the solutions orally in class, and to write technical reports describing their solutions. All of these skills will be required in your future careers.

Prerequisites: The official prerequisites for this course are Math 2233 (Differential Equations), Math 4013 (Calculus of Several Variables), and knowledge of computer programming. Depending on the problem you end up working on, some knowledge of other subjects such as Linear Algebra or Abstract Algebra might also be helpful.

In addition, this course requires you to have the ability to write clearly and correctly in English, and to be able to work with a word-processing system. The most important prerequisite is your willingness to learn whatever mathematical or other techniques are necessary to solve a particular problem.

Course Format: This is a seminar style course, not a lecture course. During the semester you will be working on applied problems. You will present your progress and discuss possible approaches regularly. There will be no exams in this course. Your written work will consist of a technical report describing the problem and its solution. The professor's role in the course is to direct the discussions and provide occasional hints.

Texts: The official text for the course is *Elements of Style*, by Strunk and White. This is a very short style manual that should be read before you begin writing your report/paper, and then used as a reference on questions of grammar and style. You may also find *Introduction to Technical Writing: Process & Practice*, by Lois Johnson Rew, to be a useful reference. There is no official mathematical text for this course, as you will be expected to find any necessary mathematical information on your own in the library. However, the book

E. Kreyszig, Advanced Engineering Mathematics, 10th ed., 2011

may often be used as reference. It covers a wide range of applied mathematics methods.

Grading: I will decide your grade based on three factors, each weighed equally: the mathematics of your problem solution, the writing of your report, and class participation.

Solution grading rubric: A solution which is clear, complete, and correct would earn a grade of A. A solution earning a grade of B may contain small errors, omissions, or gaps in the derivation. A solution earning a grade of C may contain substantial errors, omissions, or gaps.

Report grading rubric: The clarity of the mathematical presentation in a report and the quality of its writing are almost inseparable. Reports that are grammatically correct, well-organized, and easy to understand will earn a grade of A. Reports that are somewhat difficult to understand because of grammatical errors or lack of organization will earn a grade of B. Those that are very difficult to understand, for any reason, will earn a grade no higher than C.

Participation grading rubric: Your participation grade is based on attendance and on your contributions to the class discussions. Daily attendance without any participation will earn a grade of C. A grade of B will require your regular participation, even if this consists of just questions on your own work or comments on other people's work. A grade of A will be reserved for those who lead the discussions by introducing new ideas and approaches towards solving the problems.

Report Format: Your reports should be clear, correct, concise, and should contain the following components:

1. Cover and Title Page.

2. Abstract. This is a one paragraph summary of the report's contents which introduces the subject matter and describes what the report accomplishes.

3. Table of Contents.

4. Introduction. This section should discuss the purpose of the report. It should include background information, state the problem, and describe the method of solution. It should also explain why the problem is interesting.

5. Sections. The sections forming the body of the report should be consecutively numbered. The first section (or few sections) should contain the preliminary mathematical material used to set up or solve the problem. The next sections should discuss different aspects of the problem's solution. All notations and technical terms should be clearly defined, and assumptions should be clearly stated. Important facts or conclusions should be labeled as Lemmas, Theorems, Propositions, etc., and their statements should come before their proofs or derivations. Good mathematical writing, in general, should tell the reader where it is headed before it gets there! Use displays for important equations and for equations which are too long to include in the text; everything else should be written in text, in full sentences. Use a consecutive numbering system for Theorems, Lemmas, displayed equations to which you later refer, etc.

6. Summary and Conclusions. This section should summarize and criticize the results of the report. Include comments on how realistic or optimal your solution is, how

the solution might be improved, other applications of the report, directions for future research, etc.

7. Acknowledgements. This section, if necessary, consists of just a few sentences thanking individuals who helped you to solve the problem.

8. References. This is an alphabetical, consecutively-numbered list of all written sources, cited in the following format:

   [1] J. Agnew and M. S. Keener, eds., Station Hydro-Turbine Optimization, Industry-Related Problems for Mathematics Students No C–18.3, Oklahoma State University, 1980.

   [2] S. I. Grossman, Calculus, fourth edition, Harcourt Brace Jovanovich, San Diego, 1988.

   [3] G. Strang, Patterns in Linear Algebra, Amer. Math. Monthly 96 (1989), 105-107.

   Technical reports do not contain footnotes. A particular source is cited as [2, pp. 32–34] by including in square brackets the reference number, the page numbers if you wish, at the appropriate place in the text.

9. Appendices. Any mathematical proofs, calculations, tables, etc., that are too long or would interrupt the flow of the report may be included in an Appendix.

Computer Use: Reports must be prepared on a computer with a word-processing software. The technical typesetting system TEX and its various implementations (e.g., LATEX) have become the standard in the international mathematical community. Many problems also require some computer programming. You may choose the language and software package of your choice – I just care about the output.

Academic Honesty: All written work must be your own – no discussion or collaborations on the written reports are permitted.

Attendance Policy: Please notify me in advance of any unavoidable absence. Otherwise, absences and late reports will incur a penalty.