Case Studies in Applied Mathematics

MATH 5580

Time and Place: T Th 10:30-11:45 p.m. in MSCS 519B
Professor: Igor E. Pritsker
Office: MSCS 519C
Office Hours: T Th 9:30-10:30 a.m.
Phone: 744-8220
E-mail: igor@math.okstate.edu
Web: http://www.math.okstate.edu/~igor/

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

Prerequisites: Math 2233 (Differential Equations), Math 4013 (Calculus of Several Variables), and knowledge of computer programming. In addition, the course requires ability to write clearly and correctly in English, and have familiarity with a word-processing system. The most important prerequisite is your initiative to learn whatever mathematical techniques are necessary to solve any 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 the progress and discuss possible approaches daily. There will be no exams in this course. Your written work will consist of technical reports 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. Students may also find *Introduction to Technical Writing: Process & Practice*, by Lois Johnson Rew, to be a useful reference. There is no mathematical text for this course, as you will be expected to find any necessary mathematical information on your own in the library.

Grading: Half of your grade will be based on the mathematics of your problem solution, one fourth is based on the writing of your report, and one fourth is based on class participation.

A solution earning a mathematical grade of A is clear, complete, and correct. A solution earning a mathematical grade of B may contain small errors, omissions, or gaps in the derivation. A solution earning a mathematical grade of C may contain substantial errors, omissions, or gaps.

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 writing grade of A. Reports that are somewhat difficult to understand because of grammatical errors or lack of organization will earn writing grades of B. Those that are very difficult to understand, for any reasons, will earn writing grades no higher than C.

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 some participation every day, even if this consists just of 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:** 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, it should state the problem and describe the method of solution, and it should explain why the problem is interesting.
5. **Sections.** Sections forming the body of the paper should be consecutively numbered. The first section(s) should contain preliminary mathematical material used to set up or solve the problem. Succeeding 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 goes 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 system. The technical typesetting system $\mathrm{T_EX}$ and its various implementations (e.g., $\mathrm{L^AT_EX}$) have become the standard systems for the international mathematical community. Many problems also require some computer programming. You may choose the language and software package - I just care about the output.

Academic Honesty: All written work must be your own - no discussions 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 penalize you, as they would with any employer.