Course Syllabus

Vm555 Engineering Optimization

Fall 2018

Course Description:

Review and discuss basic optimality theorems and conditions;

Introduce theoretical methods for single-objective continuous optimization problems;

Present an overview of computational methods for single- and multi-objective design optimization problems, mainly with *continuous* design variables;

Introduce practical optimization software, such as Matlab optimization toolbox and Excel.

Instructor:

Name: Mian Li PhD

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Phone: 3420-6765 ext. 5201

Office: Room 520

Office hour: TBD

Textbook (Author, Book Title, Publisher, Publication Year, ISBN):

- Introduction to Optimum Design, Jasbir S. Arora, Elsevier, 2004 (Second Edition), ISBN: 0120641550 (required).
- An Engineer's Guide to MATLAB, Magrab et al, Prentice Hall, 2005 (Second Edition). ISBN: 0131454994 (recommended).

Course Prerequisites:

Linear Algebra, Applied Calculus, graduate course standard

Course Website:

I plan to use *Canvas* system for sending you emails, posting assignments, documents, etc. for the course. It is necessary that you update your email address in the system in order to receive my announcements through Canvas. It is also your responsibility that you regularly (i.e., at least twice a week, at the beginning and end of the week throughout the semester) review the entire course webpage via Canvas in case I post any new announcements, assignments, documents, etc.

Lecture:

- Monday 8:00 – 9:40, CRQ xxx
- Wednesday 8:00 – 9:40, CRQ xxx

Grading Policy (Assignments %, Project, Exams, etc.):

Homework (4 sets)	20%
Quizzes (2~3 times)	5%
Course Project	15%
Midterm Exam	25%
Final Exam	35%

Policy for Late Submission

Every homework should be submitted to the instructor by the beginning of the class on the due day. Fail to submit the homework on time will get 25% deduction per day.

If you miss the midterm exam due to an "excused absence", the percentage missed will be added to the final exam with 15% deduction. (Note: an excused absence is one that follows the University guidelines and is approved by the instructor.) While absences from the class are discouraged, sometimes circumstances arise that require missing a class. In the event that you do miss a class, it is the student's responsibility to contact someone in the class or the instructor to determine the material that was covered. Please note that the instructor can assist you in identifying the material that you have missed but that a detailed synopsis of the missed lecture will not be given.

Review of the grading: If you feel that there is a problem for you grading, you could re-submit your homework (or exam) to the instructor for a review. However, the review will be conducted by the instructor and it will take some time.

Lots of course materials, assignments, and examples will be distributed through Canvas system. Important notices will also be distributed through the email system in Canvas. ***It is students' responsibility to check the posted information in Canvas and check the course-related emails from their registered email addresses.***

Dropping policy:

Due to the arrangement of the class project (the project will start around the 3rd week of this semester conducted by individual teams), dropping the class should be done before the starting of the project (otherwise, the arrangement of teams will be forced to change significantly which is not good for anyone). Thus, the deadline of dropping this class will be Oct. 7th after the national holiday. After that, I will **NOT** sign any drop form and students have to stay in the class.

Honor Code Policy:

Standard JI honor code will be enforced in this course.

In an attempt to be fair to the entire class, the following policy will be enforced. All exams and quizzes will be "closed book"; however, you may bring to the midterm exam a single sheet of paper (A4) and to the final exam two sheets of A4 with your notes on both sides. Unless otherwise stated: (1) homework is to be submitted in a hardcopy format on a neat and not a scratch paper (standard A4), written on one-side only, (2) electronic submission (e.g., email, fax, Canvas) of homework will not be accepted. Late submission of assignments will not be accepted. If you miss the midterm exam or a quiz due to an excused absence, the percentage missed will be added to the final. An excused absence is one that is consistent with the University guidelines and approved by the instructor. While your absence from the class is discouraged, sometimes exceptional circumstances arise that require missing a class. In the event that you do miss a class, it is your responsibility to contact someone in the class or Dr. Li to determine the material that was covered. Please note that Dr. Li will be pleased to assist you in identifying the material that you missed but that a detailed synopsis of the missed lecture will not be given.

More Details:

Outline:

Concepts, definitions and examples (~2 classes)
Optimality conditions (~6 classes)
Linear programming (~3 classes)
Single objective optimization: unconstrained methods (~4 classes)
Single objective optimization: constrained methods (~3 classes)
Multi-objective optimization methods (~3 classes)
Optimization with Matlab and Excel (~1 class)
Genetic algorithms (~2 class)
Exam and project presentations (5 classes)

Project:

Course-work will consist of a project. I will divide the class into groups. Your group will choose a problem from an engineering area with which you have sufficient familiarity. You will formulate that problem as an *optimal design problem*. You will solve this problem by a technique from MATLAB Optimization Toolbox and Excel, and verify and compare your solutions by an optimization method

that will be developed by you in the MATLAB environment. More details for the project, in particular, examples of adequate/previous projects will be provided. Midterm summary (with details of problem definition and formulation) and final project presentations and written report (with details of solution, etc.) will be required.

English will be only language used in the class, in office hours, and in all other course-related scenarios.

Teaching Schedule (tentative, subject to change):

Week	NO.	Date	lectures and Exams	Comments
1	1	Sept 10	Introduction	Chapter 1
	2	Sept 12	Math review, formulation	Chapter 2, 3, appendix B
2	3	Sept 17	Unconstrained optimality	Chapter 4
	4	Sept 19	Unconstrained and constrained optimality: KKT conditions	Chapter 4
3	5	Sept 24	Constrained optimality: KKT conditions	Chapter 4
	6	Sept 26	Constrained optimality	Chapter 4
4	7		National holiday	
	8		National holiday	
5	9	Oct 08	Constrained optimality: Global optimality; Project Introduction	Chapter 4, **HW #1 due**
	10	Oct 10	Constrained optimality: More on KKT conditions	Chapter 4,5
6	11	Oct 15	Linear programming	Chapter 6
	12	Oct 17	Linear programming	Chapter 6, 7
7	13	Oct 22	Project work, Matlab/Excel	Chapter 12, Chapter 13 of Magrab
	14	Oct 24	Matlab/Excel	Chapter 12, Chapter 13 of Magrab
8	15	Oct 29	Genetic algorithms	Chapter 16, **HW #2 due**
	16	Oct 31	Genetic algorithms	Chapter 16
9	17	Nov 05	**Midterm Exam**	
	18	Nov 07	Unconstrained methods	Chapter 8, 9
10	19	Nov 12	Unconstrained methods	Chapters 8, 9
	20	Nov 14	Unconstrained methods,	Chapter 8, 9, **Project midterm report (in ppt) due**;
11	21	Nov 19	Unconstrained methods Multi-objective optimization	Chapter 8, 9, 17, **HW #3 due**
	22	Nov 21	Multi-objective optimization	Chapter 17,
12	23	Nov 26	Constrained methods	Chapter 17
	24	Nov 28	Constrained methods	Chapters 10/11
13	25	Dec 03	Project presentations	**Project presentations due**
	26	Dec 05	Project presentations	**HW #4 due**
14	27	Dec 10	**Final Exam**	**Written project report due!**