Course Number: MECE 4330-Summer I 2018
Course Title: Topics in Mechanical Engineering/Design Optimization
Class Schedule/Room: MTW 1:00 pm-3:30 pm, Eng. #1.274
Instructor: Dr. Mataz Alcoutlabi
Office/Phone: Eng. 3.238/(956) 665-8945
Office Hours: MTW 11:00 am-12:00 pm
Email: mataz.alcoutlabi@utrgv.edu
Website: http://faculty.utrgv.edu/mataz.alcoutlabi/

Textbook: Non

Lecture notes will be available on Blackboard

Resource Material and reference book:

Prerequisites:
MECE 3449 - Mech Engineering Analysis I

Course Description:

The course introduces the optimization methods of Mechanical Systems and devices to Undergraduate Students in mechanical engineering. In the context of engineering design, optimization is focused on finding the "best" solution to a specific design problem that has the best quality, properties, performance, low cost and low weight. However, determining the optimal design involves more than just the minimization or maximization of an objective function. Hence, the emphasis in this course will be on identifying the design variables that represent the physical and mechanical forms of the system and the constraints that represent limitations on the design space. The course will begin with some background on topics related to the design of "mechanical" engineering systems including mechanics of solids, elements of mechanical design such as shafts, gears, bearings and bolt assemblies subjected to combined loading, introduction to optimization, classical optimization techniques, unconstrained optimization, and constrained optimization. The reminder of course will focus on the interpolation and approximation used in optimization methods such as Lagrange's and Newton-divided difference formula.

Learning Objectives/Course Outcomes
1. To understand and develop cognitive understanding of optimization concepts.
2. To know the definition of parameter optimization.
3. To comprehend the concepts of design variables, objective and constraint functions, direct and indirect methods of optimization and Lagrange multipliers.
4. To understand and apply method and appropriate optimization technique for a specific design problem
5. To be able to apply the mathematical principles of unconstrained and constrained optimization problems
6. To become proficient in analytical and graphical methods of optimization.
7. To provide a formal quantitative approach to problem solving

Grading Policy
Midterm exam I 20%
Midterm exam II 20%
Final exam 25%
Homework and quizzes 20%
Project presentation and report 15%
Final grades are assigned according to the following grading policy:

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
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<tbody>
<tr>
<td>90 and above</td>
<td>A</td>
</tr>
<tr>
<td>80-89.9</td>
<td>B</td>
</tr>
<tr>
<td>70-79.9</td>
<td>C</td>
</tr>
<tr>
<td>60-69.9</td>
<td>D</td>
</tr>
<tr>
<td>59.9 and below</td>
<td>F</td>
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**Homework:**
Homework must be submitted neatly on 8.5” by 11” paper. It should be stapled in the top left corner and hole-punched for a standard 3-ring binder. Grid engineering paper is preferred. Only one side of the paper should be used; the back side should be left blank to be used later for corrections and review.

As in most any Engineering course, the material is best mastered through practice. Homework is one’s best opportunity to practice the concepts learned in lecture. Moreover, the material in this course can only be mastered through practice. As such, what matters most is one’s genuine and active participation.

Note that homework accounts for 10% of the final grade. Assignments will be graded based on effort demonstrated and not on whether the solution is correct. The rubric below will be used for grading.

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
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<tbody>
<tr>
<td>5, Excellent</td>
<td>All problems were attempted. All work is shown. Solutions were neat, and use required format.</td>
</tr>
<tr>
<td>4, Good</td>
<td>Nearly all problems were attempted (missing 1 at most). Steps were sufficiently detailed.</td>
</tr>
<tr>
<td>3, Fair</td>
<td>Most problems were attempted (missing at most 2 problems). Steps may not be sufficiently detailed.</td>
</tr>
<tr>
<td>2, Poor</td>
<td>Majority of problems were attempted. Steps were missing, or solutions were incomplete.</td>
</tr>
<tr>
<td>1, Unacceptable</td>
<td>A few problems were attempted. Solutions were incomplete. Work was missing for most of problems.</td>
</tr>
<tr>
<td>0, Missing</td>
<td>Assignment was not submitted.</td>
</tr>
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Homework is mandatory and must be submitted in a timely fashion. **Late homework will not be accepted without prior approval.** If you have an exigent circumstance, contact Dr. Alcoutlabi immediately to make arrangements prior to the due date. Those that make a concerted effort to attempt each problem and submit their work on time can be rewarded.

Though students are encouraged to collaborate on homework assignments, the work submitted should reflect the student’s own effort and understanding of the material. If there is evidence that the student is copying solutions from another or a solution manual, the incident will be reported to the Dean of Students Office as required by the Student Conduct Code (see section below on Academic Integrity and Dishonesty for further details).

**Quizzes:**
There will be an in-class quiz on MTW over 1 problem from the homework assignments due since the last quiz.

**Exams:**
There will be two midterm and one final exams. The midterm exams will be semi-cumulative, meaning that each will primarily cover the material since the last exam, but may include select material from the prior exam, especially if the class on average performed poorly on a specific problem type. The final exam will be comprehensive. The exam average will account for 65% of your overall grade.

**Attendance:**
1. Attendance will be taken every time the class meets. Any student arriving to class 5 minutes after the class has started will not be allowed in class. Students will be allowed a maximum of **Two absences for the whole**
semester. Five points will be deducted from the total (100%) for each absence exceeding the maximum allowable unless documentation justifying that absence is provided.

2. Students will not be permitted to leave the classroom during lectures and exams except for extreme emergencies.

Homework, Quizzes and Exams:
1. Absolutely no late assignments will be accepted.
2. Absolutely no cell phones, laptops, iPads, iPods, or any other smart technology devices are allowed in exams.
3. Make-ups for in-class exams for documented emergencies will be scheduled during the last week of class.
4. There will be a weekly in-class quiz.

Scholastic Integrity:
As members of a community dedicated to Honesty, Integrity and Respect, students are reminded that those who engage in scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and expulsion from the University. Scholastic dishonesty includes but is not limited to: cheating, plagiarism, and collusion; submission for credit of any work or materials that are attributable in whole or in part to another person; taking an examination for another person; any act designed to give unfair advantage to a student; or the attempt to commit such acts. Since scholastic dishonesty harms the individual, all students and the integrity of the University, policies on scholastic dishonesty will be strictly enforced (Board of Regents Rules and Regulations and UTRGV Academic Integrity Guidelines). All scholastic dishonesty incidents will be reported to the Dean of Students.

Drop Policy:
Students can withdraw from a course through the Office of the Registrar on or prior to:
• June 1, 2018: Last day to drop a class before it appears on the transcript and counts toward the “6-drop” limit. Last day to receive a 100% refund for dropped classes (other policies apply when a student is withdrawing from all classes).
• June 28, 2018: Drop/Withdrawal Deadline; last day for students to drop the course and receive a “DR” grade. After this date, students will be assigned a letter grade for the course that will count on the GPA.

Course Drops:
According to UTRGV policy, students may drop any class without penalty earning a grade of DR until the official drop date. Following that date, students must be assigned a letter grade and can no longer drop the class. Students considering dropping the class should be aware of the “3-peat rule” and the “6-drop” rule so they can recognize how dropped classes may affect their academic success. The 6-drop rule refers to Texas law that dictates that undergraduate students may not drop more than six courses during their undergraduate career. Courses dropped at other Texas public higher education institutions will count toward the six-course drop limit. The 3-peat rule refers to additional fees charged to students who take the same class for the third time.

Students with Disabilities:
If you have a documented disability (physical, psychological, learning, or other disability which affects your academic performance) and would like to receive academic accommodations, please inform your instructor and contact Student Accessibility Services to schedule an appointment to initiate services. It is recommended that you schedule an appointment with Student Accessibility Services before classes start. However, accommodations can be provided at any time. Brownsville Campus: Student Accessibility Services is located in Cortez Hall Room 129 and can be contacted by phone at (956) 882-7374 (Voice) or via email at accessibility@utrgv.edu. Edinburg Campus: Student Accessibility Services is located in 108 University Center and can be contacted by phone at (956) 665-7005 (Voice), (956) 665-3840 (Fax), or via email at accessibility@utrgv.edu.

Sexual Harassment, Discrimination, and Violence:
In accordance with UT System regulations, your instructor is a “responsible employee” for reporting purposes under Title IX regulations and so must report any instance, occurring during a student’s time in college, of
sexual assault, stalking, dating violence, domestic violence, or sexual harassment about which she/he becomes aware during this course through writing, discussion, or personal disclosure. More information can be found at www.utrgv.edu/equity, including confidential resources available on campus. The faculty and staff of UTRGV actively strive to provide a learning, working, and living environment that promotes personal integrity, civility, and mutual respect in an environment free from sexual misconduct and discrimination.

**Mandatory Course Evaluation Period:**
Students are required to complete an ONLINE evaluation of this course, accessed through your UTRGV account (https://my.utrgv.edu/home); you will be contacted through email with further instructions. Online evaluations will be available **July 2, 2018-July 9, 2018**. Students who complete their evaluations will have priority access to their grades.

**Topics and Tentative Course Schedule**

**Week 1**
The design process: Introduction
Optimum design problem formulation
Graphical solution method and basic optimization concepts
Fundamentals of optimum design, classical optimization techniques, objective functions, Lagrange multipliers

**Week 2:** One-dimensional minimization methods
Unconstrained optimization
Constrained optimization
Optimum Design Concepts: Optimality Conditions

**Exam I**

**Week 3:**
Practical applications of linear programming for Optimum Design: Simplex and graphical methods
Nonlinear optimization: Graphical and Lagrange multipliers methods
Optimum design with Excel Solver

**Week 4:**
Practical applications of optimization/mechanical design optimization:
- Gear train optimization and gears subjected to bending and axial loads
- Optimum design with MATLAB

**Exam II**

**Week 5:**
More on practical applications of optimization
Project Presentations

**Final Exam on Tuesday July 10**
ACKNOWLEDGEMENT OF RECEIPT OF SYLLABUS

By signing below, I hereby affirm that I have received a copy of the syllabus for MECE 4333 Topics in Mechanical Engineering and have been informed by the Instructor that it is my responsibility to carefully read and understand this document and abide by all its content. I also agree to prepare and submit to the Instructor, at the end of the semester, a folder that contains all my homework assignments, quizzes, exams, projects, reports and/or literature review (if applicable).

__________________________________________
Student ID Number

__________________________________________
Printed Name

__________________________________________
Signature

__________________________________________
Date