WORKSHEET — Request for a New Course

** Place your pointer on the underlined fields and start typing to fill in text,**
or use an X or a number to fill in “check-box” or numbered fields.

Provide information requested below that is not contained in the syllabus.
Please note the guidelines in the boxes.

Number (if known): EE 231b  __ Undergraduate  _X_ Graduate  ___ Professional

Title/subtitle: Convex Optimization in Engineering Applications – Part II

Effective: Winter 2014  (Quarter and Year)

Offered: ___ Fall  _X_ Winter  ___ Spring  ___ Summer  ___ Once Only  ___ Other ___

Instructor(s): Dr. Hamed Mohsenian-Rad

Hours per week per unit of credit may not be less than but may exceed those listed below.

• One unit for each hour per week (1:1) of colloquium, consultation, discussion, lecture, seminar, or workshop

• One unit for each three hours per week (1:3) of activity, clinic, extra reading, fieldwork, individual study, internship, laboratory, practicum, research (scheduled and outside), screening, term paper, thesis, tutorial, written work, and similar assigned problems

• One unit for each two to three hours per week (1:2-3) of studio

Units:  4

Activities and hours per week: Indicate below the number of hours per week that students will spend in the activities listed (leave blank those that do not apply).

<table>
<thead>
<tr>
<th>Activity</th>
<th>Internship</th>
<th>Seminar</th>
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<tbody>
<tr>
<td>Clinic</td>
<td>___</td>
<td>___</td>
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<tr>
<td>Colloquium</td>
<td>___</td>
<td>Lecture</td>
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<td>Consultation</td>
<td>___</td>
<td>Practicum</td>
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<tr>
<td>Discussion</td>
<td>___</td>
<td>Research (outside)</td>
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<td>Extra Reading</td>
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<td>Research (scheduled)</td>
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<tr>
<td>Field</td>
<td>___</td>
<td>Screening (outside)</td>
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<tr>
<td>Individual Study</td>
<td>___</td>
<td>Screening (scheduled)</td>
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<td></td>
<td>___</td>
<td>Other:</td>
</tr>
</tbody>
</table>

Prerequisite(s): EE 231a
Read the guidelines in this box before writing the Catalog description.

Write the description in the present tense and limit it to 50 words (do not count grading information, repeatability information, or a list of E-Z subtitles). If possible, do not use complete sentences. However, use sentences that contain more than a list of items or topics.

Examples:
Instead of "This course will introduce students to the history of . . .," use one of the following formats:
- Introduces the history of . . .
- An introduction to the history of . . .
- Introduction to the history of . . .

Instead of “Functions, equations, and graphs,” use a format similar to one of the following examples:
- Explores functions, equations, and graphs . . .
- Topics include functions, equations, and graphs . . .
- A study of functions, equations, and graphs . . .


Grading: ___ Letter Grade or petition for Satisfactory/No Credit (S/NC) ___ Letter Grade only ___ In Progress (IP)
 ___ Letter Grade or S/NC; no petition required ___ S/NC only

The statements selected below will be added to the Catalog description by the Catalog office:

Grading statement (if required):
___ Satisfactory (S) or No Credit (NC) grading is not available.
___ Graded Satisfactory (S) or No Credit (NC).
___ Normally graded Satisfactory (S) or No Credit (NC), but students may petition the instructor for a letter grade on the basis of assigned extra work or examination.
___ May be taken Satisfactory (S) or No Credit (NC) with consent of instructor and graduate advisor.
___ May be taken Satisfactory (S) or No Credit (NC) by students advanced to candidacy for the Ph.D.
___ Students who submit a term paper receive a letter grade; other students receive a Satisfactory (S) or No Credit (NC) grade.
___ Students who present a seminar receive a letter grade; other students receive a Satisfactory (S) or No Credit (NC) grade.
___ Students who present a seminar or submit a term paper receive a letter grade; other students receive a Satisfactory (S) or No Credit (NC) grade.
___ Other: ___

Repeatability statement (if required):
___ Course is repeatable.
___ Course is repeatable to a maximum of ___ units.
___ Course is repeatable as content changes.
___ Course is repeatable as content changes to a maximum of ___ units.
___ Course is repeatable as topics change.
___ Course is repeatable as topics change to a maximum of ___ units.
___ Other: ___

If the course is repeatable, may a student take more than one section of the course in a single quarter? ___ Yes ___ No

Cross-listing statement: Cross-listed with ___NA___

Credit statement (to limit credit when course content overlaps):
Credit is awarded for only one of ___
Other ___
**Breadth statement** (for CPAC, ETST, FVC, HASS, or WMST courses only):

- Fulfills the Humanities requirement for the College of Humanities, Arts, and Social Sciences.
- Fulfills the Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.
- Fulfills either the Humanities or Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.
- See the Student Affairs Office in the College of Humanities, Arts, and Social Sciences.
- Does not fulfill the Humanities or Social Sciences requirement for the College of Humanities, Arts, and Social Sciences.

**Other:**

If the course **content overlaps or duplicates the content of another course**, describe the overlap or duplication: _NA_

If the course **affects degrees, minors, and/or programs**, list the affected degrees, etc. and explain how they are affected:

This course is expected to be an “advanced course” for the Intelligent Systems, Control Systems, as well as Communications and Signal Processing tracks.

If the course **affects the prerequisites and/or descriptions of other courses**, list the affected courses and explain how they are affected:

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**Justification** for establishing the course (insert or attach):

1) The focus of the first part of this course, i.e., EE 231a, is only on identifying and formulating convex optimization problem. The formulated problems are then solved simply using standard Convex Optimization Software. In EE 231b, the students rather learn the techniques and algorithms that can be used to solve convex optimization problems to develop their own solvers, e.g., in a microcontroller, etc.

2) The fundamental topic of duality which is the foundation for most distributed optimization algorithms are not covered in EE 231a. Distributed optimization algorithms have important applications in communications, signal processing, power systems, and control systems research.

3) EE 231b covers several important, practical, but more complex classes of convex optimization problems, such as semi-definite and geometric programs that are not covered in EE 231a.

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**Syllabus** (insert or attach and include the information below): _Attached_

**Course requirements** Mid-Term Exam, Final Exam, Homework, Term Paper

If an activity selected above under “**Activities and Hours**” does not involve faculty contact (e.g., extra reading, individual study, and outside research), describe the activity and explain how it will be evaluated.

If one of the activities selected above is consultation hours, explain how these hours will be implemented and monitored.

For further information about course guidelines, see the _General Rules and Policies Governing Courses of Instruction_ at senate.ucr.edu/Committees/courses/guidelines.pdf
EE 231b Convex Optimization in Engineering Applications II Syllabus

Instructor:

Dr. Hamed Mohsenian-Rad
Assistant Professor, Department of Electrical Engineering
Office: WCH 436
Email: hamed@ee.ucr.edu

Course Purpose:


Textbook:


Other Resources:

Several papers in related IEEE journals and conferences.

Course Topics:

- Convex optimization problems [Chapters 4, 7, and 8]:
  - Convex optimization problems
  - Statistical Estimations
  - Geometric Problems
  - Generalized inequality constraints
  - Semi-Definite Programming
  - Equivalent convex problems and examples

- Duality [Chapter 5]:
  - The Lagrange dual function
  - The Lagrange dual problem
  - Geometric interpretation
  - Saddle-point interpretation
  - Optimality conditions

- Unconstraint and Equality-Constraint Optimization Methods [Chapters 9 and 10]:
- Gradient Descent Method
- Steepest Descent Method
- Newton Method for Unconstrained Optimization
- Newton Method for Equality Constraints
- Infeasible Start Newton Method

- Interior Point Method [Chapter 11]:
  - Logarithmic barrier function
  - The Barrier Method
  - Feasibility Methods
  - Problems with generalized inequalities
  - Primal-dual interior-point methods

- Decomposition and Distributed Optimization [Papers]:
  - Primal Decomposition
  - Dual Decomposition
  - Benders Decomposition
  - Distribution Optimization and Examples.

**Prerequisites:**

EE 231a: Convex Optimization for Electrical Engineering

*Note: Similar courses in other departments will be accepted upon the instructor’s approval.

**Grading (Percentage):**

Homework – 25%
Midterm Exam: 25%
Final Exam – 40%
Final Project Report and MATLAB code* – 10%

*One page showing the formulation of an example convex optimization problem in the students’ area of research together with a MATLAB code to solve it using CVX toolbox.