PURDUE UNIVERSITY
REQUEST FOR ADDITION, EXPIRATION,
OR REVISION OF A GRADUATE COURSE
(50000-60000 LEVEL)

DEPARTMENT: Engineering
EFFECTIVE SESSION: Spring 2011

INSTRUCTIONS: Please check the items below which describe the purpose of this request.

- [x] New course with supporting documents (complete proposal form)
- [ ] Adding existing course offered at another campus
- [ ] Expiration of a course
- [ ] Change in course number
- [ ] Change in course title
- [ ] Change in course credit/type

PROPOSED:
- Subject Abbreviation: SE
- Course Number: 58000
- Long Title: Engineering Optimization
- Short Title: Engineering Optimization

EXISTING:
- Subject Abbreviation: 
- Course Number: 
- Long Title: 
- Short Title: 

TERMS OFFERED: Check All That Apply:
- [x] Summer
- [x] Fall
- [x] Spring

CAMPUS(ES) INVOLVED:
- Calumet
- Ft. Wayne
- Indianapolis
- Cont Ed
- Tech Statewide
- N. Central
- W. Lafayette

Abbreviated title will be entered by the Office of the Registrar if omitted. (30 CHARACTERS ONLY)

CREDIT TYPE:
- Fixed Credit: Cr. Hrs.: 3
- Variable Credit Range:
  - Minimum Cr. Hrs.: 
  - Maximum Cr. Hrs.: 
- Equivalent Credit: Yes
- Thesis Credit: Yes

COURSE ATTRIBUTES: Check All That Apply:
- 1. Pass/Not Pass Only
- 2. Satisfactory/Unsatisfactory Only
- 3. Repeatable
- 4. Credit by Examination
- 5. Special Fee
- 6. Registration Approval Type
  - Department
  - Instructor
- 7. Variable Title
- 8. Honors
- 9. Full Time Privilege
- 10. Off Campus Experience

Schedule Type
- Lecture
- Recitation
- Presentation
- Laboratory
- Lab Prep
- Studio
- Distance
- Clinic
- Experimental
- Research
- Ind. Study
- Pract/Observe

Minutes Per Mth: 75
Meetings Per Week: 2
Weeks Offered: 16
% of Credit Allocated: 160

COURSE DESCRIPTION (INCLUDE REQUISITES/RESTRICTIONS):
Concentrates on recognizing and solving convex optimization problems that arise in engineering. Convex sets, functions, and optimization problems. Basics of convex analysis. Least-squares, linear and quadratic programs, semidefinite programming, minmax, extremal problems, and other problems. Optimality conditions, duality theory, theorems of alternative, and applications. Interior-point methods. Applications to signal processing, control, digital and analog circuit design, computational geometry, statistics, finance, and engineering. Prerequisites: 1. Graduate standing in either an engineering or science degree program.

Calumet Department Head: Donald D. Dudy Date: 7/11/10
Calumet School Dean: J. Brosberg Date: 7/6/10

Ft. Wayne Department Head: Date
Ft. Wayne School Dean: Date

Indianapolis Department Head: Date
Indianapolis School Dean: Date

North Central Faculty Senate Chair: Date
Vice Chancellor for Academic Affairs: Date

West Lafayette Department Head: Date
West Lafayette College/School Dean: Date

Graduate Area Committee Convener: Date
Graduate Dean: Date

Calumet Undergrad Curriculum Committee: Date
Ft. Wayne Chancellor: Date

Undergrad Curriculum Committee: Date
Date Approved by Graduate Council: Date
Graduate Council Secretary: Date

West Lafayette Registrar: Date

OFFICE OF THE REGISTRAR
Supporting Document for a New Graduate Course

To: Purdue University Graduate Council

From: Faculty Member: Hossein Oloomi
Department: Engineering
Campus: Fort Wayne
Date: 6/30/2010

Subject: Proposal for New Graduate Course-Documentation
Required by the Graduate Council to Accompany Registrar's Form 40G

Contact for information if questions arise:
Name: Don Mueller
Phone Number: 260-481-5707
E-mail: muellerd@ipfw.edu
Campus Address: ET 321 (Fort Wayne Campus)

Course Subject Abbreviation and Number: SE 580
Course Title: Engineering Optimization
Proposed Course Number: SE 580

Proposed Course Title: Engineering Optimization

Justification for the Course: The course should benefit anyone who uses or will use scientific computing or optimization in engineering or related work (e.g., systems engineering, machine learning, finance). More specifically, people from the following fields: Electrical Engineering (especially areas like signal and image processing, communications, control, EDA & CAD), Aero & Astro (control, navigation, design), Mechanical & Civil Engineering (especially robotics, control, structural analysis, thermal systems, design); Computer Science (especially machine learning, robotics, computer graphics, algorithms & complexity, computational geometry); Operation Research; Scientific Computing and Computational Mathematics. The course may be useful to students and researchers in several other fields as well: Mathematics, Statistics, Finance, and Economics.

Learning Outcomes and Methods of Evaluation or Assessment:
- To give students the tools and training to recognize convex optimization problems that arise in engineering
- To present the basic theory of such problems, concentrating on results that are useful in computation
- To give students a thorough understanding of how such problems are solved, and some experience in solving them
- To give students the background required to use the methods in their own research or engineering work

Method of Evaluation or Assessment:
The direct method of assessment is used to demonstrate that learning outcomes are achieved through examinations, assignments, and a project in engineering optimization.

Course grading criteria:
- Homework (20%)
- Project (20%)
- Two Exams: (60%)

Prerequisites: Graduate standing

Course Instructor:
Hossein M. Oloomi, professor, ECE
Is the instructor currently a member of Graduate Faculty? Yes

Course Outlines:
1. Introduction
2. Convex sets
3. Convex functions
4. Convex optimization problems
5. Duality
6. Approximation and fitting
7. Statistical estimation
8. Geometric problems
9. Numerical linear algebra background
10. Unconstrained minimization
11. Equality constrained minimization
12. Interior-point methods
13. Stochastic programming
14. Convex optimization examples
15. Exams

Reading List:


Library Resources: The current library resources are sufficient to support the course.
SE 580  ENGINEERING OPTIMIZATION

Credit: 3
Area: Systems Engineering
Specialization: Systems Engineering
PIC: Hossein M. Oloomi

Prerequisite: Graduate standing. Good knowledge of linear algebra. Exposure to numerical computing, optimization, and application fields helpful but not required; the applications will be kept basic and simple.


Outline:

1. Introduction 1.0
2. Convex sets 2.0
3. Convex functions 2.0
4. Convex optimization problems 2.0
5. Duality 3.0
6. Approximation and fitting 2.0
7. Statistical estimation 1.0
8. Geometric problems 1.0
9. Numerical linear algebra background 1.0
10. Unconstrained minimization 3.0
11. Equality constrained minimization 2.0
12. Interior-point methods 2.0
13. Stochastic programming 2.0
14. Convex optimization examples 4.0
15. Exams 2.0
Hossain M. Oloomi, Ph.D.

Professional Preparation:

<table>
<thead>
<tr>
<th>Institution</th>
<th>Degree</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Missouri-Rolla</td>
<td>Electrical Engineering</td>
<td>B.S., 1979-1983</td>
</tr>
<tr>
<td>Wichita State University</td>
<td>Electrical Engineering</td>
<td>M.S., 1983-1985</td>
</tr>
<tr>
<td>Wichita State University</td>
<td>Mathematics</td>
<td>M.S., 1985-1987</td>
</tr>
<tr>
<td>Wichita State University</td>
<td>Electrical Engineering</td>
<td>Ph.D., 1985-1989</td>
</tr>
</tbody>
</table>

Appointments:

2009-2008 Director of Graduate Program in Engineering, IPFW
2008-2008 Professor, Electrical Engineering, IPFW
1996-2008 Associate Professor, Electrical Engineering, IPFW
1999-2000 Visiting Scientist, ITT Industries Aerospace/Communications Division
1996-1998 Visiting Professor & Consultant, Universiti Teknologi Malaysia
1990-1996 Assistant Professor, Electrical Engineering, IPFW
1989-1990 Research Fellow, Applied Mathematics, Wichita State University
1985-1989 Research Fellow/Lecturer, Electrical Engineering, Wichita State University
1985-1989 Research Assistant, Electrical Engineering, Wichita State University

Publications:


Synergistic Activities:

3. Lilly Endowment Inc.: Opportunity for Indiana’s Future; Project: *Development of a Sequence for High School Students in Entrepreneurship and Robotics*, 2004

**Collaborators & Other Affiliations:**

(a) **Collaborators and Co-Editors**
- Vahid Badii, Senior Staff Engineer, Meggitt Safety Systems
- Sami M. Fadali, Professor of Electrical Engineering, University of Nevada
- Bongsu Kang, Associate Professor of Mechanical Engineering, IPFW
- Donald W. Mueller, Associate Professor of Mechanical Engineering & Chair, IPFW
- Mehrdad Saif, Professor & Director of School of Engineering Science, Simon Fraser University
- G. Reza Sarhangi, Professor of Mathematics, Towson University
- M. Edwin Savan, Emeritus Professor of Electrical Engineering, Wichita State University
- Bahram Shafai, Professor of Electrical Engineering, Northeastern University

(b) **Past Graduate Students**

(c) **Membership in Scientific & Professional Societies**
- *IEEE* – Institute of Electrical and Electronics Engineers
- *SIAM* – Society for Industrial and Applied Mathematics