

课程详述

COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

1.	课程名称 Course Title	运营管理 Operations Management
2.	授课院系 Originating Department	信息系统与管理工程系 Department of Information Systems & Management Engineering
3.	课程编号 Course Code	MIS 404
4.	课程学分 Credit Value	3
5.	课程类别 Course Type	专业选修课 Major Selective Course
6.	授课学期 Semester	春季 Spring
7.	授课语言 Teaching Language	中英双语 Bilingual
8.	授课教师、所属学系、联系方式 (如属团队授课, 请列明其他授课教师) Instructor(s), Affiliation & Contact (For team teaching, please list all instructors)	刘翰林 Hanlin Liu 信息系统与管理工程系 Division of Information Systems & Management Engineering liuhl@sustech.edu.cn
9.	实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	待公布 To be announced
10.	选课人数限额(可不填) Maximum Enrolment (Optional)	

11. 授课方式 Delivery Method	讲授 Lectures	习题/辅导/讨论 Tutorials	实验/实习 Lab/Practical	其它(请具体注明) Other (Please specify)	总学时 Total
学时数 Credit Hours	48	0	0	0	48
12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	MIS204 运筹与决策分析 MIS204 Prescriptive Decision Analytics				
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	无 None				
14. 其它要求修读本课程的学系 Cross-listing Dept.	无 None				

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

在学生已经掌握运筹学和运营管理基本内容的基础上，本课程将进一步介绍运筹学和运营管理的高阶分析方法，即凸优化理论及其应用。本课程旨在为学生提供识别商业和工程应用中出现的非线性优化问题的训练，介绍基本的理论知识，并专注于建模方面和应用中有用的结果。凸优化是解决大规模问题的核心工具，本课程从凸优化的角度涵盖数学规划和组合优化。主要内容包括凸集、凸函数、优化问题、半定规划、对偶理论和鲁棒优化。介绍了优化理论在机器学习、经济学和统计学的应用。

After students have learned the basic knowledge of operations research and operations management, this course will further introduce an advanced analysis method in operations research and operations management, namely convex optimization theory and its applications. This course aims to give students the training to recognize nonlinear optimization problems that arise in business and engineering applications, presenting the basic theory, and concentrating on modeling aspects and results that are useful in applications. The course covers mathematical programming and combinatorial optimization from the perspective of convex optimization, which is a central tool for solving large-scale problems. Topics include convex sets, convex functions, optimization problems, semidefinite programming, duality theory and robust optimization. Applications to machine learning, economics, and statistics are presented.

16. 预达学习成果 Learning Outcomes

1. 了解非线性和凸优化的基本概念和知识
 2. 有能力建立并且分析非线性优化问题
 3. 具有使用求解器解决一般优化问题的能力
1. Understand the basic concepts and knowledge regarding nonlinear and convex optimization
 2. Have the capability to formulate and analyze nonlinear optimization problems
 3. Have the capability to solve general optimization problems using different solvers

17. 课程内容及教学日历（如授课语言以英文为主，则课程内容介绍可以用英文；如团队教学或模块教学，教学日历须注明主讲人）

Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)

理论 (48 学时)

第 1-2 课: 课程介绍 (4 学时)

数学优化、最小二乘法和线性规划、凸优化、课程目标和内容、非线性优化。

第 3-5 课: 凸集 (6 学时)

凸集和锥体, 一些常见和重要的例子, 保持凸性的算子, 投影, 分离超平面, 多面体集, 感知器算法

第 6-8 课: 凸函数和多元分析 (6 学时)

凸函数、常见示例、泰勒展开、凸函数的性质、保持凸性的算子、拟凸函数和对数凸函数

第 9-10 课: 凸优化问题 (4 学时)

凸优化问题、线性和二次规划、二阶锥体和半定规划

第 11-13 课: 无约束优化 (6 学时)

梯度下降、最速下降、牛顿法、在线凸优化和在线学习

第 14-18 课: 约束优化 (10 学时)

拉格朗日对偶函数和问题、斯莱特条件、互补松弛、KKT 条件、示例和应用 (支持向量机)

第 19-21 课: 容忍偏差的优化 (6 学时)

算法和 CVX 求解器, 鲁棒优化简介

第 22-24 课: 离散优化 (6 学时)

最大匹配、最小生成树、背包问题、线性规划松弛、贪心算法、最大覆盖和次模函数、算法复杂度、P vs NP

Lecture (48 hours)

Class 1-2: Introduction (4 hours)

Mathematical optimization, least-squares and linear programming, convex optimization, course goals and topics,

nonlinear optimization.

Class 3-5: Convex Sets (6 hours)

Convex sets and cones, some common and important examples, operations that preserve convexity, projection, separating hyperplanes, polyhedral sets, perceptron algorithm

Class 6-8: Convex Function and Multivariate Analysis (6 hours)

Convex functions, common examples, Taylor expansions, properties of convex functions, operations that preserve convexity, quasiconvex and log-convex functions.

Class 9-10: Convex Optimization Problems (4 hours)

Convex optimization problems, linear and quadratic programs, second-order cone and semidefinite programs

Class 11-13: Unconstrained Optimization (6 hours)

Gradient descent, steepest descent, Newton's method and its variants, online convex optimization and online learning

Class 13-18: Constrained Optimization (10 hours)

Lagrange dual function and problem, Slater's condition, complimentary slackness, KKT conditions, examples and applications (Support Vector Machines)

Class 19-21: Optimization under Errors (6 hours)

Algorithms and CVX solver, brief introduction to robust optimization

Class 22-24: Discrete Optimization (6 hours)

Maximum matching, minimum spanning trees, knapsack, LP relaxation, greedy algorithms, maximum-cover and submodular functions, computational complexity, P vs NP

18. 教材及其它参考资料 **Textbook and Supplementary Readings**

Boyd, Stephen, and Lieven Vanderberghe. *Convex Optimization*. Cambridge University Press, 2004.

Bertsekas, Dimitri. *Convex Optimization Theory*. Athena Scientific, 2009.

课程评估 **ASSESSMENT**

19. 评估形式 Type of Assessment	评估时间 Time	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
出勤 Attendance		10		
课堂表现 Participation		10		
小测验 Quiz				
课程项目				
平时作业		30		

Graded Team Assignments

期中考试
Mid-Term Quiz

期末考试
Final Exam

期末报告
Final Presentation

其它（可根据需要
改写以上评估方式）

Others (The above may be modified as necessary)

	50		

20. 记分方式 **GRADING SYSTEM**

- A. 十三级等级制 **Letter Grading**
 B. 二级记分制（通过/不通过） **Pass/Fail Grading**

课程审批 REVIEW AND APPROVAL

21. 本课程设置已经过以下责任人/委员会审议通过
This Course has been approved by the following person or committee of authority

