Syllabus of Fudan University

**Department:** Management Science, School of Management, **Date:** May 28, 2024

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| **Course Code** | MANA130311 | | | | | | | |
| **Course Title** | Optimization Theory and Applications | | | | | | | |
| **Credit** | 3 | **Experiment (including**  **Computer) Credit** | 0 | **Practice Credit** | | 0 | **Aesthetic Education**  **Credit** | 0 |
| **Credit Hours Per Week** | 3 | **Education on The Hard-Working**  **Spirit Credit Hours** | 54 | **Language of Instruction** | | English | **Honors Course** | No |
| **Course Type** | □Core General Education Course  □Specific General Education Course  □Basic Course in General Discipline  □Elective General Education Course   * Others | | | | **2+X Major** ：   * **Professional Core Course**   □Professional Advanced Course | | | |
| **Course Objectives** | This course is designed to systematically introduce the theory, algorithms, and applications of optimization methods within the fields of economics and management sciences. Students will learn the fundamental techniques of optimization modeling and algorithm design. | | | | | | | |
| **Course Description** | The theoretical part of the course covers a range of topics including linear programming, integer programming, network optimization, unconstrained optimization, quadratic programming, and constrained optimization. The practical applications section delves into areas such as logistics, manufacturing, transportation, big data, project management, and finance. | | | | | | | |
| **Course Requirements:**  Students will understand the foundational methods, theories, and algorithms of optimization modeling. They will develop the capability to construct models to address practical problems and will gain proficiency in utilizing common optimization algorithms and software. | | | | | | | | |
| **Teaching Methods:**   1. **Lectures:** Fundamental theories and applications will be presented during class sessions. 2. **In-class Discussions:** The lecturer will occasionally pose discussion questions. Students are encouraged to actively participate and exchange opinions with peers. These discussions foster   deeper engagement with debatable topics. | | | | | | | | |

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| 3) **Homework Assignments:** Students will complete tasks applying the techniques discussed in class, allowing them to gain practical experience with these methods. | | | | |
| **Course Director's Academic Background:**  **Huiqi GUAN, Associate Professor, Department of Management Science, School of Management**  ***Education***  University of Miami, Coral Gables, FL, USA Ph.D., Operations Management, 2013 − 2018.  Tsinghua University, Beijing, China  M.S., Applied Mathematics, 2011 − 2013.  B.S., Applied Mathematics, 2007 − 2011.  ***Research Interests***  Supply chain contract, Interface issues with marketing and information economics, Sharing economy, Economics models in supply chain management  ***Contact Information***: 25011168 Email: [guanhuiqi@fudan.edu.cn](mailto:guanhuiqi@fudan.edu.cn) | | | | |
| **Instructor's Academic Background:**  **Huiqi GUAN, Associate Professor, Department of Management Science, School of Management**  ***Education***  University of Miami, Coral Gables, FL, USA Ph.D., Operations Management, 2013 − 2018.  Tsinghua University, Beijing, China  M.S., Applied Mathematics, 2011 − 2013.  B.S., Applied Mathematics, 2007 − 2011.  ***Research Interests***  Supply chain contract, Interface issues with marketing and information economics, Sharing economy, Economics models in supply chain management  ***Contact Information***: 25011168 Email: [guanhuiqi@fudan.edu.cn](mailto:guanhuiqi@fudan.edu.cn) | | | | |
| **Members of Teaching Team** | | | | |
| **Name** | **Gender** | **Professional**  **Title** | **Department** | **Responsibility** |
| Huiqi GUAN | Male | Associate Professor | School of Management | Instructor |
| Yinxiao WU | Male | / | School of Management | Teaching Assistant |

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| **Course Schedule**  Week Teaching content  1 Basic concepts, introduction to optimization problems  2 Convex sets, convex functions, and convex programming  3 Convex set separation theorem, Lagrange duality and optimality conditions  4 Quadratic programming  5 Linear programming, the geometric properties of linear programming  6 Simplex method, dual simplex method, sensitivity analysis, shadow price  7 An introduction to the application of the duality theorem and the interior point  algorithm for linear programming  8 Midterm Exam  9 Introduction to supporting vector machines  10 Introduction to integer programming  11 Network optimization  12 Linear search, trust-region approach, convergence  13 Unconstrained optimization method, fastest descent method, Newton method  14 Conjugate gradient method, conjugate direction method  15 Quasi-Newton method, DFP calibration and BFGS correction, class presentation  16 Penalty and Barrier Functions  17-18 Final Exam Period |
| **The design of class discussion or exercise, practice, experience and so on:**  Each student is required to present a topic, either an algorithm or an application, based on their interests and the materials learned in class. |
| **If you need a TA, please indicate the assignment of assistant:**  One TA, grading homework and preparing computer experiment |
| **Grading & Evaluation** (Provide a final grade that reflects the formative evaluation process)**:**  ***In-Class Participation (20%)***  Involvement in class discussions, group discussions, and taking a proactive role in other in-class activities  ***Homework Assignment (20%)***  Including individual assignments and a term paper  ***Midterm Exam (20%)***  A two-hour open-book examination  ***Final Exam (40%)***  A two-hour open-book examination |
| **Usage of Textbook：**  ■No Textbook |

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| **Teaching References** (Including author, title, publisher, publishing time, ISBN)**:**   1. Leonard D. Berkovitz. *Convexity and Optimization in* ℝ!. John Wiley & Sons, 2001. 2. MIT Opencourseware, Course No. 15.053. 3. Ignizio, James P., and Tom M. Cavalier. *Linear programming*. Prentice-Hall, Inc., 1994. 4. Bazaraa, Mokhtar S., Hanif D. Sherali, and Chitharanjan M. Shetty. *Nonlinear programming: theory and algorithms*. John Wiley & Sons, 2013. 5. Luenberger, David G. and Yinyu Ye. *Linear and Nonlinear Programming*. Springer, 2010. |