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**	数理逻辑导论 Introduction to Mathematical Logic
2.	**授课院系 Originating Department**	计算机科学与工程系 Department of Computer Science and Engineering
3.	**课程编号 Course Code**	CS104
4.	**课程学分 Credit Value**	2
5.	**课程类别 Course Type**	专业基础课 Major Foundational Courses
6.	**授课学期 Semester**	春季 Spring
7.	**授课语言 Teaching Language**	中英双语 English & Chinese
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）**	程京德，教学教授，计算机科学与工程系，chengjd@sustech.edu.cn Jingde Cheng, Teaching Professor, Department of Computer Science and Engineering, chengjd@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	32	0	0	0	32

Credit Hours					

12.	先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	无 none
13.	后续课程、其它学习规划 Courses for which this course is a pre-requisite	计算机科学，智能科学，及人工智能的理论课程 All theoretical courses for Computer Science, Intelligent Sciences, and Artificial Intelligence
14.	其它要求修读本课程的学系 Cross-listing Dept.	数学系 Dept. of Mathematics

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

作为 UNISCO 推荐科学技术领域分类中基础学科之首的逻辑学，是包括数学、计算机科学、智能科学在内的诸多学科之最重要的理论基础。“数理逻辑导论”课程对于数理逻辑的基本概念、原理、方法论以及重要结果给予学生一个入门性介绍，为今后深入学习研究现代逻辑及其应用的学生提供研究逻辑学课题的良好基础，为今后深入学习研究各学科理论课题的学生提供使用逻辑学方法论的基本素养。但是，因为这是一门理论性极强的课程，今后有志于从事工程技术工作的学生可不必选修此课。

“数理逻辑导论”课程的教学目标为：（1）让学生知道逻辑学的本质、目的、基本假设、范围、方法论。（2）让学生知道经典数理逻辑的本质、目的、基本假设、范围、应用领域。（3）让学生熟知经典数理逻辑中的命题演算部分。（4）让学生熟知经典数理逻辑中的一阶谓词演算部分。（5）让学生知道经典数理逻辑的局限性以及对经典数理逻辑的一些经典保存扩张及非经典替代。

Logic, as the first fundamental discipline in the fields of science and technology recommended by UNISCO, is the most important theoretical foundation for many disciplines, including mathematics, computer science, and intelligent science. The course "Introduction to Mathematical Logic" gives students an elementary introduction to the basic concepts, principles, methodology and important results of mathematical logic. It provides a good foundation for students to study modern logic and its application in depth, and also provides students with basic qualities of using logic methodology for further study and research of theoretical subjects in various disciplines. However, students interested in engineering and technical jobs in the future need not take this course, because this course is a quite theoretical one.

The teaching objectives of the course "Introduction to Mathematical Logic" are: (1) Let students know the essence, purpose, basic assumptions, scope, and methodology of logic. (2) Let students know the essence, purpose, basic assumptions, scope, and application fields of classical mathematical logic. (3) Let students be familiar with the propositional calculus in classical mathematical logic. (4) Let students be familiar with the first-order predicate calculus in classical mathematical logic. (5) Let students know the limitations of classical mathematical logic and some classical conservative expansions and non-classical alternates of classical mathematical logic.

16. 预达学习成果 Learning Outcomes

“数理逻辑导论”课程的预达学习效果为：（1）学生能够在遇到任何问题时凭借在本课程学习到的逻辑知识辨别出问题中的逻辑要素从而依据在本课程学习到的逻辑知识不犯或少犯逻辑错误。（2）学生能够使用经典数理逻辑来形式化地表达经验领域知识以及构造经验领域形式理论。（3）学生能够使用经典数理逻辑以及自动推理/证明工具解决经验领域中的推理/证明问题。（4）学生能够清楚地识别出由于经典数理逻辑的局限性所导致的经验领域应用困难课题。（5）学生能够基于本课程学习到的知识进一步学习研究现代逻辑各个分支及其应用。

The learning outcomes of the course "Introduction to Mathematical Logic" is as follows: (1) When students encounter any problem, they can identify those logic-related elements in the problem by applying the logic knowledge learned in this course, and therefore, they can avoid or minimize logical mistakes based on the logic knowledge learned in this course. (2) Students can use classical mathematical logic to formally represent knowledge in the empirical field and construct

formal theories in the empirical field. (3) Students can use classical mathematical logic and automatic reasoning/proof tools to solve reasoning/proof problems in the empirical field. (4) Students can clearly identify those difficult issues in the empirical field application that are due to the limitations of classical mathematical logic. (5) Students can further study various branches of modern logic and their applications based on the knowledge acquired in this course.

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.)

32 hours in total. 2 hours lecture for each week. Corresponding to the following sections：

1. Guidance and Mathematical Preliminaries
2. Logic: What Is It and Why Study It?
3. Basic Concepts of Logic: Reasoning, Proving, Discovery, Prediction, Argument, Deduction, Induction, and Abduction
4. Basic Concepts of Logic: Truth, Validity, and Fallacies
5. The Notion of a Conditional: The Heart of Logic
6. Logic: What Is It All About? (Mathematical Logic and Various Philosophical Logics)
7. Formal Logic Systems and Formal Theories: Model (Semantic) Theory and Proof (Syntactic) Theory
8. Formal (Object) Language of Classical Propositional Calculus (CPC) and Model Theory for CPC
9. Hilbert Style Formal System for CPC and Its Soundness and Completeness
10. Other Formal Systems for CPC
11. Formal (Object) Language of Classical First Order Predicate Calculus (CFOPC)
12. Model Theory for CFOPC
13. Hilbert Style Formal System for CFOPC and Its Soundness and Completeness
14. Other Formal Systems for CFOPC
15. Limitation of Formal Systems: Gödel's Incompleteness Theorems
16. High-Order Logic Systems

共计 32 小时，每周两小时理论课，对应以下章节：

1. 导引与数学预备知识
2. 什么是逻辑学？为什么要学习和研究逻辑学？
3. 逻辑学的基本概念：推理、证明、发现、预测、论证、演绎、归纳和假说生成
4. 逻辑学的基本概念：真理、有效性和谬误
5. 条件句概念：逻辑学的核心
6. 逻辑学的范围（数理逻辑和各种哲学逻辑）
7. 形式逻辑系统与形式理论：模型（语义）理论与证明（语法）理论
8. 经典命题演算的形式（对象）语言与模型理论
9. 经典命题演算的希尔伯特形式化系统及其健全性和完全性
10. 经典命题演算的其他形式系统
11. 经典一阶谓词演算的形式（对象）语言
12. 经典一阶谓词演算的模型理论
13. 经典一阶谓词演算的希尔伯特形式化系统及其健全性和完全性
14. 经典一阶谓词演算的其他形式系统

15. 形式系统的局限性：哥德尔不完全性定理

16. 高阶逻辑系统

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

- M. Copi and C. Cohen, “Introduction to Logic,”Routledge, 2019 (with V. Rodych) (15th Edition).
- P. J. Hurley, “A Concise Introduction to Logic,” Wadsworth, 2016 (with L. Watson) (13th Edition).
- G. Restall, “Logic: An Introduction,” Routledge, 2006.
- G. Priset, “Logic: A Very Short Introduction,” Oxford University Press, 2000.
- E. Mendelson, “Introduction to Mathematical Logic,” Chapman & Hall, 2015 (6th Edition).
- R. M. Smullyan, “A Beginner’s Guide to Mathematical Logic,” Dover Publications, 2014.
- M. Ben-Ari, “Mathematical Logic for Computer Science,” Springer, 2012 (3rd Edition).
- W. Routenberg, “A Concise Introduction to Mathematical Logic,” Springer, 2010 (3rd Edition).
- S. Reeves and M. Clarke, “Logic for Computer Science,” Addison-Wesly, 1990-2003.

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				
课堂表现 Class Performance				
小测验 Quiz				
课程项目 Projects				
平时作业 Assignments		50		
期中考试 Mid-Term Test				
期末考试 Final Exam		50		
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)**				

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