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	应用随机过程　Applied Stochastic Processes
2.	授课院系 **Originating Department**	数学系 Department of Mathematics
3.	课程编号 **Course Code**	MA208
4.	课程学分 Credit Value	3
5.	课程类别 **Course Type**	专业选修课 Major Elective Courses
6.	授课学期 **Semester**	春季 Spring
7.	授课语言 **Teaching Language**	英文 English / 中文 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**）	熊捷，教授，数学系 慧园 3-527 室 xiongj@sustc.edu.cn 0755-8801-8747 XIONG Jie, Professor, Department of Mathematics Rm.3-527, Wisdom Valley. xiongj@sustc.edu.cn 0755-8801-8747
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		无 N/A		48

12.	先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	数学分析 III（或数学分析精讲）；概率论（或概率论与数理统计）；线性代数 II Mathematical Analysis III(or Real Analysis), and Linear Algebra II, Probability Theory (or Probability and Statistics)
13.	后续课程、其它学习规划 Courses for which this course is a pre-requisite	本课程为金融数学专业基础课，是绝大部分应用统计和随机过程课程的先修课程；其它非金融数学专业学生如果想学习有广泛应用性的统计方法，也可选修本课程。 This course should be taken by everyone contemplating doing Financial Mathematics in the following years and it is a prerequisite for most Applied Probability and Stochastic Processes. It should however also be suitable for non-specialists, i.e. for all those students who wish to take a second course in Stochastic Processes to gain a certain amount of familiarity and facility in using some of the widely used statistical methods.
14.	其它要求修读本课程的学系 Cross-listing Dept.	To be determined 待定

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

介绍一些重要随机过程的基本概念。这些随机过程在实际随机模型中具有重要应用。同时介绍重要的概率方法，特别要清晰地介绍说明非常重要的条件期望方法，重点说明一些重要随机过程，如马尔可夫链，泊松过程和布朗运动等并强调其应用。

To introduce the basic concepts in stochastic processes which form the basis for all applications of applied probability and random processes, and for further probability theory. Also to introduce the important probability methods, particularly the powerful conditional expectation technique, with a strong emphasis on applying standard statistical techniques appropriately and with clear interpretation. The emphasis is on applications of stochastic models such as Markov Chains, Poisson Processes and Brownian Motion Processes.

16. 预达学习成果 Learning Outcomes

完成该课程之后，学生应该掌握最基本的概率方法和技巧，特别是非常重要的条件期望方法。学生应该掌握基本的随机过程，如马尔可夫链，泊松过程和布朗运动等；掌握基本的方法和技能来解决实际问题中有关随机过程的问题。

After completing this course, students should master a few basic probability methods and techniques, particularly the important and powerful conditional expectation method. After learning this course, they should be also familiar with a range of stochastic models such as Markov Chains, Poisson Process and Brownian Motion Process and master the basic methods and techniques for solving real life problems of the probabilistic nature and should have a conceptual and practical understanding of a range of commonly applied stochastic models.

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.)

Ch1. Introduction & Revision: (2 hours) From Random Variables to Stochastic Processes; Revision on Probability Measures, Random Variables, Random Vectors, Expectations, Variance, Independence; General Definition for Stochastic Processes; State Space; Time Parameter; For Types of Stochastic Processes.

Ch2. Conditional Expectation: (6 hours) Conditional Probability and Conditional Expectation for Discrete case; Conditional Probability and Conditional Expectation for Continuous case; Calculating Expectation by conditioning; Calculating Probability by Conditioning.

Ch3: Discrete Time Markov Chains: (12 hours) Markov Property; Definition of Discrete Time Markov Chains; Examples; One-Step Transition Probabilities; N-Step Transition Probabilities; Chapman-Kolmogorov Equations; Absolute Distributions; Classification of States; Irreducibility; Definition and Criteria for Recurrence and Transience; Period; Positive Recurrence and Null-Recurrence; Ergodicity; Limiting Distributions; Stationary Distributions; Examples, particularly Random Walks; Mean Time spent in Transient States.

Ch4: Poisson Processes: (12 hours) Exponential Distributions; Memory-less Property; Two Definitions of Poisson Processes; Properties of Poisson Processes; Arriving Times and Inter-Arriving Times; Compound Poisson Processes; Applications.

CH5: Introduction to Continuous Time Markov Chains: (4 hours) Definition of Continuous Time Markov Chains; Examples; Chapman-Kolmogorov Equations; Rate Matrix; Classification of States; The Kolmogorov Backward Equations; The Kolmogorov Forward Equations; Limiting and Stationary Distributions.

Ch6: Brownian Motion Processes (BMP): (12 hours) Definition of BMP ; Properties of BMP; Concepts; Absolute Distributions of BMP; Hitting Times of BMP; Transformation of BMP; Geometric Brownian Motion; Application of BMP in Finance: Option Pricing and The Black-Scholes Formula.

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

指定教材: Sheldon M. Ross, Introduction to Probability Models, 11th Ed. Elsevier (Singapore), 2011.

推荐参考资料: Geoffrey R. Grimmett and David R. Stirzaker, Probability and Random Processes 3rd Ed. Oxford University Press, 2001

Required: Sheldon M. Ross, Introduction to Probability Models, 11th Ed. Elsevier (Singapore), 2011.

Recommended: Geoffrey R. Grimmett and David R. Stirzaker, Probability and Random Processes 3rd Ed. Oxford University Press, 2001

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		25%		
期中考试 Mid-Term Test		25%		
期末考试 Final Exam	2 hours	50%		

期末报告 Final Presentation		4		
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