

# 数学分析与建模（一） 教学大纲

## Mathematical Analysis and Modeling (I) Subject Syllabus

### 一、课程信息 Subject Information

课程编号: Subject ID	3100311001	开课学期: Semester	1
课程分类: Category	专业教育 PA	所属课群: Section	专业基础 MF
课程学分: Credit Points	5	总学时/周: Total Hours/Weeks	80/14
理论学时: LECT. Hours	80	实验学时: EXP. Hours	0
PBL 学时: PBL Hours	0	实践学时/周: PRAC. Hours/Weeks	0
开课学院: College	东北大学 悉尼智能科技学院 Sydney Smart Technology College Northeastern University	适用专业: Stream	应用统计学 AS
课程属性: Pattern	必修 Compulsory	课程模式: Mode	互认 EQV
中方课程协调人: NEU Coordinator	王晓敏 Wang Xiaomin	成绩记载方式: Result Type	百分制 Marks
先修课程: Requisites	无 None		
英文参考教材: EN Textbooks	Mo Huixia, Li Xiaohua, Yuan Jianhua, Yuan Jianhua, Ai Wenbao, Zhu Ping, Advanced Mathematics (I), 2nd Edition, Beijing University of Posts and Telecommunications Press, 2018.		
中文参考教材: CN Textbooks	同济大学数学系, 高等数学(第七版)上册, 高等教育出版社, 2014. 邓东皋, 尹小玲, 数学分析简明教程(第二版) 上册, 高等教育出版社, 2006.		
教学资源: Resources	<a href="https://sstc.cloudcampus.com.cn/course/view.php?id=9">https://sstc.cloudcampus.com.cn/course/view.php?id=9</a>		
课程负责人(撰写人): Subject Director	王晓敏 Wang Xiaomin	提交日期: Submitted Date	单击或点击此处输入日期。
任课教师(含负责人): Taught by	王晓敏、刘艳杰 Wang Xiaomin, Liu Yanjie		
审核人: Checked by	韩鹏	批准人: Approved by	史闻博
		批准日期: Approved Date	单击或点击此处输入日期。

## 二、教学目标 Subject Learning Objectives (SLOs)

注：毕业要求及指标点可参照悉尼学院本科生培养方案，可根据实际情况增减行数

Note: GA and index can be referred from undergraduate program in SSTC website. Please add/reduce lines based on subject.

<p>整体目标: Overall Objective</p>	<p>数学分析与建模是理工科专业课程的基础，通过学习极限、微分、积分等重要概念，为学生学习其它学科以至于专业课程打下坚实基础。培养学生较强的动手能力，以及思维的逻辑性、严谨性、创新性，以及利用数学原理和方法解决实际问题的意识、兴趣和能力。培养学生掌握高等数学的基本理论和方法，尤其是思维方式，掌握知识技能的同时发展创造能力。</p> <p>Mathematical analysis and modeling is the foundation of science and engineering courses. By learning the important concepts of limit, differential and integral, it can lay a solid foundation for students to learn other subjects and even professional courses. To cultivate students' strong practical ability, logical, rigorous and innovative thinking, as well as the consciousness, interest and ability of solving practical problems by using mathematical principles and methods. Cultivate students to master the basic theories and methods of higher mathematics, especially the way of thinking, master knowledge and skills, and develop creative ability at the same time.</p>						
<p>(1) 专业目标: Professional Ability</p>	<table border="1"> <tr> <td data-bbox="517 974 609 1350">1-1</td> <td data-bbox="609 974 1343 1350"> <p>具有扎实的专业基础与学科特长，系统掌握统计与数据分析、智能仿真建模技术、量化管理优化技术、试验设计与分析、项目管理与决策及其相关领域的专门知识与技能。</p> <p>A solid professional foundation and competency, systematical mastery of the specialized knowledge and skills in statistics and data analysis, intelligent simulation modeling technology, quantitative management optimization technology, experimental design and analysis, project management and decision-making.</p> </td> </tr> <tr> <td data-bbox="517 1350 609 1727">1-2</td> <td data-bbox="609 1350 1343 1727"> <p>具有扎实的专业基础与学科特长，系统掌握信息通信系统、项目管理与决策及其相关领域专门知识与技能。</p> <p>Excellent engineering literacy, outstanding practical skills in information technology, and capable of creatively solving complex engineering problems in information and communication and related fields through scientific and technological theories and engineering practical methods, as well as the ability of doing academic cutting-edge project research.</p> </td> </tr> <tr> <td data-bbox="517 1727 609 2045">1-3</td> <td data-bbox="609 1727 1343 2045"> <p>具有扎实的专业基础与学科特长，系统掌握大数据与人工智能系统、项目管理与决策及其相关领域专门知识与技能。</p> <p>Excellent engineering literacy, outstanding practical skills in information technology, and capable of creatively solving complex engineering problems in computer science and related fields through scientific and technological theories and engineering practical methods, as well as the ability of doing academic cutting-edge project research.</p> </td> </tr> </table>	1-1	<p>具有扎实的专业基础与学科特长，系统掌握统计与数据分析、智能仿真建模技术、量化管理优化技术、试验设计与分析、项目管理与决策及其相关领域的专门知识与技能。</p> <p>A solid professional foundation and competency, systematical mastery of the specialized knowledge and skills in statistics and data analysis, intelligent simulation modeling technology, quantitative management optimization technology, experimental design and analysis, project management and decision-making.</p>	1-2	<p>具有扎实的专业基础与学科特长，系统掌握信息通信系统、项目管理与决策及其相关领域专门知识与技能。</p> <p>Excellent engineering literacy, outstanding practical skills in information technology, and capable of creatively solving complex engineering problems in information and communication and related fields through scientific and technological theories and engineering practical methods, as well as the ability of doing academic cutting-edge project research.</p>	1-3	<p>具有扎实的专业基础与学科特长，系统掌握大数据与人工智能系统、项目管理与决策及其相关领域专门知识与技能。</p> <p>Excellent engineering literacy, outstanding practical skills in information technology, and capable of creatively solving complex engineering problems in computer science and related fields through scientific and technological theories and engineering practical methods, as well as the ability of doing academic cutting-edge project research.</p>
1-1	<p>具有扎实的专业基础与学科特长，系统掌握统计与数据分析、智能仿真建模技术、量化管理优化技术、试验设计与分析、项目管理与决策及其相关领域的专门知识与技能。</p> <p>A solid professional foundation and competency, systematical mastery of the specialized knowledge and skills in statistics and data analysis, intelligent simulation modeling technology, quantitative management optimization technology, experimental design and analysis, project management and decision-making.</p>						
1-2	<p>具有扎实的专业基础与学科特长，系统掌握信息通信系统、项目管理与决策及其相关领域专门知识与技能。</p> <p>Excellent engineering literacy, outstanding practical skills in information technology, and capable of creatively solving complex engineering problems in information and communication and related fields through scientific and technological theories and engineering practical methods, as well as the ability of doing academic cutting-edge project research.</p>						
1-3	<p>具有扎实的专业基础与学科特长，系统掌握大数据与人工智能系统、项目管理与决策及其相关领域专门知识与技能。</p> <p>Excellent engineering literacy, outstanding practical skills in information technology, and capable of creatively solving complex engineering problems in computer science and related fields through scientific and technological theories and engineering practical methods, as well as the ability of doing academic cutting-edge project research.</p>						

	1-4	具有卓越的技术素养和突出的应用统计学实践能力,具备在应用统计学及其相关领域通过科学技术理论和方法创造性的解决复杂问题、从事学术前沿问题研究的能力。 Excellent technical literacy, outstanding practical skills in applied statistics, and capable of creatively solving complex engineering problems in applied statistics and related fields through scientific and technological theories and engineering practical methods, as well as the ability of doing academic cutting-edge project research.
(2) 德育目标: Essential Quality	2-1	理解高等数学理论知识对于刻画工程实践问题的重要意义。 Understand the significant meanings of the advanced mathematics in depicting the practical engineering problems.
	2-2	认知当前全球,数学理论的发展对提升中国工程关键技术及核心竞争力的重要意义。 Understand the technology development, key techniques and the core competitiveness in the area of the China engineering in the world.
<b>课程教学目标与毕业要求的对应关系 Matrix of GA &amp; SLOs</b>		
毕业要求 GA	指标点 GA Index	教学目标 SLOs
1、理学知识:具有扎实的数学基础,能够将数学、自然科学和专业用于解决复杂实际问题。 Apply knowledge of mathematics, natural science, fundamentals and an engineering specialization to the solution of complex engineering problems.	指标点 1-1: 具有较强的演绎推理能力、准确计算能力、分析归纳能力、抽象思维能力,掌握数学、自然科学和相关专业知识,并使用其建立正确的数学、物理学等模型以解释复杂实际问题。 Capable of deductive reasoning, accurate calculation, analysis and induction and abstract thinking. Establishing correct mathematical and physical models with the professional knowledge of mathematics, natural science, etc. to solve complex practical problems.	1-1, 1-2
2、问题分析:能够借助应用统计学的基本原理、方法和手段,识别、表达、并通过文献研究分析复杂实际问题,以获得有效结论。 Identify, formulate, research literature and analyze complex practical problems reaching substantiated conclusions using first principles of mathematics and sciences.	2-1 能够应用数学、自然科学和工程学的基本原理、方法和手段,分析、识别、表达本专业相关的复杂工程问题。 Capable of analyzing, identifying and elaborating complex practical problems related to this major with the applying of the basic principles of Applied Statistics.	1-2, 1-3, 2-1
	2-2 能够应用数学、自然科学和工程学的基本原理、方法和手段,针对实际复杂工程问题设计针对性的技术方案,并综合运用文献、科学基座和技术手段予以解决。 Capable of drawing on the basic principles of applied statistics to design targeted	1-3, 1-4, 2-1, 2-2

	schemes for complex practical problems, and using literature, scientific theories and technical means to solve them.	
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### 三、教学内容 Content (Topics)

注：以中英文填写，各部分内容的表格可根据实际知识单元数量进行复制、扩展或缩减

Note: Filled in both CN and EN, extend or reduce based on the actual numbers of knowledge unit

理论教学 Lecture

知识单元序号: Knowledge Unit No.	1	支撑教学目标: SLOs Supported	1-1, 1-2, 1-3, 1-4
知识单元名称 Unit Title	函数与极限 Functions and Limits		
知识点: Knowledge Delivery	映射与函数 Mappings and functions		
	数列极限 Limits of sequences		
	函数极限 Limits of functions		
	无穷小与无穷大 Infinitesimal and infinite		
学习目标: Learning Objectives	了解: Recognize	函数和初等函数的概念 Concepts of functions and elementary functions 函数的性质 Properties of functions	
	理解: Understand	数列和函数极限的定义 Definitions of limit of a sequence and a function 连续函数的定义和性质 Definition and properties of continuous functions	
	掌握: Master	极限的性质及运算法则 Properties and operation rules of limits 两个重要极限 Two important limits 无穷小的比较 Order of the infinitesimals	
德育目标 Moral Objectives	2-2 认知当前全球，数学理论的发展对提升中国工程关键技术及核心竞争力的重要意义。 Understand the technology development, key techniques and the core competitiveness in the area of the China engineering in the world.		
重点: Key Points	极限的性质及运算法则 Properties and operation rules of limits		
难点: Focal points	极限的性质 Properties of limits 两个重要极限 Two important limits		

知识单元序号: Knowledge Unit No.	2	支撑教学目标: SLOs Supported	1-1, 1-2, 1-3, 1-4
知识单元名称 Unit Title	导数与微分 Derivative and Differential		
知识点: Knowledge Delivery	导数的概念 Concepts of derivatives		
	求导法则 Rules of finding derivatives		
	高阶导数 Higher order derivatives		

	隐函数以及参数方程的求导数法则 Derivation of implicit functions and parametric equations
	函数的微分 Differential of a function
学习目标: Learning Objectives	了解: Recognize 导数的概念 Concept of derivatives 函数的微分 Differential of a function
	理解: Understand 隐函数和由参数方程所确定的函数的导数 Derivation of implicit functions and parametric equations
	掌握: Master 求导法则 Rules of finding derivatives 高阶导数 Higher order derivatives
德育目标 Moral Objectives	2-1 理解高等数学理论知识对于刻画工程实践问题的重要意义。 Understand the significant meanings of the advanced mathematics in depicting the practical engineering problems.
重点: Key Points	求导法则 Rules of finding derivatives 高阶导数 Higher order derivatives
难点: Focal points	隐函数和由参数方程所确定的函数的导数 Derivation of implicit functions and parametric equations

知识单元序号: Knowledge Unit No.	3	支撑教学目标: SLOs Supported	1-1, 1-2, 1-3, 1-4
知识单元名称 Unit Title	微分中值定理与导数的应用 Mean Value Theorem and Applications of Derivatives		
知识点: Knowledge Delivery	区间套定理 Theorem of nested interval		
	闭区间上连续函数的性质 Properties of continuous functions on a closed interval		
	微分中值定理 Differential mean value theorems		
	洛必达法则 L' Hospital's rules		
	泰勒公式 Taylor's theorem		
学习目标: Learning Objectives	了解: Recognize 区间套定理 Theorem of nested interval 闭区间上连续函数的性质 Properties of continuous functions on a closed interval		
	理解: Understand 微分中值定理及其证明 Differential mean value theorem and their proofs		
	掌握: Master 罗必达法则 L' Hospital's rules 函数单调性、极值以及凹凸性质 Monotonicity, extreme values and convexity of functions		
德育目标 Moral Objectives	2-2 认知当前全球，数学理论的发展对提升中国工程关键技术及核心竞争力的重要意义。 Understand the technology development, key techniques and the core competitiveness in the area of the China engineering in the world.		
重点: Key Points	拉格朗日定理 Lagrange's theorem		

难点: Focal points	泰勒公式 Taylor's theorem
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知识单元序号: Knowledge Unit No.	4	支撑教学目标: SLOs Supported	1-1, 1-2, 1-3, 1-4
知识单元名称 Unit Title	不定积分 Indefinite Integrals		
知识点: Knowledge Delivery	不定积分的概念与性质 Concepts and properties of indefinite integrals		
	不定积分的换元法和分部积分法 Integration by substitution, integration by parts of indefinite integrals		
	有理函数的积分 Integration of rational functions		
学习目标: Learning Objectives	了解: Recognize	不定积分的概念与性质 Concepts and properties of indefinite integrals	
	理解: Understand	有理函数的积分 Integration of rational functions	
	掌握: Master	不定积分的换元法和分部积分法 Integration by substitution, integration by parts of indefinite integrals	
德育目标 Moral Objectives	2-2 认知当前全球，数学理论的发展对提升中国工程关键技术及核心竞争力的重要意义。 Understand the technology development, key techniques and the core competitiveness in the area of the China engineering in the world.		
重点: Key Points	不定积分的换元法和分部积分法 Integration by substitution, integration by parts of indefinite integrals		
难点: Focal points	有理函数的积分 Integration of rational functions		

知识单元序号: Knowledge Unit No.	5	支撑教学目标: SLOs Supported	1-1, 1-2, 1-3, 1-4
知识单元名称 Unit Title	定积分 Definite Integrals		
知识点: Knowledge Delivery	定积分的概念与性质 Concepts and properties of definite integrals		
	微积分基本定理 Fundamental theorems of calculus		
	牛顿-莱布尼兹公式 Newton-Leibniz formula		
	定积分的换元法和分部积分法 Integration by substitution, integration by parts of definite integrals		
	定积分的应用 Applications of definite integrals		
学习目标: Learning Objectives	了解: Recognize	定积分的概念与性质 Concepts and properties of definite integrals	
	理解: Understand	定积分的应用 Applications of definite integrals	
	理解: Understand	反常积分 Improper integrals	

	掌握: Master	微积分基本定理 Fundamental theorems of calculus 牛顿-莱布尼兹公式 Newton-Leibniz formula 定积分的换元法和分部积分法 Integration by substitution, integration by parts of definite integrals
德育目标 Moral Objectives	2-2 认知当前全球，数学理论的发展对提升中国工程关键技术及核心竞争力的重要意义。 Understand the technology development, key techniques and the core competitiveness in the area of the China engineering in the world.	
重点: Key Points	牛顿-莱布尼兹公式 Newton-Leibniz formula 定积分的换元法和分部积分法 Integration by substitution, integration by parts of definite integrals	
难点: Focal points	微积分基本定理 Fundamental theorems of calculus 定积分的换元法 Integration by parts in definite integrals	

#### 四、教学安排 Teaching Schedule

注：可根据实际情况增减行数

Note: Please add/reduce lines based on subject.

教学内容 Teaching Content	学时(周)Hour(Week)			
	理论 LECT.	实验 EXP.	实践 PRAC.	PBL
函数与极限 Functions and Limits	18	0	0	0
导数与微分 Derivative and Differential	12	0	0	0
微分中值定理与导数的应用 Mean Value Theorem and Applications of Derivatives	22	0	0	0
不定积分 Indefinite Integrals	12	0	0	0
定积分 Definite Integrals	16	0	0	0
总计 Total	80	0	0	0

#### 五、教学方法 Teaching Methodology

注：可根据实际情况增减行数或修改内容

Note: Please add/reduce lines or revise content based on subject.

勾选 Check	教学方法与特色 Teaching Methodology & Characters
<input checked="" type="checkbox"/>	课堂教学：板书与多媒体相结合、以板书为主

	Combination of blackboard writing and multimedia, mainly blackboard writing
<input checked="" type="checkbox"/>	实践能力传授：理论与行业、实际案例相结合 Combining theory with industrial practical problems
<input checked="" type="checkbox"/>	课程思政建设：知识讲授与德育相结合 Knowledge delivery with ethic education
<input type="checkbox"/>	PBL 教学： Problem-based learning
<input type="checkbox"/>	其他： Other:

## 六、成绩评定 Assessment

注：可根据实际情况增减行数或修改内容

Note: Please add/reduce lines or revise content based on subject.

考核环节: Assessment Content	平时 Behavior	环节负责人: Director	刘艳杰 Liu Yanjie
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	30
考核方式: Measures	平时成绩，以学生平时课堂出勤、表现、课堂教师随机提问，学生平时作业完成情况综合评定，其中，学生平时课堂出勤、表现、课堂教师随机提问占比 20%，学生平时作业完成情况占比 80%。 According to instant answer to the teacher's questions, comprehensive report and question performance, the mark is evaluated, where question performance and instant answer accounts for 10%, assignments performance (pre-lecture and post-lecture) accounts for 90%.		

考核环节: Assessment Content	期中 Mid-term	环节负责人: Director	刘艳杰 Liu Yanjie
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	20
考核方式: Measures	以闭卷形式进行 2 次阶段小测验 (threshold test)，每次 120 分钟。每次考试成绩占期中总成绩 50%。 Two threshold tests in the form of closed book, with 120 minutes each time. Each test score accounts for 50% of the total mid-term score.		

考核环节: Assessment Content	期末 Final	环节负责人: Director	王晓敏
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	50
考核方式: Measures	闭卷考试，考试时间 120 分钟。 Closed book examination, 120 minutes.		



## 七、改进机制 Improvement Mechanism

注：未尽事宜以教学团队以及学院教学指导委员会商定为准。

Note: Matters not covered in this file shall be determined by TAB of SSTC, NEU.

<b>教学大纲改进机制 Subject Syllabus Improvement Mechanism</b>			
考核周期(年): Check Period (YR)	4	修订周期(年): Revise Period (YR)	4
改进措施: Measures	课程负责人根据课程教学内容与人才培养目标组织课程团队讨论并修改教学大纲，报分管教学工作副院长审核后由执行院长批准。 The subject coordinator shall be responsible for the syllabus discussion and improvement, and the revised version shall be submitted to deputy dean (teaching affairs) for reviewing then to executive dean for approval.		
<b>成绩评定改进机制 Assessment Improvement Mechanism</b>			
考核周期(年): Check Period (YR)	1	修订周期(年): Revise Period (YR)	1
改进措施: Measures	课程负责人根据课程教学内容、课堂教学效果以及成绩分布，对课程教学方法和成绩评定环节进行改进，并同步优化评定办法。 The subject coordinator shall revise the syllabus based on the teaching content, effect and result distribution while optimize the assessment measures.		