东北大学秦皇岛分校本科课程教学大纲

一、课程基本信息

<table>
<tr><td>开课单位</td><td colspan="3">悉尼智能科技学院</td><td>课程代码</td><td colspan="5">3100311001</td></tr>
<tr><td>中文名称</td><td colspan="8">数学分析与建模（一）</td></tr>
<tr><td>英文名称</td><td colspan="8">Mathematical Analysis and Modeling (I)</td></tr>
<tr><td>总学时</td><td>80</td><td rowspan="2">理论学时</td><td rowspan="2">80</td><td rowspan="2">实验学时</td><td rowspan="2">0</td><td rowspan="2">上机学时</td><td rowspan="2">0</td><td rowspan="2">设计学时</td><td rowspan="2">0</td><td rowspan="2">课外学时</td><td rowspan="2">0</td></tr>
<tr><td>学　分</td><td>5</td></tr>
<tr><td>课程类型</td><td colspan="8">☑理论课程　☐理论（含实验）课程　☐实践类课程</td></tr>
<tr><td>课程类别</td><td colspan="8">☑通识类　☐学科基础类　☐专业方向类　☐实践类</td></tr>
<tr><td>适用专业</td><td colspan="8">应用统计学</td></tr>
<tr><td>先修课程</td><td colspan="8">无</td></tr>
<tr><td>建议开课学期</td><td colspan="8">☑1-1 ☐1-2 ☐2-1 ☐2-2 ☐3-1 ☐3-2
☐4-1 ☐4-2 ☐5-1 ☐5-2 ☐*（代表每学期都开设）</td></tr>
<tr><td>考核方式</td><td colspan="3">☑考试 ☐考查</td><td>成绩分制</td><td colspan="4">☑百分制 ☐五级制 ☐二级制</td></tr>
<tr><td>使用教材</td><td colspan="8">1、Advanced Mathematics (I), 2nd Edition, Beijing University of Posts and Telecommunications Press, 2018.</td></tr>
<tr><td>参考书及教学资源</td><td colspan="8">1、同济大学数学系，高等数学(第八版)上册，高等教育出版社， 2023.
2、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.</td></tr>
<tr><td>其他说明</td><td colspan="8">无</td></tr>
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二、课程简介

中文描述

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扎实基础。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。

English Description

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.

三、课程目标

1、知识目标：

1-1：深刻理解数列极限和函数极限的定义，熟练掌握求数列极限和函数极限的方法；。

1-2：熟练掌握一元函数、复合函数、隐函数的求导方法；深刻理解导数的定义和几何意义，能够熟练地应用一元函数的一阶、二阶导数研究函数的单调性和极值，研究函数图形的凹凸性和拐点，并能描绘函数的图形。

1-3：深刻理解微分中值定理的思想、几何意义，并能用微分中值定理解决相关的问题。

1-4：理解不定积分的定义，能够熟练地用换元法和分部积分法求不定积分；理解定积分的定义、思想及性质，能够熟练地用换元法和分部积分法等方法求解定积分。

1-5：熟练掌握用定积分来表达一些几何量（面积、体积及弧长等）与物理量（功、压力及引力等）的方法。

1-6：系统地掌握高等数学的基本概念、基本定理和基本方法，为学习后续课程和进一步获得数学知识奠定必要的数学基础。

2、能力目标：

2-1：具有用各种方法求函数极限的能力。

2-2：具有用微分中值定理证明等式和不等式等相关问题的能力。

2-3：具有用函数的一阶导数、二阶导数研究函数性态的能力。

2-4：具有求熟练求解不定积分和定积分的能力，以及用定积分解决几何和物理问题的能力。

2-5：具有抽象思维和逻辑思维能力，具有运用数学知识和数学技术解决实际问题的能力。通过数学问题解法的多样性，提高数学素养、发散思维能力，以及探索精神和创新能力。

3、德育/素养目标：

3-1：培养学生的理想信念、价值取向、政治信仰、社会责任等，使学生能够树立正确的人生观、价值观，使他们具有精确的推断、全面的观察、理性的思维等本领。

3-2：培养学生的数学素养和科学素质，使学生具有科学观点和科学思维方法，具有自主学习和终身学习的能力。培养具有不畏困难、锲而不舍、敢于尝试、不惧失败、迎难而上的精神。

3-3：培养学生严谨的学风、良好的社会责任感，坚定文化自信。培养学生的团队精神、科学精神、探索精神、创新精神和爱国情怀。

表 1 课程目标与毕业要求的对应关系

毕业要求	指标点	课程目标	关联 (H/M/L)
1. 理学知识：具有扎实的数学基础，能够将数学、自然科学和专业知识用于解决复杂实际问题。	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。	1-1、1-2、1-3、1-4、1-5、1-6、2-5、3-2	H
3．设计/开发解决方案：能够设计针对复杂实际问题的解决方案，设计满足特定需求的系统、单元或流程，并能够在设计环节中体现创新意识，考虑社会、健康、安全、法律、文化以及环境等因素。	3-1：能够设计针对本专业相关复杂实际问题的解决方案。	2-4、2-5 3-1、3-2	M

四、主要教学内容

（一）理论教学

第 1 章：Fundamental Knowledge of Calculus（支撑教学目标 1-1、2-1、3-2）

【1】知识点：

(1)Mappings and functions.

(2)Limits of sequences.

(3)Limits of functions.

(4)Infinitesimal and infinite.

(5)Continuous functions.

【2】学习目标：

了解：Concepts of functions and elementary functions ; Properties of functions.

理解：Definitions of limit of a sequence and a function; Definition and properties of continuous functions.

掌握：Properties and operation rules of limits; Two important limits; Order of the infinitesimals.

【3】重点内容：

(1)Properties and operation rules of limits.

(2)Properties of continuous functions.

【4】难点内容：

(1)Properties of limits.

(2)Two important limits.

【5】思政案例：

Extreme interpretation is the process of perpetual motion and infinite proximity. The limit is like our initial ideal, and we should never forget our original intention. Only through unremitting efforts can we achieve success.

第 2 章：Derivative and Differential（支撑教学目标 1-2、2-3、2-5）

【1】知识点：

(1)Concepts of derivatives.

(2)Rules of finding derivatives.

(3)Higher order derivatives.

(4)Derivation of implicit functions and parametric equations.

(5)Differential of a function.

【2】学习目标：

了解：Concept of derivatives; Differential of a function.

理解：Derivation of implicit functions and parametric equations.

掌握：Rules of finding derivatives; Higher order derivatives.

【3】重点内容：

(1)Rules of finding derivatives.

(2)Higher order derivatives.

【4】难点内容：

Derivation of implicit functions and parametric equations.

第 3 章：The Mean Value Theorem and Applications of Derivatives（支撑教学目标 1-3、1-6、2-2、2-5）

【1】知识点：

(1)The mean value theorems (Rolle’s theorem, Lagrange’s theorem and Cauchy’s theorem).

(2)L’ Hospital’s rules.

(3)Taylor’s theorem.

(4)Monotonicity, extreme values and convexity of functions.

【2】学习目标：

了解：Taylor’s theorem.

理解：The mean value theorems and their proofs.

掌握：L’ Hospital’s rules; Monotonicity, extreme values and convexity of functions.

【3】重点内容：

(1)Lagrange’s theorem.

(2)L’ Hospital’s rules.

【4】难点内容：

Taylor’s theorem.

第 4 章：Indefinite Integrals（支撑教学目标 1-4、2-4、2-5、3-1）

【1】知识点：

(1)Concepts and properties of indefinite integrals.

(2)Integration by substitution and integration by parts.

(3)Integration of rational functions.

【2】学习目标：

了解：Concepts and properties of indefinite integrals.

理解：Integration of rational functions.

掌握：Integration by substitution and integration by parts.

【3】重点内容：

(1)Integration by substitution.

(2)Integration by parts.

【4】难点内容：

Integration of rational functions.

【5】思政案例：

Calculus is the study of the contradictory relationship between differentiation and integration. It shows a new world for people's thinking activities, and cultivates students' thinking qualities such as rationality, fluency, flexibility, etc. We should feel the rational beauty and wisdom beauty of calculus thought.

第 5 章：Definite Integrals（支撑教学目标 1-4、1-5、1-6、2-4、2-5、3-1、3-3）

【1】知识点：

(1)Concepts and properties of definite integrals.

(2)Fundamental theorems of calculus.

(3)Newton-Leibniz formula.

(4)Integration by substitution and integration by parts in definite integrals.

(5)Applications of definite integrals.

(6) Improper integrals.

【2】学习目标：

了解：Concepts and properties of definite integrals.

理解：Applications of definite integrals; Improper integrals.

掌握：I Fundamental theorems of calculus; Newton-Leibniz formula; Integration by substitution and integration by parts in definite integrals.

【3】重点内容：

(1)Newton-Leibniz formula.

(2)Integration by substitution and integration by parts in definite integrals.

【4】难点内容：

Fundamental theorems of calculus.

【5】思政案例：

In the mid-17th century, the ideas and methods of calculus gave birth to Newton's classical mechanics and the law of universal gravitation. Combined with thermodynamics, it led to the emergence of the first industrial revolution and promoted social development. At the beginning of the 19th century, based on calculus, electromagnetics rapidly developed, triggering the Second Industrial Revolution. In the 20th century, calculus was combined with economics, successfully solving classical optimization problems and promoting rapid development of the world economy.

五、教学安排与学时分配

This course is based on classroom teaching. Classroom teaching focuses on the basic concepts, basic theories and basic principles of this course. The course focuses on the fundamental task of cultivating morality and cultivating people, consolidating basic knowledge, improving innovation ability, and establishing a correct outlook on life, world outlook and values. The distribution of class hours is shown in Table 2.

表 2 学时分配表

讲 课 内 容		学时				
		讲课	实验	上机	设计	课外
第 1 章	Fundamental Knowledge of Calculus	18	0	0	0	0
第 2 章	Derivative and Differential	12	0	0	0	0
第 3 章	The Mean Value Theorem and Applications of Derivatives	22	0	0	0	0
第 4 章	Indefinite Integrals	12	0	0	0	0
第 5 章	Definite Integrals	16	0	0	0	0
小计		80	0	0	0	0
总计	80					

六、教学方法

1、Combination of blackboard writing and multimedia, mainly blackboard writing.

2、Combining theory with industrial practical problems

3、Knowledge delivery with ethic education.

七、成绩评定

1、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%.

2、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.

Closed book examination, 120 minutes.

1. The score is assessed by the hundred-percent system. The course assessment consists of three parts, the usual performance, the midterm test and the closing exam. Specific requirements and scoring methods are as follows:

(1) Usual performance scores account for 30%, mainly including the attendance, the assignment performance and the classroom Performance.

(2) The midterm score is 20% of the total score.

(3) The final exam (closed book, 120 minutes) is 50% of the total score.

2. Students who are missing more than 1/3 of the required assignment, or who are missing more than 1/3 of the planned class hours, will be disqualified from the course assessment.

八、评价及持续改进

1、教学大纲

考核周期：4 年，修订周期：4 年。

改进措施：课程负责人组织课程团队所有教师讨论后提出改进意见，经教研室主任审核后由教学院长批准。

1、Teaching syllabus

Assessment period: 4 years, revision period: 4 years.

Improvement measures: The course leader organizes all teachers in the course team to discuss and put forward improvement suggestions, which are reviewed by the director of the teaching and research department and approved by the dean of teaching.

2、成绩评定考核

考核周期：1 学年，评价依据：学生最终成绩综合分析。

改进措施：根据学生最终成绩的分布，进行相应的内容调整和优化，并改进教学方法。

2、Performance assessment

Assessment period: 1 academic year, evaluation basis: comprehensive analysis of students' final scores.

Improvement measures: According to the distribution of students' final scores, adjust and optimize the corresponding content, and improve the teaching method.

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撰写： 刘艳杰

审核： 韩鹏

批准： 史文博

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