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">3060213039</td></tr>
<tr><td>中文名称</td><td colspan="8">数学建模（双语）</td></tr>
<tr><td>英文名称</td><td colspan="8">Mathematical Modeling</td></tr>
<tr><td>总学时</td><td>56</td><td rowspan="2">理论学时</td><td rowspan="2">56</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>3.5</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（中外合作办学）</td></tr>
<tr><td>先修课程</td><td colspan="8">数学分析、高等代数、离散数学、概率论与数理统计</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">Frank R. Giordano, William P. Fox and Steven B. Horton，《A First Course in Mathematical Modeling, Fifth edition》，Richard Stratton，2013，5th Edition.</td></tr>
<tr><td>参考书及教学资源</td><td colspan="8">1、Mark M. Meerschaert[著]，刘来福[译]:《数学建模方法与分析》，机械工业出版社，2009.
2、姜启源等，《数学模型》，高等教育出版社，2018，第 5 版.</td></tr>
<tr><td>其他说明</td><td colspan="8"></td></tr>
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二、课程简介

中文描述

数学建模课程是面向应用统计学（中外合作办学）专业开设的一门专业方向选修课。课程融合数学应用、数学软件应用及计算机编程等内容。旨在提高学生应用数学知识解决实际问题的能力。通过本课程的教学，学生应了解建模的意义、特点以及利用数学理论和方法分析和解决实际问题的全过程，掌握建立数学模型的一般方法和步骤，培养学生应用数学和现代工具解决实际问题的能力，为今后步入工作岗位尽快适应工作奠定良好的基础。

English Description

The mathematical modeling course is an elective course in the field of Applied Statistics. The course integrates mathematical applications, mathematical software applications, and computer programming. Intended to enhance students' ability to apply mathematical knowledge to solve practical problems. Through the teaching of this course, students should understand the significance and characteristics of modeling, as well as the entire process of analyzing and solving practical problems using mathematical theories and methods. They should master the general methods and steps of establishing mathematical models, cultivate their ability to apply mathematics and modern tools to solve practical problems, and lay a solid foundation for quickly adapting to work in the future.

三、课程目标

1、知识目标：

1-1：数学建模基础知识 Mathematical Modeling basics Overview；

1-2：数学建模过程的必要环节 How to make reasonable, simplified assumptions, using mathematical language to express the actual problem, and analyzes the results of the model；

1-3：简单的模型 Simple model；

1-4：连续类数学模型 Continuous models；

1-5：离散类数学模型 Discrete models；

1-6：优化模型 Optimization models.

2、能力目标：

2-1：培养学生应用数学和现代工具解决实际问题的能力 Developing students' ability to apply mathematics and modern tools to solve practical problems

2-2：通过科学思维方法的训练，培养学生运用数学原理解决实际问题的工程能力 Through the training of scientific thinking methods, cultivate students' engineering ability to apply mathematical principles to solve practical problems;

2-3：培养科学与工程应用的意识和素质，逐步培养学生的探索精神和创新能力 Cultivate awareness and quality of scientific and engineering applications, gradually cultivate students' exploratory spirit and innovative ability.

3、德育/素养目标：

3-1：以创新为动力，培养具有自学能力、创新意识、实践能力及团体协作能力的技能应用型人才 Motivated by innovation, cultivate skilled and applied talents with self-learning ability, innovative consciousness, practical ability, and group collaboration ability;

3-2：认知思想认识与行为习惯培养相结合的必要性，坚持知行合一原则 The necessity of combining cognitive thinking and behavioral habit cultivation, adhering to the principle of unity of knowledge and action.

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	关联性（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。 GA1. Science Knowledge: Apply knowledge of mathematics, natural science, fundamentals and an engineering specialization to the solution of complex engineering problems.	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: 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 至 1-6；2-1 至 2-3；3-1、3-2.	H
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。 GA2. Problem Analysis: Identify, formulate, research literature and analyze complex practical problems reaching substantiated conclusions using first principles of mathematics and sciences.	2-2：能够借助应用统计学的基本原理、方法和手段，针对复杂实际问题设计针对性的方案，并综合运用文献、科学理论和技术手段予以解决 2-2: Capable of drawing on the basic principles of applied statistics to design targeted schemes for complex practical problems, and using literature, scientific theories and technical means to solve them.	1-1 至 1-6；2-1 至 2-3；3-1、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。 GA3. Design/Development of Solutions: Design solutions for complex practical problems and design systems, components or processes that meet specified needs with appropriate consideration for public health, and safety, cultural, societal and environmental considerations.	3-1：能够设计针对本专业相关复杂实际问题的解决方案； 3-1: Capable of designing solutions to complex practical problems related to this major;	1-1 至 1-6；2-1 至 2-3；3-1、3-2.	M

四、主要教学内容

（一）理论教学

第 1 章 数学建模基础及描述变化 Modeling basics Modeling Change （支撑教学目标 1-1；2-1 至 2-3；3-1、3-2）

【1】知识点：

1.1 比例验证 Testing for Proportionality;

1.2 差分方程建模 Modeling Change with Difference Equations;

1.3 差分方程近似变化建模 Approximating Change with Difference Equations;

1.4 动力系统求解 Solutions to Dynamical Systems;

1.5 差分方程组系统 Systems of Difference Equations.

【2】学习目标：

了解：数学建模基础 Modeling basics overview of the course

理解：比例建模，差分建模，微分方程及方程组建模 Testing for Proportionality; Modeling Change with Difference Equations; Approximating Change with Difference Equations; Solutions to Dynamical Systems; Systems of Difference Equations.

掌握：比例建模，差分建模，微分方程及方程组建模 Testing for Proportionality; Modeling Change with Difference Equations; Approximating Change with Difference Equations; Solutions to Dynamical Systems; Systems of Difference Equations.

【3】重点内容：

差分及差分方程组建模，微分方程及微分方程组建模 Modeling Change with Difference Equations; Approximating Change with Difference Equations; Solutions to Dynamical Systems; Systems of Difference Equations.

【4】难点内容：

差分及差分方程组建模，微分方程及微分方程组建模 Modeling Change with Difference Equations; Approximating Change with Difference Equations; Solutions to Dynamical Systems; Systems of Difference Equations.

【5】思政案例：

数学建模必须将理论知识与实际应用相结合，坚持知行统一。The necessity of combining cognitive thinking and behavioral habit cultivation, adhering to the principle of unity of knowledge and action.

第 2 章：数学建模过程，比例与几何相似建模 The Modeling Process, Proportionality and Geometric Similarity（支撑教学目标 1-2；1-2；2-1 至 2-3；3-1、3-2）

【1】知识点：

2.1 汽车刹车距离数学模型 Mathematical Models Vehicular Stopping Distance;

2.2 Kepler 第三定律比例建模分析 Modeling Using Proportionality-Kepler's Third Law;

2.3 几何相似建模 Modeling Using Geometric Similarity;

2.4 汽车耗油量建模 Automobile Gasoline Mileage;

2.5 身高体重力量及灵敏度建模分析 Body Weight and Height, Strength and Agility.

【2】学习目标：

了解：Kepler 第三定律比例建模分析 Modeling Using Proportionality-Kepler's Third Law;

理解：几何相似建模 Modeling Using Geometric Similarity

掌握：汽车刹车距离数学模型，汽车耗油量建模，身高体重力量及灵敏度建模分析 Mathematical Models Vehicular Stopping Distance，Automobile Gasoline Mileage，Body Weight and Height, Strength and Agility

【3】重点内容：

2.3 几何相似建模 Modeling Using Geometric Similarity;

2.4 汽车耗油量建模 Automobile Gasoline Mileage;

2.5 身高体重力量及灵敏度建模分析 Body Weight and Height, Strength and Agility.

【4】难点内容：

2.3 几何相似建模 Modeling Using Geometric Similarity;

2.4 汽车耗油量建模 Automobile Gasoline Mileage;

2.5 身高体重力量及灵敏度建模分析 Body Weight and Height, Strength and Agility.

第 3 章：拟合模型 Model Fitting （支撑教学目标 1-3；2-1 至 2-3；3-1、3-2）

【1】知识点：

3.1 数据可视化拟合模型 Fitting Models to Data Graphically;

3.2 拟合模型的分析化方法 Analytic Methods of Model Fitting;

3.3 最小二乘拟合 Applying the Least-Squares Criterion;

3.4 最优拟合模型的选择 Choosing a Best Fitting Model.

【2】学习目标：

了解：数据可视化拟合模型 Fitting Models to Data Graphically;

理解：数据可视化拟合模型，拟合模型的分析化方法，最小二乘拟合，最优拟合模型的选择 Fitting Models to Data Graphically; Analytic Methods of Model Fitting; Applying the Least-Squares Criterion; Choosing a Best Fitting Model.

掌握：数据可视化拟合模型，拟合模型的分析化方法，最小二乘拟合，最优拟合模型的选择 Fitting Models to Data Graphically; Analytic Methods of Model Fitting; Applying the Least-Squares Criterion; Choosing a Best Fitting Model.

【3】重点内容：

拟合模型的分析化方法，最小二乘拟合，最优拟合模型的选择 Analytic Methods of Model Fitting; Applying the Least-Squares Criterion; Choosing a Best Fitting Model.

【4】难点内容：

拟合模型的分析化方法，最小二乘拟合，最优拟合模型的选择 Analytic Methods of Model Fitting; Applying the Least-Squares Criterion; Choosing a Best Fitting Model.

第 4 章：经验建模分析 Experimental Modeling （支撑教学目标 1-4；2-1 至 2-3；3-1、3-2）

【1】知识点：

4.1 Chesapeake Bay 捕捞模型及单项函数建模 Harvesting in the Chesapeake Bay and Other One-Term Models;

4.2 高次多项式建模 High-Order Polynomial Models;

4.3 低次多项式建模 Smoothing: Low-Order Polynomial Models;

4.4 三次样条建模 Cubic Spline Models.

【2】学习目标：

了解：Chesapeake Bay 捕捞模型及单项函数建模 Harvesting in the Chesapeake Bay and Other One-Term Models;

理解： 高次多项式建模，低次多项式建模，三次样条建模 High-Order Polynomial Models; Smoothing: Low-Order Polynomial Models; Cubic Spline Models.

掌握：高次多项式建模，低次多项式建模，三次样条建模 High-Order Polynomial Models; Smoothing: Low-Order Polynomial Models; Cubic Spline Models

【3】重点内容：

高次多项式建模，低次多项式建模，三次样条建模 High-Order Polynomial Models; Smoothing: Low-Order Polynomial Models; Cubic Spline Models

【4】难点内容：

三次样条建模 Cubic Spline Models.

第 5 章：仿真建模 Simulation Modeling （支撑教学目标 1-4；2-1 至 2-3；3-1、3-2）

【1】知识点：

5.1 确定性问题仿真建模：曲线围成的面积 Simulating Deterministic Behavior: Area Under a Curve;

5.2 生成随机数 Generating Random Numbers;

5.3 仿真随机问题 Simulating Probabilistic Behavior;

5.4 汽油消耗与运输存储问题模型 Inventory Model: Gasoline and Consumer Demand；

5.5 排队模型 Queuing Models.

【2】学习目标：

了解：确定性问题仿真建模：曲线围成的面积 Simulating Deterministic Behavior: Area Under a Curve;

理解：生成随机数，仿真随机问题，汽油消耗与运输存储问题模型，排队模型 Generating Random Numbers; Simulating Probabilistic Behavior; Inventory Model: Gasoline and Consumer Demand；Queuing Models.

掌握：生成随机数，仿真随机问题，汽油消耗与运输存储问题模型，排队模型 Generating Random Numbers; Simulating Probabilistic Behavior; Inventory Model: Gasoline and Consumer Demand；Queuing Models.

【3】重点内容：

5.2 生成随机数 Generating Random Numbers;

5.3 仿真随机问题 Simulating Probabilistic Behavior;

5.4 汽油消耗与运输存储问题模型 Inventory Model: Gasoline and Consumer Demand；

5.5 排队模型 Queuing Models.

【4】难点内容：

5.4 汽油消耗与运输存储问题模型 Inventory Model: Gasoline and Consumer Demand；

5.5 排队模型 Queuing Models.

第 6 章：离散概率模型 Discrete Probabilistic Modeling （支撑教学目标 1-4；2-1 至 2-3；3-1、3-2）

【1】知识点：

6.1 离散概率系统建模 Probabilistic Modeling with Discrete System;

6.2 系统可靠性建模 Modeling Component and System Reliability;

6.3 线性回归 Linear Regression.

【2】学习目标：

了解：离散概率系统建模，系统可靠性建模，线性回归 Probabilistic Modeling with Discrete System; Modeling Component and System Reliability; Linear Regression

理解：离散概率系统建模，系统可靠性建模，线性回归 Probabilistic Modeling with Discrete System; Modeling Component and System Reliability; Linear Regression

掌握：离散概率系统建模，系统可靠性建模，线性回归 Probabilistic Modeling with Discrete System; Modeling Component and System Reliability; Linear Regression

【3】重点内容：

线性回归 Linear Regression.

【4】难点内容：

线性回归 Linear Regression.

第 7 章：图论建模 Graphs Modeling （支撑教学目标 1-4；2-1 至 2-3；3-1、3-2）

【1】知识点：

7.1 图论模型 Graphs as Models;

7.2 图的表达 Describing Graphs;

7.3 图论建模 Graph Models；

7.4 图论模型求解 Using Graph Models to Solve Problems；

7.5 图问题与数学规划问题的关系 Connections to Mathematical Programming.

【2】学习目标：

了解：图论模型 Graphs as Models;

理解：图的表达，图论建模，图论模型求解，图问题与数学规划问题的关系 Describing Graphs; Graph Models；Using Graph Models to Solve Problems; Connections to Mathematical Programming.

掌握：图的表达，图论建模，图论模型求解，图问题与数学规划问题的关系 Describing Graphs; Graph Models；Using Graph Models to Solve Problems; Connections to Mathematical Programming.

【3】重点内容：

图的表达，图论建模，图论模型求解，图问题与数学规划问题的关系 Describing Graphs; Graph Models；Using Graph Models to Solve Problems; Connections to Mathematical Programming.

【4】难点内容：

图问题与数学规划问题的关系 Connections to Mathematical Programming.

第 8 章：决策论建模 Modeling with Decision Theory （支撑教学目标 1-4；2-1 至 2-3；3-1、3-2）

【1】知识点：

8.1 概率与期望基础理论 Probability and Expected Value Rolling the Dice;

8.2 决策树 Decision Trees;

8.3 序列决策与条件决策 Sequential Decisions and Conditional Probabilities；

8.4 不同准则下的决策过程 Decisions Using Alternative Criteria.

【2】学习目标：

理解：概率与期望基础理论，决策树，序列决策与条件决策，不同准则下的决策过程 Probability and Expected Value Rolling the Dice; Decision Trees; Sequential Decisions and Conditional Probabilities; Decisions Using Alternative Criteria.

掌握：概率与期望基础理论，决策树，序列决策与条件决策，不同准则下的决策过程 Probability and Expected Value Rolling the Dice; Decision Trees; Sequential Decisions and Conditional Probabilities; Decisions Using Alternative Criteria.

【3】重点内容：

概率与期望基础理论，决策树，序列决策与条件决策，不同准则下的决策过程 Probability and Expected Value Rolling the Dice; Decision Trees; Sequential Decisions and Conditional Probabilities; Decisions Using Alternative Criteria.

【4】难点内容：

序列决策与条件决策，不同准则下的决策过程 Sequential Decisions and Conditional Probabilities; Decisions Using Alternative Criteria.

第 9 章：博弈论建模 Game Theory Modeling （支撑教学目标 1-5、1-6；2-1 至 2-3；3-1、3-2）

【1】知识点：

9.1 博弈论：完全冲突 Game Theory: Total Conflict;

9.2 完全冲突博弈：纯策略与混合策略 Total Conflict as a Linear Program Model: Pure and Mixed Strategies;

9.3 决策模型的改进：与大自然博弈 Decision Theory Revisited: Games against Nature；

9.4 纯策略博弈模型的求解方法 Alternative Methods for Determining Pure Strategy Solutions；

9.5 2 X 2 纯策略博弈模型的简便求解方法 Alternative Shortcut Solution Methods for the 2X2 Total Conflict Game；

9.6 部分冲突博弈：囚徒困境 Partial Conflict Games: The Classical Two-Person Game.

【2】学习目标：

了解：博弈论：完全冲突 Game Theory: Total Conflict;

理解：完全冲突博弈：纯策略与混合策略，决策模型的改进：与大自然博弈，纯策略博弈模型的求解方法，2 X 2 纯策略博弈模型的简便求解方法，部分冲突博弈：囚徒困境 Total Conflict as a Linear Program Model: Pure and Mixed Strategies; Decision Theory Revisited: Games against Nature; Alternative Methods for Determining Pure Strategy Solutions; Alternative Shortcut Solution Methods for the 2X2 Total Conflict Game; Partial Conflict Games: The Classical Two-Person Game.

掌握：完全冲突博弈：纯策略与混合策略，决策模型的改进：与大自然博弈，纯策略博弈模型的求解方法，2 X 2 纯策略博弈模型的简便求解方法，部分冲突博弈：囚徒困境 Total Conflict as a Linear Program Model: Pure and Mixed Strategies; Decision Theory Revisited: Games against Nature; Alternative Methods for Determining Pure Strategy Solutions; Alternative Shortcut Solution Methods for the 2X2 Total Conflict Game; Partial Conflict Games: The Classical Two-Person Game.

【3】重点内容：

完全冲突博弈：纯策略与混合策略，决策模型的改进：与大自然博弈，纯策略博弈模型的求解方法，2 X 2 纯策略博弈模型的简便求解方法，部分冲突博弈：囚徒困境 Total Conflict as a Linear Program Model: Pure and Mixed Strategies; Decision Theory Revisited: Games against Nature; Alternative Methods for Determining Pure Strategy Solutions; Alternative Shortcut Solution Methods for the 2X2 Total Conflict Game; Partial Conflict Games: The Classical Two-Person Game.

【4】难点内容：

部分冲突博弈：囚徒困境 Partial Conflict Games: The Classical Two-Person Game.

第 10 章：微分方程建模 Modeling with a Differential Equation （支撑教学目标 1-4；2-1 至 2-4；3-1 至 3-3）

【1】知识点：

10.1 人口增长模型 Population Growth;

10.2 药物在体内释放浓度建模 Prescribing Drug Dosage;

10.3 刹车距离改进建模 Braking Distance Revisited；

10.4 SIR 人口增长模型 SIR population spreading model with ODE.

【2】学习目标：

理解：人口增长模型，药物在体内释放浓度建模，刹车距离改进建模，SIR 人口增长模型 Population Growth; Prescribing Drug Dosage; Braking Distance Revisited; SIR population spreading model with ODE.

掌握：人口增长模型，药物在体内释放浓度建模，刹车距离改进建模，SIR 人口增长模型 Population Growth; Prescribing Drug Dosage; Braking Distance Revisited; SIR population spreading model with ODE.

【3】重点内容：

SIR 人口增长模型 SIR population spreading model with ODE.

【4】难点内容：

SIR 人口增长模型 SIR population spreading model with ODE.

第 11 章：微分方程组建模 Modeling with Systems of Differential Equations （支撑教学目标 1-5；2-1 至 2-3；3-1、3-2）

【1】知识点：

11.1 一阶微分自治系统的相图求解 Graphical Solutions of Autonomous Systems of First-Order;

11.2 种群竞争模型 A Competitive Hunter Model;

11.3 食饵捕食者模型 A Predator--Prey Model;

11.4 军备竞赛模型 Two Military Examples;

11.5 微分动力系统的稳定性分析及应用 Stability of ODE systems and application.

【2】学习目标：

了解：一阶微分自治系统的相图求解 Graphical Solutions of Autonomous Systems of First-Order;

理解：种群竞争模型，食饵捕食者模型，军备竞赛模型，微分动力系统的稳定性分析及应用 A Competitive Hunter Model; A Predator--Prey Model； Two Military Examples; Stability of ODE systems and application.

掌握：种群竞争模型，食饵捕食者模型，军备竞赛模型，微分动力系统的稳定性分析及应用 A Competitive Hunter Model; A Predator--Prey Model； Two Military Examples; Stability of ODE systems and application.

【3】重点内容：

种群竞争模型，食饵捕食者模型，微分动力系统的稳定性分析及应用 A Competitive Hunter Model; A Predator--Prey Model；Stability of ODE systems and application.

【4】难点内容：

种群竞争模型，食饵捕食者模型，微分动力系统的稳定性分析及应用 A Competitive Hunter Model; A Predator--Prey Model；Stability of ODE systems and application.

第 12 章：连续模型的优化方法 Optimization of Continuous Models （支撑教学目标 1-6；2-1 至 2-3；3-1、3-2）

【1】知识点：

12.1 批量订货与存贮问题 An Inventory Problem: Minimizing the Cost of Delivery and Storage;

12.2 多元函数的优化方法 Methods to Optimize Function of Several Variables;

12.3 带约束问题的优化 Constrained Continuous Optimization;

12.4 捕鱼业的资源可持续性管理 Managing Renewable Resources: The Fishing Industry.

【2】学习目标：

理解：批量订货与存贮问题, 多元函数的优化方法, 带约束问题的优化, 捕鱼业的资源可持续性管理 An Inventory Problem: Minimizing the Cost of Delivery and Storage; Methods to Optimize Function of Several Variables; Constrained Continuous Optimization Managing; Renewable Resources: The Fishing Industry；Managing Renewable Resources: The Fishing Industry.

掌握：批量订货与存贮问题, 多元函数的优化方法, 带约束问题的优化, 捕鱼业的资源可持续性管理 An Inventory Problem: Minimizing the Cost of Delivery and Storage; Methods to Optimize Function of Several Variables; Constrained Continuous Optimization Managing; Renewable Resources: The Fishing Industry；Managing Renewable Resources: The Fishing Industry.

【3】重点内容：

批量订货与存贮问题, 多元函数的优化方法, 带约束问题的优化, 捕鱼业的资源可持续性管理 An Inventory Problem: Minimizing the Cost of Delivery and Storage; Methods to Optimize Function of Several Variables; Constrained Continuous Optimization Managing; Renewable Resources: The Fishing Industry；Managing Renewable Resources: The Fishing Industry.

【4】难点内容：

带约束问题的优化 Constrained Continuous Optimization Managing.

五、教学安排与学时分配

表 3 学时分配表

讲　　课　　内　　容		学时				
		讲课	实验	上机	设计	课外
第 1 章	数学建模基础及描述变化 Modeling basics Overview of the course；Modeling Change	4	0	0	0	0
第 2 章	数学建模过程，比例与几何相似建模 The Modeling Process, Proportionality	4	0	0	0	0
第 3 章	拟合模型 Model Fitting	4	0	0	0	0
第 4 章	经验建模分析 Experimental Modeling	4	0	0	0	0
第 5 章	仿真建模 Simulation Modeling	4	0	0	0	0
第 6 章	离散概率模型 Discrete Probabilistic	4	0	0	0	0
第 7 章	图论建模 Modeling Using Graph	4	0	0	0	0
第 8 章	决策论建模 Modeling with Decision	6	0	0	0	0
第 9 章	博弈论建模 Game Theory	6	0	0	0	0
第 10 章	微分方程建模 Modeling with a Differential Equation	4	0	0	0	0
第 11 章	微分方程组建模 Modeling with Systems of Differential Equations	6	0	0	0	0
第 12 章	连续模型的优化方法 Optimization of Continuous Models	6	0	0	0	0
小计		56	0	0	0	0
总计	56					

六、教学方法

1、讲授基本原理，理论联系实际，强调程序编写的基本思想和方法，培养学生创新能力。Teach basic principles, integrate theory with practice, emphasize the fundamental ideas and methods of programming, and cultivate students' innovative abilities.

2、采用多媒体和板书结合的教学方式、网络答疑和传统答疑相结合的答疑方式，提高课堂生机和答疑能力。 Adopting a combination of multimedia and blackboard teaching methods, as well as a combination of online and traditional Q&A methods, to enhance classroom vitality and Q&A abilities.

3、理论教学、讨论形式相结合，调动学生的学习积极性，培养学生的自学能力和解决实际问题的能力。 Combining theoretical teaching with discussion forms to stimulate students' learning enthusiasm, cultivate their self-learning ability and problem-solving ability.

七、成绩评定

本门课程依据全程监控的理念进行考核。课程考核包括 4 个部分，分别为出勤、作业、讨论

课和结课考试。具体要求及评分方法如下(This course is assessed based on the concept of full process monitoring. The course assessment includes four parts, namely attendance, homework, discussion class, and final exam. The specific requirements and scoring methods are as follows:)：

1、出勤：本门课程的所有环节均要求学生参与并签到，不得缺勤。出勤成绩占总成绩的 10%。每缺勤一次扣 1 分。缺勤 3 次进行谈话提醒，无故缺勤 4 次及以上者，取消本门课程的考试资格。Attendance: All aspects of this course require students to participate and sign in, and absence is not allowed. Attendance score accounts for 10% of the total score. Deduct 1 point for each absence. Those who are absent for 3 times will receive a conversation reminder. Those who are absent for 4 or more times without reason will have their exam qualification for this course cancelled.

2、作业：本门课程有 4 次课内作业，要求学生必须独立完成并在规定时间提交。作业成绩占总成绩的 20%，每次作业占 5%。未按时提交作业或作业有抄袭（雷同）现象的，该次作业成绩按零分计。 Homework: This course has 4 in class assignments, which require students to complete independently and submit within the specified time. The homework score accounts for 20% of the total score, with each assignment accounting for 5%. If the homework is not submitted on time or there is plagiarism (similarity) in the homework, the grade for that homework will be calculated as zero points.

3、讨论课：本门课程设有 2 次讨论课，要求学生按照讨论题目分组查阅资料，归纳总结，撰写报告，制作汇报用 PPT。讨论课每个小组都要进行讲问答评。讨论课占总成绩的 10%，每次讨论课占 5%；Discussion class: This course has 2 discussion classes, requiring students to group according to the discussion topic to search for information, summarize, write a report, and create a PPT for the report. Each group in the discussion class is required to conduct a Q&A evaluation. Discussion classes account for 10% of the total grade, with each discussion class accounting for 5%;

4、结课考试：结课考试占总成绩的 60%。 Closing Exam: The closing exam accounts for 60% of the total score.

补充说明：出勤成绩+作业成绩合计为平时成绩，按 100 分算。平时成绩不足 60 分者取消考试资格。Additional explanation: The total of attendance score and homework score is the regular score, calculated at 100 points. Those who score less than 60 points on a regular basis will be disqualified from the exam.

八、评价及持续改进

1、教学大纲 Syllabus

考核周期：4 年，修订周期：4 年。Assessment cycle: 4 years, Revision cycle: 4 years.

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

2、成绩评定考核 Achievement assessment

考核周期：1 学年，评价依据：学生最终成绩综合分析。Assessment period: 1 academic year, evaluation basis: comprehensive analysis of students' final grades.

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。Improvement measures: According to the distribution of students' final grades, the corresponding content adjustment and optimization will be carried out, and the teaching methods will be improved.

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