課程大綱及進度表-偏微分方程導論-2018-09

偏微分方程導論 Introduction to Partial Differential Equations
課程碼: C143700 分班碼: None 開課序號: 006 學分數: 3

核心能力
■ 掌握連續與逼近的能力
Ability to handle continuity phenomena and approximations.
□ 處理數字及符號運算的能力
Ability to operate with symbols and digits.
□ 透視形像與空間的能力
Ability to visualize space, shape, and images.
□ 利用計算機處理數學的能力
Ability of computer to do mathematics.
□ 應用隨機理論的能力
Ability to apply stochastic mathematics.
□ 處理大量數據的能力
Ability to handle large amount of data.
□ 處理離散型數學的能力
Ability to do mathematics relating to discrete models.
□ 獨立研究與撰寫論文的能力
Ability to do independent researches and to write thesis.
□ 使用計算機的能力
Abilities to use computer as a tool.

基本素養 無
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課程概述 Course Description
本課程學習偏微分方程的概念與基本類型以及它們的屬性。討論邊界問題,傅立葉級數,調和函數。
研究 Green 等式和 Green 函數,在空間的波,在空間及平面的邊界,一般特徵值問題,與波分佈的想法。
We study the concepts and basic types of PDE, and their properties. Then we discuss boundary problems, Fourier Series, and Harmonic Funtions. Next we investigate the ideas of Green’s Identities and Green’s Functions, Waves in Space, Boundaries in the Plane and in Space, General Eigenvalue Problems, and Distributions.
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先修課程或先備能力 Prerequisite Course(s): 高等微積分，線性代數，微分方程，計算器，數學軟體
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教師聯絡資訊 Contact with Teacher
開課教師：方永富
研究室: 數館 210 室
e-mail: yffang@mail.ncku.edu.tw
電話: 275-7575 轉 65131
授課時間: 星期一 5-6, 星期三 7,
Office Hours: 星期一，四：12:10-13:00
助教資訊 Contact with Tutor
本課程將沒有助教協助研討課，負責講解作業及小考測驗

課程學習目標 Course Objectives
In the 1st semester:
Where PDEs Come From, Waves and Diffusions
Reflections and Sources, Boundary Problems, and Fourier Series
Harmonic Functions, Green's Identities, Green's Functions, and Waves in Space
In the 2nd semester:
Waves in Space
Boundaries in the Plane and in Space
General Eigenvalue Problems
Distributions and Transforms
PDE Problems from Physics
Nonlinear PDEs

課程進度 Course Outline
In the 1st semester:
週次 Week 進度說明 Progress Description
1 Ch.1 Where PDEs Come From
2 Ch.1 Where PDEs Come From
3 Ch.2 Waves and Diffusions
4 Ch.2 Waves and Diffusions
5 Ch.3 Reflections and Sources
6 Ch.3 Reflections and Sources
7 Ch.4 Boundary Problems
8 Ch.4 Boundary Problems
9 Ch.4 Boundary Problems
10 Ch.5 Fourier Series
11 Ch.5 Fourier Series
12 Ch.5 Fourier Series
13 Ch.6 Harmonic Functions
14 Ch.6 Harmonic Functions
15 Ch.7 Green's Identities and Green's Functions
16 Ch.7 Green's Identities and Green's Functions
17 Ch.9 Waves in Space
18 Ch.9 Waves in Space
以上每週進度教師可依上課情況做適度調整。The schedule may be subject to change.

In the 2nd semester:
週次 Week 進度說明 Progress Description
1 Ch.9 Waves in Space
2 Ch.9 Waves in Space
3 Ch.10 Boundaries in the Plane and in Space
4 Ch.10 Boundaries in the Plane and in Space
5 Ch. 10 Boundaries in the Plane and in Space
6 Ch. 11 General Eigenvalue Problems
7 Ch. 11 General Eigenvalue Problems
8 Ch. 11 General Eigenvalue Problems
9 Ch. 12 Distributions and Transforms
10 Ch. 13 Distributions and Transforms
11 Ch. 12 Distributions and Transforms
12 Ch. 13 PDE Problems from Physics
13 Ch. 13 PDE Problems from Physics
14 Ch. 13 PDE Problems from Physics
15 Ch. 13 PDE Problems from Physics
16 Ch. 14 Nonlinear PDEs
17 Ch. 14 Nonlinear PDEs
18 Ch. 14 Nonlinear PDEs

以上各週進度教師可依上課情況做適當調整。The schedule may be subject to change.

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教學方法 Teaching Strategies
方法 百分比%
講授 Lecture 70
討論 Discussion 15
報告 Presentation 15

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課程教材 Course Material
Lecture Notes, Homework, Quizzes, 計算器, 數學軟體

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參考書目 References
Partial Differential Equations, An Introduction (Chapter 1 - 9) by Walter Strauss (2nd edition)
Partial Differential Equations, An Introduction (Chapter 9 - 14) by Walter Strauss (2nd edition)
Partial Differential Equation by Fritz John
Partial Differential Equations by Lawrence Evans
Semilinear Schrödinger equations by Thierry Cazenave

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評量方式 Grading
方法 百分比%
出席 Participation: 1%
期末考 Final: 40%
口頭報告 Presentation : 29%
作業 Homework: 30%

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學習規範 Course Policy
1. 作業不能遲交。
2. 缺考需要醫師證明、或家長證明、或學校公假單。
3. 考試違規，報請學校處理。

課程網址 Course Website:
NCKU Moodle

備註 Remarks
課程概述 Course Description
In the first semester:
We want to study where PDEs come from. Next we discuss waves and diffusions. Then we investigate the idea of reflections and sources. Furthermore we learn boundary problems, Fourier series, and harmonic functions. Finally we will talk about Green’s identities, Green’s functions, Waves in 2D and 3D.

In the second semester:
We want to study the waves in space. Next we investigate boundaries in the plane and in space. Then we learn general eigenvalue problems. Furthermore we study distributions and transforms. Finally we study PDE problems from physics and nonlinear PDEs.

In the 1st semester:
Ch.1 Where PDEs Come From
Ch.2 Waves and Diffusions
Ch.3 Reflections and Sources
Ch.4 Boundary Problems
Ch.5 Fourier Series
Ch.6 Harmonic Functions
Ch.7 Green’s Identities and Green’s Functions
Ch.9 Waves in Space

In the 2nd semester:
Ch.9 Waves in Space
Ch.10 Boundaries in the Plane and in Space
Ch.11 General Eigenvalue Problems
Ch.12 Distributions and Transforms
Ch.13 PDE Problems from Physics
Ch.14 Nonlinear PDEs

有關課程其他調查 Other Surveys of Courses
1. Is there any industry specialist invited in this course? How many times? No
2. Is there any in (out of) school practicum involved in this course? How many hours? No

開課系所 Department/Institute: 應數所 MATH
開課教師 Instructor: 方永富 Fang, Yung-Fu
開課學年 Academic Year: 0106
開課學期 Semester: 2
開課序號 Serial Number: 005
課程屬性碼 Attribute Code: L1
課程碼 Course Number: C143700
分班碼 Class Code: 
學分數 No. of Credits: 3
課程語言 Medium of Instruction: 中文

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