Florida Institute of Technology

ADDING A NEW COURSE TO THE CURRICULUM

This course is available for student registration only after the approval process has been completed.

SUBJECT MTH (e.g., CSE)
COURSE NO. 3210 (e.g., 1301)
CREDIT HOURS 3
TERM TO BE ADDED TO THE FILE Fall 2010 (e.g., Fall 2010)

CLASS HOURS 45/semester
LECTURE HOURS
LAB HOURS
CONTACT HOURS (IFU ONLY)

DEPARTMENT Mathematical Sciences
SCHEDULE TYPE Lecture (A)
(e.g., Computer Sciences)
(e.g., Lecture, Lab or Special Topics/Project)

☐ COLLEGE OF AERONAUTICS - 23
☐ COLLEGE OF PSYCHOLOGY AND LIBERAL ARTS - 25
☐ NATHAN M. BISK COLLEGE OF BUSINESS - 24
☒ COLLEGE OF SCIENCE - 26
☐ COLLEGE OF ENGINEERING - 1
☐ EXTENDED STUDIES DIVISION / NATHAN M. BISK COLLEGE OF BUSINESS - 90

COMPUTER TITLE Restricted to 25 characters, including spaces Intro to PDE & Apps

CATALOG TITLE Introduction to Partial Differential Equations and Applications

CATALOG DESCRIPTION OF COURSE Restricted to 350 characters, including spaces

Includes heat, wave and Laplace equations, initial and boundary value problems of mathematical physics and Fourier series. Also covers Dirichlet problem and potential theory, D'Alambert's solutions for wave equation, and Fourier and Laplace transforms, Poisson integral formula. PDEs in higher dimensions and special functions of mathematical physics.

In addition, please attach a course syllabus and/or more detailed description.

RESTRICTIONS ☒ Prerequisite MTH 2001
Course Number
☐ Corequisite Course Number

☐ Prerequisite MTH 2201
Course Number
☐ Corequisite Course Number

☐ Prerequisite
Course Number
☐ Corequisite Course Number

GRADES TO BE ISSUED ☒ A, B, C, D, F
☐ A, B, C, D, F, CEU
☐ CEU
☐ S, U
☐ P, F
☐ Other

ADDITIONAL RESTRICTION
(e.g., Major, Class Level, Department Head Approval)

If this course replaces a course currently offered in BANNER, please indicate old course information and the date/term the course may be removed from the system.

SUBJECT Alpha Prefix (e.g., CSE) MTH COURSE NO. (e.g., 1301) 3201

APPROVALS: Upon completion of appropriate department approvals, submit form to Chair, Graduate Council, or Chair, Undergraduate Curriculum Committee for approval below and forward to Catalog Director.

Originator 4/26/10

Date

Chair, Graduate Council

Date

Department Head/Program Chair 4/26/10 OR

Date

Dean or Associate Dean 4/26/10

Date

Chair, Undergraduate Curriculum Committee

Date

CATALOG DIRECTOR

These changes/additions have been made for the University Catalog/policy management system and entered into the BANNER term named above.

Catalog Director

Date

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Florida Institute of Technology • Office of the Registrar
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REG-036-409
INTRODUCTION to PARTIAL DIFFERENTIAL EQUATIONS and APPLICATIONS

MTH 3210, Fall 2010, MW 12:30 pm - 1:45 pm

Fredrick C. Crawford Building 210

Ugur G. Abdulla
Office Hours: S311, TR 2-3 pm

COURSE DESCRIPTION

Partial differential equations (PDEs) are central to mathematics, whether pure or applied. They arise in mathematical models of real world problems, where dependent variables vary continuously as functions of several independent variables, usually space and time. Supported with the power of modern software tailored to suitable discretised approximations of the equations, applicability of the theory of PDEs penetrates all areas of modern science and technology and it is continuing to grow day by day. The course presents partial differential equations starting from their physical origin and motivation. In particular, it deals with the classical equations of mathematical physics, namely the wave equation, Laplace's equation and the heat equation, as well as first order partial differential equations arising in continuum mechanics as conservation laws. The course exposes the basic ideas critical to the study of PDEs – separation of variables, integral transforms, special functions of the mathematical physics, characteristics and most importantly the Fourier series and related topics. A sizable practical part of the course is devoted to solving explicitly various physical problems by using these methods. Reference is continuously made to underlying physics. MATLAB software will
be used for some important model problems and the Computing Lab of the Department of Mathematical Sciences will be available for students during some classes.

TEXTBOOK

The required textbook is


Other recommended textbook is


GRADING POLICY

Homework and in-class quizzes will be assigned periodically. Your performance will contribute to 20% of your final grade.

There will be two midterm exams and a final exam. Each midterm will be administered on the dates below, in the same classroom and at the same time as the scheduled lecture. The midterms will focus mainly on the material covered in two chapters of the textbook within the previous 4-5 weeks. They consist of practical problems of the same type as those covered in quizzes and homework. Your performance in each midterm exam will contribute to 25% of your final grade.

The two hour final exam is comprehensive. It will be administered on the date below, in the same classroom. Material covered after the second midterm test will form 50% of the final exam. Your performance in final exam will contribute to 30% of your final grade.

Total score of 60 will be available from homework and quizzes; each midterm exam will be graded in 75’s and final will be graded in 90’s (i.e., the maximum score is 300). Your final grade will be determined by curving all final scores.

Exam 1 Monday, September 13
Exam 2 Monday, October 18
Final December xx.

SYLLABUS

1 Introduction

• What are Partial Differential Equations
• Initial and Boundary Conditions
• Linear PDEs-The Principle of Superposition
• Separation of Variables for Linear, Homogeneous PDEs
• Eigenvalue Problems

2 Major Three PDEs and Underlying Physics

• Second-Order, Linear, Homogeneous PDEs
• The Heat Equation and Diffusion
• The Wave Equation and the Vibrating String
• Transmission of Sound Waves
• Initial and Boundary Conditions for the Heat and Wave Equations
• Laplace’s Equation-The Potential Equation
• Using Separation of Variables to Solve the Major Three PDEs

3 Solving the Major Three PDEs via Fourier Series

• The Fourier Series
• Completeness
• Homogeneous Heat Equation for a Finite Rod
• Homogeneous Wave Equation for a Finite String
• Homogeneous Laplace’s Equation on a Rectangular Domain
• Nonhomogeneous Problems

4 Integral Transforms

• The Laplace Transform for PDEs
• Fourier Sine and Cosine Transforms
• The Fourier Transform
• The Heat Equation in Unbounded Regions
• Distributions, the Delta Function and Generalized Fourier Transforms

5 PDEs in Higher Dimensions and Special Functions of Mathematical Physics

• The Heat and Wave Equations on a Rectangle: Multiple Fourier Series
• Laplace’s Equation in Polar Coordinates: Poisson Integral Formula
• The Wave and Heat Equations in Polar Coordinates. Bessel Functions
• Dirichlet Problem on a Ball, Cauchy-Euler Equation, Legendre Polynomials
• Diffusion of Heat in a Ball, Spherical Bessel’s Equation, Harmonics.

6 Characteristics

• First-Order PDEs with Constant Coefficients
• First-Order PDEs with Variable Coefficients
• The Infinite String
• Characteristics for Semi-Infinite and Finite String Problems