Florida Institute of Technology

ADDING A NEW COURSE TO THE CURRICULUM

This is a request for reactivation of a course in the system. □ Yes □ No

New courses are available beginning with the fall term in which they appear in the University Catalog.

SUBJECT MTH COURSE NO.* 3 2 0 0 CREDIT HOURS 4 ACADEMIC YEAR TO BE ADDED TO THE FILE Fall 2018 (e.g., 1301)

*Justify level if 1000-level and no co- or prerequisites

CLASS HOURS 75/semester LECTURE HOURS 45/semester LAB HOURS 30/semester CONTACT HOURS (CEU ONLY) N/A

DEPARTMENT Mathematical Sciences

(e.g., Biological Sciences)

SCHEDULE TYPE Lecture/Lab (C)

(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 AND COMPUTING – 01

COMPUTER TITLE Honors Differential EQ

This course will be entered into the system as: Bi-Level □ Cross-Listed □ Dual-Numbered □ Full-Load □ None of these/Standard Listing □

CATALOG TITLE Honors Differential Equations

CATALOG DESCRIPTION OF COURSE Restricted to 350 characters, including spaces

Provides analysis of differential equations. Emphasizes proofs. Includes existence and uniqueness theorems, Lyapunov stability theory, differential and integral inequalities, Gronwall-Bellman lemma, matrix exponential, differential equations depending on a parameter, continuity, and differentiability or a solution with respect to a parameter

This description has been approved by the catalog office EmJoy 1-18-2018

Catalog & Curriculum Manager Date

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

REQUIREMENTS □ Prerequisite MTH 1020 □ Corequisite Course Number

□ Prerequisite MTH 3102 □ Corequisite Course Number

□ Prerequisite Course Number □ Corequisite Course Number

□ Prerequisite Course Number □ Corequisite Course Number

□ and □ or □ and □ or □ and □ or

□ A, B, C, D, F □ A, B, C, D, F, CEU/Audit

□ CEU □ S, U □ P, F

□ Other

ADDITIONAL RESTRICTIONS □ and □ or □ and □ or □ and □ or

(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 Prefix (e.g., MTH) COURSE NO. (e.g., 1301) TERM TO INACTIVATE

□ Yes □ No Will this course be used to measure program-level student learning outcomes? If yes, review and signature required.**

□ Yes □ No Will this course be used to satisfy the scholarly inquiry requirement? If yes, attach "Q" materials for review.

□ Yes □ No Will this course impact any existing programs? If yes, attach "Changing Graduation Requirements" form for each program impacted.

□ Yes □ No Will this course be used to satisfy the Cross Cultural (CC) requirement? If yes, attach confirmation memo from QEP2 Committee.

APPROVALS: On completion of description and course number verification, affix appropriate signatures as indicated, and submit to the Office of Graduate Programs, or Undergraduate Curriculum Committee Chair for placement on agenda.

Chair, Graduate Council Date

Date

Chair, Undergraduate Curriculum Committee Date

Date

**Chair, Academic Programs Assessment Committee Date

CATALOG & CURRICULUM MANAGER

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

Catalog & Curriculum Manager Date

REGISTRAR’S USE ONLY

SCACRSE SCADETL SCAPREQ SCABASE ACALOG SCARRS CIP Code 27.0503 Operator Init. Date

Florida Institute of Technology • Office of the Registrar

150 West University Boulevard, Melbourne, FL 32901-6975 • 321-674-8114 • Fax 321-674-7827

RGR-350-1217
Honors Differential Equations, MTH 3200, Spring 2019

Instructor: TBD

Textbook: *Ordinary Differential Equations, W. Walter*

**Course Information:** This is a rigorous, proof-based introductory course on the theory of differential equations. The aim of the course is to give a thorough and systematic introduction to the classical theory of the Cauchy problem for ordinary differential equations and systems. The main topics covered will be existence and uniqueness theorems for linear differential equations and systems, Lyapunov stability theory for linear differential equations and systems, local and global existence and uniqueness theorems for nonlinear differential equations.

**Expected Outcomes:** Upon completion of this course, students will understand the theoretical aspects of qualitative theory of ordinary differential equations, and be able to solve certain classes of differential equations and systems. More specifically:

- Students will how to solve certain classes of differential equations of the first order.
- Students will learn how get a priori estimates for a solution of the Cauchy problem for linear differential equations and systems.
- Students will learn fundamental existence and uniqueness theorems for linear differential equations and systems.
- Students will learn elements of Lyapunov stability theory for linear differential equations and systems.
- Students will learn how to study boundary value problems for linear differential equations and systems.
- Students will learn Sturm's comparison theorem for second order linear differential equations.
- Students will learn how to study linear differential systems depending on a parameter.
- Students will learn local existence and uniqueness theorems and blow-up phenomenon for nonlinear differential equations.

**Course Description and Schedule**

- **Week 1. First Order Equations: Some Integrable Cases:** The initial value problem; Separable equation; Homogeneous equation, Linear Differential Equations of the First Order, The Cauchy formula; The Bernoulli equation; Differential inequalities; The Gronwall–Bellman lemma.
- **Week 2-3. Existence and Uniqueness Theorems:** Systems of Differential Equations of the First Order; Higher Order Linear Differential Equations
- **Week 4-5. Homogeneous Linear Differential Systems:** Fundamental matrix; The Cauchy matrix; Liouville's formula. Fundamental set of solutions; The Cauchy function; Wronskian; Liouville's formula.
- **Midterm Exam 1**
- **Week 6. Inhomogeneous Linear Differential Equations and Systems:** Method of variation of parameters; The Cauchy formula.
• **Week 7. Linear Differential Equations and Systems with Constant Coefficients:** Matrix exponential; Jordan normal form of a matrix; the structure of the fundamental system of solutions; Construction of solutions; the Cauchy-Euler Equation.

• **Week 8. Continuous Dependence and Differentiability with Respect to the Parameter:** Well-posedness of the Cauchy problem; Continuous dependence of a solution on a parameter; Differentiability of a solution with respect to a parameter.

• **Week 9-10. Lyapunov Stability Theory for Linear Differential Equations and Systems:** Stability; Uniform stability; Asymptotic stability; Stability and asymptotic stability of linear differential equations and systems with constant coefficients.

• **Midterm Exam 2**

• **Week 11-12. Boundary Value Problems for Linear Differential Equations and Systems:** General boundary value problem; Green's function; Periodic problem; Floquet theory; Second order linear differential equations; Sturm's comparison theorem.

• **Week 13-15. Nonlinear differential equations and systems:** Local existence and uniqueness theorem; Continuation of a solution; Global existence theorems.

• **Final Exam**

**Grading:** Final grades will be based on homework, including a project (20%), two midterm exams (20% each), and the final exam (40%).
MTH 3200 ‘Honors Differential Equations’ Spring Semester 2019 (January–May)

Instructor: T B D

- Lecture: T B D
- Office Hours: T B D

Text:

Wolfgang Walter, Ordinary Differential Equations, SPRINGER, ISBN: 978-0387984599 (REQUIRED)

Topics

- First Order Equations: Some Integrable Cases  The initial value problem; Separable equation; Homogeneous equation.
- Linear Differential Equations of the First Order  The Cauchy formula; The Bernoulli equation; Differential inequalities; The Gronwall–Bellman lemma.
- Existence and Uniqueness Theorems  Systems of Differential Equations of the First Order; Higher Order Linear Differential Equations;
- Homogeneous Linear Differential Systems  Fundamental matrix; The Cauchy matrix; Liouville’s formula.
- Homogeneous Linear Differential Equations of Higher Order  Fundamental set of solutions; The Cauchy function; Wronskian; Liouville’s formula.
- Inhomogeneous Linear Differential Systems  Method of variation of parameters; The Cauchy formula.
- Inhomogeneous Linear Differential Equations of Higher Order  Method of variation of parameters; The Cauchy formula.
- Linear Differential Equations and Systems with Constant Coefficients  Matrix exponential; Jordan normal form of a matrix; the structure of the fundamental system of solutions; Construction of solutions; the Cauchy-Euler Equation.
- Continuous Dependence and Differentiability with Respect to the Parameter  Well-posedness of the Cauchy problem; Continuous dependence of a solution on a parameter; Differentiability of a solution with respect to a parameter.
- Boundary Value Problems for Linear Differential Equations and Systems  General boundary value problem; Green’s function; Periodic problem; Floquet theory; Second order linear differential equations; Sturm’s comparison theorem.
- Nonlinear differential equations and systems  Local existence and uniqueness theorem; Continuation of a solution; Global existence theorems.

- Midterm Exams: There will be two midterm exams during classes. These exams will be announced at least one week in advance.
• **Final Exam:** The final exam is comprehensive.

**Grading:** Your course grade will be based on homework (60 pts), project (40pts), 2 midterm exams (100 pts each) and a final exam (200 pts). Hence there are 500 possible course points. Only students with **excused absences** may make-up work – no exceptions (consult your student handbook). An excused absence requires either a *University* excuse or official documentation. e.g. a doctors note. **ATTENDANCE IS REQUIRED.**
The addition or removal of any graduation requirement in a major or minor requires that this form, accompanied by supporting documentation, be completed and approved as indicated below. Incomplete or incorrect forms will not be processed.

COLLEGE: College of Science

DEPARTMENT: Mathematical Sciences

DEGREE LEVEL: Undergraduate

PROGRAM TITLE: Mathematical Sciences

TO BE INITIATED WITH CATALOG YEAR 20     18     /20     19

CHANGE REQUESTED FOR  □ major program  □ minor program 7 0 7 6

Major/Minor Code

Program changes are effective beginning with the fall term in which they appear in the University Catalog.

□ Yes  □ No  Will this change impact the program’s assessment process? If yes, attach a description of how the assessment will be impacted and the new process.

DESCRIPTION OF REQUESTED CHANGES: Attach a more detailed description and any supporting documentation

Requirement of MTH 2201 changes to MTH 2201 OR MTH 3200

Approvals: On completion of appropriate department approvals, submit form to Chair, Graduate Council, or Chair, Undergraduate Curriculum Committee, for approval below and forward to the Catalog & Curriculum Manager.

Originator: 1/17/18

Department Head/Minor Program Chair: 1/17/18

Dean or Associate Dean: 1/17/18

Chairs, Graduate Council: Date

Chairs, Undergraduate Curriculum Committee: Date

REGISTRAR'S USE ONLY

CAPP/ Degree Evaluation

Academic Year  □ Yes  □ No  Update completed  Date  Initials

Catalog Management System

Academic Year  □ Yes  □ No  Update completed  Date  Initials
The addition or removal of any graduation requirement in a major or minor requires that this form, accompanied by supporting documentation, be completed and approved as indicated below. Incomplete or incorrect forms will not be processed.

COLLEGE: College of Science

DEPARTMENT: Mathematical Sciences

DEGREE LEVEL: Undergraduate

PROGRAM TITLE: Mathematical Sciences - Applied Mathematics

TO BE INITIATED WITH CATALOG YEAR 2018/2019

CHANGE REQUESTED FOR: [ ] major program [ ] minor program

Major/Minor Code: 7077

Program changes are effective beginning with the fall term in which they appear in the University Catalog.

☐ Yes ☐ No Will this change impact the program's assessment process? If yes, attach a description of how the assessment will be impacted and the new process.

DESCRIPTION OF REQUESTED CHANGES: Attach a more detailed description and any supporting documentation

Requirement of MTH 2201 changes to MTH 2201 OR MTH 3200

Approvals: On completion of appropriate department approvals, submit form to Chair, Graduate Council, or Chair, Undergraduate Curriculum Committee, for approval below and forward to the Catalog & Curriculum Manager.

Chair, Graduate Council

Date

OR

Chair, Undergraduate Curriculum Committee

Date

Dean or Associate Dean

Date

REGISTRAR'S USE ONLY

☐ Yes ☐ No Update completed Date Initials

CAPP / Degree Evaluation

Academic Year

☐ Yes ☐ No Update completed Date Initials

Catalog Management System

Academic Year

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RGR-231-315
The addition or removal of any graduation requirement in a major or minor requires that this form, accompanied by supporting documentation, be completed and approved as indicated below. Incomplete or incorrect forms will not be processed.

COLLEGE: College of Science

DEPARTMENT: Mathematical Sciences

DEGREE LEVEL: Undergraduate

PROGRAM TITLE: Biomathematics

TO BE INITIATED WITH CATALOG YEAR 2018/2019

CHANGE REQUESTED FOR □ major program □ minor program

Program changes are effective beginning with the fall term in which they appear in the University Catalog.

☐ Yes ☐ No

Will this change impact the program's assessment process? If yes, attach a description of how the assessment will be impacted and the new process.

DESCRIPTION OF REQUESTED CHANGES: Attach a more detailed description and any supporting documentation

Requirement of MTH 2201 changes to MTH 2201 OR MTH 3200

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Chair, Graduate Council

Date

OR

Chair, Undergraduate Curriculum Committee

Date

Dean or Associate Dean

Date

REGISTRAR'S USE ONLY

☐ Yes ☐ No Update completed __________________________ Initials

Academic Year

Collector / Degree Evaluation

☐ Yes ☐ No Update completed __________________________ Initials

Academic Year

Catalog Management System