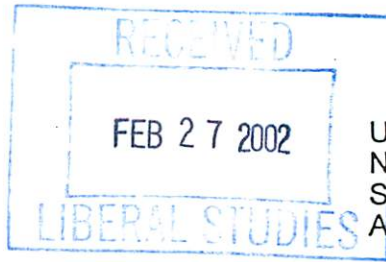


LSC Use Only
Number: _____
Submission Date: _____
Action-Date: _____



UWUCC USE Only
Number: 01-62f
Submission Date: _____
Action-Date: UWUCC App 4/16/02
Senate App 5/7/02

CURRICULUM PROPOSAL COVER SHEET
University-Wide Undergraduate Curriculum Committee

I. CONTACT

Contact Person Gerald Buriok Phone 7 2608
Department Mathematics

II. PROPOSAL TYPE (Check All Appropriate Lines)

COURSE MATH 241 Differential Equations
Suggested 20 character title

____ New Course* _____
Course Number and Full Title

Course Revision MATH 241 Differential Equations
Course Number and Full Title

____ Liberal Studies Approval + _____
for new or existing course Course Number and Full Title

____ **Course Deletion** _____
Course Number and Full Title

____ **Number and/or Title Change** _____
Old Number and/or Full Old Title
New Number and/or Full New Title

Course or Catalog Description Change MATH 241 Differential Equations
Course Number and Full Title

____ **PROGRAM:** _____ Major _____ Minor _____ Track

____ **New Program*** _____
Program Name

____ **Program Revision*** _____
Program Name

____ **Program Deletion*** _____
Program Name

____ **Title Change** _____
Old Program Name

New Program Name

III. Approvals (signatures and date)

George E. Mitchell 10/11/01
Department Curriculum Committee

Gerald Buriok 10/11/01
Department Chair

[Signature] 02/26/02
College Curriculum Committee

[Signature] 2/27/02
College Dean

+ Director of Liberal Studies (where applicable)

*Provost (where applicable)

Part II. Description of Curriculum Change

1. New syllabus of record. (Attached.)
2. Summary of proposed revisions.

The proposed change is in the prerequisite, replacing "MATH 122, 124, or 227" with "MATH 122 or 124." The catalog description is reworded to more accurately describe the content of the course.

- a. Proposed new catalog description:

MATH 241 Differential Equations

3c-01-3sh

Prerequisite: MATH 122 or MATH 124

An emphasis is placed on techniques of solution and applications of differential equations. Topics include first order equations, second order linear equations, systems of linear equations and series solutions of differential equations

- b. Old catalog description

MATH 241 Differential Equations

3c-01-3sh

Prerequisite: MATH 122, 124, or 227.

Emphasis is placed on techniques of solution and elementary physical applications. A thorough study is made of differential equations classified as order one-degree one, linear, and nonhomogeneous. Solution techniques involving reduction of order techniques, the differential operator, and infinite series are introduced.

3. Justification/rationale for change.

Several years ago there was a three-semester calculus sequence MA127 Calculus I, MA 128 Calculus II, and MA 227 Calculus III. This sequence was deactivated in 1998 and we wish to remove all reference to these courses from the catalog. The description is changed to more accurately reflect the content of the course.

4. Old syllabus of record. (Attached.)
5. Liberal Studies course approval form and checklist. (Not applicable.)

Part III. Letters of Support. (Attached.)

I. Catalog Description

MATH 241 Differential Equations

3 credits
3 lecture hours
0 lab hours
(3c-01-3sh)

Prerequisite: MATH 122 or 124

An emphasis is placed on techniques of solution and applications of differential equations. Topics include first order equations, second order linear equations, systems of linear equations and series solutions of differential equations.

II. Course Objectives

1. Students will learn the techniques of solution of first order differential equations.
2. Students will study applications of first order differential equations.
3. Students will learn the theory of second order linear differential equations.
4. Students will learn the techniques for solving second order linear differential equations.
5. Students will study applications of second order differential equations.
6. Students will learn elementary methods for solving systems of linear differential equations.
7. Students will learn how to use series to solve differential equations.

III. Course Outline

A. Introduction (3 hours)

1. Definitions and Terminology
2. Initial-Value Problems
3. Differential Equations as Mathematical Models

B. First-Order Differential Equations (7 hours)

1. Solution Curves Without the Solution
2. Separable Variables
3. Linear Equations
4. Exact Equations
5. A Numerical Solution

C. Modeling with First-Order Differential Equations (5 hours)

1. Linear Equations
2. Nonlinear Equations
3. Systems of Linear and Nonlinear Differential Equations

D. Higher-Order Differential Equations (12 hours)

1. The Theory of Linear Equations
2. Homogeneous and Nonhomogeneous Equations
3. Reduction of Order

4. Homogeneous Linear Equations with Constant Coefficients
 5. Nonhomogeneous Linear Equations with Constant Coefficients
 6. Variation of Parameters
 7. Cauchy-Euler Equations
 8. Solving systems of Linear Equations by Elimination
 9. Nonlinear Equations
- E. Modeling with Higher-Order Differential Equations (5 hours)
1. Spring/Mass Systems
 2. Series Circuits
 3. Applications of Nonlinear Equations
- F. Systems of Linear First-order Differential Equations (5 hours)
1. Preliminary Theory
 2. Homogeneous Linear Systems with Constant Coefficients
 3. Variation of Parameters
 4. The Matrix Exponential
- G. Series solutions of Linear Equations (5 hours)
1. Solutions About Ordinary Points
 2. Solutions About Singular Points
 3. Two Special Equations

IV. Evaluations Methods

The final grade for the course will be determined as follows:

50% Tests. Tests will be based on the lecture material.

20% Final Examination. The final examination will be comprehensive.

30% Homework, Quizzes, and Projects. These will cover both lecture and textbook assignments. The projects will be designed to extend the lecture material or to develop an application not discussed in class.

Grades will be assigned as follows:

A: 90%-100%

B: 80%-89%

C: 70%-79%

D: 60%-69%

F: 0%-59%

V. Required Textbook

Dennis G. Zill. A First Course in Differential Equations with Modeling Applications, Pacific Grove, CA: Brooks/Cole,

VI. Special Resource Requirements

Some instructors may require students to purchase special calculators.

VII. Bibliography

1. Diacu, Florin, An Introduction to Differential Equations, Order and Chaos, New York: W. H. Freeman and Company, 2000.
2. Tenenbaum, Morris and Pollard, Harry, Ordinary Differential Equations, An Elementary Textbook for Students of Mathematics, Engineering, and the Sciences, New York: Dover Publications, Inc., 1963.
3. Williamson, Richard E., Introduction to Differential Equations and Dynamical Systems, Second Edition, New York: McGraw-Hill, 2001

Mathematics Department
Indiana University of Pennsylvania
Indiana, PA 15705

Course Number: MA 241
Course Title: Differential Equations
Credits: 3 semester hours
Prerequisites: MA 122, MA 124, or MA 227
Textbook: Differential Equations
Davis
Prentice Hall
Revised: 9/96

Catalog Description:

Emphasis is placed on techniques of solution and elementary physical applications. A thorough study is made of differential equations classified as order one-degree one, linear and nonhomogeneous. Solution techniques involving reduction of order techniques, the differential operator, and infinite series are introduced.

Course Outline/Time Schedule:

- I. Introduction to Differential Equations
 - A. Basic Definitions and Terminology
 - B. Some Qualitative Considerations
 - 1. Direction Fields
 - 2. Phase Portraits

- II. First-Order Differential Equations
 - A. Preliminary Theory
 - B. Separable Variables
 - C. Exact Equations
 - D. Linear Equations
 - E. Applications
 - 1. Linear Equations
 - 2. Nonlinear Equations
 - F. Numerical Solutions: Euler Methods
 - G. Numerical Solutions: Runge-Kutta Methods
 - H. Numerical Solutions: Multistep Methods

III. Higher-Order Differential Equations

- A. Preliminary Theory: Linear Equations
 - 1. Initial-Value and Boundary-Value Problems
 - 2. Homogeneous Equations
 - 3. Nonhomogenous Equations
- B. Reduction of Order
- C. Homogeneous Linear Equations with Constant Coefficients
 - 1. Method of Solution
 - 2. Trajectories and the Phase Plane
- D. Undetermined Coefficients
- E. Variation of Parameters
- F. Cauchy-Euler Equation
- G. Applications: Initial-Value Problems
 - 1. Spring/Mass Systems: Free Undamped Motion
 - 2. Spring/Mass Systems: Free Damped Motion
 - 3. Spring/Mass Systems: Driven Motion
 - 4. Analogous Systems
- H. Applications: Boundary-Value Problems
- I. Systems of Differential Equations
- J. Numerical Solutions
- K. Nonlinear Higher-Order Equations

IV. Systems of First-Order Differential Equations

- A. Preliminary Theory: Linear Systems
- B. Homogeneous Linear Systems
 - 1. Distinct Real Eigenvalues
 - 2. Repeated Eigenvalues
 - 3. Complex Eigenvalues
- C. Variation of Parameters
- D. Stability
 - 1. Linear Systems
 - 2. Nonlinear Systems

V. Series Solutions

- A. Review of Power Series; Power Series Solutions
- B. Solutions About Ordinary Points
- C. Solutions About Singular Points
- D. Bessel's Equation

LIBERAL STUDIES COURSE APPROVAL, PARTS 1-3: GENERAL INFORMATION CHECK-LIST

I. Please indicate the LS category(ies) for which you are applying:

LEARNING SKILLS:

- First Composition Course Second Composition Course
 Mathematics

KNOWLEDGE AREAS:

- | | |
|---|--|
| <input type="checkbox"/> Humanities: History | <input type="checkbox"/> Fine Arts |
| <input type="checkbox"/> Humanities: Philos/Rel Studies | <input type="checkbox"/> Social Sciences |
| <input type="checkbox"/> Humanities: Literature | <input type="checkbox"/> Non-Western Cultures |
| <input type="checkbox"/> Natural Sci: Laboratory | <input type="checkbox"/> Health & Wellness |
| <input type="checkbox"/> Natural Sci: Non-laboratory | <input checked="" type="checkbox"/> Liberal Studies Elective |

II. Please use check marks to indicate which LS goals are primary, secondary, incidental, or not applicable. When you meet with the LSC to discuss the course, you may be asked to explain how these will be achieved.

Prim Sec Incid N/A

- | | | | | |
|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|--|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | A. Intellectual Skills and Modes of Thinking: |
| | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 1. Inquiry, abstract logical thinking, critical analysis, synthesis, decision making, and other aspects of the critical process. |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 2. Literacy--writing, reading, speaking, listening. |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 3. Understanding numerical data. |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 4. Historical consciousness. |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | 5. Scientific Inquiry. |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 6. Values (Ethical mode of thinking or application of ethical perception). |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 7. Aesthetic mode of thinking. |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | B. Acquiring a Body of Knowledge or Understanding Essential to an Educated Person |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | C. Understanding the Physical Nature of Human Beings |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | D. Collateral Skills: |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 1. Use of the library. |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 2. Use of computing technology. |

III. The LS criteria indicate six ways that courses should contribute to students' abilities. Please check all that apply. When you meet with the LSC, you may be asked to explain your check marks.

1. Confront the major ethical issues which pertain to the subject matter; realize that although "suspended judgment" is a necessity of intellectual inquiry, one cannot live forever in suspension; and make ethical choices and take responsibility for them.
2. Define and analyze problems, frame questions, evaluate available solutions and make choices.
3. Communicate knowledge and exchange ideas by various forms of expression, in most cases writing and speaking.
4. Recognize creativity and engage in creative thinking.
5. Continue learning even after the completion of their formal education.
6. Recognize relationships between what is being studied and current issues, thoughts, institutions, and/or events.

Liberal Studies Course Approval , Parts 4 - 6:

IV.

- A. MATH 241 is not a multiple-section course. Currently one section of MATH 241 is offered each semester.
- B. Whenever appropriate, information will be introduced which will reflect the contributions made to mathematics by women and racial minorities.
- C. The Mathematics Department wishes to exercise the exception and claim that the primary purpose of this course is the development of higher level quantitative skills. The syllabus for MATH 241 was developed to provide students with basic knowledge of differential equations in order that they may apply it in upper division courses in their majors. Success in these courses requires an understanding of descriptive and analytical approaches to problem solving.
- D. MATH 241 is the continuation of an introductory calculus sequence. Basic concepts of calculus are the foundation of this course. MATH 241 serves the purpose of developing analytical and quantitative skills which can be applied in upper level courses, particularly those related to physics and mathematics.

CHECK LIST -- LIBERAL STUDIES ELECTIVES

Knowledge Area Criteria which the course must meet:

- Treat concepts, themes and events in sufficient depth to enable students to appreciate the complexity, history and current implications of what is being studied; and not be merely cursory coverage of lists of topics.
- Suggest the major intellectual questions/problems which interest practitioners of a discipline and explore critically the important theories and principles presented by the discipline.
- Allow students to understand and apply the methods of inquiry and vocabulary commonly used in the discipline.
- Encourage students to use and enhance, wherever possible, the composition and mathematics skills built in the Skill Areas of Liberal Studies.

Liberal Studies Elective Criteria which the course must meet:

- Meet the "General Criteria Which Apply to All Liberal Studies Courses."
- Not be a technical, professional or pre-professional course.

Explanation: Appropriate courses are to be characterized by learning in its broad, liberal sense rather than in the sense of technique or pre-professional proficiency. For instance, assuming it met all the other criteria for Liberal Studies, a course in "Theater History" might be appropriate, while one in "The Craft of Set Construction" probably would not; or, a course in "Modern American Poetry" might be appropriate, while one in "New Techniques for Teaching Writing in Secondary Schools" probably would not; or, a course on "Mass Media and American Society" might be appropriate, while one in "Television Production Skills" probably would not; or, a course in "Human Anatomy" might be appropriate, while one in "Strategies for Biological Field Work" probably would not; or, a course in "Intermediate French" might be appropriate, while one in "Practical Methods for Professional Translators" probably would not.

Mathematics Department Curriculum Changes

Response Form

The Mathematics Department has informed me of the proposed changes listed below, and I support these changes.

The Mathematics Department has informed me of the proposed changes listed below, and I do not support these changes.

Comments:

Physics
Department

Richard D. Roberts 5/31/01
Chairperson / Date

1. Delete MATH 227 from prerequisite list for MATH 241.