



Differential Equations – MATH 203

University Studies Program

Course Outline

COURSE IMPLEMENTATION DATE: Pre 1998
OUTLINE EFFECTIVE DATE: January 2013
COURSE OUTLINE REVIEW DATE: December 2017

GENERAL COURSE DESCRIPTION:

Differential equations are used to model change throughout the sciences. Course topics include: techniques for solving first order differential equations (separable equations, exact equations, integrating factors), with applications (population dynamics, mechanics); homogeneous and general second order linear equations; the Wronskian; higher order linear equations; power series solutions; the Laplace transform. General theory such as existence and uniqueness theorems will be discussed as appropriate.

Program Information: This course can be used to satisfy the requirements of an Associate of Science degree at College of the Rockies. This course is intended for students who are pursuing a Bachelor of Science degree.

Delivery: This course is delivered face to face.

COTR Credits: 3

Hours for this course: 60 hours

Typical Structure of Instructional Hours:

Instructional Activity	Duration
Lecture Hours	45
Seminars / Tutorials	
Laboratory / Studio Hours	15
Practicum / Field Experience Hours	
Other Contact Hours	
Total	60

Practicum Hours (if applicable):

Type of Practicum	Duration
On-the-job Experience	N/A
Formal Work Experience	N/A
Other	N/A
Total	

Course Outline Author or Contact:

James L. Bailey, Ph.D.

Signature

APPROVAL SIGNATURES:

Department Head
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Department Head Signature

Dean of Instruction Signature

EDCO

Valid from: January 2013 – December 2017

Education Council Approval Date

COURSE PRE-REQUISITES AND TRANSFER CREDIT

Prerequisites: MATH 104

Corequisites: MATH 201 or MATH 205

Flexible Assessment (FA):

Credit can be awarded for this course through FA Yes No

Learners may request formal recognition for flexible assessment at the College of the Rockies through one or more of the following processes: External Evaluation, Worksite Assessment, Demonstration, Standardized Test, Self-assessment, Interview, Products/Portfolio, Challenge Exam. Contact an Education Advisor for more information.

Transfer Credit: For transfer information within British Columbia, Alberta and other institutions, please visit <http://www.cotr.bc.ca/Transfer>

Students should also contact an academic advisor at the institution where they want transfer credit.

Prior Course Number: N/A

Textbooks and Required Resources:

Textbook selection varies by instructor and may change from year to year. At the Course Outline Effective Date the following textbooks were in use:

Boyce, William E. and DiPrima, Richard C. *Elementary Differential Equations and Boundary Value Problems* (9th edition). John Wiley & Sons, Inc., 2009

Please see the instructor's syllabus or check COTR's online text calculator http://www.cotr.bc.ca/bookstore/cotr_web.asp?IDNumber=164 for a complete list of the currently required textbooks.

LEARNING OUTCOMES:

University Studies at the College of the Rockies allows students to complete their first two years of study towards a university degree. College students gain academic knowledge and skills in their chosen subjects. They also cover general problem-solving and critical thinking skills. The combination can empower them to participate as educated citizens in the economic, political, and cultural life of their communities.

Because differential equations are used in any field which attempts to model change, this course is appropriate for many careers, including Biology, Chemistry, Commerce, Computer Science, Engineering, Geology, Mathematics, Medicine, and Physics.

Upon the successful completion of this course, you should be able to:

- Solve any first order linear differential equation using separation of variables, exact equations, or integrating factors.
- Use first order differential equations to model applied problems including population dynamics and mechanics.
- Solve any second order homogeneous linear differential equation with constant coefficients using the characteristic equation with distinct real roots, repeated real roots, or complex conjugate roots.
- Solve any second order nonhomogeneous linear differential equation with constant coefficients using the methods of undetermined coefficients or variation of parameters.
- Use second order linear differential equations with constant coefficients to model a variety of applied physical situations including projectile motion with linear damping, mechanical and electrical vibrations, and forced vibrations.
- Solve any higher order homogeneous linear differential equation with constant coefficients.
- Solve any higher order nonhomogeneous linear differential equation with constant coefficients using the methods of undetermined coefficients, annihilators, or variation of parameters.
- Understand the existence and uniqueness theorems for differential equations.
- Use power series to find solutions to higher order linear differential equation with nonconstant coefficients at any ordinary point.
- Use power series to find solutions to higher order linear differential equation with nonconstant coefficients at any regular singular point.
- Understand Bessel's equation and Bessel functions
- Use Laplace transforms to solve initial value problems including piecewise continuous forcing functions and impulse functions.

This course should help you:

- use written and oral communication skills effectively, employing methods appropriate to message and context.
 - think clearly and critically, fusing experience, knowledge and reasoning into considered judgment.
 - identify, interpret, and solve problems, effectively implementing and evaluating proposed strategies.
 - organizational, problem solving, and critical thinking skills
 - an ability to work both independently and in groups
 - an ability to transfer knowledge to new contexts
 - practice comprehending and interpreting abstract materials from text
 - an appreciation of the importance of persistence, attitude and energy
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COURSE TOPICS:

1. First order differential equations
 - a) Linear equations
 - b) Separable equations
 - c) Modeling
 - d) Applied problems
 - i) Population dynamics
 - ii) Mechanics
 - e) Exact equations
 - f) Integrating factors
 - g) Homogeneous equations
 - h) Existence and uniqueness theorems
2. Second order linear differential equations
 - a) Homogeneous equations with constant coefficients
 - b) Fundamental solutions
 - c) Linear independence; the Wronskian
 - d) Characteristic equation
 - i) complex roots
 - ii) repeated roots; reduction of order
 - e) Nonhomogeneous equations
 - i) Undetermined coefficients
 - ii) Variation of parameters
 - f) Applied problems
 - i) Mechanical and electrical vibrations
 - ii) Forced vibrations
3. Higher order differential equations
 - a) General theory
 - b) Homogeneous equations with constant coefficients
 - c) Nonhomogeneous equations
 - i) Undetermined coefficients
 - ii) Variation of parameters
4. Series solutions
 - a) Power series
 - b) Series solutions near an ordinary point
 - c) Regular singular points

- d) Euler equations
 - e) Series solutions near a regular singular point
 - f) Bessel's equation
5. Laplace transforms
- a) Definition
 - b) Solution of initial value problems
 - c) Step functions
 - d) Discontinuous forcing functions
 - e) Impulse functions
 - f) The convolution integral

See instructor's syllabus for the detailed outline of weekly readings, activities and assignments.

ESSENTIAL SKILLS DEVELOPED IN THIS COURSE:

Students can expect to develop the following skills in this course:

Computer Skills

- Start the computer, log in, start a program
- Understand file management: save, store and retrieve documents
- Use email to send and read messages, attach documents
- Access COTR's online learning resources

Skills for Busy Students

- Manage study time effectively
- Set educational priorities and goals
- Recognize personal learning style
- Use effective note-taking strategies
- Develop problem-solving and memory skills
- Practice strategies to reduce stress level and deal with anxiety
- Practice strategies to succeed at exams and tests
- Use support systems and College resources

Research Skills

- Understand what constitutes *plagiarism* in academic writing

Keyboarding Skills

- Use alphabetic, figure and symbol keys

EVALUATION AND ASSESSMENT (Face to Face Delivery)

Assignments	% Of total Grade
Final exam	50%
Midterm Tests – Best 2 of 3	30%
Assignments	<u>20%</u>
Total	100%

Please see the instructor syllabus for specific classroom policies related to this course, such as details of evaluation, penalties for late assignments, and use of electronic aids.

EXAM POLICY

Students must attend all required scheduled exams that make up a final grade at the appointed time and place.

Individual instructors may accommodate for illness or personal crisis. Additional accommodation will not be made unless a written request is sent to and approved by the appropriate Department Head prior to the scheduled exam.

Any student who misses a scheduled exam without approval will be given a grade of "0" for the exam.

COURSE GRADE

Course grades are assigned as follows:

Grade	A+	A	A-	B+	B	B-	C+	C	C-	D	F
Mark (Percent)	≥ 90	89-85	84-80	79-76	75-72	71-68	67-64	63-60	59-55	54-50	< 50

A grade of "D" grants credit, but may not be sufficient as a prerequisite for sequential courses.

ACADEMIC POLICIES

See www.cotr.bc.ca/policies for general college policies related to course activities, including grade appeals, cheating and plagiarism.

COURSE CHANGES:

Information contained in course outlines is correct at the time of publication. Content of the courses is revised on an ongoing basis to ensure relevance to changing educational, employment, and marketing needs. The instructor will endeavour to provide notice of changes to students as soon as possible. The instructor reserves the right to add or delete material from courses.