

GOSHEN COLLEGE MATHEMATICS DEPARTMENT MATH 321 DIFFERENTIAL EQUATIONS – FALL 2022-23

Motivation	The study of differential equations and the calculus originated with the work of Isaac Newton and Gottfried Wilhelm Leibnitz. The development of these theories is considered one of the major intellectual achievements of the seventeenth century. The theories were developed in order to explain the physical motion of objects. Since that time, differential equations have been used to explain and predict the course of chemical reactions, animal populations, radioactive decay, military arms races, economic growth, the spread of diseases and rumors, and more. The techniques of differential equations are standard tools for engineers, physical scientists, and applied mathematicians.
Catalog Description	The solution and application of ordinary differential equations; analytic solutions for linear systems; qualitative behavior of nonlinear systems; approximation and computer methods. Earns 3 credits.
Learning Objectives	Students will obtain the ability to
	• create and critique differential equation models of a variety of natural phenomena,
	• solve ordinary differential equations using qualitative, analytic, and numeric techniques, and
	• interpret solutions of ordinary differential equations.
	At a higher level, each student will improve her or his ability to solve problems, communicate clearly and precisely, learn from a variety of resources, utilize technology, and appreciate the applicability of mathematics.
Prerequisite	Math 211 Calculus I provides sufficient calculus background to be successful in this course; however, this upper-level mathematics course also requires a higher degree of mathematical maturity, which may be acquired in other courses such as Math 205 Discrete Mathematics or Math 213 Calculus II. You will be asked to assimilate new mathematical and computational concepts and techniques at a deeper level than in your earlier mathematics courses.
Instructor	David Housman, SC 117, dhousman@goshen.edu, 574-535-7405. Office hours will be posted on Moodle and my office door.
Class	MWF $1:00 - 1:50$ AM in SC 107. Attendance and participation are expected. Class activities will complement, not substitute, for the reading, problem solving, and concept discussing students engage in outside of class.
Textbook	Bryan Kurt, <i>Differential Equations: A Toolbox for Modeling the World</i> , SIMIODE, 2022, ISBN: 978-1-63877-937-7. The link is to a web page describing the book. There are links on that page to obtain free supplementary materials and to purchase a pdf copy of the book for \$39. A pdf copy of the table of contents and chapter 1 is available on Moodle.
	To read this text, you should stop at each reading question, attempt to answer it (use

	paper and a calculator when necessary), and check your answer against the author's answer. If you do not understand something when reading the text or listening in class, write a question. Ask your classmates or the instructor your accumulated questions.
Software	<u>CoCalc</u> will be used for computation and report preparation. This is free software, and the Mathematics Department will purchase licenses so that your course project will run on a private server.
Grading	Grades will depend upon your performance on assignments (35%), modeling projects (35%), a midterm exam (10%), and a comprehensive final exam (20%). If helpful, the grade on the final exam will replace the midterm exam score. Each of these three components will be weighted equally. The course grade will be translated into letter grades in the following manner.
	Minimum Percentage 93 90 87 83 80 77 73 70 67 60 0 Letter Grade A A- B+ B B- C+ C C- D+ D F
Assignments	Exercises assigned will test your ability to solve problems like those presented in class and the text. Each student will turn in a complete set of solutions on paper or a pdf document uploaded in Moodle. If computer software is used to obtain an answer, include an organized print out of the computations performed. Assignments will typically be due on Tuesdays at 1:00 PM.
Extra Credit	Receive extra credit toward your assignments grade by doing one or more of the following: (1) find content errors in the textbook or posted course materials and describe the error in writing; (2) attend a quantitative presentation (e.g., <u>Science Speakers</u>) or participate in a quantitatively based activity and describe in writing some interesting mathematical aspect of the presentation or activity; or (3) participate in a <u>Career Services</u> event and describe your most important discovery. For any of these activities, the description should be at least one substantive paragraph and be submitted to the instructor on paper or via email.
Projects	A project is a more open-ended and complex exploration of mathematical ideas, often involving a real-world application. The projects assigned should help you synthesize and apply course concepts and techniques. Each project may be completed by an individual or groups of two or three students. The report should be completed in the appropriate CoCalc notebook Projects will typically be due on Tuesdays at 1:00 PM.
Exams	Exhibit your ability to use differential equation concepts and techniques in well- defined contexts and without assistance or collaboration. Think of the midterm exam (worth 10%) as a practice for the final exam (worth 20%) because the final exam grade, if higher, will replace your midterm exam grade. The midterm exam is tentatively scheduled for Wednesday, October 12. The final exam is scheduled for Thursday, December 8, $3:30 - 5:30$ PM.
Due Date Policy	Assignments, projects, and exams can only be rescheduled or made up if (1) there is a serious medical problem, a death in the immediate family, or an irreconcilable conflict with another official Goshen College activity; (2) there is written documentation signed by proper authorities; and (3) the instructor is notified prior to the due date or as soon as possible afterwards.
Disability Services	Goshen College is committed to providing all students equal access to programs and facilities. Students who need accommodations based on disability should contact Judy Weaver, coordinator of access services. You can contact Judy by visiting the

Academic Success Center (ASC) in the library, emailing jweaver@goshen.edu or calling 574-535-7560. Students must register with ASC before faculty are required to provide reasonable accommodations. To ensure that learning needs are met, contact the coordinator of access services by the first week of classes.
The Academic Success Center offers individual tutoring by appointment at <u>tutorcal.goshen.edu</u> . Unfortunately, I only know of one student on campus who has completed a differential equations course. So, I recommend that you rely on your classmates and my office hours.
Any student who has difficulty accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in the course, is urged to contact the Dean of Students, Gilberto Pérez Jr. (<u>gperez@goshen.edu</u>) for support. Furthermore, please notify the instructor if you are comfortable in doing so. He may be able to provide additional assistance or flexibility in meeting the requirements of the course.
Course materials (videos, assignments, exams, problem sets, etc) are for use in this course only. You may not upload them to external sites, share with any person outside this course, or post for public commentary without written permission from the professor. Sharing recordings outside of the class could lead to a copyright or FERPA violation. Goshen College prohibits any student from duplicating, downloading, or distributing class recordings with anyone outside of this class, for any reason.
You are encouraged to use all available resources to learn the concepts and techniques discussed in this course. Conversations with other students and the instructor can be an effective learning method. Reading other books and web pages can be another effective learning method. However, copying someone else's work subverts the learning process.
For assignments and projects, you may look at and discuss another person's written work, but you may not directly copy that work when writing you answers. You may collaborate with others, but any written work developed during such a collaboration should be destroyed before writing your own solutions. You should give written acknowledgement to people with whom you have had discussions and to any written materials (other than the texts) that were helpful. When completion by a group of students is permitted, the above restrictions do not apply to persons within the group.
For exams, you may <i>not</i> use any resources unless a specific exception is stated by the instructor.
Failure to observe the above rules will result in a zero on the assignment, project, or exam. Any violation of academic integrity will be reported to the Associate Academic Dean.
Observation of the above rules will help you learn the material well and give you the satisfaction of knowing that you have earned your grade.