

COURSE SYLLABUS

# Course Prefix, Number, and Title:

Math 125: Calculus II

# Credits:

4 credits

# University Name:

Dakota State University

# Academic Term/Year:

Spring 2024

## Last date to Drop and receive 100% refund:

Wednesday, 17 January 2024

## Last date to Withdraw and earn a grade of 'W':

Tuesday, 02 April 2024

# Course Meeting Time and Location:

MTWF 10:00-10:50 am, DSC 121

# Instructor Information:

## Name:

Dr. Jeffrey S. Palmer

## Office:

DSC 146I

## Phone Number(s):

605-679-7668

## Email Address:

jeff.palmer@dsu.edu

## Office Hours:

T 09:00-09:50 am, MTWF 11:00-11:50 am, WF 08:30-08:50 am, or by appointment

# Approved Course Description:

## Catalog Description:

A continuation of the study of calculus, including the study of sequences, series, polar

coordinates, parametric equations, techniques of integration, applications of

integration, indeterminate forms, and improper integrals (2023-2024 DSU

Undergraduate Catalog).

## Additional Course Information:

None

# Prerequisites:

## Course Prerequisite(s):

Completion of Math 123 - Calculus I

## Technology Skills:

This course will make use of WebAssign, Microsoft Excel, Stella Architect and other appropriate

tools.

# Student Learning Outcomes:

As you explore the concepts, ideas and applications encountered in this course do not be content to simply get an answer. Rather, you should constantly be asking yourself questions. What am I doing? Why am I doing this? What does this mean? I hope you will develop knowledge of, skill in, and understanding of those fundamental calculations that are needed in your mathematical toolbox. Mathematics is not moving symbols around on a piece of paper and obtaining the correct answer. You should always be asking yourself what you are doing and why you are doing it. We will use our mathematical toolbox to examine applied problems from a variety of disciplines. Applications from biology, chemistry, physics, business, economics, and other disciplines form an integral part of the course. Mathematics is not a cookbook discipline; the ultimate validation of your skills and understanding is reflected in your ability to develop solutions to problems that are new and unfamiliar to you. You will encounter, in course assignments and evaluations, activities that require problem solving and critical thinking. Finally, I hope that you will come to understand and appreciate both the power and the shortcomings of technology, particularly the computer, as a tool for understanding mathematical concepts and for solving applied problems. In conclusion, as a student in this course you are expected to:

* learn, practice, and master basic skills,
* understand important concepts,
* apply your knowledge to other disciplines,
* engage in problem solving and critical thinking,
* use technology as an appropriate tool.

# Course Materials:

## Required Textbook(s):

Single Variable Calculus: Early Transcendentals, 8th Edition by James Stewart (Cengage Learning)

bundled with an Access Code Card for WebAssign

go to <http://www.webassign.net/login.html>

select Enter Class Key

enter the Class Key for the course section you are registered for:

Section 01: dsu 8576 0079

## Required Supplementary Materials:

None, however, students may use a scientific calculator.

## Optional Materials:

None.

# Course Delivery and Instructional Methods:

On Mondays, Tuesdays, and Wednesdays we will typically spend the first 15-20 minutes answering questions on homework problems you have been assigned. The remaining 30-35 minutes will be devoted to classroom presentation, principally lecture and computer demonstration, of the material covered in chapters 5-11 of your textbook (the core material). Certain additional topics may from time to time be introduced and some sections will be skipped. On Fridays we will be discussing material (roughly from chapter 9 of your text) on mathematical modeling and differential equations. When appropriate, we will take advantage of *Excel* spreadsheets and the systems modeling software *Stella Architect* to assist us with our inquiries and investigations.

# Communication and Feedback:

## Preferred Email Contact Method:

Please send all e-mail communications to Dr. Palmer or Professor Palmer at my [jeff.palmer@dsu.edu](mailto:jeff.palmer@dsu.edu) account.

## Email Response Time:

Typically, I access and read email once per day Monday through Friday when classes are in session. I generally respond to email messages within 48 hours, excluding weekends and holidays.

## Feedback on Assignments:

With extremely limited exceptions, I typically return work to students within 1 week, often earlier, of the due date, excluding holidays.

# Evaluation Procedures:

## Assessments:

Homework will be assigned on a regular basis, usually at the completion of our classroom discussion of each of the course lessons. Your percentage score on all such assignments will be used to calculate your homework grade (out of 48 points) for the course. Additionally, it is my plan to give a minimum of ten 12-point quizzes/worksheets during the semester. Your eight highest scores will count toward your final grade. There are no make-ups for missed quizzes. Finally, there are four examinations (180 points total) scheduled for this course – see the Tentative Course Outline and Schedule below. Each exam will be cumulative, covering material from the beginning of the course through the preceding Friday, however, the emphasis will be on new material. If you miss an exam for a valid reason, you may be allowed to make up that exam or to replace it with your score on the Final Exam (Exam 4) at the discretion of the instructor.

## Final Examination:

Monday, 29 April 2024, 10:30 am – 12:30 pm

## Performance Standards and Grading Policy:

Your grade will be calculated using your accumulated point total (48 points for Homework assignments, 96 points from Quizzes/Worksheets, and 180 points from Examinations). The grading scale is

>85% 276 – 324 points A  
 >70% 227 – 275 points B  
 >60% 195 – 226 points C  
 >50% 162 – 194 points D  
 <50% 000 – 161 points F

Students near a cutoff may receive a higher grade at the discretion of the instructor.

# Tentative Course Outline and Schedule:

| Date | Day | Topic |  |
| --- | --- | --- | --- |
| 08-Jan-24 | M | Introduction and Objectives |  |
| 09-Jan-24 | T | 4.9 Antiderivatives |  |
| 10-Jan-24 | W | 5.1 Areas and Distances |  |
| 11-Jan-24 | R |  |  |
| 12-Jan-24 | F | 5.2 The Definite Integral |  |
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|  |  |  |  |
| 15-Jan-24 | M | NO CLASS - MARTIN LUTHER KING JR. DAY |  |
| 16-Jan-24 | T | 5.3 The Fundamental Theorem of Calculus |  |
| 17-Jan-24 | W | 5.4 Indefinite Integrals and the Net Change Theorem LAST DAY TO ADD/DROP A FULL SEMESTER CLASS |  |
| 18-Jan-24 | R |  |  |
| 19-Jan-24 | F | 5.4 / 5.5 |  |
|  |  |  |  |
|  |  |  |  |
| 22-Jan-24 | M | 5.5 The Substitution Rule |  |
| 23-Jan-24 | T | 6.1 Areas Between Curves |  |
| 24-Jan-24 | W | 6.1 / 6.2 |  |
| 25-Jan-24 | R |  |  |
| 26-Jan-24 | F | *Modeling Application: Newton’s Law of Heating and Cooling - Introduction* |  |
|  |  |  |  |
|  |  |  |  |
| 29-Jan-24 | M | 6.2 Volumes |  |
| 30-Jan-24 | T | 6.3 Volumes by Cylindrical Shells |  |
| 31-Jan-24 | W | 7.1 Integration by parts |  |
| 01-Feb-24 | R |  |  |
| 02-Feb-24 | F | *Modeling Application: Newton’s Law of Heating and Cooling - Conclusion* |  |
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|  |  |  |  |
| 05-Feb-24 | M | Catch Up and Review |  |
| 06-Feb-24 | T | EXAM 01 |  |
| 07-Feb-24 | W | 7.1 / 7.2 |  |
| 08-Feb-24 | R |  |  |
| 09-Feb-24 | F | *Modeling Application: Single Species Population Growth - Introduction* |  |
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|  |  |  |  |
| 12-Feb-24 | M | 7.2 Trigonometric Integrals |  |
| 13-Feb-24 | T | 7.3 Trigonometric Substitution |  |
| 14-Feb-24 | W | 7.3 / 7.4 |  |
| 15-Feb-24 | R |  |  |
| 16-Feb-24 | F | *Modeling Application: Single Species Population Growth - Conclusion* |  |
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|  |  |  |  |
| 19-Feb-24 | M | NO CLASS - PRESIDENT'S DAY |  |
| 20-Feb-24 | T | 7.4 Integration of Rational Functions by Partial Fractions |  |
| 21-Feb-24 | W | 7.7 Approximate Integration |  |
| 22-Feb-24 | R |  |  |
| 23-Feb-24 | F | *Modeling Application: Free Fall Motion - Introduction* |  |
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|  |  |  |  |
| 26-Feb-24 | M | 7.7 / 7.8 |  |
| 27-Feb-24 | T | 7.8 Improper Integrals |  |
| 28-Feb-24 | W | 8.1 Arc Length |  |
| 29-Feb-24 | R |  |  |
| 01-Mar-24 | F | *Modeling Application: Free Fall Motion - Conclusion* |  |
|  |  |  |  |
|  |  |  |  |
| 04-Mar-24 | M | 8.1 / 8.5 |  |
| 05-Mar-24 | T | 8.5 Probability |  |
| 06-Mar-24 | W | 11.1 Sequences |  |
| 07-Mar-24 | R |  |  |
| 08-Mar-24 | F | *Modeling Application: Interacting Populations - Introduction* |  |
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| 11-Mar-24 | M | NO CLASS - SPRING BREAK |  |
| 12-Mar-24 | T | NO CLASS - SPRING BREAK |  |
| 13-Mar-24 | W | NO CLASS - SPRING BREAK |  |
| 14-Mar-24 | R | NO CLASS - SPRING BREAK |  |
| 15-Mar-24 | F | NO CLASS - SPRING BREAK |  |
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|  |  |  |  |
| 18-Mar-24 | M | Catch Up and Review |  |
| 19-Mar-24 | T | EXAM 02 |  |
| 20-Mar-24 | W | 11.1 / 11.2 |  |
| 21-Mar-24 | R |  |  |
| 22-Mar-24 | F | *Modeling Application: Interacting Populations - Conclusion* |  |
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|  |  |  |  |
| 25-Mar-24 | M | 11.2 Series |  |
| 26-Mar-24 | T | 11.3 The Integral Test and Estimates of Sums |  |
| 27-Mar-24 | W | 11.3 / 11.4 |  |
| 28-Mar-24 | R |  |  |
| 29-Mar-24 | F | NO CLASS - EASTER HOLIDAY |  |
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|  |  |  |  |
| 01-Apr-24 | M | 11.4 The Comparison Tests |  |
| 02-Apr-24 | T | 11.5 Alternating Series LAST DAY TO WITHDRAW |  |
| 03-Apr-24 | W | 11.5 / 11.6 |  |
| 04-Apr-24 | R |  |  |
| 05-Apr-24 | F | *Modeling Application: Harmonic Motion - Introduction* |  |
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|  |  |  |  |
| 08-Apr-24 | M | Catch Up and Review |  |
| 09-Apr-24 | T | EXAM 03 |  |
| 10-Apr-24 | W | 11.6 Absolute Convergence and the Ratio and Root Tests |  |
| 11-Apr-24 | R |  |  |
| 12-Apr-24 | F | *Modeling Application: Harmonic Motion - Conclusion* |  |
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|  |  |  |  |
| 15-Apr-24 | M | 11.7 Strategies for Testing Series |  |
| 16-Apr-24 | T | 11.7 / 11.8 |  |
| 17-Apr-24 | W | 11.8 Power Series |  |
| 18-Apr-24 | R |  |  |
| 19-Apr-24 | F | 11.9 Representations of Functions as Power Series |  |
|  |  |  |  |
|  |  |  |  |
| 22-Apr-24 | M | 11.9 / 11.10 |  |
| 23-Apr-24 | T | 11.10 Taylor and Maclaurin Series |  |
| 24-Apr-24 | W | 11.11 Applications of Taylor Polynomials |  |
| 25-Apr-24 | R |  |  |
| 26-Apr-24 | F | Wrap Up and Conclusions |  |
|  |  |  |  |
|  |  |  |  |
| 29-Apr-24 | M | FINAL EXAM 10:30 am – 12:30 pm |  |
| 30-Apr-24 | T |  |  |
| 01-May-24 | W |  |  |
| 02-May-24 | R |  |  |
| 03-May-24 | F |  |  |

# Student Success Services and Supports:

## ADA Accommodations:

Dakota State University strives to ensure that physical resources, as well as information and communication technologies, are reasonably accessible to users to provide equal access to all. If you encounter any accessibility issues, you are encouraged to immediately contact the instructor of the course and Dakota State University's Office of Disability Services, which will work to resolve the issue as quickly as possible.

DSU's Office of Disability Services is located in the Learning Engagement Center and can be contacted by calling 605-256-5121 or emailing [dsu-ada@dsu.edu](mailto:dsu-ada@dsu.edu). Students seeking ADA accommodations (such as non-standard note taking or extended time and/or a quiet space taking exams and quizzes) can access the DSU website <https://dsu.edu/student-life/disability-services/index.html> for additional information and the link to the Disability Services Request Form. You will need to provide documentation of your disability and the ADA Coordinator must confirm the need before officially authorizing accommodations.

## DSU Knowledge Base:

The DSU Knowledge Base contains links and resources to help students by providing information about the following topics: User Accounts & Passwords, Academic Tools & Resources, Software & Apps Support, WiFi & Network Access, Campus Emergency Alert System, Campus Printing, IT Security & Safe Computing, and the Support Desk (which is there to help both on and off-campus students). The Knowledge Base can be accessed through the link below:

* [DSU Knowledge Base](https://support.dsu.edu/TDClient/KB/)

## D2L Support for Students:

The D2L Support for Students site is designed to provide DSU students a D2L support resource center that contains user guides, tutorials, and tips for using the D2L learning environment. The D2L Support for Students site can be accessed through the link below:

* [DSU D2L Support Resources for Students](https://d2l.sdbor.edu/d2l/home/606414)

# Classroom Policies:

## Attendance and Make-up Policy:

While there is no policy of required attendance of lectures in this course, it is unlikely that you will be able to earn a good grade without regularly attending the lectures. When you miss class, whatever the reason, you really miss important material from three lectures not one. Obviously, the lesson covered that day is missed but you also miss out on important connections of that day’s material with the previous day’s lesson and the following day’s lesson. Also, if you are on academic probation or are an at-risk student, you are required to attend every class meeting. You are expected to arrive at lecture on time and to remain for the entire class period. If for some reason you must arrive late or leave early, please do so quietly. Talking or other behavior that disrupts lecture will not be tolerated. If for any reason I am late for the start of class and you have not received official notification that the class has been canceled, you are expected to remain for 15 minutes before “assuming" that the lecture has been canceled for the day. Above all else, show respect for your classmates. Your attendance, behavior, and participation in the class have effects on others beside yourself.

# DSU Policies:

## Complaint Procedure

Dakota State University seeks to resolve student concerns and complaints in a fair and prompt manner. Students may file a complaint using the [DSU Concerns and Feedback form](https://dsu.wufoo.com/forms/dsu-concerns-and-feedback/). SARA complaints from out-of-state students may be filed using the procedures noted [here](https://catalog.dsu.edu/content.php?catoid=35&navoid=1632&hl=complaint&returnto=search#student-complaints).

## Grade Appeal Policy

If a student believes the final grade assigned in a course was inappropriate, he/she may appeal that grade by filing a formal grade appeal within 15 days of the start of the next academic session. Please see the [Undergraduate Catalog](https://catalog.dsu.edu/content.php?catoid=35&navoid=1614&hl=grade+appeal&returnto=search#Grade_Appeal_Process) or [Graduate Catalog](https://catalog.dsu.edu/content.php?catoid=36&navoid=1666#grade-appeal-process) for the required process to appeal a final grade.

# South Dakota Board of Regents Policy Statements

## Freedom in Learning Statement:

Under Board of Regents and Regental Institutions policy, student academic performance may be evaluated solely on an academic basis, not on opinions or conduct in matters unrelated to academic standards. Discussion and debate are critical to education and professional development. Students should be free to take reasoned exception to the data or views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled. While the exploration of controversial topics may be an important component of meeting the student learning outcomes in a course, no student will be compelled or directed to personally affirm, adopt, or adhere to any divisive concepts (as defined in SDCL 13-1-67). Students who believe that an academic evaluation reflects prejudiced or capricious consideration of student opinions or conduct unrelated to academic standards should contact their home institution to initiate a review of the evaluation.

## ADA Statement:

The Regental Institutions strive to ensure that physical resources, as well as information and communication technologies, are reasonably accessible to users to provide equal access to all. If you encounter any accessibility issues, you are encouraged to immediately contact the instructor of the course and the Office of Disability Services, which will work to resolve the issue as quickly as possible. Please note: if your home institution is not the institution you are enrolled at for a course (host institution), then you should contact your home institution’s Office of Disability services. The disability services at the home and host institution will work together to ensure your request is evaluated and responded to in a timely manner.

## Academic Dishonesty and Misconduct:

Cheating and other forms of academic dishonesty and misconduct run contrary to the purposes of higher education and will not be tolerated. Academic dishonesty includes, but is not limited to, AAC Guideline 5.3.A – Syllabi BOR Required Policy Statements (Last Revised 01/2023) Page 2 of 2 plagiarism, copying answers or work done by another student (either on an exam or an assignment), allowing another student to copy from you, and using unauthorized materials during an exam. The Regental Institution’s policy and procedures on cheating and academic dishonesty can be found in your home institution’s Student Handbook and the governing Board of Regents policies can be found in BOR Policy 2:33 and BOR Policy 3:4. The consequences for cheating and academic dishonesty are outlined in policy.

All forms of academic dishonesty will result in a grade of 0 for the assignment, project, quiz, or exam in question. In addition, I may forward evidence of cheating to the Academic Integrity Board on campus for their consideration. Students found guilty of a second offense of academic dishonesty in this class will also receive a course grade of F.

## Acceptable Use of Technology:

Acceptable Use of Information Technology Resources: While Regental Institutions strive to provide access to computer labs and other technology, it is the student’s responsibility to ensure adequate access to the technology required for a course. This may include access to a computer (not Chromebooks, iPads, etc.), webcam, internet, adequate bandwidth, etc. While utilizing any of the information technology systems students, faculty and staff should observe all relevant laws, regulations, BOR Policy 7.1, and any institutional procedural requirements.

## Emergency Alert Communication:

In the event of an emergency arising on campus under BOR Policy 7:3, your Regental Home Institution will notify the campus community via the emergency alert system. It is the responsibility of the student to ensure that their information is updated in the emergency alert system. The student’s cell phone will be automatically inserted if available and if not, their email address is loaded. Students can at any time update their information in the student alert system.

**Modeling Application Topics:**

***Newton’s Law of Heating and Cooling***

This is usually the first modeling lesson during the second semester. Newton’s Law of Heating/Cooling states that the time rate of change of the temperature of an object is directly proportional to the difference between the current temperature of the object and the temperature of the surrounding environment. The model equation is essentially identical to that covered in our Model Lake exercise and the problem is used to review (for returning students) and illustrate (for new students) the use of qualitative analysis to determine the behavior of a model without solving the model equation.

***Single Species Population Growth***

After a brief review of the exponential growth model covered previously, we formulate the model for logistic growth where the per-capita growth rate of the population is a density-dependent, decreasing, linear function of population size. This is our first example of a nonlinear model equation, and although we now have developed in the course the tools needed to solve this (and our previous) equation exactly, we first work through a qualitative analysis of the behavior of the model and verify our results with a *Stella* simulation. Students are encouraged to investigate more complex models of density-dependent population growth. As a project, students investigate harvesting a logistically growing resource and determine the maximum sustainable yield.

***Free Fall Motion***

We formulate and analyze a second-order equation for the free-fall motion of an object (classical problem in introductory physics) experiencing a viscous drag force due to air resistance (extension of the classical model). A *Stella* simulation is used to investigate whether it takes longer to rise or to fall. Students investigate further extensions of free-fall motion including Newtonian drag forces and the effects of variation in the force of gravity as the object rises above the surface of the earth.

***Interacting Populations***

A non-linear system of equations describing a predator-prey interaction is formulated, investigated qualitatively (this system does not have an exact analytical solution that we can write down), and simulated in *Stella*. Students investigate models of two competing species (businesses, military forces) and of cooperative species interactions.

***Harmonic Motion***

The classical second-order equation for the movement of a mass on a spring (simple harmonic motion) is formulated, investigated using qualitative techniques, and simulated in *Stella*. This model is extended to include a viscous drag force (giving rise to damped harmonic motion). Students investigate models with an external forcing function that gives rise to resonance (one possible explanation for the Tacoma Narrows Bridge collapse) and beat patterns (such as occur with heart rhythms).

# The instructor reserves the right to amend this syllabus.