

North Carolina Agricultural and Technical State University

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Introduction to Differential Equations

North Carolina Agricultural and Technical State University

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NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY

COURSE SYLLABUS

College Name: College of Science and Technology
Department Name: Department of Mathematics
Course Name: Introduction to Differential Equations

COURSE INFORMATION

- Course Number/Section: MATH 341
- Term:
- Semester Credit Hours: 3
- Times and Days:
- Class Location:

INSTRUCTOR CONTACT INFORMATION

- Instructor:
- Office Location:
- Office Phone:
- Email Address:

Faculty must notify students of the approximate time and method they can expect to receive an answer to all communications (e.g., email, phone, course messages). Excluding holidays, the response should be provided within 48 hours.

If there's a graduate teaching assistant assigned to work with this course, please include their names also.

STUDENT HOURS

These are times students may visit the professor without an appointment to request the assistance they need.

NOTE: Students are responsible for reading, understanding, and following the syllabus.

: AM ☐ / PM ☐ – : AM ☐ / PM ☐

Monday ☐ Tuesday ☐ Wednesday ☐ Thursday ☐ Friday ☐

COURSE PREREQUISITES

MATH 132

COURSE DESCRIPTION

This course covers first-order differential equations, linear and nonlinear models of first-order differential equations, second and higher-order differential equations, linear models of higher-order differential equations, systems of linear differential equations, and Laplace transforms.

STUDENT LEARNING OBJECTIVES/OUTCOMES (SLO)

Learning outcomes should be specific, measurable, and focused on the content knowledge the students are expected to master and not what the faculty will teach.

If the course is a General Education Course, the SLO should be listed and labeled as “General Education.”

- SLO 1: Demonstrate the ability to identify and solve first-order differential equations to questions on examinations and homework assignments.
- SLO 2: Solve real world examples using their knowledge of first-order differential equations on examinations and homework assignments.
- SLO 3: Identify and solve second and higher-order linear differential equations to questions on examinations and homework assignments.
- SLO 4: Solve real world examples using their knowledge of second-order linear differential equations on examinations and homework assignments.
- SLO 5: Solve linear differential equations using the method of Laplace Transform on examinations and homework assignments.

REQUIRED TEXTBOOKS AND MATERIALS

Any course-level subscriptions and tools linked in Blackboard Learn learning management system (LMS) should be listed here. The Blackboard LMS must have links to their student data privacy statement.

REQUIRED TEXTS:

Zill, D. G. (2019). *Differential equations with boundary-value problems* (9th ed.). Singapore: Cengage. ISBN:978-1305965799

REQUIRED MATERIALS:

SUGGESTED COURSE MATERIALS

SUGGESTED READINGS/TEXTS:

SUGGESTED MATERIALS:

TI -83, TI -83 Plus, TI-84 and 84 Plus or equivalent calculators are allowed. Students are not allowed to use TI-89, TI-Nspire calculators.

GRADING POLICY

ASSIGNMENTS AND GRADING POLICY

94% and above	A		76% - 74%	C
93% - 90%	A-		73% - 70%	C-
89% - 87%	B+		69% - 67%	D+
86% - 84%	B		66% - 64%	D
83% - 80%	B-		63% - 60%	F
79% - 77%	C+			

For GRADUATE COURSES: See 2019-2020 Graduate Catalog p.38 for graduate grading scale and Non-Graded Courses

GRADING ALLOCATION

Course grades are based on a weighted grading scale of 100%. The breakdown for the course is as follows: *[Faculty, please adjust according to your course.]*

Category	# of Activities	Percentage Grade Weight
Self-Introduction	1	1%
Homework (Cengage-WebAssign)	22	25%
Assignments	6	12%
Tests	3	36%
Final Exam	1	26%
Total	33	100%

COURSE POLICIES

USE OF BLACKBOARD AS THE LEARNING MANAGEMENT SYSTEM

Blackboard is the primary online instructional and course communications platform. Students can access the course syllabus, assignments, grades, and learner support resources. Students are encouraged to protect their login credentials, complete a Blackboard orientation, and log in daily to the course.

Note: Uploading assignments through Blackboard presents a challenge for Chromebook users in locating the files for submission. If you use a Chromebook, please be sure you also have access to a Mac computer or Windows computer so you can fully participate in your Blackboard class. For more information about student computer recommendations, please visit <https://hub.ncat.edu/administration/its/computer-recommendations.php>.

MAKE-UP EXAMS

See << Update Academic Year >> *Undergraduate Bulletin*:

<https://www.ncat.edu/provost/academic-affairs/bulletins/index.php>

**For GRADUATE STUDENTS: See 2019-20 Graduate Catalog p. 54
EXTRA CREDIT**

LATE WORK

SPECIAL ASSIGNMENTS

For GRADUATE STUDENTS: FAILING TO MEET COURSE REQUIREMENTS (Graduate Catalog p.40)

For GRADUATE STUDENTS: CLASS ATTENDANCE (see 2019-20 Graduate Catalog p. 53-54)

Students are expected to attend class and participate on a regular basis in order to successfully achieve course learning outcomes and meet federal financial aid requirements ([34 CFR 668.22](#)). Class attendance in online courses is defined as active participation in academically-related course activities. Active participation may consist of course interactions with the content, classmates, and/or the instructor. Examples of academically-related course activities include, but are not limited to:

- Completing and submitting assignments, quizzes, exams, and other activities within Blackboard or through Blackboard (3rd-party products).
- Participating in course-related synchronous online chats, discussions, or meeting platforms such as Blackboard Collaborate in which participation is tracked.

CLASSROOM CITIZENSHIP

Courtesy, civility, and respect must be the hallmark of your interactions.

COMPLIANCE WITH THE AMERICANS WITH DISABILITIES ACT

North Carolina A&T State University is committed to following the requirements of the Americans with Disabilities Act Amendments Act (ADAAA) and Section 504 of the Rehabilitation Act. If you need an academic accommodation based on the impact of a disability, you must initiate the request with the Office of Accessibility Resources (OARS) and provide documentation in accordance with the Documentation Guidelines at N.C. A&T. Once documentation is received, it will be reviewed. Once approved, you must attend a comprehensive meeting to receive appropriate and reasonable accommodations. If you are a student registered with OARS, you must complete the Accommodation Request Form to have accommodations sent to faculty.

OARS is located in Murphy Hall, Suite 01 and can be reached at 336-334-7765, or by email at accessibilityresources@ncat.edu. Additional information and forms can be found on the internet at <https://www.ncat.edu/provost/academic-affairs/accessibility-resources/index.php>.

Please note: Accommodations are not retroactive and begin once the Disability Verification Form is provided to faculty.

TITLE IX

North Carolina A&T State University is committed to providing a safe learning environment for all students—free of all forms of discrimination and harassment. Sexual misconduct and relationship violence in any form are inconsistent with the university’s mission and core values, violates university policies, and may also violate federal and state law. Faculty members are considered “Responsible Employees” and are required to report incidents of sexual misconduct and relationship violence to the Title IX Coordinator. If you or someone you know has been impacted by sexual harassment, sexual assault, dating or domestic violence, or stalking, please visit the Title IX website to access information about university support and resources. If you would like to speak with someone confidentially, please contact Counseling Services at 336-334-7727 or the Student Health Center at 336-334-7880.

TECHNICAL SUPPORT

If you experience any problems with your A&T account, you may call Client Technology Services (formerly Aggie Tech Support and Help Desk) at 336-334-7195, or visit <https://hub.ncat.edu/administration/its/dept/ats/index.php>.

FIELD TRIP POLICIES / OFF-CAMPUS INSTRUCTION AND COURSE ACTIVITIES

If applicable:

Off-campus, out-of-state, foreign instruction, and activities are subject to state law and university policies and procedures regarding travel and risk-related activities. Information regarding these rules and regulations may be found at <https://www.ncat.edu/campus-life/student-affairs/index.php>.

STUDENT HANDBOOK

<https://www.ncat.edu/campus-life/student-affairs/departments/dean-of-students/student-handbook.php>

STUDENT TRAVEL PROCEDURES AND STUDENT TRAVEL ACTIVITY WAIVER

https://hub.ncat.edu/administration/student-affairs/staff-resources/student_activity_travel_waiver.pdf

OTHER POLICIES (e.g., Copyright Guidelines, Confidentiality, etc.)

STUDENT HANDBOOK

<https://www.ncat.edu/campus-life/student-affairs/departments/dean-of-students/student-handbook.php>

[Graduate Catalog](#)

SEXUAL MISCONDUCT POLICY

<https://www.ncat.edu/legal/title-ix/sexual-harassment-and-misconduct-policies/index.php>

FAMILY EDUCATIONAL RIGHTS AND PRIVACY ACT (FERPA)

<https://www.ncat.edu/registrar/ferpa.php>

STUDENT COMPLAINT PROCEDURES

<https://www.ncat.edu/current-students/student-complaint-form.php>

STUDENT CONDUCT AND DISCIPLINE

North Carolina A&T State University has rules and regulations that govern student conduct and discipline meant to ensure the orderly and efficient conduct of the educational enterprise. It is the responsibility of each student to be knowledgeable about these rules and regulations.

Please consult the following about specific policies such as academic dishonesty, cell phones, change of grade, disability services, disruptive behavior, general class attendance, grade appeal, incomplete grades, make-up work, student grievance procedures, withdrawal, etc.:

- Undergraduate Bulletin
<https://www.ncat.edu/provost/academic-affairs/bulletins/index.php>
- Graduate Catalog
<https://www.ncat.edu/tgc/graduate-catalog/index.php>
- Student Handbook
<https://www.ncat.edu/campus-life/student-affairs/departments/dean-of-students/student-handbook.php>

ACADEMIC DISHONESTY POLICY

Academic dishonesty includes but is not limited to the following:

1. Cheating or knowingly assisting another student in committing an act of cheating or other academic dishonesty;
2. Plagiarism (unauthorized use of another's words or ideas as one's own), which includes but is not limited to submitting exams, theses, reports, drawings, laboratory notes or other materials as one's own work when such work has been prepared by or copied from another person;
3. Unauthorized possession of exams or reserved library materials; destroying or hiding source, library or laboratory materials or experiments or any other similar actions;
4. Unauthorized changing of grades, or marking on an exam or in an instructor's grade book or such change of any grade record;
5. Aiding or abetting in the infraction of any of the provisions anticipated under the general standards of student conduct;
6. Hacking into a computer and gaining access to a test or answer key prior to the test being given. N.C. A&T reserves the right to search the emails and computers of any student suspected of such computer hacking (if a police report of the suspected hacking was submitted prior to the search); and
7. Assisting another student in violating any of the above rules.

A student who has committed an act of academic dishonesty has failed to meet a basic requirement of satisfactory academic performance. Thus, academic dishonesty is not only a basis for disciplinary action, but may also affect the evaluation of a student's level of performance. Any student who commits an act of academic dishonesty is subject to disciplinary action.

In instances where a student has clearly been identified as having committed an act of academic dishonesty, an instructor may take appropriate disciplinary action, including loss of credit for an assignment, exam, or project; or awarding a grade of "F" for the course, **subject to review and endorsement by the chairperson and dean.**

For GRADUATE STUDENTS: Reference for academic dishonesty – 2010-2020 Graduate Catalog, p.58-59

For GRADUATE STUDENTS: STUDENT RELIGIOUS OBSERVANCE (see Graduate Catalog, p.55)

ASSIGNMENTS AND ACADEMIC CALENDAR

Include topics, reading assignments, due dates, exam dates, withdrawal dates, pre-registration and registration dates, all holidays, and convocations.*

THE WEEK OF MM/DD/YY	SUBJECT	UNIT LEARNING OUTCOMES (ULO)	READING IN TEXT, ACTIVITY, HOMEWORK, EXAM
	Unit 1: Introduction to Differential Equations - Definitions and Terminology	<p>ULO 1: State the order of DE and classify linear or nonlinear DE. (SLO 1 – 5)</p> <p>ULO 2: Verify if a given (explicit or implicit) function is a solution of a given DE. (SLO 1 – 5)</p> <p>ULO 3: Solve initial value problems (IVP) with given initial conditions and general solution. (SLO 1 – 5)</p> <p>ULO 4: Explain the steps of building mathematical model using DE, using the population models as an example. (SLO 1 – 5)</p>	<p>1. Read Textbook: Zill, D. G. (2019). <i>Differential equations with boundary-value problems</i> (9th ed.).</p> <p>a. Chapter 1: Introduction to Differential Equations</p> <p>2. Complete: Homework # 1 (ULO 1- 4)</p>
	Unit 2: Initial-Value Problems and Differential Equations as Mathematical Models	<p>ULO 1: State the order of DE and classify linear or nonlinear DE. (SLO 1 – 5)</p> <p>ULO 2: Verify if a given (explicit or implicit) function is a solution of a given DE. (SLO 1 – 5)</p>	<p>1. Read Textbook: Zill, D. G. (2019). <i>Differential equations with boundary-value problems</i> (9th ed.).</p> <p>a. Chapter 1: Introduction to Differential Equations</p> <p>2. Complete: Homework # 2 (ULO 1- 4)</p> <p>3. Complete: Homework # 3</p>

		<p>ULO 3: Solve initial value problems (IVP) with given initial conditions and general solution. (SLO 1 – 5)</p> <p>ULO 4: Explain the steps of building mathematical model using DE, using the population models as an example. (SLO 1 – 5)</p>	<p>(ULO 1- 4)</p> <p>4. Complete: Assignments# 1 (ULO 1- 4)</p>
	Unit 3: First-Order Differential Equations - Separable Equations	<p>ULO 1: Solve separable first order DE. (SLO 1 – 5)</p> <p>ULO 2: Identify integrating factor for linear first order DE and solve linear first order DE using integrating factor. (SLO 1 – 5)</p> <p>ULO 3: Solve exact DE. (SLO 1 – 5)</p> <p>ULO 4: Solve homogeneous DE and Bernoulli DE by appropriate substitutions. (SLO 1 – 5)</p> <p>ULO 5: Solve IVP of above types of Des. (SLO 1 – 5)</p>	<p>1. Read Textbook: Zill, D. G. (2019). <i>Differential equations with boundary-value problems</i> (9th ed.).</p> <p>a. Chapter 2: First-Order Differential Equations - Separable Equations</p> <p>2. Complete: Homework # 4 (ULO 1- 5)</p>
	Unit 4 - First-Order Differential Equations - Linear Equations	<p>ULO 1: Solve separable first order DE. (SLO 1 – 5)</p> <p>ULO 2: Identify integrating factor for linear first order DE and solve linear first order DE using integrating factor. (SLO 1 – 5)</p> <p>ULO 3: Solve exact DE. (SLO 1 – 5)</p> <p>ULO 4: Solve homogeneous DE and Bernoulli DE by</p>	<p>1. Read Textbook: Zill, D. G. (2019). <i>Differential equations with boundary-value problems</i> (9th ed.).</p> <p>a. Chapter 2: First-Order Differential Equations - Linear Equations</p> <p>2. Complete: Homework # 5 (ULO 1- 5)</p> <p>3. Complete: Assignments# 2 (ULO 1- 4)</p>

		appropriate substitutions. (SLO 1 – 5)	
		ULO 5: Solve IVP of above types of Des. (SLO 1 – 5)	
	Unit 5: Exact Equations and Solutions by Substitutions	<p>ULO 1: Solve separable first order DE. (SLO 1 – 5)</p> <p>ULO 2: Identify integrating factor for linear first order DE and solve linear first order DE using integrating factor. (SLO 1 – 5)</p> <p>ULO 3: Solve exact DE. (SLO 1 – 5)</p> <p>ULO 4: Solve homogeneous DE and Bernoulli DE by appropriate substitutions. (SLO 1 – 5)</p> <p>ULO 5: Solve IVP of above types of Des. (SLO 1 – 5)</p>	<p>1. Read Textbook: Zill, D. G. (2019). <i>Differential equations with boundary-value problems</i> (9th ed.). a. Chapter 2: First-Order Differential Equations - Linear Equations</p> <p>2. Complete: Homework # 5 & 6 (ULO 1- 5)</p> <p>3. Complete: Test # 1 (ULO 1- 5)</p>
	Unit 06: Linear and Nonlinear Models	<p>ULO 1: Solve growth/decay model, cooling/warming model, logistic model, and chemical reaction model using techniques learned in Chapter 2, such as separating variable, linear first order DE. (SLO 1 – 5)</p> <p>ULO 2: Find the value of unknown quantity in above models using solution form. (SLO 1 – 5)</p> <p>ULO 3: Find the value of some parameters in above models using given conditions and solution form. (SLO 1 – 5)</p> <p>ULO 4: Find the doubling</p>	<p>1. Read Textbook: Zill, D. G. (2019). <i>Differential equations with boundary-value problems</i> (9th ed.). a. Chapter 3: Modeling with First-Order Differential Equations.</p> <p>2. Complete: Homework # 7 & 8 (ULO 1- 5)</p> <p>3. Complete: Assignments# 3 (ULO 1- 4)</p>

		time, triple time, quadruple time (for growth model), or half-life (for decay model). (SLO 1 – 5)	
		ULO 5: Find the behavior of solution of models as time goes to infinity. (SLO 1 – 5)	
	Unit 07: Preliminary Theory – Linear Equations	<p>ULO 1: Describe the format and geometrical meaning of initial value problems for nth-order linear DE. (SLO 1 – 5)</p> <p>ULO 2: Explain the superposition principles for linear DEs. (SLO 1 – 5)</p> <p>ULO 3: Describe linearly dependence and independence. (SLO 1 – 5)</p> <p>ULO 4: Evaluate the Wronskian of n functions. (SLO 1 – 5)</p> <p>ULO 5: Describe the general solutions of linear homogeneous and nonhomogeneous DEs. (SLO 1 – 5)</p>	<p>1. Read Textbook: Zill, D. G. (2019). <i>Differential equations with boundary-value problems</i> (9th ed.). a. Chapter 4: Higher-Order Differential Equations.</p> <p>2. Complete: Homework # 9 (ULO 1- 5)</p>
	Unit 08: Reduction of Order and Homogeneous Linear Equations with Constant Coefficients	<p>ULO 1: Explain and apply reduction of order method to reduce of the order of a linear DE by one if one nontrivial solution of the associated homogeneous DE is known. (SLO 1 – 5)</p> <p>ULO 2: Solve homogeneous second or higher order linear DE with constant coefficients. (SLO 1 – 5)</p>	<p>1. Read Textbook: Zill, D. G. (2019). <i>Differential equations with boundary-value problems</i> (9th ed.). a. Chapter 4: Higher-Order Differential Equations.</p> <p>2. Complete: Homework # 10 & 11 (ULO 1- 2)</p> <p>3. Complete: Assignment # 4 (ULO 1-2)</p>
	Unit 09:		1. Read Textbook: Zill, D. G.

	Undetermined Coefficients – Superposition Approach and Annihilator Approach	<p>ULO 1: Solve nonhomogeneous second order or higher linear DE with constant coefficients using undermined coefficient method and superposition principle. (SLO 1 – 5)</p> <p>ULO 2: Explain the form of particular solution for a given DE with nonhomogeneous term of polynomial functions, exponential functions, sine and cosine functions, and the product of those functions. (SLO 1 – 5)</p>	<p>(2019). <i>Differential equations with boundary-value problems</i> (9th ed.).</p> <p>a. Chapter 4: Higher-Order Differential Equations.</p> <p>2. Complete: Homework # 12 & 13 (ULO 1- 2)</p>
	Unit 10: Variation of Parameters and Cauchy-Euler Equations	<p>ULO 1: Describe the method of Variation of Parameters. (SLO 1 – 5)</p> <p>ULO 2: Solve second order or higher Cauchy-Euler equations. (SLO 1 – 5)</p> <p>ULO 3: Solve nonhomogeneous linear DE using variation of parameters. (SLO 1 – 5)</p>	<p>1. Read Textbook: Zill, D. G. (2019). <i>Differential equations with boundary-value problems</i> (9th ed.).</p> <p>a. Chapter 4: Higher-Order Differential Equations.</p> <p>2. Complete: Homework # 14 & 15 (ULO 1- 3)</p> <p>3. Complete: Test # 2 (ULO 1 – 3)</p>
	Unit 11: Modeling with Higher-Order Differential Equations	<p>ULO 1: Build second order linear DE for Mass/Spring system: free undamped motion; free damped motion; driven motion. (SLO 1 – 5)</p> <p>ULO 2: Solve the DEs from the Mass/Spring system to find the motion functions and answered related questions. (SLO 1 – 5)</p>	<p>1. Read Textbook: Zill, D. G. (2019). <i>Differential equations with boundary-value problems</i> (9th ed.).</p> <p>a. Chapter 5: Modeling with Higher-Order Differential Equations.</p> <p>2. Complete: Homework # 16 (ULO 1- 2)</p> <p>3. Complete: Assignment #5 (ULO 1 – 2)</p>
	Unit 12: Definition of Laplace Transform	ULO 1: Evaluate Laplace transform of a function using definition. (SLO 1 – 5)	<p>1. Read Textbook: Zill, D. G. (2019). <i>Differential equations with boundary-value problems</i> (9th ed.).</p>

		ULO 2: Find Laplace transform of a function using rules and properties. (SLO 1 – 5)	a. Chapter 7: Laplace Transform 2. Complete: Homework # 17 (ULO 1- 2)
	Unit 13: Inverse Transforms and Transform of Derivatives	ULO 1: Evaluate inverse Laplace transform of some rational functions of s using the basic rules. (SLO 1- 5) ULO 2: Use Laplace Transform to solve IVP of linear DE with constant coefficients. (SLO 1- 5)	1. Read Textbook: Zill, D. G. (2019). <i>Differential equations with boundary-value problems</i> (9th ed.). a. Chapter 7: Laplace Transform 2. Complete: Homework # 18 & 19 (ULO 1- 2)
	Unit 14: Operational Properties I	ULO 1: Evaluate Laplace transform of products of polynomial functions and sine cosine functions with exponential function using The First Translation Theorem. (SLO 1- 5) ULO 2: Find inverse Laplace transform using The First Translation Theorem. (SLO 1- 5) ULO 3: Solve more initial value problems. (SLO 1- 5)	1. Read Textbook: Zill, D. G. (2019). <i>Differential equations with boundary-value problems</i> (9th ed.). a. Chapter 7: Laplace Transform 2. Complete: Homework # 20 (ULO 1- 3) 3. Complete: Assignment # 6 (ULO 1- 3)
	Unit 15: Operational Properties II	ULO 1: Evaluate Laplace transform of products of polynomial functions and sine cosine functions with exponential function using The First Translation Theorem. (SLO 1- 5) ULO 2: Find inverse Laplace transform using The First Translation Theorem. (SLO 1- 5) ULO 3: Solve more initial value problems. (SLO 1- 5)	1. Read Textbook: Zill, D. G. (2019). <i>Differential equations with boundary-value problems</i> (9th ed.). a. Chapter 7: Laplace Transform 2. Complete: Homework # 21 (ULO 1- 3) 3. Complete: Test # 3 (ULO 1- 3) 4. Complete: Final Exam

* These descriptions and timelines are subject to change at the discretion of the instructor.