



# **INSTRUCTIONAL PACKAGE**

MAT 242  
Differential Equations

Effective Term  
Fall 2022/Spring 2023/Summer 2023

# INSTRUCTIONAL PACKAGE

## Part I: Course Information

Effective Term: Fall 2022/Spring 2023/Summer 2023

COURSE PREFIX: MAT 242

COURSE TITLE: Differential Equations

CONTACT HOURS: 4.0

CREDIT HOURS: 4.0

### **RATIONALE FOR THE COURSE:**

This four-semester hour differential equations course is used primarily by colleges and universities in their engineering, science and mathematics majors. The mathematics taught in this course is the basis for at least one more calculus course and is used in statistics, physics and other specialized courses in the student's major.

### **COURSE DESCRIPTION:**

This course includes the following topics: solution of linear and elementary non-linear differential equations by standard methods with sufficient linear algebra to solve systems; applications; series; Laplace transform; and numerical methods. (Prerequisite: Analytic Geometry and Calculus III). This course is transferable to public senior institutions as part of the South Carolina Commission on Higher Education Statewide Articulation Agreement.

### **PREREQUISITES/CO-REQUISITES:**

Credit level [MAT 240](#) Minimum Grade of C or Credit level [MAT 240](#) Minimum Grade of TC)

\***Online/Hybrid** courses require students to complete the [DLi Orientation Video](#) prior to enrolling in an online course.

### **REQUIRED MATERIALS:**

1. Please visit the Bookstore online site for most current textbook information. Use the direct link below to find textbooks.

[BOOKSTORE](#).

Enter the semester, course prefix, number and section when prompted and you will be linked to the correct textbook.

2. Scientific/Graphing Calculator.

### **ENTRY LEVEL COMPETENCIES:**

2022-2023

1. Find derivatives and antiderivatives of algebraic and transcendental functions.
2. Evaluate definite integrals of algebraic and transcendental functions.
3. Find power series representations of functions.
4. Understand the Fundamental Theorem of Calculus.
5. Understand the use of calculus concepts in parametric and polar form.

**TECHNICAL REQUIREMENTS:**

Access to Desire2Learn (D2L), HGTC's student portal for course materials, myHGTC and college email access.

**STUDENT IDENTIFICATION VERIFICATION**

Students enrolled in online courses will be required to participate in a minimum of one (1) proctored assignments and/or one (1) virtual events to support student identification verifications. Please refer to your Instructor Information Sheet for information regarding this requirement.

**CLASSROOM ETIQUETTE:**

As a matter of courtesy to other students and your professor, please turn off cell phones and other communication/entertainment devices before class begins. If you are monitoring for an emergency, please notify your professor prior to class and switch cell phone ringers to vibrate.

**NETIQUETTE:** is the term commonly used to refer to conventions adopted by Internet users on the web, mailing lists, public forums, and in live chat focused on online communications etiquette. For more information regarding Netiquette expectations for distance learning courses, please visit [Online Netiquette](#).

**Part II: Student Learning Outcomes****COURSE LEARNING OUTCOMES and ASSESSMENTS\*:**

The student should be able to:

1. Classify the differential equations with respect to their order and linearity.
2. Identify, analyze and subsequently solve physical situations whose behavior can be modelled by ordinary differential equations.
3. Understand the existence-uniqueness theorem of differential equations.
4. Solve exact differential equations.
5. Solve first-order ordinary differential equations.
6. Solve exact differential equations.

7. Convert separable and homogeneous equations to exact differential equations by integrating factors.
8. Solve Bernoulli differential equations.
9. Find solution of higher-order linear differential equations.
10. Determine solutions to second order linear homogeneous differential equations with constant coefficients.
11. Express the basic existence theorem for higher-order linear differential equations.
12. Determine solutions to second order linear non-homogeneous differential equations with constant coefficients.
13. Apply the method of undetermined coefficients to solve the non-homogeneous linear differential equations with constant coefficients.
14. Use the method of variations of parameters to find a solution of higher-order linear differential equations with variable coefficients.
15. Solve the Cauchy-Euler equations.
16. Solve systems of linear differential equations.
17. Determine the type of a linear differential equation systems.
18. Use the operator method to solve linear systems with constant coefficients.
19. Solve the linear systems in normal form.
20. Solve the homogeneous linear systems with constant coefficients.
21. Understand the basic properties of the Laplace and inverse Laplace transform..
22. Use the Laplace transform to find solutions of linear differential equations.
23. Use Euler's Method to compute numerical solutions to linear differential equations.
24. Determine error estimates for numerical solutions.

### **UNIT I: Introduction, First-Order Differential Equations**

1. Definitions and Terminology (1.1)
2. Initial-Value Problems (1.2)
3. Differential Equations as Mathematical Models (1.3)

4. Solution Curves Without a Solution (2.1)
5. Separable Equations (2.2)
6. Linear Equations (2.3)
7. Exact Equations (2.4)
8. Solutions by Substitution (2.5)

### **UNIT II: Modeling with First-Order ODEs, Higher-Order Differential Equations**

1. Linear Models (3.1)
2. Preliminary Theory (4.1)
3. Reduction of Order (4.2)
4. Homogeneous Linear Equations with Constant Coefficients (4.3)
5. Undetermined Coefficients-Superposition Approach (4.4)
6. Undetermined Coefficients-Annihilator Approach (4.5)
7. Variation of Parameters (4.6)
8. Cauchy-Euler Equations (4.7)

### **UNIT III: Modeling with Higher-Order Differential Equations, Laplace Transform**

1. Linear Models: Initial-Value Problems (5.1)
2. Definition of Laplace Transform (7.1)
3. Inverse Transforms and Transforms of Derivatives (7.2)
4. Operational Properties I (7.3)
5. Operational Properties II (7.4)
6. The Dirac Delta Function (7.5)\*\*
7. Systems of Linear Differential Equations (7.6)

### **UNIT IV: Systems of Linear First-Order Differential Equations**

1. Preliminary Theory of Linear Systems (8.1)
2. Homogeneous Linear Systems (8.2)
3. Nonhomogeneous Linear Systems (8.3)

### **UNIT V: Series Solutions of Linear Equations, Numerical Methods**

1. Review of Power Series (6.1)
2. Solutions About Ordinary Points (6.2)
3. A Numerical Method (2.6)
4. Euler Methods and Error Analysis (9.1)\*\*
5. Runge-Kutta Methods (9.2)\*\*

\*\*AS TIME PERMITS

***\*Students – please refer to the Instructor’s Course Information sheet for specific information on assessments and due dates.***

## Part III: Grading and Assessment

### EVALUATION OF REQUIRED COURSE MEASURES/ARTIFACTS\*

***\*Students, for the specific number and type of evaluations, please refer to the Instructor's Course Information Sheet.***

#### GRADING SYSTEM:

- A 90-100%
- B 80-89%
- C 70-79%
- D 60-69%
- F Below 60%

Grades earned in courses impact academic progression and financial aid status. Before withdrawing from a course, be sure to talk with your instructor and financial aid counselor about the implications of that course of action. Ds, Fs, Ws, WFs and Is also negatively impact academic progression and financial aid status.

The Add/Drop Period is the first 5 days of the semester for **full term** classes. Add/Drop periods are shorter for accelerated format courses. Please refer to the academic calendar for deadlines for add/drop ([ACADEMIC CALENDAR](#)). You must attend at least one meeting of all of your classes during that period. If you do not, you will be dropped from the course(s) and your Financial Aid will be reduced accordingly.

## Part IV: Attendance

Horry-Georgetown Technical College maintains a general attendance policy requiring students to be present for a minimum of 80 percent (80%) of their classes in order to receive credit for any course. Due to the varied nature of courses taught at the college, some faculty may require up to 90 percent (90%) attendance. Pursuant to 34 Code of Federal Regulations 228.22 - Return to Title IV Funds, once a student has missed over 20% of the course or has missed two (2) consecutive weeks, the faculty is obligated to withdraw the student and a student may not be permitted to reenroll. **Instructors define absentee limits for their class at the beginning of each term; please refer to the Instructor Course Information Sheet.**

**For online and hybrid courses**, check your Instructor's Course Information Sheet for any required on-site meeting times. Please note, instructors may require tests to be taken at approved testing sites, and if you use a testing center other than those provided by HGTC, the center may charge a fee for its services.

## Part V: Student Resources



### THE STUDENT SUCCESS AND TUTORING CENTER (SSTC):

The SSTC offers to all students the following **free** resources:

1. **Academic tutors** for most subject areas, **Writing Center support**, and **college success skills**.
2. Online **tutoring** and academic support resources.
3. Professional and interpersonal communication **coaching** in the EPIC Labs.

Visit the [Student Success & Tutoring Center](#) website for more information. To schedule tutoring, contact the SSTC at [sstc@hgtc.edu](mailto:sstc@hgtc.edu) or self-schedule in the Penji iOS/Android app or at [www.penjiapp.com](http://www.penjiapp.com). Email [sstc@hgtc.edu](mailto:sstc@hgtc.edu) or call SSTC Conway, 349-7872; SSTC Grand Strand, 477-2113; and SSTC Georgetown, 520-1455, or go to the [Online Resource Center](#) to access on-demand resources.



### STUDENT INFORMATION CENTER: TECH Central

TECH Central offers to all students the following **free** resources:

1. **Getting around HGTC:** General information and guidance for enrollment, financial aid, registration, and payment plan support!
2. Use the [Online Resource Center \(ORC\)](#) including Office 365 support, password resets, and username information.
3. **In-person workshops, online tutorials and more services** are available in Desire2Learn, Student Portal, Degree Works, and Office 365.
4. **Chat with our staff on TECH Talk**, our live chat service. TECH Talk can be accessed on the student portal and on TECH Central's website, or by texting questions to (843) 375-8552.

Visit the [Tech Central](#) website for more information. Live Chat and Center locations are posted on the website. Or please call (843) 349 – TECH (8324), Option #1.

### STUDENT TESTING:

Testing in an **online/hybrid** course may be accomplished in a variety of ways:

- Test administered within D2L
- Test administered in writing on paper
- Test administered through Publisher Platforms

Further more tests may have time limits and/or require a proctor.

Proctoring can be accomplished either face-to-face at an approved site or online through our online proctoring service. To find out more about proctoring services, please visit the [Online Testing](#) section of the HGTC's Testing Center webpage.

The **Instructor Information Sheet** will have more details on test requirements for your course.

### **DISABILITY SERVICES:**

HGTC is committed to providing an accessible environment for students with disabilities. Inquiries may be directed to HGTC's [Accessibility and Disability Service webpage](#). The Accessibility and Disability staff will review documentation of the student's disability and, in a confidential setting with the student, develop an educational accommodation plan.

Note: It is the student's responsibility to self-identify as needing accommodations and to provide acceptable documentation. After a student has self-identified and submitted documentation of a disability, accommodations may be determined, accepted, and provided.

### **STATEMENT OF EQUAL OPPORTUNITY/NON-DISCRIMINATION STATEMENT:**

Horry-Georgetown Technical College prohibits discrimination and harassment, including sexual harassment and abuse, on the basis of race, color, sex, national or ethnic origin, age, religion, disability, marital or family status, veteran status, political ideas, sexual orientation, gender identity, or pregnancy, childbirth, or related medical conditions, including, but not limited to, lactation in educational programs and/or activities.

### **TITLE IX REQUIREMENTS:**

All students (as well as other persons) at Horry-Georgetown Technical College are protected by Title IX—regardless of their sex, sexual orientation, gender identity, part- or full-time status, disability, race, or national origin—in all aspects of educational programs and activities. Any student, or other member of the college community, who believes that he/she is or has been a victim of sexual harassment or sexual violence may file a report with the college's Chief Student Services Officer, campus law enforcement, or with the college's Title IX Coordinator, or designee.

\*Faculty and Staff are required to report incidents to the Title IX Coordinators when involving students. The only HGTC employees exempt from mandatory reporting are licensed mental health professionals (only as part of their job description such as counseling services).

### **INQUIRIES REGARDING THE NON-DISCRIMINATION/TITLE IX POLICIES:**

**Student and prospective student** inquiries concerning Section 504, Title II, and Title IX and their application to the College or any student decision may be directed to the Vice President for Student Affairs.

**Dr. Melissa Batten, VP Student Affairs**

*Title IX Coordinator*

Building 1100, Room 107A, Conway Campus

PO Box 261966, Conway, SC 29528-6066

843-349-5228



[Melissa.Batten@hgtc.edu](mailto:Melissa.Batten@hgtc.edu)

**Employee and applicant** inquiries concerning Section 504, Title II, and Title IX and their application to the College may be directed to the Vice President for Human Resources.

**Jacquelyne Snyder, VP Human Resources**

*EEO and Title IX Coordinator*

Building 200, Room 212A, Conway Campus

PO Box 261966, Conway, SC 29528-6066

843-349-5212

[Jacquelyne.Snyder@hgtc.edu](mailto:Jacquelyne.Snyder@hgtc.edu)