**Instructor:** Dr. Dhruba R. Adhikari  
Ph: (470) 578-5423  
E-mail: dadhikar@kennesaw.edu  
Office: D-243  

**Classroom and Time:**  
D-112  TR 2:00 PM--3:15 PM  
**Office Hours:**  
TR 10:30--11:00AM, or by appointment

---

**Math 2306/61 Ordinary Differential Equations**  
Fall 2019

**Prerequisite:** Math 2202 (Calculus II) with a grade of “C” or better


**Supplemental Instruction:** The Supplemental Instruction (SI) program of KSU supports this class, and the SI leader is Erik Burke (eburke16@students.kennesaw.edu).

**Course Description:** An introduction to the theory of ordinary differential equations (ODEs), methods of solving first and higher order linear differential equations and linear systems, some applications in the sciences and engineering, the Laplace transform and its application in solving differential equations and linear systems, stability analysis and Euler’s numerical algorithm.

**Learning Outcomes:**  
Upon successfully completing this course, students will be able to  
1. solve special types of first order ordinary differential equations, including separable equations, linear first order equations, Bernoulli's equation, exact equations, etc.;  
2. solve second and higher order homogeneous and nonhomogeneous linear equations and linear systems with constant coefficients by using the methods of undetermined coefficients and variation of parameters, and apply the methods to solve problems in applications; and  
3. find Laplace transforms and inverse Laplace transforms and apply these to solve linear differential equations and linear systems.

**Tentative Contents:**

**Chapter 1: First-Order Differential Equations**  
1.1: Modeling via Differential Equations  
1.2: Analytic Technique: Separation of Variables  
1.3: Qualitative Technique: Slope Fields  
1.4: Numerical Technique: Euler's Method  
1.5: Existence and Uniqueness of Solutions  
1.6: Equilibria and the Phase Line  
1.7: Bifurcations  
1.8: Linear Equations  
1.9: Integrating Factors for Linear Equations

**Chapter 2: First-Order Systems**  
2.1: Modeling via Systems  
2.2: The Geometry of Systems  
2.3: Damped Harmonic Oscillator  
2.4: Additional Analytic Methods for Special Systems
Chapter 3: Linear Systems
3.1: Properties of Linear Systems and the Linearity Principle
3.2: Straight-Line Solutions
3.3: Phase Planes for Linear Systems with Real Eigenvalues
3.4: Complex Eigenvalues
3.5: Special Cases: Repeated and Zero Eigenvalues
3.6: Second-Order Linear Equations
3.7: The Trace-Determinant Plane

Chapter 4: Forcing and Resonance
4.1: Forced Harmonic Oscillators
4.2: Sinusoidal Forcing
4.3: Undamped Forcing and Resonance

Chapter 5: Nonlinear Systems*
5.1: Equilibrium Point Analysis*
5.2: Qualitative Analysis*

Chapter 6: Laplace Transforms
6.1: Laplace Transforms
6.2: Discontinuous Functions
6.3: Second-Order Equations
6.4: Delta Functions and Impulse Forcing
6.5: Convolutions*

Note: The sections with an asterisk (*) will be covered only if time permits. See the tentative schedule on page 4.

Technology Statement: A TI-83/84 calculator is permitted to use throughout the course. Please get an approval from the instructor to use other calculator types during tests and final exam. Use of calculators (such as TI-89) with symbolic computation capabilities will not be permitted on tests and final exams. DE Tools that comes with the textbook helps greatly with understanding concepts. You may also need to use DE Tools for lab assignments although you can use any other your favorite software instead.

Homework/Lab Assignments: Homework will be posted on D2L when a section is completed, but it will not be collected for grading. Completion of homework assignments in a timely fashion enhances your learning of the topics covered in lectures and prepares you for subsequent topics. However, a mere completion of homework assignments does not warrant your success in the course. You are encouraged to collaborate with your classmates on homework. You are expected to be continuously involved in the thought process for developing concepts and skills that you are expected to gain for a successful completion of the course.

Lab assignments is 15% of your final grade. There will be three sets of lab assignments. The assignments are due in paper form at the start of the class on due dates. A lab assignment submitted after its due date but before it has been returned to class may be accepted with a heavy penalty (usually 25%, 50%, 75%; depending upon the span of the lateness of the submission; it will be the instructor’s judgment call). A lab assignment turned in after the class has received grade for it will not be accepted under any circumstances.
Lab assignments submission guidelines:

- All lab assignments should be submitted in paper stapled together (credit may be deducted if not).
- Email submissions are not accepted under any circumstances.
- Write your name legibly at the top of the first page.
- Lab assignments are due at the beginning of the class on their due dates.

You are expected to write up your solutions independently although you are allowed to discuss lab assignments with your classmates. If submissions are found identical to ones of your fellow classmates, you will receive no credit, and consequently, you may be considered having Academic Misconduct as defined under Code of Academic Integrity (briefed below). In addition, you will be reported to the concerned office of Kennesaw State University for further actions.

Academic Integrity Statement: Every KSU student is responsible for upholding the provisions of the Student Code of Conduct, as published in the Undergraduate and Graduate Catalogs. Section 5c of the Student Code of Conduct addresses the University’s policy on academic honesty, including provisions regarding plagiarism and cheating, unauthorized access to university materials, misrepresentation/falsification of university records or academic work, malicious removal, retention, or destruction of library materials, malicious/intentional issue of computer facilities and/or services, and misuse of student identification cards. Incidents of alleged academic misconduct will be handled through the established procedures of the Department of Student Conduct and Academic Integrity (SCAI), which includes either an “informal” resolution by a faculty member, resulting in a grade adjustment, or a formal hearing procedure, which may subject a student to the Code of Conduct’s minimum one semester suspension requirement. See also https://web.kennesaw.edu/scai/content/ksu-student-code-conduct

Grading and Evaluation/Makeup Policy:
Lab = 15%, Test 1 = 20%, Test 2 = 20%, Test 3 = 20%, Final Exam (cumulative) = 25%

You are expected to attend all classes, participate in class discussions and complete lab/homework assignments. All tests and the cumulative final exam are closed book and closed notes. Make-up tests will only be allowed for a university approved excuse in writing or for an emergent health problem. In the latter case, a note from a doctor’s office must be presented as soon as your returning to KSU. Wherever possible, you should inform me prior to missing a test. Everyone must take the final. The final exam percentage will be used to replace your one lowest test score if it helps your average. There will be no extra credit in this course, and therefore please do not ask for one.

Grade Scheme:
A for [90%, 100%), B for [80%, 90%), C for [70%, 80%), D for [60%, 70%), F for [0, 60%)

Notice on Course Withdrawal: Students are responsible for maintaining and managing their enrollment status in their classes. A persistent nonattendance does not imply a withdrawal. Per university policy, I will assign a grade of WF to all students who cease to attend the class and do not participate in graded items during or prior to the last two weeks of the semester. The last date of attendance is required to be reported when assigning a grade of WF. Note that my compliance with this policy may affect your financial aid.
**Student Disability Services:** Any student with a documented disability needing academic adjustments is requested to notify the instructor as early in the semester as possible. Verification from KSU Student Disability Services is required. All discussions will remain confidential.

**Classroom Behavior:** All phones, tablets, laptops must be put silent for the duration of each class. Music players cannot be used for the duration of class or testing. You are expected to arrive in class on time, be prepared for learning, and not be disruptive during the class. You may be asked to leave classroom for any misconduct or inappropriate behavior.

**Class Attendance:** Regular attendance is expected and will be recorded. A class roll will be passed around in class every day, and it is your responsibility to sign in it. Missing a class can leave you a lot behind in the course, and in this case, you will be responsible for all announcements, assignments and materials covered in class. I will need to report the last day of attendance when submitting grades to the university.

### Tentative Schedule:

<table>
<thead>
<tr>
<th>Day</th>
<th>Section</th>
<th>Day</th>
<th>Section</th>
<th>Day</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug 20</td>
<td>1.1</td>
<td>Sept 24</td>
<td>2.1, 2.2</td>
<td>Oct 24</td>
<td>3.7</td>
</tr>
<tr>
<td>Aug 22</td>
<td>1.2, 1.3</td>
<td>Sept 26</td>
<td>2.2</td>
<td>Oct 29</td>
<td>3.6</td>
</tr>
<tr>
<td>Aug 27</td>
<td>1.3</td>
<td>Oct 1</td>
<td>2.3, 2.4</td>
<td>Oct 31</td>
<td>4.1</td>
</tr>
<tr>
<td>Aug 29</td>
<td>1.4</td>
<td>Oct 3</td>
<td>3.1, 3.2</td>
<td>Nov 5</td>
<td>4.2, 4.3</td>
</tr>
<tr>
<td>Sep 3</td>
<td>1.5</td>
<td>Oct 8</td>
<td>3.2</td>
<td>Nov 7</td>
<td>5.1*</td>
</tr>
<tr>
<td>Sep 5</td>
<td>1.6</td>
<td>Oct 10</td>
<td>3.3, Lab 2 Due</td>
<td>Nov 12</td>
<td>5.2*, Lab 3 Due</td>
</tr>
<tr>
<td>Sept 10</td>
<td>1.7, Lab 1 Due</td>
<td>Oct 15</td>
<td>3.4</td>
<td>Nov 14</td>
<td>6.1, 6.2</td>
</tr>
<tr>
<td>Sept 12</td>
<td>1.8</td>
<td>Oct 17</td>
<td>3.5</td>
<td>Nov 19</td>
<td>6.3</td>
</tr>
<tr>
<td>Sept 17</td>
<td>1.9</td>
<td>Oct 22</td>
<td>Test 2</td>
<td>Nov 21</td>
<td>Test 3</td>
</tr>
<tr>
<td>Sept 19</td>
<td>Test 1</td>
<td>Nov 21</td>
<td>Test 3</td>
<td>Dec 3</td>
<td>6.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nov 29</td>
<td>Break/Holidays</td>
<td>Dec 5</td>
<td>6.5*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** The sections with an asterisk (*) will be covered if time permits.

*The instructor reserves the right to make changes up to this point of the syllabus and will notify students at their students.kennesaw.edu address at least one week prior to the date the changes should take effect.*

### Important Dates:

| Aug. 19  | First day of Fall 2019 classes | Sep. 19  | Test 1               |
| Sep. 2   | Labor Day (no class)           | Oct. 22  | Test 2               |
| Oct. 9   | Withdrawal deadline            | Nov. 21  | Test 3               |
| Nov. 25 - 29 | Break/Holidays           | Dec. 10  | Final Exam (1:00 PM - 3:00 PM) |
| Dec. 9   | Last day of Fall classes       |          |                      |