MATH 151 – Engineering Mathematics I
Texas A&M University

Catalog Description: Math 151: Engineering Mathematics I. Rectangular coordinates, vectors, analytic geometry, functions, limits, derivatives of functions, applications, integration, computer algebra (MATLAB). MATH 171 designed to be a more demanding version of this course. Prerequisite: MATH 150 or equivalent or acceptable score on TAMU Math Placement Exam. Credit will not be given for more than one of MATH 131, MATH 142, MATH 147, MATH 151 and MATH 171.

Learning Outcomes
This course focuses on quantitative literacy in mathematics along with real world applications to physics, related rate problems, and optimization. Upon successful completion of this course, students will be able to:

- Understand vectors and vector functions, both graphically and quantitatively, and apply them to real world situations involving velocity, forces, and work.
- Construct vector and parametric equations of lines and understand vector functions and their relationship to parametric equations.
- Understand the concept of a limit graphically, numerically, and algebraically, and apply the relationship between limits, continuity, and differentiability in determining where a function is continuous and/or differentiable.
- Define the limit definition of the derivative and calculate derivatives using the limit definition, differentiation formulas, the chain rule, and implicit differentiation, with applications to tangent line and velocity problems.
- Calculate limits and derivatives of vector functions with applications to physics such as computing velocity and acceleration vectors.
- Identify exponential, logarithmic, and inverse trigonometric functions, and compute limits and derivatives involving these classes of functions.
- Apply the derivative to mathematically model velocity and acceleration as well as real world related rate applications, such as calculating the rate at which the distance between two moving objects is changing or the rate at which the volume of a cone being filled with water is changing.
- Approximate functions and function values using the derivative and the tangent line.
- Identify and understand indeterminate forms and apply the derivative to calculate limits using L’Hospital’s Rule.
- Understand and apply the Intermediate Value Theorem and the Mean Value Theorem, and be able to logically determine when these theorems can be used.
- Use calculus and logic to sketch graphs of functions and analyze their properties, including where a function is increasing/decreasing and in describing the concavity of the function.
- Determine the maximum/minimum values of functions, including applied optimization problems.
- Compute antiderivatives and understand the concept of integration as it relates to area and Riemann sums.
- Articulate the relationship between derivatives and integrals using the Fundamental Theorem of Calculus, and evaluate definite integrals using the Fundamental Theorem of Calculus.
- Use a Computer Algebra System to solve problems.
Core Objectives

Critical Thinking

- Students will think critically about limits in determining how the limit conceptually relates to the behavior of the function.
- Students will think critically about continuity and differentiability to justify whether a function is continuous and or differentiable at a point.
- Students will evaluate the proper technique to use when computing limits and derivatives of functions.
- Students will synthesize data determined from the first and second derivatives to determine the properties and shape of a function.
- Students will use inquiry to determine on what intervals a function is increasing/decreasing and to determine the intervals of concavity of the function by analyzing the signs of the first and second derivatives.
- Students will innovatively think about how to solve related rate word problems and optimization problems.
- Students will analyze functions using continuity and the derivative in determining the maximum and minimum values of the function, and if they exist.
- Students will develop a critical understanding of the relationship between the derivative and the integral using the Fundamental Theorem of Calculus.

Communication Skills

- Students will recognize and construct graphs of basic functions, including polynomials, exponential functions, logarithmic functions, and trigonometric functions.
- Students will justify solutions to optimization problems in writing.
- Students will interpret information from the derivatives of a function in order to develop a visual sketch of the graph of the function and to communicate in writing the properties of the function.
- Students will identify points of discontinuity and non-differentiability by examining the graphs of functions.
- Students will express mathematical concepts, such as the definition of the derivative, both abstractly with equations and in writing solutions to problems.
- Students will develop solutions to problems that involve the use of theorems, such as the Squeeze Theorem, the Intermediate Value Theorem, and the Mean Value Theorem.
- Students will use graphs of functions to determine the value of definite integrals as they relate to area.
- Students will be required to communicate orally with other group members when working on Computer Algebra System projects or other group activities.
- Students will communicate orally in group discussion in the required weekly recitation sessions.
Empirical and Quantitative Skills

- Students will analyze limits numerically to determine the sign of the infinite limit.
- Students will analyze numerical data in determining the signs of the first and second derivative in order to make conclusions on the shape of the graph.
- Students will compute derivatives and interpret the results as they relate to tangent line, velocity, and other rate of change problems.
- Students will numerically approximate the values of a function by using the tangent line approximation.
- Students will calculate antiderivatives of functions and use initial data to determine any unknown constants.
- Students will make conclusions involving maximum and minimum values of functions (both local and absolute) based on information from the derivative.
- Students will manipulate given information to develop a function to be used in optimization problems and then apply calculus to find and interpret the optimal solution.
- Students will approximate the value of a definite integral numerically using Riemann sums.
- Students will compute definite integrals and interpret the results as they relate to area under a curve.
- Students will manipulate given information to create a related rate model involving known quantities, and then apply calculus to solve for an unknown rate of change.
Math 151: Engineering Math I

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Web Site: http://www.math.tamu.edu/~ssinjini/Math151/151topics.html

Dr. Sengupta’s Office Hours for Fall 2014 Math 151:
MW F @ 2:00 to 4:00 PM or by appointment.

Email: You are required to check your neo email regularly for class announcements.

Calculator Policy: Calculators are not allowed on exams or quizzes, although they may be used on homework assignments.

Class Times
- Section 522, 523, 524: MWF 11:30 am – 12:20 pm HELD 109
- Section 525, 526, 527: MWF 9:10 – 10:00 am HELD 109
- Section 540, 541, 542: MWF 10:20 – 11:10 am HELD 109

Textbook: Calculus: Early Vectors by Stewart. (Note: You have already paid for an electronic copy of this textbook when you registered for this course. The online book will be available to you on WebAssign.) The computer labs will use the textbook Matlab: An introduction with Applications by Amos Gilat. (ISBN: 978-0470767856)

WebAssign: All homework will be online and based on the online system, WebAssign, which will be accessible @ http://www.math.tamu.edu/courses/eHomework/ Homework will be due every week on Wednesdays by 11:55 pm unless otherwise notified. There are two sets of homework problems for each section. The Practice problems are for practice only and are NOT graded. The practice problems are similar to the homework problems. The Homework problems ARE graded and you are allowed 3 attempts and unlimited time to answer each of the homework problems. It is suggested that you try the practice problems before using up all three of your tries while attempting to answer the homework problems. The two lowest homework grades will be dropped at the end of the semester. Occasionally, there may be a written homework assignment that has to be turned in.

Highly Suggested Homework Problems: There are problems at the back of each chapter that will prepare you for exams but will not be graded. The answers to the odd numbered problems can be found at the back of the book. It is crucial that you learn how to work these problems. A list of the “highly suggested problems” are provided for each chapter here:
http://www.math.tamu.edu/courses/math151/currenthw.html

Class Notes: Completed class notes will be posted on e-campus http://e-campus.tamu.edu/
Exam Schedule: There will be 3 in-term exams as well as a cumulative final exam for this course. The in-term exams are two hour long common exams and will be held at night from 7:30 to 9:30 pm. Calculators are not allowed on the exams. Room information for the common exams will be made available later during the semester. You will be required to bring a 882E (long, thin, green) scantron for each of the common exams.

- Exam I : Thursday, October 2\textsuperscript{nd} 2014
- Exam II : Thursday, October 30\textsuperscript{th} 2014
- Exam III : Tuesday, December 2\textsuperscript{nd} 2014

Comprehensive Final Exam Schedule
- Section 525, 526, 527: Monday, December 15\textsuperscript{th} from 8:00 – 10:00 am HELD 109
- Section 540, 541, 542: Tuesday, December 16\textsuperscript{th} from 8:00 – 10:00 am HELD 109
- Section 522, 523, 524: Wednesday, Dec. 17\textsuperscript{th} from 10:30 am – 12:30 pm HELD 109

Grading Policy:
Due to confidentiality, grades can only be discussed in person, not via phone or email.

<table>
<thead>
<tr>
<th></th>
<th>Weight</th>
<th>Final Grade Ranges</th>
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</thead>
<tbody>
<tr>
<td>Homework:</td>
<td>8%</td>
<td>90% ≤ A ≤ 100%</td>
</tr>
<tr>
<td>Quizzes:</td>
<td>8%</td>
<td>80% ≤ B &lt; 90%</td>
</tr>
<tr>
<td>Lab Assignments:</td>
<td>9%</td>
<td>70% ≤ C &lt; 80%</td>
</tr>
<tr>
<td>Average of 3 Common Exams</td>
<td>50%</td>
<td>60% ≤ D &lt; 70%</td>
</tr>
<tr>
<td>Final Exam:</td>
<td>25%</td>
<td>0% ≤ F &lt; 60%</td>
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</tbody>
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Grade Disputes: All grade disputes must be dealt with at the time you get back your exam. If the grade was not totaled correctly, you have up to 2 business days from when the paper was first returned to the class to get the correction made.

Make-Up Policy: No make-up examinations will be given without a university approved excused absence (See the Texas A&M University Student Rules.). Make up exams are administered by the department on specific dates and MUST be taken on one of these make up days. If you miss an exam, notify me by email or in person ASAP in order to schedule your make-up exam. The Texas A&M University Explanatory Statement for Absence from Class Form will NOT be accepted. It is the student's responsibility to schedule a makeup!
**Recitation/Lab:** Your section will meet twice weekly with your TA for recitation/lab. On Tuesdays, you will be in lab where you will complete MATLAB assignments and work with Maplets. On Thursdays, you will be in recitation. During recitation sessions, your TA will answer questions, review material, and give weekly quizzes for a grade. You must attend the recitation and lab sessions you are registered for. Please check Howdy for the weekly recitation/lab times for your specific section.

This course will act as a pilot for the TAMU course re-accreditation program. You might be required to solve a problem or analyze data or write a paragraph to test your analytical and communication skills etc. The outcome will not affect your class grade. You will be notified in advance of such exercises. It is anticipated that this activity might take up one recitation.

**Quizzes:** There may be quizzes given during lectures. Class quizzes may not necessarily be announced beforehand and it is your responsibility to be up-to-date on the material already covered in class and to make sure that you are present for a quiz. There will be weekly quizzes in the lab sessions. The lowest Quiz grade will be dropped at the end of the semester.

**Week-in-Reviews:** these are 2 hour review sessions offered every week after 5:00 pm. In these sessions, supplemental problems pertaining to the material taught in the previous week will be solved. You will be provided with the Week-in-review (WIR) questions beforehand and solutions will be posted after each session. The WIR for Math 151 this semester will be held by Sengupta and Pearlstein. Times and locations for these sessions will be announced in class and on my webpage. You are strongly encouraged to attend at least some of the WIR sessions.

**Math 151 Help sessions:** these will be offered Sunday through Thursday beginning from the second week of classes. Check the link on my webpage for times and location.

**Copyright Policy:** All exams, printed handouts, class notes, assignments, online homework problems, quizzes, worksheets, and web-materials are protected by U.S. Copyright Laws. No multiple copies can be made without my written permission. No exams, quizzes, or assignments may be shared with anyone outside of this class. Class notes, online material, online homework problems, exams, quizzes, worksheets, handouts, or subsets thereof may NOT be posted on Facebook, Twitter, Yahoo!Answers, YouTube, blogs, wikis, forums, videos, podcasts, or any other social media.
Aggie Honor Code: “An Aggie does not lie, cheat, or steal or tolerate those who do.” Upon accepting admission to Texas A&M University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning, and to follow the philosophy and rules of the Honor System. Students will be required to state their commitment on examinations, research papers, and other academic work. Ignorance of the rules does not exclude any member of the TAMU community from the requirements or the processes of the Honor System. For additional information please visit http://aggiehonor.tamu.edu/.

Americans with Disabilities Act: The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, in Cain Hall, Room B118, or call 845-1637. For additional information visit http://disability.tamu.edu.

Tentative Weekly Schedule
Week 1:  Appendix D, 1.1
Week 2:  1.2, 1.3, 2.1
Week 3:  2.3, 2.5, 2.6
Week 4:  2.7, 3.1, 3.2
Week 5:  Exam I, 3.3, 3.4
Week 6:  3.5, 3.6, 3.7
Week 7:  3.8, 3.9, 3.10
Week 8:  3.11, 4.1, 4.2
Week 9:  Exam II, 4.3, 4.4
Week 10: 4.5, 4.6, 4.8
Week 11: 5.1, 5.2, 5.3
Week 12: 5.5, 5.7, 6.1
Week 13: 6.2, 6.3
Week 14: Exam III, 6.4