QEP Theme: Advancing Student Learning Through Enhancement of Critical Thinking and Analytical Reasoning

TOUGALOO COLLEGE
TOUGALOO, MS 39174
Mathematics Department
MAT 316 Differential Equations
3 semester hours
Dr. Ravinder Kumar
rkumar@tougaloo.edu
Fall 2015

Name: ____________________

Course Outline and Syllabus
Disclaimer: Dr. Ravinder Kumar reserves the right to review, and make changes to this document as deemed necessary.

QEP Component for Course:
Mathematics is nothing but critical thinking and analytical reasoning among other things.

Critical Thinking:
In this course students will learn about (differential) equations that use differentials, a significant shift from an algebraic equation. Solution of differential equations is very important in physics and engineering. Although, software to obtain (approximate) solutions of differential equations are available and are widely used in engineering, it is important for a learner to understand how these methods originate in mathematics; mathematical software cannot be developed without sound knowledge of mathematical theories.

Analytical Reasoning:
Students will learn different types of differential equations and methods to solve differential equations of each type. They will apply the techniques learned by them in some problems from physics.

Office: K-1 Phone 977-7791
Office Hours: M,W, F: 1:00 pm – 2:00 pm, T: 9:00 – 12:00 noon
Schedule: MWF: 11:00 – 12:00 noon

Course Description:
First order differential equations, linear equations of higher order, power series solutions of linear equations, Laplace transform and linear systems of differential equations.

Prerequisite: MAT 222 (Calculus II) with a grade of at least C.
Supplementary Textbooks (Optional)
2- Finizio/Ladas, An Introduction to Differential Equations, Wadsworth, Inc.,
Belmont, California, 1982.
3- Rainville & Bedient, Elementary Differential equations, Macmillan Publishing
4- Edwards & Penney, Elementary Differential Equations, Prentice-Hall, In., New

**Attendance**
Each student is expected to be in class and to be on time. If a student is five or more minutes late then the
records will indicate a tardy. If a student is tardy twice then this will be counted as an absence. If a student has
more then three unexcused absences his/her semester grade will automatically drop by one letter grade. All
excuses must be reported to me with the proper validation before they can be recorded in my class booklet as
an excused absence. These policies are stated on current student handbook. “Tougaloo College believes that its
students must learn to take major responsibility for their own education. Tougaloo students are required to attend all of their classes
and be responsible for all assigned course material and all material covered in class. When students are absent from class, it is the
student’s responsibility to notify the instructor and ascertain what the instructor requires regarding missed material or assignments”.

If you wish to withdraw, do so officially. The "W" will not hurt your grade point average whereas the F will.

**Academic Integrity:**
It is expected that a student attending Tougaloo College will be scrupulously honest. Therefore, plagiarism,
cheating or any form of dishonesty associated with this course will be dealt with in accordance with the
policies of Tougaloo College. These policies are stated on the current student handbook.

**Class Structure:** Part of each class will be used to discuss problems with previous homework
assignments. New topics will be introduced and discussed. Quizzes and tests will be given. Homework
will be given online using webwork. You should read the section(s) to be covered before the lecture,
and should pay careful attention to what material is being developed in the lecture. Use the lecture as a
guide to what material you will need to study. There is a lot of information in the book that won't be
covered in the lecture but which is valuable to you as background information for better understanding
the material you are expected to learn.

I encourage calculators and/or computers usage in this class. A scientific calculator or graphic
calculator (TI-82, TI 83 or TI-84) will be fine. Graphing calculators or computers may be used to help
the student solve homework problems. The students may use the computers in Supplemental
Instructions Lab (Kincheloe 105). While the department encourages the use of calculators and
computer software, students are not permitted to use calculators or computer software, that have a built
in **Computer Algebra System**, during evaluation (i.e. exams, quizzes, and final exam), for example

Casio: CFX-9970G (including, for example, CFX-9970GE) and Algebra fx 2.0, Casio ClassPad;
Texas Instruments: TI 86, TI-89 and TI-92 (including, for example, TI-92 Plus), TI-NSquare CAS;
Hewlett-Packard: HP-40G and HP-49G Or any other calculators with equivalent capability.
Computer Software: Wolframalpha, MATHEMATICA, Scientific Notebook, MATLAB
Students may not use devices that can communicate wirelessly with other devices or persons.

**How Critical Thinking & Problem Solving Skills Support Math and Science Design Curriculum**

Mathematical formulas and scientific theories are more than textbook material; they underlie the products and interactions of today’s technological society. Beyond repeating theory and formula, students need to understand how to apply math and science knowledge to different situations and challenges. Hands-on, project-based math and science curriculum activities provide opportunities for students to think critically about the use of math and science in solving problems, deepening their knowledge of the basics. For example, in completing engineering design project based on realistic constraints that professionals in the field may face, such as a change in federal safety requirements, students need to think critically about how to revise their design prototype to satisfy its design goals and meet its scientific requirements.

**Assignments:** Homework will be frequently posted on webwork (http://webwork.tougaloo.edu/webwork2/MAT316fall13/). Please visit this website every day and look for email announcements for the online homework. These assignments should be completed in preparation for quizzes, tests and final examinations. If you don't do your homework you will not do well in class. Webwork generates individualized homework problems. You will be asked to generate your copy and print it or save it. You are advised to actually do these problems with paper and pencil. You may be asked to submit your work for webwork assignments from time to time for earning the full credit reported by webwork.

You will be asked to do problems that you may not be very good at. You should always try to do the best job you can, because that is how you improve your skills. Never give up. Never try to do the minimum. Just "getting by" is surely a bad idea. If you have problems with the course, you should make an appointment with me and make plans to solve these problems early in the semester.

All written assignments should be completed on time, typewritten or computer based. All paper is to be typed according to APA style.

**Reading**

It is very important to pre-read and post-read topics from your book. This will help improve comprehension of the course work as the grades. It is expected that students will do the pre-reading before the start of a topic in the class as well as do reading of topics/pages assigned in the class. Refer to the course calendar at the end of this document

I am here to help you learn the material. If you are having problems, see me right away. Do not wait until the day before a test. Talk with me to set up a time when we can get together.

**Assessment**

1- Three (or two) tests, worth 100 points each, will be given.
2- One take-home test for 100 points will be given at the end of the semester as a test grade was well as preparation for the final exam.
3- Home work will count for one test grade.
4- Quizzes and a writing assignment together will be counted for one test grade
5- You can earn extra points. Always be prepared for in-class pop-up questions for bonus points.
6- Late assignments are not fair to the class professor or other students and will therefore carry a HARSH penalty. Any assignment handed in late will incur a penalty of 10% deduction of marks for every day or part of a day that it remains not submitted. Not accepted after one week.
7- Final examination will be comprehensive. It will be counted for 200 points or equivalent to two test grades.
8- Letter grades will be assigned as follows:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>More than 88%</td>
</tr>
<tr>
<td>B</td>
<td>More than 78%</td>
</tr>
<tr>
<td>C</td>
<td>More than 65%</td>
</tr>
<tr>
<td>D</td>
<td>More than 55%</td>
</tr>
<tr>
<td>F</td>
<td>Less than 55%</td>
</tr>
</tbody>
</table>

9- An important part of studying is getting ready for a test. This includes testing yourself to see if you can answer the kinds of questions you are likely to be asked.
10-All Exams will be closed book and notes, and will include all material covered, including any homework and quizzes.
11-Mid-term grades will be determined by Exams, Homework, in class activities, Quizzes given prior to the day of midterm. Grading scale will be same % as in #8 above.

**Missed Work**
12-All quizzes and assignments are online. No make-up for assignments and quizzes will be given.
13-If you happen to miss a test, it is your responsibility to contact me on the first day of attendance after missing the test to reschedule the make-up. Make-up work will be harder than the original.

**Parental/Guardian Tracking of your Progress**
Please fill the form that will be passed onto you in the class. Filling of this form is mandatory whether you want to allow your parents/brother/sister/guardian etc. to discuss your progress with me, in case you indicated so on FERPA; or otherwise.

**Note to seniors and other students.**
If you are taking this course to satisfy the graduation requirements, I cannot treat you any different from any other student. Your final grade is strictly based on your performance in homework, quizzes, tests, and other class activities. There is no extra credit by any means. Please drop the class or withdraw. Make your
decision right now before it is too late. I am sorry I am not of any more help to you. You will be given final
exam based on complete syllabus.

Special Needs Statement (Proposed):
If you have a disability for which you are or may be requesting an accommodation, you are
encouraged to contact both your instructor and the Student Disabilities Service team.

Expected Tougaloo College Student Outcomes:
The expected outcomes are stated on the current course catalog.

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Section</th>
<th>Reading/Test/Quiz</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/23/2013</td>
<td>Intro to Course</td>
<td></td>
<td>Reading: 1.1</td>
</tr>
<tr>
<td>8/26/2013</td>
<td>Intro to Basic Terminology</td>
<td>1.1, 2.1</td>
<td>Reading 1.2</td>
</tr>
<tr>
<td>8/28/2013</td>
<td>Some Math Models</td>
<td></td>
<td>1.2</td>
</tr>
<tr>
<td>8/30/2013</td>
<td>Separable DE</td>
<td></td>
<td>2.2</td>
</tr>
<tr>
<td>9/04/2013</td>
<td>Homogenous DE</td>
<td></td>
<td>2.3</td>
</tr>
<tr>
<td>9/06/2013</td>
<td>Exact DE</td>
<td></td>
<td>2.4</td>
</tr>
<tr>
<td>9/09/2013</td>
<td>Linear Equations</td>
<td>2.2</td>
<td>Quiz: Homogenous DE</td>
</tr>
<tr>
<td>9/11/2013</td>
<td>Linear Equations</td>
<td>2.5</td>
<td>Reading: 2.6</td>
</tr>
<tr>
<td>9/13/2013</td>
<td>Bernoulli, Ricatti, Clairaut DE</td>
<td>2.6</td>
<td></td>
</tr>
<tr>
<td>9/16/2013</td>
<td>Bernoulli, Ricatti, Clairaut DE</td>
<td>2.6</td>
<td>Quiz: Linear DE</td>
</tr>
<tr>
<td>9/18/2013</td>
<td>Substitutions</td>
<td></td>
<td>2.7</td>
</tr>
<tr>
<td>9/20/2013</td>
<td>Picard’s Method</td>
<td>2.8</td>
<td>Reading 3.1</td>
</tr>
<tr>
<td>9/23/2013</td>
<td>Orthogonal Trajectories</td>
<td></td>
<td>3.1</td>
</tr>
<tr>
<td>9/25/2013</td>
<td>Problem Solving Session</td>
<td></td>
<td>Reading: 3.2</td>
</tr>
<tr>
<td>9/27/2013</td>
<td>Test on Chapters 1 &amp; 2</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>9/30/2013</td>
<td>Applications of Linear DE</td>
<td></td>
<td>3.2</td>
</tr>
<tr>
<td>10/02/2013</td>
<td>Applications of Linear DE</td>
<td></td>
<td>3.3</td>
</tr>
<tr>
<td>10/04/2013</td>
<td>Applications of Non-Linear DE</td>
<td>3.3</td>
<td>Reading: 4.1</td>
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<tr>
<td>10/07/2013</td>
<td>Applications of Non-Linear DE</td>
<td></td>
<td>3.1</td>
</tr>
<tr>
<td>10/09/2013</td>
<td>Problem Solving Session</td>
<td></td>
<td></td>
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<tr>
<td>10/11/2013</td>
<td>Test on Chapter 3</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>10/14/2013</td>
<td>Linear DE of Higher Order IVP, BVP</td>
<td>4.1</td>
<td>Reading Wronskian</td>
</tr>
<tr>
<td>10/16/2013</td>
<td>Linear Independent, Dependent Wronskian</td>
<td>4.1</td>
<td></td>
</tr>
<tr>
<td>10/18/2013</td>
<td>Superposition Principle, Fundamental Set of Solutions</td>
<td>4.1</td>
<td></td>
</tr>
<tr>
<td>10/21/2013</td>
<td>Solution of Non-Homogenous Linear DE</td>
<td>4.1</td>
<td></td>
</tr>
<tr>
<td>10/23/2013</td>
<td>Solution of Non-Homogenous Linear DE</td>
<td>4.1</td>
<td></td>
</tr>
<tr>
<td>10/25/2013</td>
<td>Constructing Second Solution</td>
<td>4.2</td>
<td></td>
</tr>
<tr>
<td>10/28/2013</td>
<td>Homogenous Lin DE w/constant coefficients</td>
<td>4.3</td>
<td>Quiz: Section 4.1</td>
</tr>
<tr>
<td>10/30/2013</td>
<td>Homogenous Lin DE w/constant coefficients</td>
<td>4.3</td>
<td>Reading 4.5</td>
</tr>
<tr>
<td>Date</td>
<td>Topic</td>
<td>Section(s)</td>
<td>Notes</td>
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<tr>
<td>11/01/2013</td>
<td>Method of Undetermined Coefficients</td>
<td>4.4</td>
<td></td>
</tr>
<tr>
<td>11/04/2013</td>
<td>Method of Undetermined Coefficients</td>
<td>4.4</td>
<td></td>
</tr>
<tr>
<td>11/06/2013</td>
<td>Differential Operators/ Annihilator Approach</td>
<td>4.5/4.6</td>
<td></td>
</tr>
<tr>
<td>11/08/2013</td>
<td>Annihilator Approach</td>
<td>4.6</td>
<td></td>
</tr>
<tr>
<td>11/11/2013</td>
<td>Problem Solving Session</td>
<td>4.6</td>
<td>Reading: 4.7</td>
</tr>
<tr>
<td>11/13/2013</td>
<td>Method of Variation of parameters</td>
<td>4.7</td>
<td></td>
</tr>
<tr>
<td>11/15/2013</td>
<td>Cauchy Euler Equation</td>
<td>6.1</td>
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<tr>
<td>11/18/2013</td>
<td><strong>Test Chapter 4</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11/20/2013</td>
<td>Laplace Transform</td>
<td>7.1</td>
<td>Take-Home</td>
</tr>
<tr>
<td>11/22/2013</td>
<td>Laplace transforms of Basic Functions</td>
<td>7.1</td>
<td></td>
</tr>
<tr>
<td>12/02/2013</td>
<td>Inversse Transform</td>
<td>7.2</td>
<td>Take-Home due</td>
</tr>
<tr>
<td>12/04/2013</td>
<td>Using Transforms for Solutions</td>
<td>7.4</td>
<td></td>
</tr>
<tr>
<td>Final Exam</td>
<td>Comprehensive: Content: 40% before MidTerm, 60% after MidTerm</td>
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</tbody>
</table>

**STUDY HINTS**

Mathematics is different from other subjects in that the quantity of reading material is usually not great. It is much more important to remember that each word of a reading assignment must be understood. It is not unusual for a student to read a section in the textbook several times. Reading speed is of little benefit in mathematics. In general, it is better to go quite slowly, letting the meanings seep in. Also, pausing frequently to go over in your mind what you have just read, saying these ideas in your own words, and trying to relate them to what you have already learned are excellent steps to learning. Time spent on thoroughly understanding the reading material will mean that less time will usually be required to do the problems.

The great temptation is to go immediately to the written assignment and look back in the text to find an example to fit the requirements of the problem at hand. This method may work on some problems, but the overall goal of understanding the course material is defeated. Problems worked in this way rarely stay in the memory long.

First, carefully read all the examples given, and actually work them with paper and pencil along with authors, then use the written assignment as a mini test, looking back for hints in the text only when you need to. In this way you will find that the idea in the section will become your own. This means that when test time rolls around, review of your lessons will bring back to your mind all that you have learned, and you will be equipped to perform well on the test without the crutch of the text examples.

I am here to assist you in learning the content of this course. I welcome the opportunity to serve you. Please don't hesitate to contact members in mathematics department, and/or myself as soon as you feel that you need additional help.
Computer Use at Tougaloo College:

The Microcomputer Labs located on H-21 and K-105, offer IBM compatible for use by Tougaloo students. A variety of software applications, including word processing, spreadsheet, database management are provided. Also available: MATHEMATICA, Maple, ALGEBRA...etc. Each is a unique new way to work with formulas, numbers, and graphs. Staff assistance, software documentation, and additional guidelines and procedures are available in the Microcomputer Center. You must supply diskettes to maintain your documents or data. Individual 3.5" diskettes are available for sale in the bookstore.

Remember: NOT WHAT YOU LEARN BUT WHAT YOU CAN RECALL MAKES YOU A WISE STUDENT.

Helpful Weblinks

http://khanacademy.org
http://patrickjmt.com
http://mathworld.wolfram.com/First-OrderOrdinaryDifferentialEquation.html
http://tutorial.math.lamar.edu/Classes/DE/DE.aspx
http://www.efunda.com/math/ode/ode.cfm
http://www.analyzemath.com/calculus.html
http://www.youtube.com/watch?v=ZqHB132Wgmw
http://www.sosmath.com/diffeq/diffeq.html
http://www.math.poly.edu/courses/ma2132/Notes/MA2132FirstOrder.pdf
http://www.ltcconline.net/greenl/courses/204/firstOrder/FirstOrder.htm
http://www.openculture.com/math_free_courses

APA Style Referencing

http://www.library.cornell.edu/resrch/citmanage/apa (Examples of references)
http://citationmachine.net/ (helps create references)