MAT 254.01 - Differential Equations
COURSE SYLLABUS (Winter 2017)

Professor: Steve Tuckey

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Classroom: 220 William Atkinson Hall (Tue./Thu., 9:00 to 10:50 AM)

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Course Materials: http://bit.ly/mat254wn17

Course Description:

In this course, students will explore solutions of first order differential equations, linear differential equations with constant coefficients, variation of parameters, Laplace transforms, eigenvectors and eigenvalues and application to solution of systems of linear first order equations. Computer access and a graphing calculator are required.

Prerequisite: 2.0 in the past two years in JC's MAT 154.

Math 254 Core Course Objectives:

Successful MAT 254 students will be able to:

- ✓ Solve first-order differential equations that are separable, homogeneous, exact, or linear.
- ✓ Solve second-order differential equations with constant coefficients.
- ✓ Use numerical methods to solve a differential equation.
- ✓ Solve systems of differential equations.
- ✓ Solve applications including harmonic motion, damped motion, electrical circuits, growth & decay.
- ✓ Use appropriate technology, including graphing calculator and computer algebra system.

Math 254 Associate Degree Outcomes:

ADO 3: Demonstrate computational skills and mathematical reasoning

Apply arithmetic skills and mathematical reasoning by solving problems, documenting process, interpreting results and evaluating the reasonableness of outcomes.

ADO 7: Think Critically

Demonstrate critical thinking through questioning, interpreting, analyzing, evaluating, inferring from and synthesizing information to solve problems from a variety of settings.

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COURSE REQUIREMENTS

REQUIRED MATERIALS:

- **Textbook:** *Differential Equations*, 4th Edition; by Blanchard, Devaney, and Hall; Thompson - Brooks Cole Publishers (ISBN: 1133109039)
- **Course Pack**: Provided by Steve (you're welcome!)
- **Calculator:** Your choice; *Laptops/notebooks are permitted & strongly encouraged*
- **MAPLE:** Computer software available on campus computers & *for discounted purchase*
- **Other:** *Large* 3-ring binder, large eraser, ***pencils***, highlighters

HOMEWORK & PROJECTS:

The single best way to ***learn*** math is to ***do*** math. Homework is the persistent, focused practice that fosters learning of skills and concepts. There will be suggested homework associated with each section of material covered, and these are intended as practice (neither collected nor graded). Graded (with partial credit) homework sets and projects (some group-based) will be assigned *at least* once per week, and will consist of similar book-sourced problems and instructor-designed exercises. Since homework is all about practice and growth, ***"make explicit all work and reasoning" is the default requirement***. You will receive no credit for solutions that appear to be copied from a solutions manual or Maple. *Working with* others is never justification for submitting the *work of* others.

Please note: **Late homework will NOT be accepted**, so you must make arrangements for submitting your work by class time if absence is unavoidable. One particularly useful tool for this is a free, "scan-to-PDF" app for mobile devices (e.g., "CamScanner" for Android).

EXAMINATIONS:

Examinations are performances of student understanding; as such, they will allow students to demonstrate mastery of the skills and concepts from the homework and lectures. Special requirements (e.g., MAPLE use) and allowances (e.g., student-prepared notes sheets) will depend upon the particular topics and will be discussed in class. The final exam is cumulative for the entire course. Due to the abbreviated nature of the course, some exams will take place in the **JC Testing Lab** (just downstairs from our classroom), *outside of our class session times*. For times and info, see: https://www.jccmi.edu/library/testing-lab/

COURSE POLICIES

ATTENDANCE POLICY:

Students are expected to attend all class meetings, arriving on time, and staying until the end. **In-class assignments may not be made up**, **therefore attendance is vital**. The student is responsible for obtaining any missed materials from other students; that is to say, *office hours are not a replacement for class time*. Moreover, **homework and exams may *not* be made up**. Any electronic submission of homework is due by the start of class time.

EXTRA CREDIT:

There will be no opportunities for extra credit. Your grade calculation is based solely on your performance on course assignments listed above.

Grading Policy and Scale:

A 2.0 or "C" is a passing grade. Only courses with passing grades count toward graduation. Other colleges transfer in only courses with passing grades, though some institutions often have higher transfer standards. Financial aid sources, including most employers, require *at least* a passing grade. Also, earning less than a 2.0 in a class results in being unable to participate in the next level of courses in a discipline that requires MAT 254 as a prerequisite.

Grading Scale:

90 -100% → 4.0	65 - 69% → 1.5
85 - 89% → 3.5	60 - 64% → 1.0
80 - 84% → 3.0	50 - 59% → 0.5
75 - 79% → 2.5	0 - 49% → 0.0
70 - 74% → 2.0	

Weighted Grade Calculation:

Homework & Projects: *40%*
Midterm Exams: *40%*
Cumulative Final: *20%*

Incomplete Policy:

A student may request an incomplete from the instructor. The incomplete will be granted only if the student can provide documentation that his or her work up to that point is sufficient in quality, but lacking in quantity, due to circumstances beyond the student's control. Final determination of whether an incomplete will be given is the instructor's decision. (***JC Policy***)
Please Note: *An "Incomplete" grade is* ***not*** *a valid strategy for avoiding a failing grade.*

Academic Honesty Policy:

You are *strongly encouraged* to work with each other, but **all your submitted work must be your own.** In other words, working as a group is a great way to learn material, but anything you submit for a grade must be evidence of your own thought processes, not the explicit work of someone else. If I suspect you of academic dishonesty, I will follow ***JC's Academic Honesty Policy*** and take appropriate action up to and including assigning a **failing grade** for the assignment, examination, or the course itself (as deemed appropriate).

Classroom Expectations:

The following are expectations that we can all share.

We are each responsible for our work, our learning, and our behavior in class.
This course will require consistent, mindful effort on your part. Mathematics is a subject that requires regular, thoughtful practice to understand and master.

We are each respectful of everyone in the class (including ourselves).
Please silence mobile devices, minimize distractions, refrain from using any tobacco products, and come prepared (and on time) to ask/answer questions and work together.

We are patient and persistent, even in the face of frustration (with others or ourselves).
Remember, at this level, it is not only understandable to be 'stumped' by problems at first, *this is to be expected*. What separates successful students from unsuccessful ones is almost entirely *patient persistence*, and a willingness to *engage with others*.

We will communicate with each other promptly regarding problems or concerns.
Regular, direct communication solves more problems than it causes. Please do not hesitate to contact me for any reason, and I will do the same.

WHERE TO GET HELP:

Given the level of this course's mathematical sophistication, your fellow students and I are your best resources for learning. Even so, there are many other sources to consider and investigate. Be creative, be resourceful, and *share what you find* -- we're all in this together!

I ***strongly*** advise you start up a *regular study group* as soon as you are able with some of your classmates. At the very least, write down names and contact information for your peers and call on each other when needed. For more information on starting and maintaining a study group, check out the following link: **http://bit.ly/math-study-group**

TENTATIVE OUTLINE: A brief (and *tentative*) list of the sections covered in the course

- **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 Plane)
  - → *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 (The Damped Harmonic Oscillator)
  - → 2.4 (Additional Analytic Methods for Special Systems)
  - → 2.5 (Euler's Method for Systems)
- **Chapter 3: Linear Systems**
  - → 3.1 (Properties of Linear Systems and the Linearity Principle)
  - → 3.2 (Straight-Line Solutions)
  - → 3.3 (Phase Portraits 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)*
- **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)*