A. Instructor: Dr. J. Brennan ([jbrennan@wustl.edu](mailto:jbrennan@wustl.edu), 935-9447)  
Office: Brauer Hall, 3002  
Office Hours: Wed 4-5:30 pm or by appointment

TA: Yuanzi Sun ([yuanzi@wustl.edu](mailto:yuanzi@wustl.edu))  
Office: Brauer 3039  
Office Hours: By appointment only

B. Catalog Description: The course will introduce students to mathematical principles essential for graduate study in any engineering discipline. Applied mathematical concepts will be demonstrated by applications to various areas in energy, environmental, biomedical, chemical, mechanical, aerospace, electrical, and civil engineering.

C. Prerequisites: One semester each of differential equations and matrix algebra.

D. Course Webpage: Course materials and grades will be posted in the course page on Canvas ([http://wustl.instructure.com](http://wustl.instructure.com)). Note that there is a free app you can download for iOS or Android through the AppStore or Google Play Store. You will need to specify “wustl.instructure.com” as your school when you first log in.

For any questions regarding lecture material, homework assignments, or exams, please post on the “Discussion” tool on Canvas. Dr. Brennan will monitor that space and respond as soon as she is able. You are also welcome to answer each other’s questions! Note that any postings of solutions to assignments will result in a grade of zero for that particular problem for ALL students. Also, Dr. B may choose not to answer any questions about homework, exams, etc. within 24 hours of the due date.


F. Course Objectives: Develop a strong understanding of equation solving and mathematical analysis methods that will serve as a basis for graduate coursework and for modeling and theory development during graduate study.

G. Course Topic List  
Chapters indicate recommended reading in Greenberg. *Items in italics will not be explicitly covered in class.*

- ODEs (Ch 1-2)  
- Systems of equations (Ch 8)  
- Vectors (Ch 9)  
- Matrices (Ch 10)  
- Vectors in 3-space (Ch 14)  
- Scalar and vector fields (Ch 16)  
- Higher-order ODEs (Ch 3)  
- Power series solutions (Ch 4)  
- Laplace transforms (Ch 5)  
- Numerical solutions (Ch 6)  
- Eigenvalue problems (Ch 11)  
- Phase planes (Ch 7 + suppl.)  
- Fourier series (Ch 17)  
- PDEs: Diffusion eqn (Ch 18)  
- PDEs: Laplace eqn (Ch 20)  
- PDEs: Numerical solns (if time)

*Course topics and schedule are subject to change.*
H. **Assessment of Course Outcomes**: Homework, Exams, and In-Class Participation

I. **Homework Formatting and Grading**
Homework assignments should be written or typed on standard 8.5” by 11” paper stapled in the upper left corner. All problems should be done in the same order in which they were assigned. If your problem solutions are mixed up in any way, you may not get credit for the problems that are out of order! In addition, your homework should be legible and easy to read. If it is not legible, you may lose points or even be given a zero on the entire assignment. **Tip**: The easier it is for the grader to understand and follow your work, the happier the grader will be. Happy graders tend to be nice graders. 😊

Homework will be graded on the basis of 10 points per problem. A problem worked perfectly or with only 1 or 2 minor errors will get 10 points. A problem with more than 2 minor errors but no major (logic) errors will get 7.5 points. A problem with 1 major error or more than 3 minor errors will get 5 points. A problem with more than 1 major error will get 2.5 points. A problem with no credible effort will get zero points.

J. **Using Software on Your Homework**
There may be homework problems that request that you use software (e.g., Maple, Wolfram Alpha, MATLAB, Mathematica, MathCad, etc.) to solve a problem. There may also be problems in which it can be very helpful to use software to check some of the trickier arithmetic. In general, you should **always** show as much work as possible — the goal of the homework, etc., is for me to know whether you know how to solve these problems. If you use a piece of software to perform any part of a homework solution, **you must submit a printed screenshot showing your typed input into the software and the resulting output. You must also tell me which software you used.** Otherwise, I may assume that you do not know how to obtain the answer yourself and/or that you simply copied it from somewhere/someone.

With that in mind, we live in the age of computers, and I firmly believe that we should all be fluent with using computers to solve problems. Therefore, I encourage you to check your work using the mathematical software of your choice and to explore various types of software to learn how to use them.

K. **Late Homework**
Homework is due to me before lecture begins on the assigned day (generally every Thursday). If you are late to class or miss class due to an unexcused absence, your homework is late. Twice during the semester, you may turn in an assignment for full credit up to 24 hours late (turned in by 4:00 p.m. on Friday), but it will not be accepted any later than that unless special arrangements are made. **If you wish to use a late allowance, email both me and the TA, and make arrangements with the TA to turn in your homework directly to them (most likely, you will turn it in to the TA’s pendaflex folder outside Brauer 1015).** Don’t use up your “late allowances” too soon — it is wise to save them for when you are sick or otherwise in a serious bind.

L. **Exams**
You may make up a “crib card” for your use during each exam. The card can be no larger than 4” x 6” (10.16 cm x 15.24 cm), but it can contain whatever content you wish. I will spot check card sizes to make sure that you have not used too large of a card. The final exam will be cumulative, so you may use all of the cards you created throughout the semester. In other words, don’t throw them out after each exam!

During each exam, you may not have anything on your desk/workspace other than writing utensils, your crib card, and the exam itself. Any other items (including calculators!) are NOT permitted, and having them will be considered cheating. You may have a water bottle, provided
that you keep the water bottle on the floor below your seat. Do not look around (e.g., at anyone else or their exam), as doing so will be considered cheating and treated accordingly.

If you are unable to take an exam on the assigned date because of a medically verifiable illness or a school-sponsored activity you must provide me with appropriate documentation as soon as possible, and no later than two weeks in advance of the exam, so that appropriate accommodations can be made. I will consider last-minute medical and family emergencies on a case-by-case basis.

Exam Dates
Exam 1: Thursday, 10/5, in class
Exam 2: Thursday, 11/9, in class
Final Exam: Wednesday, 12/20, 6-8 pm, location TBD

*Note: The final exam date may be changed to be earlier during finals week.*

*The final exam will be cumulative with an emphasis on “new” material.*

M. Grading

<table>
<thead>
<tr>
<th>Contribution of assessments:</th>
<th>Guaranteed grade cutoffs</th>
</tr>
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<tbody>
<tr>
<td>Homework 15%</td>
<td>90 \leq A, 68 \leq C &lt; 72</td>
</tr>
<tr>
<td>Exams (2) 25% (each)</td>
<td>85 \leq A- &lt; 90, 65 \leq C- &lt; 68</td>
</tr>
<tr>
<td>Final Exam 30%</td>
<td>82 \leq B+ &lt; 85, 62 \leq D+ &lt; 65</td>
</tr>
<tr>
<td>Participation 5%</td>
<td>78 \leq B &lt; 82, 58 \leq D &lt; 62</td>
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<tr>
<td></td>
<td>75 \leq B- &lt; 78, 55 \leq D- &lt; 58</td>
</tr>
<tr>
<td></td>
<td>72 \leq C+ &lt; 75, F &lt; 55</td>
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</tbody>
</table>

The lowest homework score will be dropped. Each homework will receive equal weighting in your final grade. If I feel that an assignment or exam was too difficult, I may scale everyone’s grade upwards (i.e., add points to everyone’s final score). There is no preset distribution of final grades (i.e., I have no problem with giving an “A” to everyone, provided it is earned). **If >85% of the class completes the end-of-semester evaluation, I will award a 2% bonus to everyone’s grade.**

N. Regrades

Regrades must be submitted within one week after the exam or homework solution has been posted. After this time, I will not discuss any regrades. If you believe your work was graded incorrectly, resubmit the entire original work to me (i.e., the complete original homework or exam), including a separate sheet of paper on which you have a written description of the error with references to the posted solution. *I will not negotiate your grade on any problem in a face-to-face discussion.* Whenever you submit work for a regrade, I will review the issue extremely carefully and correct any mistakes made. Please note that if you resubmit work for a regrade, I will regrade the entire document (not just the problem of concern). Any changes I make to the exam/assignment grade will be final.

O. In Case of a Major Disruption to Your Life…

During the semester, it is possible that a major disruption will occur in your life (death in your family, unexpected move, family issues, etc.) that prevents you from focusing fully on your studies. I am more than willing to work with you to help you through these disruptions, but I cannot do so unless you communicate with me about it. In addition, you need to tell me about it as soon as possible so that I have adequate time to make appropriate alternate arrangements. For example, if something happens the day before an exam, you need to tell me about it before you take the exam. Once you have taken the exam, I cannot do anything to change your grade on that exam. However, if you tell me before you take the exam, we might be able to arrange extended time, an alternate date, etc., depending on the circumstances.
P. Academic Integrity
Effective learning, teaching, and research all depend on the ability of members of the academic community to trust one another and to trust the integrity of work that is submitted for academic credit or conducted in the wider arena of scholarly research. Such an atmosphere of mutual trust fosters the free exchange of ideas and enables all members of the community to achieve their highest potential.

Therefore, in this class you are encouraged to discuss course material with other students, as this activity can be a key part of learning. However, everything you turn in should be your own work, unless I explicitly tell you otherwise. Copying answers or parts of answers from other students or other resources (the Internet, etc.) is not permitted in any way. This activity will be considered as willful cheating and will be dealt with as described below.

We will be actively searching for academic dishonesty on all assignments, exams, etc. If you are found guilty of cheating, all students involved will receive a zero on the assessment in question, and in severe cases, an F in the course. All students involved may also be reported to the Discipline Committee of the School of Engineering and Applied Sciences, which could lead to expulsion from the University and/or deportation for international students. This is your only warning. For more information, visit https://engineering.wustl.edu/current-students/student-services/Pages/academic-integrity-policy.aspx.

Q. Diversity
I consider our classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability — and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming, and inclusive environment for every other member of the class.

R. Academic Accommodations
Any accommodations for students with special needs must be documented with and initiated by Disability Resources through Cornerstone. In addition, please notify me of any necessary accommodations during the first week of class.

S. Conduct
As a graduate student, you are expected to behave with professionalism and integrity both in and out of class. As such, please arrive to class on time. If you arrive late, please enter with minimal disruption to the class. While in class, you are expected to engage in all class activities and exhibit consideration and respect towards other students, the TA, and myself. If you need to miss class for any reason, please notify me in advance.

P. Accommodations based upon sexual assault:
The University is committed to offering reasonable academic accommodations to students who are victims of sexual assault. Students are eligible for accommodation regardless of whether they seek criminal or disciplinary action. Depending on the specific nature of the allegation, such measures may include but are not limited to: implementation of a no-contact order, course/classroom assignment changes, and other academic support services and accommodations. If you need to request such accommodations, please direct your request to Kim Webb (kim_webb@wustl.edu), Director of the Relationship and Sexual Violence Prevention Center. Ms. Webb is a confidential resource; however, requests for accommodations will be shared with the appropriate University administration and faculty. The University will maintain as confidential any accommodations or protective measures provided to an individual student so long as it does not impair the ability to provide such measures.
If a student comes to me to discuss or disclose an instance of sexual assault, sex discrimination, sexual harassment, dating violence, domestic violence or stalking, or if I otherwise observe or become aware of such an allegation, I will keep the information as private as I can, but as a faculty member of Washington University, I am required to immediately report it to my Department Chair or Dean or directly to Ms. Jessica Kennedy, the University’s Title IX Coordinator. If you would like to speak with the Title IX Coordinator directly, Ms. Kennedy can be reached at (314) 935-3118, jw kennedy@wustl.edu, or by visiting her office in the Women's Building. Additionally, you can report incidents or complaints to Tamara King, Associate Dean for Students and Director of Student Conduct, or by contacting WUPD at (314) 935-5555 or your local law enforcement agency. You can also speak confidentially and learn more about available resources at the Relationship and Sexual Violence Prevention Center by calling (314) 935-8761 or visiting the 4th floor of Seigle Hall.

Q. Bias Reporting:
The University has a process through which students, faculty, staff and community members who have experienced or witnessed incidents of bias, prejudice or discrimination against a student can report their experiences to the University’s Bias Report and Support System (BRSS) team. See: brss.wustl.edu

R. Mental Health:
Mental Health Services’ professional staff members work with students to resolve personal and interpersonal difficulties, many of which can affect the academic experience. These include conflicts with or worry about friends or family, concerns about eating or drinking patterns, and feelings of anxiety and depression. See: shs.wustl.edu/MentalHealth