Advanced Applied Mathematics

Math 422 and 522
Room 237 Modern Bio West Building
Tuesdays and Thursdays – 2.00pm – 3.15pm

Description of Course
The course covers advanced topics in vector calculus, solution methods for ordinary differential equations with an emphasis on power series and Frobenius series, special functions, the theory of complex variables, Sturm-Liouville theory and orthogonal polynomials, Fourier series and integral transform, method of separation of variables applied to the solution of partial differential equations of elliptic, parabolic and hyperbolic type.

Course Prerequisites or Co-requisites
(MATH 215 or MATH 410) and MATH 223 and (MATH 254 or MATH 355 or MATH 250B)

Instructor and Contact Information
Instructor: Jerry Moloney, Meinel 536
Instructor Office Hours: Meinel 536, Mondays 3:30 p.m. – 4:30 p.m. and Wednesdays 2:30 p.m. – 3:30 p.m.
Grader: Isak Kilen, Meinel 532
Grader Office Hours: Meinel 554, Fridays 1:00 p.m. to 2:00 p.m.
Class Website: http://acms.math.arizona.edu/Math422-522/index.html

Deadlines

January 22, 2019 (undergrads) and February 5, 2019 (grads) Last day to drop without a grade.
February 6, 2019 (undergrad) and February 5 2019 (grads) Last day to change from pass/fail to regular grade or vice versa with only instructor approval on a Change of Schedule form. Last day to file Grade Replacement Opportunity (GRO), deadline is 11:59 PM. Last day for department staff to add/drop in UAccess.
February 7, 2019 (undergrad) - Change of Schedule form with Instructor and Dean's permission is required to change from pass/fail to regular grade or vice versa.
March 3, 2019 (all students) - Last day to make registration changes without the Dean's signature.
March 4, 2019 (all students) - All Change of Schedule forms to ADD or CHANGE classes require not only the instructor's signature indicating permission, but also the Dean's signature. By policy, permission from the Dean to make a registration change at this time requires an extraordinary reason.
March 26, 2019 (all students) - Last day for students to withdraw from a class online through UAccess. Last day for students to change to/from audit with only instructor approval. Last day for instructor to administratively drop students.

For more information please see Dates and Deadlines link: https://registrar.arizona.edu/dates-and-deadlines/view-dates?field_display_term_value=191&=Apply

Course Format and Teaching Methods
Two one hour and fifteen minute lectures per week. Homeworks are assigned each week and are due one week from posting at the website www.acms.arizona.edu. There will be two one hour and fifteen minute tests and a two hour final exam.

Examinations: Two one and a quarter hour tests will be given and there will be a two-hour final
examination. The final examination will be based upon the entire course. No books, notes or
calculators are allowed in these examinations. Your final grade for this course will be determined
by the scores of all examinations and the homework grades. The dates of each test will announced
at least one week before it is scheduled. The final exam counts twice as much as each one-hour
test and the homework will contribute the equivalent of a single test. No make-up examinations
will be given. If you have missed one or several one-hour tests through no fault of your own,
the final grade for this course will be determined by replacing the missing test scores with the
score of the final examination. If you miss the final examination and if you have a well-documented
excuse showing that for reasons beyond your control it has been absolutely impossible for you to
take the final examination, and if you had a passing grade at the time of the final examination, a
grade of I will be given for the course. In all other cases a score of zero will be assigned for the
final examination and the course grade evaluated accordingly.

Course Syllabus

Prerequisites for this course include an introductory vector calculus and ordinary differential
equations course. A student who is rusty on vectors should review Chapter 5 while Chapter 11 has
a good review of ordinary differential equations. I will take ODE review materials from Chapter 11.

Week 1: Vector Calculus – multiple products, line integrals (5.4, 6.6, 7.1-7.2)

Week 2: Line Integral (cont), surface integrals, divergence, Green’s and Stoke’s theorem (7.3-
7.5)


Week 4: Singular Points and Method of Frobenius [12.2,12.4]

Week 5: Special functions – Legendre polynomials, Bessel functions [12.3-12.5-12.6]

Week 6: Sturm Liouville theory, Eigenfunction expansions [14.3-14.4]

Week 7: Fourier Series – Sine cosine and complete [15.1-15.3]

Week 8: Orthogonal Polynomials, generating functions [14.1-14.2]

Week 9: Functions of a Complex variable, Cauchy-Riemann and complex integration [18.1-18.3]

Week 10: Cauchy integral formula, Taylor and Laurent series [18.4-18.5]

Week 11: Residue theorem, evaluation of real definite integrals [18.6, 19.2]

Week 12: Fourier integral transform – Sine, cosine and complex [17.5]

Week 13: Additional properties and Applications of Fourier transform

Week 14: Method of solution to partial differential equations – Laplace eqn [Ch16, 16.2]

Week 15: Method of solution to partial differential equations – Diffusion eqn [Ch16 16 16.5]

Week 16: Method of solution to partial differential equations – Wave equation [Ch 16 16.3-16.4]

Course Objectives and Expected Learning Outcomes

The course will provide the student with exposure to advanced mathematical techniques employed
widely in research within the physical sciences and engineering disciplines. Graduate students
taking Math 522 will be assigned additional homeworks and/or small class projects over the
Absence and Class Participation Policy

The UA’s policy concerning Class Attendance, Participation, and Administrative Drops is available at: http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, http://policy.arizona.edu/human-resources/religious-accommodation-policy.

Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: https://deanofstudents.arizona.edu/absences

Participating in the course and attending lectures and other course events are vital to the learning process. As such, attendance is required at all lectures and discussion section meetings. Absences may affect a student’s final course grade. If you anticipate being absent, are unexpectedly absent, or are unable to participate in class online activities, please contact me as soon as possible. To request a disability-related accommodation to this attendance policy, please contact the Disability Resource Center at (520) 621-3268 or drc-info@email.arizona.edu. If you are experiencing unexpected barriers to your success in your courses, the Dean of Students Office is a central support resource for all students and may be helpful. The Dean of Students Office is located in the Robert L. Nugent Building, room 100, or call 520-621-7057.

Makeup Policy for Students Who Register

Students who register late will be assigned homework grades for the missed homeworks as an average of the first 5 homeworks they complete.

Course Communications

All course related materials are posted at the website http://www.acms.arizona.edu/Math422-522/index.html. Additional course notes with supplementary materials are also posted at this website. Class information will also be posted to D2L.

Required Texts or Readings

Availability: purchased, library reserve with limited ebook access.

Assignments and Examinations: Schedule/Due Dates

There will be two one hour and fifteen minute tests with dates announced in advance as well as the Final Exam held on Wednesday May 6th, 2019 – 3:30-5:30pm. All tests are held in the classroom.

No books, notes or calculators are allowed in these examinations. Your final grade for this course will be determined by the scores of all examinations and the homework grades. The dates of each test will announced at least one week before it is scheduled. The final exam counts twice as much as each one-hour test and the homework will contribute the equivalent of a single test. No make-up examinations will be given. If you have missed a one-hour test through no fault of your own, the final grade for this course will be determined by replacing the missing test scores with the score of the final examination. If you miss the final examination and if you have a well-documented excuse showing that for reasons beyond your control it has been absolutely impossible for you to take the final examination, and if you had a passing grade at the time of the final examination, a grade of I will be given for the course. In all other cases a score of zero will be assigned for the final examination and the course grade evaluated accordingly.
Final Examination or Project

Final Exam on Wednesday May 6th, 2019 – 3:30-5:30pm. Final Exam Regulations: https://www.registrar.arizona.edu/courses/final-examination-regulations-and-information, and Final Exam Schedule: http://www.registrar.arizona.edu/schedules finals.htm

Grading Scale and Policies

Grades for the course are assigned as follows:

<table>
<thead>
<tr>
<th>Homework 100pts</th>
<th>Test 1 100 pts</th>
<th>Test 2 100 pts</th>
<th>Final 200pts</th>
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Letter grades are assigned as a percentage of the total score: A(>85%-100%), B(>70%-85%), C (>60%-70%), D (>50%-60%) and F (≤ 50%). The overall score for the class is computed as a percentage of 500 total points.

Homeworks missed will be assigned 0 pts and the overall homework score will be calculated as an average over the total number of assigned homeworks. Assigned homeworks are due in class or before 5pm on the due date in the instructor's office.

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete and http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal respectively.

Classroom Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

Students are asked to refrain from disruptive conversations with people sitting around them during lecture. Students observed engaging in disruptive activity will be asked to cease this behavior. Those who continue to disrupt the class will be asked to leave lecture or discussion and may be reported to the Dean of Students.

The use of personal electronics such as laptops, iPads, and other such mobile devices is distracting to the other students and the instructor. Their use can degrade the learning environment. Therefore, students are not permitted to use these devices during the class period.

Threatening Behavior Policy

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students.

Accessibility and Accommodations

At the University of Arizona we strive to make learning experiences as accessible as possible. If you anticipate or experience barriers based on disability or pregnancy, please contact the Disability Resource Center (520-621-3268, https://drc.arizona.edu/) to establish reasonable accommodations.

Code of Academic Integrity

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code
of Academic Integrity as described in the UA General Catalog. See: http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity.

The University Libraries have some excellent tips for avoiding plagiarism, available at http://new.library.arizona.edu/research/citing/plagiarism.

*Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor’s express written consent.* Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

**UA Nondiscrimination and Anti-harassment Policy**

The University is committed to creating and maintaining an environment free of discrimination; see http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy

Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

**Additional Resources for Students**

UA Academic policies and procedures are available at http://catalog.arizona.edu/policies

Student Assistance and Advocacy information is available at http://deanofstudents.arizona.edu/student-assistance/students/student-assistance

**Confidentiality of Student Records**


**Subject to Change Statement**

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.