ASEN 5227 (Sections 001, 001B)
Aerospace Mathematics 1
Fall 2017

Time: Tue, Thurs, 03:30-4:45 **Location:** ECCR 150 **Website:** D2L ASEN 5227	**Instructor:** Mahmoud I. Hussein Associate Professor of Aerospace Engineering Sciences; H. Joseph Smead Faculty Fellow OFFICE: ECAE 194 Hours: Wed 3:00pm-5:00 pm E-MAIL: mih@colorado.edu Tel: 303-492-3177
	Teaching Assistant: Ashwin Yerasi Graduate Student Research Assistant OFFICE: ECAE 128 Hours: Tue 11:00am-12:00 pm Wed 11:00am-12:00 pm E-MAIL: ashwin.yerasi@colorado.edu

Description: Aerospace Math 1 provides an introduction to methods of advanced engineering analysis. The prime focus of the course is on elements of **vector and tensor analysis** as these form the basis for the theoretical development of advanced continuum mechanics (including fluid and solid mechanics) and other aerospace engineering topics such as dynamics and control. In addition, as a special topic, the course will cover **analysis of numerical ODE methods** with emphasis on concepts such as accuracy and stability. Depending on time, the topic of **calculus of variations** may also be briefly covered.

Objective: Introduce vector and tensor analysis methods and, tentatively, calculus of variations for advanced engineering (including aerospace) applications, and introduce fundamental analysis techniques for common numerical methods pertaining to ODEs.

Prerequisites: Undergraduate calculus, differential equations, and simple programming skills, particularly with MATLAB and/or Mathematica.

Reference (not mandatory): Harman, T.L., Dabney, J.B., and Richert, N.J., Advanced Engineering Mathematics with MATLAB.

Additional References (not mandatory):

1. Boas, *Mathematical Methods in the Physical Sciences*, 2006
2. Borisenko and Tarapov, *Vector and Tensor Analysis with Applications*, Dover, 1968.
3. Hildebrand, *Methods of Applied Mathematics, 2nd Ed.*, Prentice-Hall, 1965.
4. Kreyszig, *Advanced Engineering Mathematics, 8th Ed.*, Wiley, 1999.
5. Reddy and Rasmussen, *Advanced Engineering Analysis*, Wiley, 1982, Reprint, Krieger, 1990.
6. Trefethen and Bau, III, *Numerical Linear Algebra*, 1997

Topical Outline

1. Elements of Vector and Tensor Analysis and Linear Algebra (Class Notes; Ref. Chaps. 1-4, 13,14)
   - Vector algebra
   - Topics in linear algebra
   - Coordinate systems and vector calculus
   - Dyadics and tensors
2. Calculus of Variations and Variational Methods (Class Notes; Text Chap. 12) [Tenatative]
   - Extrema of functions
   - Extrema of functionals and the Euler-Lagrange equation
   - Variational methods of approximation
3. Techniques and Analysis of Numerical Ordinary Differential Equations (Class Notes; Ref. Chap. 5-6)
   - Classification
   - Initial value problems
   - Systems of ODEs
   - Analysis of Numerical methods

Coursework	Grading
Exercise Sheets (bi-weekly)	N/A (not to be handed in)
Homework (bi-weekly)	15%
Exam 1	25%
Project	30%
Exam 2	30%

Notes

1. Homework assignments and solutions are posted on the class website. These assignments will be graded. If you must miss class for an excused absence, you may submit your homework early. Late homework will be subject to deductions in grade. If you know in advance that you must miss a homework due date, send your instructor an e-mail to make arrangements.
2. Exercise sheets and solutions will also be posted on the class website. These exercise problems are not to be handed in. However, they supplement the homework assignments in providing coverage of the course material and you are expected to complete these exercise sheets on a timely manner and prior to the exams.
3. The Project reports are due 5pm on the due date, or as indicated on the project assignment handout. If you have a late submission, 10% of the grade will be deducted. If you must miss class for an excused absence, you may submit early. Project assignments submitted after the next class session following the due date are not accepted as the project will be reviewed in that class session.
4. Exams will be take-home. **Collaboration on exams, using another student's work as your own, or allowing another student to use your work as their own is academic misconduct and is not tolerated.**
5. Always submit work with a professional appearance. Neatness, clarity, and completeness count.
6. Please see "**Statements on University Rules and Regulations**" page below for more information concerning university policies, rules and regulations.

Additional Information for Section 001B

The students of Section 001B will be talking the course remotely. Video screening and recordings will be available to these students through the BBA system. Students are encouraged to attend the classes via online connection during class; however this is not a requirement.

To join the class live, follow the instructions below:

Your Zoom meeting ID for your ASEN 5227 course (for the Fall 2017 semester): **324-759-344**

Here is how to connect to your Zoom meeting ID:

- Join via web browser: https://cuboulder.zoom.us/j/324759344
- Join via Zoom app (using meeting ID)
- Join via phone: 1-646-558-8656 or 1-408-638-0968

Additionally, if you need help with getting Zoom up and running, please visit the following link:

http://www.colorado.edu/oit/services/conferencing-services/web-conferencing-zoom

Finally, please ensure you include the following accessibility statement in your syllabus:

This course requires the use of the Zoom conferencing tool which is currently not accessible to users using assistive technology. If you use assistive technology to access the course material, please contact your faculty member immediately to discuss.

Contact:
John Azbell, CTS, Distance Learning Studios Manager
Office of Information Technology | University of Colorado Boulder
Email: John.Azbell@Colorado.EDU; Tel.: (303) 492-2676

Any questions concerning the Zoom meeting process, or the BBA set up for the class in general, should be addressed to Mr. John Azbell (see contact information above) and copied to the course instructor, Prof. Mahmoud Hussein.

Statements on University Rules and Regulations:

- If you qualify for accommodations because of a disability, please submit to your professor a letter from Disability Services in a timely manner (for exam accommodations provide your letter at least one week prior to the exam) so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities. Contact Disability Services at 303-492-8671 or by e-mail at dsinfo@colorado.edu.

If you have a temporary medical condition or injury, see Temporary Injuries under Quick Links at Disability Services website (http://disabilityservices.colorado.edu/) and discuss your needs with your professor.

- Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, a student with a religious obligation should contact the instructor to discuss possible arrangements for accommodation.
  See full details at
  http://www.colorado.edu/policies/observance-religious-holidays-and-absences-classes-andor-exams

- Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, color, culture, religion, creed, politics, veteran's status, sexual orientation, gender, gender identity and gender expression, age, disability, and nationalities. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise the course instructor of this preference early in the semester so that I may make appropriate changes to my records. See policies at
  http://www.colorado.edu/policies/student-classroom-and-course-related-behavior
  and at
  http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code

- The University of Colorado Boulder (CU-Boulder) is committed to maintaining a positive learning, working, and living environment. The University of Colorado does not discriminate on the basis of race, color, national origin, sex, age, disability, creed, religion, sexual orientation, or veteran status in admission and access to, and treatment and employment in, its educational programs and activities. (Regent Law, Article 10, amended 11/8/2001). CU-Boulder will not tolerate acts of discrimination or harassment based upon Protected Classes or related retaliation against or by any employee or student. For purposes of this CU-Boulder policy, "Protected Classes" refers to race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, or veteran status. Individuals who believe they have been discriminated against should contact the Office of Discrimination and Harassment (ODH) at 303-492-2127 or the Office of Student Conduct (OSC) at 303-492-5550. Information about the ODH, the above referenced policies, and the campus resources available to assist individuals regarding discrimination or harassment can be obtained at http://www.colorado.edu/institutionalequity/

- All students of the University of Colorado at Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor Code Council (honor@colorado.edu; 303-735-2273). Students who are found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). Other information on the Honor Code can be found at http://www.colorado.edu/policies/student-honor-code-policy and at http://honorcode.colorado.edu