Syllabus

MAE 3303 - Aerodynamics of Compressible Flow
(Required course by AE program)

1. **Instructor:** Zhen Han
2. **Email Address:** han@uta.edu
3. **Office Phone No.:** 817-272-7376
4. **Office Location:** 204B, Woolf Hall
5. **Office Hours:** M/W 10:00am - 11:30am
6. **Meeting Days&Times:** M/W/F 9:00am - 9:50am, Jan 14 - May 3, 2013
7. **Final Exam Schedule:** 8:00am - 10:30am, Wednesday, May 8, 2013
8. **Meeting Location:** WH311
9. **Course Website:** elearn.uta.edu
    - Quiz/homework/exam grades will be posted on the course website
    - Check your grades every week and report errors within a week
10. **Course Prerequisites:** C or better in MAE 2315, C or better in MAE 3309 (or MAE 3310), C or better in MAE 3360.
11. **Required Readings/Materials:** Text book: Fundamentals of Aerodynamics, Fifth Edition, John D. Anderson, Jr.. McGraw-Hill. ISBN: 978-0-07-339810-5.
12. **Course Contents:**
    (a) **Aerodynamic Characteristic of Airfoil and Wings**
        - Airfoil nomenclature
        - Aerodynamic forces and moments
        - Center of pressure and aerodynamic center
        - Airfoil characteristics

- General thin airfoil theory
- Wings of finite span

(b) **Introduction to compressible flow**

- Compressibility of a fluid and compressible flow
- A brief review of thermodynamics
- Adiabatic and isentropic flows
- Energy equation
- Total properties
- Sonic reference conditions
- Governing equations for inviscid flows

(c) One-dimensional flow and normal shock waves

- One-dimensional flow equations
- Speed of sound and Mach number
- Alternative forms of energy equations
- Total reference conditions in terms of Mach number
- Propagation of disturbance
- Formation of a normal shock wave
- Normal shock relations
- Measurement of velocity in a compressible flow
- Moving normal shock waves

(d) Oblique shock and expansion waves

- Mach wave
- Oblique shock wave relations
- Supersonic flow over wedges and cones
- Shock interactions and reflections
- Detached shock wave
- Prandtl-Meyer expansion waves
- Shock-expansion theory: applications to supersonic airfoils
- Shock-wave/boundary-layer interaction

(e) Compressible flow through nozzles, diffusers and wind tunnels

- Governing equations for quasi-one-dimensional flow

- Area-velocity relation
- Mach number - Area relation for isentropic flow through a nozzle
- Chocked flow
- Converging-diverging nozzle operations
- Diffusers
- Supersonic wind tunnel

(f) Subsonic compressible flow over airfoils: linear theory

- Rotational and irrotational flows
- Velocity potential equation
- Linearized velocity potential equation
- Pressure coefficient of the linearized theory
- Linearized subsonic flow and compressibility corrections
- Critical Mach number and critical pressure coefficient
- Drag-divergence Mach, sound barrier, area rule, and supercritical airfoils

(g) Linearized supersonic flow

- Linearized supersonic pressure coefficient
- Wave drag
- Application to supersonic airfoil

13. **Course Learning Goals/Objectives:** An understanding of the fundamentals and calculations of compressible flow

14. **Attendance:** Attendance is required

15. **Specific Course Requirements**

(a) **Quizzes:**

- Approximately 10 in-class pop-quizzes
- No make-up quiz for any absence

(b) **Homework:**

- Assigned in each week and due at the beginning of Wednesday's class
- If not explicitly stated otherwise, each homework problem will be graded out of 10 points

- Must follow the required format (see Homework Instructions)
- All homework that is obviously transcribed will receive a score of zero.
- There might be homework due in the final review week.
- No late homework is accepted

(c) **Exams:**

- 2 midterms and 1 final (3 exams total)
- Closed book/notes (Appendices A, B, and C in the text book will be provided)
- No electronic devices except scientific calculators
- Comprehensive final exam
- No make-up exam for unapproved absence

(d) **Key Assignments:** *Key assignments are utilized to assess students' ability to identify, formulate and solve engineering problems in this class. This semester, all exams will be designated as key assignments. Students must score no less than 50% in each of two exams to pass the key assignments. If any key assignment is not passed, the student will not pass the class even if he/she scores perfectly in other assignments/exams/quizzes.*

(e) **Grading Policy:**

- Pop-quizzes: 5% (Bonus)
- Homework: 10%
- Exams: 90% (3 exams, 30% each)

(f) **Final Letter Grade Assignments:**

Percent	Letter Grade
≥ 90	A
≥ 80 <90	B
≥ 70 <80	C
≥ 60 <70	D
<60	F

16. **Other Information:**

- **Drop Policy:** Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the

late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. Students will not be automatically dropped for non-attendance. Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. Contact the Financial Aid Office for more information.

- **Americans with Disabilities Act:** The University of Texas at Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including the Americans with Disabilities Act (ADA). All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability or by calling the Office for Students with Disabilities at (817) 272-3364.

- **Academic Integrity:** It is the philosophy of The University of Texas at Arlington that academic dishonesty is a completely unacceptable mode of conduct and will not be tolerated in any form. All persons involved in academic dishonesty will be disciplined in accordance with University regulations and procedures. Discipline may include suspension or expulsion from the University. According to the UT System Regents Rule 50101, 2.2, "Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts."

- **Student Support Services Available:** The University of Texas at Arlington provides a variety of resources and programs designed to help

students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. These resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals to resources for any reason, students may contact the Maverick Resource Hotline at 817-272-6107 or visit www.uta.edu/resources for more information.

- **Electronic Communication Policy:** The University of Texas at Arlington has adopted the University MavMail address as the sole official means of communication with students. MavMail is used to remind students of important deadlines, advertise events and activities, and permit the University to conduct official transactions exclusively by electronic means. For example, important information concerning registration, financial aid, payment of bills, and graduation are now sent to students through the MavMail system. All students are assigned a MavMail account. Students are responsible for checking their MavMail regularly. Information about activating and using MavMail is available at http://www.uta.edu/oit/email/. There is no additional charge to students for using this account, and it remains active even after they graduate from UT Arlington.

- **Final Review Week:** A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week unless specified in the class syllabus. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. Classes are held as scheduled during this week and lectures and presentations may be given.

- **Academic Dishonesty**

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