

The University of Texas at San Antonio  
Department of Mechanical Engineering  
ME 5633 Gas Dynamics | CRN: 24594  
Syllabus

**Course Description:**

(2-3) 3 Credit Hours.

Integral and differential forms of the conservation equations, one-dimensional flow, oblique shock and expansion waves, and supersonic, transonic, and hypersonic flows.

**Prerequisites:**

Graduate standing and consent of instructor.

**Instructors:**

Christopher Combs, Ph.D.

Office: EB 3.04.26

E-mail: [ccombs@utsa.edu](mailto:ccombs@utsa.edu)

Office Hours: Monday & Wednesday 10 AM-12 Noon or by appointment

Debashis Basu, Ph.D., P.E.

Senior Research Engineer, Southwest Research Institute

E-mail: [debashis.basu@swri.org](mailto:debashis.basu@swri.org)

Office Hours: Wednesday 5-6 PM

**Time:**

Lecture: 8/26 | 6:00-7:15 PM

8/28-10/9 | Wednesday 6:00-8:30 PM

10/14-11/25 | TBD

11/20 | Wednesday 6:00-7:15 PM

11/25 | Monday 6:00-7:15 PM

12/2-12/4 | TBD

**Location:**

Lecture: EB 3.04.30

**Textbook:**

Anderson, J. D., Modern Compressible Flow, 3rd Edition, McGraw-Hill

**Major prerequisites by topic:**

1. Differential and Integral Calculus
2. Fluid Dynamics
3. Thermodynamics

**Topics covered:**

1. Speed of sound
2. Compressible conservation equations
3. Normal shocks
4. Rayleigh/Fanno flow
5. Oblique shocks and expansion fans
6. Shock reflections and intersections
7. Area-velocity relationship and nozzles
8. Unsteady wave motion
9. Method of characteristics

- 10. Hypersonic flows
- 11. Non-equilibrium flows
- 12. Compressible boundary layers

**Grading:**

The grading will be calculated as follows:

Homework	30%
Midterm Exam	30%
Final Exam	40%
<b>Total</b>	<b>100%</b>

A standard decade scale ( $A \geq 90\%$ ,  $B+ = 88-89.9$ ,  $B = 80-87.9\%$ ,  $C+ = 78-79.9\%$ ,  $C = 70-77.9\%$ ,  $D = 60-69.9\%$ ,  $F < 60\%$ ) will be used to assign final grades in this course. The instructors reserve the right to curve grades in a manner that will benefit students.

**Exam Policy:**

Per the UTSA Mechanical Engineering Department’s exam policy, there will be no bathroom breaks during an exam (unless a student provides a medical note). There will also be no electronic devices (phone, smart watch, camera, electronic glasses, computer, unapproved calculator, etc.) on student body (in pockets, boots, clothing, etc.) or within reach (under seat, on adjacent seat, etc.) during exams. Having an unapproved electronic device accessible during an exam will be considered cheating and handled as a case of academic dishonesty.

**Approved Calculators for Exams:**

The FE exam calculator policy ([www.ncees.org](http://www.ncees.org)) will be used for exams. Only the models listed below may be used during exams:

- Hewlett Packard – all HP 33s and HP 35s (~\$60) models
- Casio - all fx-115 (~\$17) and fx-991 (~\$18) models
- Texas Instruments - all TI-30X (~\$10) and TI-36X (~\$19) models

**Excused Absences:**

Excused absences include personal illnesses, deaths in the family, religious holidays, and UTSA sponsored activities. For illnesses, you must provide documentation (physician’s statement/note, etc.) within 3 class meetings in order to be excused. Absences in observance of religious holidays are authorized only if you notify your instructor in writing (email or physical note) at least one week in advance. UTSA sponsored events require an original signed letter on UTSA letterhead from the faculty or staff sponsor.

**Make-up Exams:**

Make-up exams will not be allowed unless previously approved by the instructor.

**Late Work:**

Late work will only be accepted if a student has an excused absence on the day an assignment is due. Students missing class on the due date of an assignment owing to a planned excused absence (religious holiday or UTSA sponsored activity) should arrange with the instructor an appropriate time to submit the assignment. If an assignment is not submitted, the grade will always be a 0.

**Lecture Attendance:**

While attendance in the lecture portion of the class is not mandatory, the student will be responsible for learning all of the material covered in the lectures.

**Extra Credit**

Any potential extra credit opportunities will be offered by the instructor to the class as a whole and will never be offered exclusively to individual students hoping to improve their grade. Solicitations by students for extra credit opportunities will not be provided with a response, given that this action would violate UTSA policy by promoting differential treatment between students.

**Scholastic Dishonesty:**

Scholastic dishonesty is a serious offense that includes, but is not limited to, copying homework, cheating on a test, plagiarism, or collusion. The Office of Student Life (458-4720) should be contacted if a student has questions about what constitutes scholastic dishonesty/  
[http://utsa.edu/studentlife/conduct/scholastic\\_dishonesty.html](http://utsa.edu/studentlife/conduct/scholastic_dishonesty.html)

While it is acceptable to look at other students' reports for the purpose of seeing the format and style, it is a violation of University policy to plagiarize (copy) text from other students' work without proper citation. Figures must also be original.

Cases of suspected scholastic dishonesty related to exams and written reports will be prosecuted through the UTSA Office of Student Life, with the recommended penalty that the student receive an "F" grade for the class.

**Blackboard:**

Some of the documents you need for this course will be posted in Blackboard. It is your responsibility to check Blackboard on a regular basis throughout the semester. I may post important messages regarding assignments, schedules, and any changes to the syllabus through in Blackboard. These messages may require a response from you. Some assignments and quizzes will be posted to Blackboard as well.

To learn how to navigate Blackboard, you can view these tutorials:

<https://www.youtube.com/playlist?list=PLontYaReEU1seUE3ACG3sEc3zR7Br7URU>

**Electronic Devices:**

Laptops and/or tablets are encouraged in class. I will show you step-by-step how to complete various assignments and we will also have activities where your electronic devices will be very useful to you. (Remember, you can borrow a laptop from the library: <https://lib.utsa.edu/services/technology-lending>).

Phones must be on silent or vibrate during class time. If you are using your device in a way that is distracting or not related to class, you may be asked to either put away the device or to leave class. Also, please do not sit in class with headphones or earbuds in your ears. This can be distracting and is considered to be unprofessional.

**Audio/Video Recording:**

Feel free to record any lectures or presentations in my class for your own personal use at UTSA. However, these recordings may not be duplicated, shared, or disseminated without the express written consent of the instructor.

**Course Evaluation:**

I use the feedback provided by my students in course evaluations to improve my teaching. Additionally, course evaluations are a strategy used by the university as one factor in evaluating an instructor's effectiveness. As a faculty member, I encourage you to complete the course evaluation during the availability period near the end of the semester so that I can make improvements for my next group of students.

**University Policies:**

Required university policy link: <http://teaching.utsa.edu/wp-content/uploads/2018/07/Required-University-Policies.pdf>

Roadrunner's Creed: <https://www.utsa.edu/studentlife/creed.html>

**Student Support Services:**

<http://teaching.utsa.edu/wp-content/uploads/2018/07/UTSA-Student-Support-Services.pdf>

**Responsible Employee Notice:**

The University has an obligation to maintain an environment free of sexual harassment and sexual violence, thus many University employees, including the instructor, have mandatory reporting and response obligations and may not be able to honor a complainant's request for confidentiality. Complainants who want to discuss a complaint in strict confidence may use the resources outlined in HOP Section IX.A.5, "Confidential Support and Resources" at the following link: <http://www.utsa.edu/hop/chapter9/9-24.html>

**Disclaimer:**

This syllabus is provided for informational purposes regarding anticipated course content and schedule of courses. It is based on the most recent information available on the date of its issuance and is as accurate and complete as possible. I reserve the right to make any changes necessary and/or appropriate and will make every effort to communicate any changes in a timely manner in class. Students are responsible for staying up to date on any changes to the syllabus that may occur during the term of this course.

**The University of Texas at San Antonio**  
**Department of Mechanical Engineering**  
**ME 5663 Gas Dynamics**  
**Fall 2019**  
**Course Schedule**

*(all dates tentative, changes will be announced in class)*

<b>Class</b>	<b>Date</b>	<b>Lecture Topic</b>	<b>Instructor(s)</b>	<b>Homework Assignment</b>
1	26-Aug	Course Overview and Introduction	Combs	
2	28-Aug	Ch. 1 - Compressible Flow and Thermo Review, Derivation of Conservation Equations, Navier-Stokes and RTT	Basu	
3	4-Sep	Ch. 1 & Ch. 2 Completed Chapter 3 Begins, All Derivations Completed	Basu	HW 1 assigned
4	11-Sep	Ch. 3 - 1D Flow, Speed of Sound, Comp. Cons. Eqs., Normal Shock Relations, Rayleigh/Fanno Flow	Basu	HW 1 due, HW 2 assigned
5	18-Sep	Ch. 3 - Example Problems, Ch. 4 - Shock Reflections, Reflections, Intersections and Jets	Basu	HW 2 due, HW 3 assigned
6	25-Sep	Ch. 4 - Example Problems, 3D Flows Ch. 5 - Area-Velocity Relation and Nozzles	Basu	
7	2-Oct	Ch. 5 - Continue Area-Velocity Relation and Nozzles Midterm Review	Basu	HW 3 due
<b>8</b>	<b>9-Oct</b>	<b>Midterm Exam</b>	<b>Basu</b>	
9	14-Oct	Ch. 5 - Example Problems and Exam Discussion	Combs	
10	16-Oct	Ch. 7 - Unsteady Wave Motion	Combs	HW 4 assigned
11	21-Oct	Ch. 7 - Method of Characteristics	Combs	
12	23-Oct	Ch. 7 - Example Problems	Combs	
13	28-Oct	Wind Tunnel Facility Types and Design Considerations	Combs	HW 4 due
14	30-Oct	Ch. 15 - Hypersonic Flow	Combs	HW 5 assigned
15	4-Nov	Ch. 16 - High-Temperature Gases and Non-Equilibrium	Combs	
16	6-Nov	Compressible Boundary Layers	Combs	HW 5 due, HW 6 assigned
17	11-Nov	Shock-Wave/Boundary-Layer Interactions	Combs	HW 6 due
18	13-Nov	Ramjets and Scramjets	Combs	
19	18-Nov	Experimental Measurements in Compressible Flows	Combs	
20	20-Nov	Computational Methods for Compressible Flows I	Basu	
21	25-Nov	Computational Methods for Compressible Flows II	Basu	
	27-Nov	<i>Thanksgiving - No Class</i>		
27	2-Dec	Final Exam Review	Combs	
<b>28</b>	<b>4-Dec</b>	<b>Final Exam</b>	<b>Combs</b>	