Plan

AE 707 – Aerodynamics of Aerospace Vehicles

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Contact

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- Office hours: By appointment made by email at least 2 hours prior

Topics

1. Potential flow, Circulation and lift generation, Kutta condition.
2. Thin airfoil theory, Source, Vortex and doublet panel methods.
3. Potential flow over finite wings, lifting-line theory, Vortex lattice method.
4. Subsonic compressible flow over airfoils, Prandtl-Glauert Compressibility correction.
5. Supersonic flow over airfoils, Ackeret Theory. Oblique shocks and expansion waves, shock expansion method.
6. Supersonic flow over finite wings, subsonic / supersonic leading edge. Linearized theory, Supersonic vortex lattice method.
7. Slender Body Theory: Introduction to Transonic flows, Conical flows, Hypersonic flow and high-temperature flows.

Course material

Textbooks

- Anderson, Fundamentals of aerodynamics, 5 ed., McGraw Hill, 2010
- Bertin & Cummings, Aerodynamics for engineers, 6 ed. Pearson, 2013
- Kuethe & Chow, Foundations of aerodynamics, 5 ed., John Wiley, 1998
- Ashley & Landahl, Aerodynamics of wings & bodies, Dover, 1985

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References

- Houghton, Carpenter, Collicott & Valentine, Aerodynamics for engineering students, 6 ed., Elsevier, 2013
- Shapiro, The dynamics and thermodynamics of compressible fluid flow – Vol. 1, Ronald Press, New York, 1953
- Talay, Introduction to the aerodynamics of flight, NASA SP-367, 1975

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Very few notes/slides will be uploaded; students must take notes

Evaluation

Test	%
Quiz 1	10
Programming Assignment 1	15
Mid-semester exam	20
Quiz 2	10
Programming Assignment 2	15
Attendance	5
End-semester exam	25

Details on Quizzes

- There will be 2 quizzes, one in each half of the semester
- The tentative dates for the quizzes are 26th Aug and 21st Oct
- Each quiz will cover all topics from the start of the respective half semester to the day before the quiz
- Each quiz will be of 45 minutes
- Quizzes will be conducted in the last half of normal classes

Details on Programming Assignments

- This is a group activity – the class will be divided into 8-9 groups of 4-6 students each
- No discussion or collaboration is allowed between groups
    - If any sign of duplication is observed, 100% penalty will be applied for all parties involved
    - No excuses will be entertained in this regard
    - Also, each such student in the delinquent group(s) will get a grade penalty for each infraction
- Assignments received within 1 week of the announced deadline will incur 50% penalty; further delays will incur 100% penalty
- You can use any language: eg. python, C, MATLAB, etc.

Details on Programming Assignments (Contd.)

All students in a group may not be equally good at programming initially

- However, it is the responsibility of the group as a whole to impart the necessary skills to all group members
- In particular, all group members should get together and participate in the programming activity

To encourage and ensure the acquisition of programming knowledge by the entire class, there will be a presentation for each assignment where

- 1 group member will be randomly chosen to defend the program/results
- No other group member can contribute to the presentation
- Entire group will be evaluated based on the one student's presentation

Issues with group dynamics should be brought to the attention of the instructor/TAs well in advance of the submission deadline

- Last-week issues will not be entertained

Attendance Policy

Attendance is compulsory

- IITB attendance policy for the students will be strictly followed
- There will be 5 marks for attendance in the final grade
- Students whose attendance is below 80% of the total no. of classes will not get any marks in this regard; others will get the full 5 marks

Attendance will be taken in the first 3 minutes of class

Students entering later than 3 minutes will be marked absent (no excuses!)

Grading policy

Your score will be first normalized with the highest score

AA: 100 – 90, AB: 90 – 80, BB: 80 – 70, BC: 70 – 60,
CC: 60 – 50, CD: 50 – 40, DD: 40 – 30, FR: Below 30

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Note:

- The above assumes that actual score of at least one student is ≥ 85
- If not, then no one will be given an AA grade
- Scores will be normalized as: score = (your_actual_score) $\times$ 90/85
- Letter grades will then be assigned based on the scheme given above