AE 616/236: HW 2. Due 23/10/2024, 12 noon. Total=30

This is a GRADED Group work (see groupings on next page – same as for previous homework).

Submit a link to a Google Colab document of your work, including detailed explanation, code listing and the results as mentioned below. Make sure that the Colab workbook can be EXECUTED by all (TAs and me); please do verify this for hassle-free grading. Also, you have to submit a pdf created directly from the Google Colab document (for my ease of grading). Ensure that there is no loss of information in the export to pdf.

Although the following problems are disparate, please solve them in the same Colab workbook, for ease of submission and evaluation.

You may use your own root-finding function, or any existing package.

NB: A further 20 marks is allocated to the presentation of your work, to be held immediately after the submission deadline. The overall 60 marks will be scaled to 10% of your final grade.

1. (10 points) **Fanno flow:** Consider example 8.3 of Yahya's textbook that was discussed in class; it had a specified supersonic inlet, sonic outlet and pre-shock Mach number, and you were asked to find the lengths of the duct upstream and downstream of the shock. Now consider the related, and more practical, problem, where you are given the length of the duct and the inlet (supersonic) Mach number, and told that the outlet is sonic. Write a code to find the location of the normal shock in the duct, if it exists. Show that it reproduces the solution of the example problem. Also exercise your code by making up some other problems. Do you find situations where your code fails to produce any answer? Why?

2. (10 points) **Interaction of shocks of opposite families:** Write a code (and run it) to solve Example 6.5 of Oosthuizen's textbook (which has a mistake towards the end of the solution). Find and solve similar examples from other textbooks/references to validate your code.

3. (10 points) **Shock expansion theory:** Write a code (and run it) to solve Example 4.15 of Anderson (2003) involving calculation of supersonic flow over a flat plate using shock-expansion theory. Calculate the c_l and c_d. Also, calculate the precise slip-line angle (see Fig. 4.37 of the book). Find similar examples from other textbooks/references to validate your code.

Group	Roll No	Name
1	24m0003	Ambuj Nayan
	23m0035	Mahesh Vitthalrao Bayas
	23m1653	Mohit Dhaka
	24m0011	Aditya Nilesh Dhamne
	24m0055	Mayur Mayur
2	22b1833	Namala Aadarsh
	24m0032	Darsh Yogesh Butala
	24m0038	Rahul Giri
	24m0002	S Rishabh Kumar
3	24m0013	Manish Barle
	24m0031	Shivangi Dhawan
	23m0023	Manish Kumar
	210100137	Shiva Sudhan R
	24m0016	Mayank Kumar
4	23m0022	Apurva Danabhai Chavda
	24m0037	Yaragani Sai Goutham
	23m1634	Sumit Anand
	24m0034	Shravanth H R
5	190010050	Piyush Hemantkumar Gautam
	24m0039	Sachin Kumar
	24m0040	Manish Sunil Lakhode
	24m0058	Kushal Shanbhag Narcinva
6	24m0015	Ghanshyam Balasaheb Kadam
	24m0014	Sai Sitharth
	24m0004	Patel Jaydipkumar Lalitkumar
	24m0006	Ajaykumar Nandubhai Prajapati
7	24d0003	G Vijaya Lahari
	24m0007	Sanjeev Kumar
	24m0041	Yash Ganeshbhai Maturkar
	24m0012	Patel Arpeet Nileshkumar
	24m0035	Simran Simran
8	24m0005	Abisheik Visagan M
	24m0028	Prasham Mehul Doshi
	24m0010	Santhosh Kumar R
	24m0061	Kurapati Ruby
	23m1624	Sandeep Kumar Singh
9	24d0004	Nitesh Patidar
	24m0036	Guntupalli Venkata Sai
	24m0063	Nivethitha Nagarajan
	24m0059	Arpit Singhal
	24m0029	Soorya Sridhar
10	24m0008	Kodari Sravan
	24m0009	Vinay Kumar Vemulapati
	24m0065	Ram Naresh Mahato
	24m0001	Murali Krishna Y
	23m0036	Yarranagula Krishna Teja