

FCH AE 604 JAN 2018 (Computational Fluid Mechanics)

First Course Handout containing the following details of the course:

- 1. Objectives:** The main motivation in this course is to teach the subject in terms of analysis and design of numerical methods for solving different fluid dynamical equations.
- 2. Prerequisites:** It is expected that the students should have knowledge about fluid dynamics, at the undergraduate level.
- 3. Course Contents:**

Topic	No. of lectures	Lab units
Basics of Governing Equations	3	0
Space-time discretization for PDE	2	0
Classification of PDE	2	0
Grid Generation	2	0
Waves and disturbances in fluid flow	2	0
Space-time scales in fluid flow	1	0
Classical methods for solving parabolic PDEs	4	1
Methods for solving elliptic PDEs	8	1
High Accuracy Methods	4	1
Time Discretization	4	1
Error Analysis: DNS, LES	4	0
Solution of Navier-Stokes Equations	4	0
Total contact "hours"	40	4

*** These are major assignments; each will need equivalent of three afternoons**

- 4. Special Emphasis:** Analysis of numerical schemes used to solve fluid dynamical equations, from the perspective of robustness, efficiency and above all the accuracy of the solution.
- 5. Lecture, Tutorial & Lab Schedule & Venue:** Three lectures, no tutorials. In home assignments, the students are expected to solve problems using computers, either using PC/ laptop etc. at their own convenience and place.

6. **Office Hours:** The students are encouraged to contact instructor at all times, after contacting over the phone.
7. **Evaluation Components & Policies:** Mid semester will have 20%; End semester (comprehensive exam) will have 50% and rest will be for assignments, quiz etc. Attendance is considered very important.
8. **Course Policies:** The instructor will instruct and assist through pedagogy, and students should learn with all sincerity and regularity. No part of the syllabus is considered to be expendable.
9. **Books & References: Suggested text and reference material:**
 - i. **Computational Fluid Dynamics:** (Vol. 1 and 2) C. Hirsch
 - ii. **Computational Fluid Flow and Heat Transfer,** Tannehill, Anderson, Pletcher
 - iii. **High Accuracy Computing Method:** Tapan K. Sengupta (Cambridge Univ. Press, New York 2013)
 - iv. **NPTEL Lectures on Foundations of Scientific Computing: available on Youtube (40 lectures of 55 minutes duration) at**

<http://nptel.iitm.ac.in/courses/101104013/1>