



**Birla Institute of Technology & Science, Pilani**  
Hyderabad Campus

**FIRST SEMESTER 2022-2023**  
Course Handout Part II

29/08/2022

In addition to Part I (General Handout for all courses appended to the timetable), this portion gives further specific details regarding the course.

Course No : **CE F231**  
Course Title : **Fluid Mechanics**  
Instructor-in-charge: **K. SRINIVASA RAJU**  
Chamber No. : **D-107**

**Scope and Objective of the Course:**

This course is an introduction to the field of fluid mechanics. The study covers the fundamentals of fluid transport, including our understanding of governing laws of conservation of mass, energy, and momentum. The emphasis in this course will be to stress more on the above governing laws and their various applications. The unified approach will enable students to tackle real-life problems more comprehensively and provide a broader view of the subject. Another learning curve in the course is acquainting the students with MATLAB.

**Course Level Outcomes:** After successful completion of this course, the student will be able to:

1. Explain the properties of fluids, concepts of fluid statics as well, as buoyancy
2. Compare various methods of flow measurement.
3. Analyze fluid flow through pipes
4. Derive expressions of non-dimensional parameters in model analysis
5. Analyze fluid mechanics from a MATLAB perspective

Student Learning Outcomes (SLOs) assessed in this course – **(a), (b), (c), and (k)**

**Text Book:**

- T1. K. Srinivasa Raju and D. Nagesh Kumar (2020) Fluid Mechanics: Problem-solving using MATLAB, Prentice Hall of India (PHI), New Delhi, ISBN-978-93-89347-63-0

**Reference Books/sources:**

- R1. Modi, P.N. and Seth, S.M. (2019) Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House, New Delhi



- R2. NPTEL Introduction to Fluid Mechanics, Department of Mechanical Engineering, IIT Kharagpur (<https://nptel.ac.in/courses/112/105/112105269/>) (Accessed on 2.8.2020)
- R3. NPTEL Fluid Mechanics, Department of Chemical Engineering, IIT Kanpur (<https://nptel.ac.in/courses/103/104/103104043/#>) (Accessed on 2.8.2020)
- R4. NPTEL Fluid Mechanics, Department of Mechanical Engineering, IIT Kanpur (<https://nptel.ac.in/courses/112/104/112104118/>) (Accessed on 2.8.2020)
- R5. Introduction to Fluid Mechanics and Fluid Engineering, Department of Mechanical Engineering, IIT Kharagpur (<https://nptel.ac.in/courses/112/105/112105183/>) (Accessed on 2.8.2020)
- R6. NPTEL Advanced Fluid Mechanics, Department of Mechanical Engineering, IIT Kharagpur (<https://nptel.ac.in/courses/112/105/112105218/>) (Accessed on 2.8.2020)
- R7. Getting Started with MATLAB (<https://www.mathworks.com/help/matlab/getting-started-with-matlab.html>) (Accessed on 2.8.2020)

#### Lecture-wise Course Plan:

| Lecture No. | Learning objectives  | Topics to be covered  | Chapter in the Text Book | SLO* |
|-------------|--|---|--------------------------|------|
| 1-3         | List the properties of fluids<br>Relate salient properties of fluids   | Mass density, Specific weight, Viscosity, Surface Tension, Compressibility, and Capillarity, Introduction to MATLAB                 | Ch-1(T1)<br>Ch-1(R1)     | a    |
| 4-6         | Discuss fluid pressure at point and variation of pressure<br><br>Relate absolute gauge and vacuum pressure<br><br>Categorize devices for measurement of pressure                       | Pascal's law, Manometer, and its Variations   | Ch-2(T1)<br>Ch-2(R1)     | a, b |
| 7-10        | Compare the total pressure on the plane and curved surface<br><br>Draw pressure diagram for horizontal, vertical, and inclined surfaces<br><br>Stability of floating bodies            | Computation of pressure force, Center of pressure on various surfaces, Metacentric height, Stability Analysis                       | Ch-3,4(T1)<br>Ch-3,4(R1) | a, b |
| 11-13       | State and differentiate five major categories of fluid flow<br><br>Describe the flow pattern in streamline, path lines and streak lines<br><br>Outline three basic principles of fluid | Study of various flow patterns, Rigid body motion, Streamline, Path line, Streak line, Stream function, Velocity Potential, Flownet | Ch-5(T1)<br>Ch-6(R1)     | a, b |



|       |   |  |                        |         |
|-------|---|--|------------------------|---------|
|       | flow  |  |                        |         |
| 14-17 | Describe salient points of Euler's and Bernoulli's equation.<br><br>Apply Bernoulli's equation in the measurement of fluid flow<br><br>List of devices used for measurement of flow | Bernoulli's equation and its Applications, i.e., Venturimeter, Orifice meter, Pitot tube, etc. | Ch-6(T1)<br>Ch-7(R1)   | a, b    |
| 18-19 | Solve forces on pipe bends using the Impulse momentum equation.   | Momentum principle, pipe bends, etc.   | Ch-7(T1)<br>Ch-8(R1)   | a, b    |
| 20-22 | Classify orifices and Mouthpieces<br><br>Compare and contrast the flow patterns through orifices and mouthpieces  | Various types of orifices and mouthpieces  | Ch-8(T1)<br>Ch-9(R1)   | b, k    |
| 23-25 | Categorize notches and weirs<br><br>Describe flow pattern over notches and weirs  | Various types of notches and weirs   | Ch-9 (T1)<br>Ch-10(R1) | b, k    |
| 26-31 | Apply laws of fluid friction in flow through pipes.<br><br>Compare major and minor losses in pipes<br><br>Assess flow through pipes in parallel, series, and branched networks.     | Darcy-Weisbach equation, Pipes in series, Parallel, Branching of pipes, etc.                   | Ch-10(T1)<br>Ch-11(R1) | a, b, k |
| 32-35 | Compare laminar through circular pipes, inclined pipes, and parallel plates   | Hagen-Poiseuille Law for circular pipes flows between two parallel plates.                     | Ch-11(T1)<br>Ch-13(R1) | a, b    |
| 36-42 | Classify and explain two methods of Dimensional Analysis  | Buckingham pie method, Model analysis  | Ch-16(T1)<br>Ch-17(R1) | a, b, e |

#Supplementary material will be provided wherever required.

#### **+ Student Learning Outcomes (SLOs):**

SLOs are outcomes (a) through (k) plus any additional outcomes that may be articulated by the program.

- (a) an ability to apply knowledge of mathematics, science, and engineering
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data
- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- (d) an ability to function on multidisciplinary teams
- (e) an ability to identify, formulate, and solve engineering problems
- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic,



environmental, and societal context

- (i) a recognition of the need for and an ability to engage in life-long learning
- (j) a knowledge of contemporary issues
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

#### Evaluation Scheme:

| Component number | Evaluation Component                                 | Duration (min) | Weightage (%) | Date & Time           | Nature of Component |
|------------------|--|----------------|---------------|-----------------------|---------------------|
| 1                | Mid-Semester Examination                             | 90             | 30            | 04/11 1.30 - 3.00PM   | Closed Book         |
| 2                | Course Project                                       | --             | 10            | Continuous Evaluation | Open                |
| 3                | Surprise Quiz in Lecture and Tutorial (At least 10)* | --             | 20            | Continuous Evaluation | Open                |
| 4                | Comprehensive Examination                            | 180            | 40            | 28/12 FN              | Closed Book         |

\*Best (n-2) would be considered; n is the total number of surprise quizzes conducted.

**Chamber Consultation Hour: MONDAY 5-6 P.M**

**Notices:** Notices concerning this course will be uploaded on Google Classroom Page for this course.

**Make-up Policy:** Make-ups will not be granted under any circumstances.

**Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**INSTRUCTOR-IN-CHARGE**  
**CE F231**

