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**FIRST SEMESTER 2022-2023**

# Course Handout

Date: 11-08-2023

In addition to part-I (General Handout for all courses appended to the time table), this portion gives further specific details regarding the course.

*Course No.* : *ME F212*

## Course Title : FLUID MECHANICS

*Instructors* : Sayan Das

## Instructor-in-Charge : Sayan Das

*Tutorial Instructors* :Sayan Das, Pardha Saradhi G V, N Jalaiah, Supradeepan K

**Scope and Objective of the Course:**

Fluid Mechanics deals with the fundamental laws governing the mass, momentum and energy transfer. The objective of this course is to lay a solid foundation in understanding the properties and behaviour of fluids by means of integral and differential equations along with specific applications related to turbomachines as fluid systems. Since these three phenomena (mass, momentum and energy) are very similar in nature, an integrated approach would not only conserve efforts but also contributes to a greater understanding of this subject. In this course, more emphasis will be given to fluids and its motion in a given system.

**Textbooks:**

1. Frank M White, "Fluid Mechanics", Tata McGraw-Hill, 7th Edition, 2012.

**Reference books**

1. Robert W. Fox and Alan T. Mc Donald, "Introduction to Fluid Mechanics", John Wiley & Sons Private Ltd., 2013, 8th Edition.
2. Yunus A Cengel and John M Cimbala, "Fluid Mechanics", McGraw-Hill, 3rd Edition, 2015.
3. James R. Welty, Charles E. Wicks and Robert E. Wilson, "Fundamentals of Momentum, Heat and Mass transfer", John Wiley & Sons (Asia) private limited., 2008, 5th Edition.
4. James. A. Fay, "Introduction to Fluid Mechanics", Prentice Hall of India, 2007.
5. Milton Van Dyke, "An Album of Fluid Motion", Parabolic Press, 12th Edition.

**Course Plan:**

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| **Lecture No.** | **Learning objectives** | **Topics to be covered** | **Chapter in the Text Book** |
| 1-3 | Basic fluid property relations and frameworks to study fluidic systems. | Fluid properties, continuum fluid | Ch. 1 |
| 4-6 | Applications of hydrostatic principle. | Pressures in static fluid; Static forces on surfaces | Ch. 2 |
| 7-10 | Dynamics of Inviscid fluid, Euler and Bernoulli’s equations and Applications | Fluid Kinematics, stream function, velocity potential, vorticity | Ch. 4 |
| 10-14 | Basic relation between control mass and control volume (RTE) | Integral relations for a control volume: Conservation of mass, momentum and energy | Ch. 3 |
| 15-20 | Application of differential equations to simplified 1-D fluid flow problems. | Differential relations for fluid in motion: Newtonian Fluid; Navier-Stokes equations; Viscous Flows | Ch. 4 |
| 21-24 | Nondimensionalization of basic flow equations, dimensionless numbers and relations between model and prototype. | Dimensional analysis of Navier-Stokes equations; Similarity technique | Ch. 5 |
| 25-30 | Drag force and power calculations of unidirectional internal flow problems. | Internal flows through pipes and ducts | Ch. 6 |
| 31-36 | Drag force and power calculations of unidirectional external flow problems. | External flows past immersed bodies; boundary layer concepts and equations | Ch. 7 |
| 37-40 | Application of auxiliary functions and their relation to analyze fluid flow behavior. | Inviscid fluids, potential flow, rotational & irrotational flows | Ch. 8 |
| 41-42 | Understanding the basic of compressible flows. | Compressible flows |  |

**Evaluation Scheme:**

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| **Component** | **Duration**  **(min.)** | **Weightage (%)** | **Date & Time** | **Nature of Component** |
| Mid sem | 90 Min. | 30% | 09/10 - 9.30 - 11.00AM | Closed book |
| Compre | 180 Min. | 40% | 06/12 FN | Closed book/Open Book |
| CMS based quiz | 5-10 min | 10% | Will be announced in class | Open book |
| Evaluative Tutorials | 50 Min. | 20% |  | Open Book |

**Chamber Consultation Hour:** Monday and Tuesday 5:00 PM to 6:00 PM

**Notices:** All notices concerning this course shall be communicated only through **CMS** (theinstitute’s web based course managementsystem) students are advised to visit CMS regularly for latest updates.

**Make-up Policy:** Make-up shall be given only to the genuine cases with prior confirmation.

**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**

**(ME F212)**