
# Department of Physics

# College of Education

# University of Salahalddin - Hawler

# Subject: Fluid dynamics

# Course Book – (second year)

# Lecturer's name Ass. prof. Dr. Muhamad Abdullah Hamad

# Academic Year: 2022/2023, First Semester

# Course Book

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| **1. Course name** | **Fluid dynamics** |
| **2. Lecturer in charge** | **Muhamad Abdullah Hamad** |
| **3. Department/ College** | **Physics / Education** |
| **4. Contact** | muhamad.hamad@su.edu.krd<br>**Tel: ( 0750 4224153)** |
| **5. Time (in hours) per week** | **Theory: 3 hours/week** |
| **6. Office hours** | **Sunday 08:30 – 09:30, 10:30-12:30**<br>**Monday 08:30 – 10:30, 12:30-1:30** |
| **7. Course code** | |
| **8. Teacher's academic profile** | |
| **9. Keywords** | **Fluid dynamics, fluids** |

## 10. Course overview:

This course intends to provide an overview of the principles of **Fluid mechanics** which is the branch of physics concerned with the mechanics of fluids (liquids, gases, and plasmas) and the forces on them. It has applications in a wide range of disciplines, including mechanical, civil, chemical and biomedical engineering, geophysics, oceanography, meteorology, astrophysics, and biology. The study of fluid mechanics goes back at least to the days of ancient Greece, when Archimedes investigated fluid statics and buoyancy and formulated his famous law known now as the Archimedes' principle, which was published in his work *On Floating Bodies*—generally considered to be the first major work on fluid mechanics. Rapid advancement in fluid mechanics began with Leonardo da Vinci (observations and

experiments), Evangelista Torricelli (invented the barometer), Isaac Newton (investigated viscosity) and Blaise Pascal (researched hydrostatics, formulated Pascal's law), and was continued by Daniel Bernoulli with the introduction of mathematical fluid dynamics in *Hydrodynamica* (1739).

## 11. Course objective:

To develop a fundamental understanding of the science and engineering of fluid mechanics, through rigorous theoretical discussions, analytical examples, practical applications, and computational projects.

## 12. Student's obligation

The students can contribute to a positive learning experience for everyone in the classroom, by fulfilling their fundamental duties:

1. Students should make every effort to maintain good attendance in their classes.
2. Each student should participate in the classroom. Discussing relevant subjects at appropriate times can spark new conversations and produce valuable debates.
3. Students need to respect the ideas and opinions of their classmates in and outside of the classroom.
4. The students should finish homework before entering the classroom.

**Grade information:** Weekly assignments (total weight 10% of grade). Midterm1 (15% of grade), Midterm2 (15% of grade) and Final exam (60% of grade)

## 13. Forms of teaching

**I will try to use a variety of teaching methods, including lectures, tutorials, project work, discussion, and computer-aided learning. I will focus on the way the discussion with the students, where students participate through questions solution**

## 14. Assessment scheme

**Exams**: midterm and final exam.

Exams are meant to test your understanding and ability to apply concepts covered in the course. I therefore do not expect you to memorize constants and equations. I will provide you with a sheet of relevant equations. I will give you the value of any constants you need. Although the main focus of the exams

will be problem solving, all exams will likely contain one conceptual question with a written part to verify that you understand and can explain the physical concepts. Exam and homework problems will be from the textbook

## 15. Student learning outcome:

Be able to analyze and design fluid mechanics components, and acquire the skill requisite to take part in any complex fluid mechanics systems.

## 16. Course Reading List and References:

**Textbooks**:1- LECTURE NOTES ON FLUID DYNAMICS

Mr. Shiva Prasad U Assistant Professor Dr. Govardhan Dr.Professor

INSTITUTE OF AERONAUTICAL ENGINEERING (Autonomous) Dundigal – 500043, Hyderabad

2. Modi and Seth, "Fluid Mechanics", Standard book house, 2011.

3. S.K.Som & G.Biswas, "Introduction to Fluid Machines", Tata Mc Graw Hill publishers Pvt. Ltd, 2010.

4. Potter, "Mechanics of Fluids", Cengage Learning Pvt. Ltd., 2001.

5. V.L. Streeter and E.B. Wylie, "Fluid Mechanics", McGraw Hill Book Co.,

## 17.THE TOPICS:

### Chapter one: Properties of fluids

**1.1. Introduction**

**1.2. Fluid**

**1.3. Liquids and their properties**

**1.4. Density-mass density-weight density-specific volume**

**1.5. Specific gravity**

**1.6. Viscosity–Newton's law of viscosity–types of fluids–effect of temperature on viscosity**

**–effect of pressure on viscosity**

**1.7. Thermodynamic properties**

**1.8. Surface tension and capillarity**

**1.9. Compressibility and bulk modulus**

**1.10. Vapour pressure**

***Highlights***

**Chapter Two: PRESSURE MEASUREMENT**

**Outlines:**

**2.1.** Pressure of a liquid

**2.2.** Pressure head of a liquid

**2.3.** Pascal's law

**2.4.** Absolute and gauge pressures.

**2.5.** Measurement of pressure–

Manometers–Mechanical gauges

***Highlights***

**Chapter Three: BUOYANCY AND FLOATATION**

**3.1. BUOYANCY**

**3.2. CENTRE OF BUOYANCY**

## Chapter Four: FLUID KINEMATICS

**4.1. Introduction**

**4.2. Description of fluid motion Langrangian method Eulerian method**

**4.3. Types of fluid flow—steady and unsteady flows uniform and non-uniform flows–one-, two- and three-dimensional flows rotational and irrotational flows—laminar and turbulent flows—compressible and incompressible flows**

**4.4. Types of flow lines—path line—stream line—stream tube—streak line**

**4.5. Rate of flow or discharge**

**4.6. Continuity equation**

**Highlights**

## Chapter five: FLUID DYNAMICS

**5.1.** Introduction

**5.2.** Different types of heads (or energies) of a liquid in motion

**5.3.** Bernoulli's equation

**5.4.** Euler's equation for motion

**5.5.** Bernoulli's equation for real fluids

**5.6.** Practical applications of Bernoulli's equation- Venturi meter - Orifice meter—Pitot tube

***Highlights***

**Chapter Six: LAMINAR FLOW AND TURBULENT FLOW IN PIPES**

**6.1. : LAMINAR FLOW**

**6.2.REYNOLDS EXPERIMENT**

**6.3. TURBULENT FLOW IN PIPES**

| **18. Practical Topics (If there is any)** | |
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**19. Examinations (Examples):**

Q1: ) *What are the characteristics of an ideal fluid ?*

Q2/ *A plate 0.05 mm distant from a fixed plate moves at 1.2 m/s and requires a force of 2.2 N/m*$^2$ *to maintain this speed. Find the viscosity of the fluid between the plates.*

**20. Extra notes:**

**21. Peer review** پێداچوونەوەی هاوەڵ