# Fluid Mechanics

Course Code:

ME 331

Course Period:

Autumn

Course Type:

Core

Credits:

3

Theoric:

2

Practice:

2

Laboratory Hour:

0

ECTS:

6

Prerequisite Courses:

Differential Equations [1]
Thermodynamics I [2]
Course Language:

English

Courses given by:

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Ali Bahadır Olcay [4]
Course Objectives:

The course aims to provide basic understanding in fluid mechanics and background knowledge to higher-level courses in fluid mechanics.

Course Content:

Fundamental principles of fluid mechanics and their application to engineering problems. Fluid statics. Fluid flow concepts. Control-volume analysis. Conservation equations and applications. Dimensional analysis and similitude. Flow of viscous fluids, simple laminar flow systems, turbulence, internal and external flow applications.

Course Methodology:

1: Lecture, 3: Homework

Course Evaluation Methods:

A: Midterm and final exams, B: Quiz, C: Homework

| **Learning Outcomes** | **Program Outcomes** | **Teaching Methods** | **Assessment Methods** |
|---|---|---|---|
| 1) Adequate knowledge on properties of fluids, pressure distribution in hydrostatic systems, integral and differential forms of momentum balance and laminar and turbulent flows | 1 | 1,3 | A,B,C |
| 2) Ability to identify, formulate, and solve complex engineering problems involvinglaminar and turbulent flows; ability to select and<br><br>apply proper analysis and modeling methods for this purpose. | 1,2,3 | 1,3 | A,B,C |

| **COURSE CONTENT** | | |
|---|---|---|
| **Week** | **Topics** | **Study Materials** |
| 1 | Properties of fluids, basic concepts | Textbook |
| 2 | Pressure, hydrostatics and its application | Textbook |
| 3 | Hydrostatic force and moment calculations | Textbook |
| 4 | Flow kinematics | Textbook |
| 5 | Conservation of mass, Bernoulli equation | Textbook |
| 6 | Applications of Bernoulli equation | Textbook |
| 7 | Conservation of momentum | Textbook |

| | | |
|---|---|---|
| 8 | Applications of integral momentum equation | Textbook |
| 9 | Dimensionless analysis, laws of similarity and scaling | Textbook |
| 10 | Flows in pipes, friction factor | Textbook |
| 11 | Moody chart | Textbook |
| 12 | Differential mass and momentum balance equations | Textbook |
| 13 | Analytic solutions of Navier-Stokes equations | Textbook |
| 14 | External flows, lift and drag forces | Textbook |

| **RECOMMENDED SOURCES** | |
|---|---|
| **Textbook** | |
| **Additional Resources** | Fluid Mechanics Fundamentals and Applications, Cengel and Cimbala (Ders kitabı)<br>Fluid Mechanics, F. White<br><br>A First Course in Fluid Mechanics, R.H. Sabersky, A.J. Acosta, E.G.<br><br>Hauptmann<br><br>Fluid Mechanics with Applications, A. Esposito<br><br>Introduction to fluid mechanics, R.W. Fox |

| **ASSESSMENT** | | |
|---|---|---|
| **IN-TERM STUDIES** | **NUMBER** | **PERCENTAGE** |
| Midterms | 2 | 50 |
| Homeworks | 2 | 10 |
| Quizzes | 2 | 10 |
| **Total** | | **100** |
| **CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE** | | 30 |
| **CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE** | | 70 |
| **Total** | | **100** |

| **COURSE'S CONTRIBUTION TO PROGRAM** |
|---|

| No | Program Learning Outcomes | | Contribution | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | NA | 1 | 2 | 3 | 4 | 5 | |
| 1 | Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied knowledge in these areas in complex engineering problems. | | | | | **X** | | |
| 2 | Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose. | | | | **X** | | | |
| 3 | Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose. | **X** | | | | | | |
| 4 | Ability to devise, select, and use modern techniques and tools needed for analyzing and solving complex problems encountered in engineering practice; ability to employ information technologies effectively. | **X** | | | | | | |
| 5 | Ability to design and conduct experiments, gather data, analyze and interpret results for investigating complex engineering problems or discipline specific research questions. | **X** | | | | | | |
| 6 | Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually. | **X** | | | | | | |
| 7 | Ability to communicate effectively in Turkish, both orally and in writing; knowledge of a minimum of one foreign language; ability to write effective reports and comprehend written reports, prepare design and production reports, make effective presentations, and give and receive clear and intelligible instructions. | **X** | | | | | | |
| 8 | Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself. | **X** | | | | | | |
| 9 | Consciousness to behave according to ethical principles and professional and ethical responsibility; knowledge on standards used in engineering practice. | **X** | | | | | | |
| 10 | Knowledge about business life practices such as project management, risk management, and change management; awareness in entrepreneurship, innovation; knowledge about sustainable development. | **X** | | | | | | |

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|---|---|---|---|---|---|---|---|---|
| 11 | Knowledge about the global and social effects of engineering practices on health, environment, and safety, and contemporary issues of the century reflected into the field of engineering; awareness of the legal consequences of engineering solutions. | **X** | | | | | | |
| 12 | Ability to work professionally in both thermal and mechanical systems areas, including design and realization. | **X** | | | | | | |
| 13 | Ability to verify and validate numerical solutions to engineering problems. | **X** | | | | | | |

| **ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION** | | | |
|---|---|---|---|
| Activities | Quantity | Duration (Hour) | Total Workload (Hour) |
| Course Duration (Excluding exam weeks: 12x Total course hours) | 12 | 4 | 48 |
| Hours for off-the-classroom study (Pre-study, practice) | 14 | 4 | 56 |
| Midterms | 2 | 3 | 12 |
| Homework | 2 | 4 | 8 |
| Quiz | 2 | 3 | 6 |
| Final examination | 1 | 10 | 10 |
| **Total Work Load** | | | 138 |
| **Total Work Load / 25 (h)** | | | 5.6 |
| **ECTS Credit of the Course** | | | 6 |