ME302 FLUID MECHANICS II

INSTRUCTORS:
Assoc. Prof. Dr. Nureddin DİNLER, Room: 402
Assist. Prof. Dr. Salih KARAASLAN, Room: 406

Teaching Assistants: will be announced.
Teach. Assist. Yunus Emre GÖNÜLAÇAR
Teach. Assist. Fatih DEMİR
Teach. Assist. Güven Hasret YILMAZ

Prerequisite:
ME301 Fluid Mechanics I

COURSE PLAN

Week	Topics
1	**DIFFERENTIAL ANALYSIS OF FLUID MOTION**: Derivation of continuity equation. Stream function for two-dimensional incompressible flows.
2	**DIFFERENTIAL ANALYSIS OF FLUID MOTION**: Motion of fluid elements (kinematics), derivation of momentum equation.
3	**INCOMPRESSIBLE INVISCID FLOW:** Derivation and application of Euler's equation. Derivation and application of Bernoulli equation. Static, stagnation and dynamic pressure.
4	**INCOMPRESSIBLE INVISCID FLOW:** Irrotational flow. Bernoulli equation for irrotational flow. Velocity potential and stream function.
5	**INCOMPRESSIBLE INVISCID FLOW:** Elementary plane flows. Superposition of plane flows.
6	**DIMENSIONAL ANALYSIS AND SIMILITUDE:** Introduction. Buckingham Pi theorem. Determination of Pi groups.
7	**DIMENSIONAL ANALYSIS AND SIMILITUDE:** Dimensionless groups of significance in fluid mechanics. Flow similarity and model studies.
8	**MIDTERM EXAM I** and **EXPERIMENT I**
9	**BOUNDARY LAYER:** The boundary layer concept, boundary layer thicknesses.
10	**BOUNDARY LAYER:** Laminar flat-plate boundary layer: Exact solution. Momentum integral equations.
11	**FLOW ABOUT IMMERSED BODIES:** Drag and lift forces acting on immersed bodies. **EXPERIMENT II**
12	**FLOW ABOUT IMMERSED BODIES:** Flow over cylinder and sphere: Drag and lift forces. Flow over different geometrical shapes.
13	**MIDTERM EXAM II**
14	**COMPRESSIBLE FLOW:** Introduction. Analysis of steady one-dimensional compressible flow. Fanno line and Rayleigh line.

Course Objective:
To teach derivation and application of basic equations in differential form governing the fluid motion, solution of differential equations to find velocity distribution, calculation of forces exerted by flows on bodies, introduce the dimensional analysis, similitude and the boundary layer concept.

Course Outcomes:
Understanding and usage of basic approaches employed for detailed analysis of flow fields and their applications to engineering problems.

Text Book:
1. Introduction to Fluid Mechanics, R. W. Fox, P. J. Pritchard and A. T. McDonald, John Wiley & Sons,Inc., Seventh Edition.

Reference Books:
2. Introduction to Fluid Mechanics, D. F. Young, B. R. Munson and T. H. Okiishi and W. W. Huebsch John Wiley & Sons, Inc., 5^{th} Edition.
3. Mechanics of Fluids, M. C. Potter and D. C. Wiggert, Prentice Hall, Second Edition.

Assessment Criteria:

Midterm Exams: % 45 (2 exams)

Quizzes: % 10
After the completion of each chapter, a 15 minute quiz is given.

Experiments: %5
After completion of the related chapters, two experiments are carried out. The experiments are performed as groups. The date of the experiments and the groups are posted in the term. Before coming to an experiment, students should read the handouts. **Every student must attend both experiments.**

Final Exam: % 40