ME 420 COURSE PROFILE

DEGREE PROGRAM: Mechanical Engineering

COURSE NUMBER: ME 420	**COURSE TITLE:** Fluid Mechanics II
REQUIRED COURSE OR ELECTIVE COURSE: Elective	**TERMS OFFERED:** Winter
TEXTBOOK / REQUIRED MATERIAL: Computational Methods for Fluid Dynamics by J.H. Ferziger & M. Peric (3rd edition)	**PRE / CO-REQUISITES:** MECHENG 320. II (3 credits)
COGNIZANT FACULTY: R. Akhavan **BULLETIN DESCRIPTION:** Use of commercial CFD packages for solving realistic fluid mechanics and heat transfer problems of practical interest. Introduction to mesh generation, numerical discrimination, stability, convergence, and accuracy of numerical methods. Applications to separated, turbulent, and two-phase flows, flow control, and flows involving heat transfer. Open-ended design project.	**COURSE TOPICS:** 1. Internal and external flow. 2. Unsteady and separated flows. 3. Turbulent flows. 4. Flows with heat transfer. 5. Computational fluid dynamics.
COURSE STRUCTURE/SCHEDULE: Lecture: 1 day per week at 1.5 hours; Lab: 1 day per week at 1.5 hours	

COURSE OBJECTIVES: for each course objective, links to the Program Outcomes are identified in brackets.	1. To review the governing equations of fluid mechanics and heat transfer [1] 2. To teach numerical solution of governing equations of fluid mechanics and heat transfer [1] 3. To teach the use of commercial computational fluid dynamics packages [1, 2, 5, 7] 4. To present the performance metrics, selection criteria, and design principles for fluid flow systems in practical applications [1, 2, 4, 5, 6, 7] 5. To teach teamwork and communication with written and visual means [1, 3, 4, 5] 6. To present the basics of turbulence phenomenology and modeling [1, 2, 4, 6, 7] 7. To provide exposure to modern computational techniques in fluid dynamics [1, 2, 6] 8. To present a variety of applications of fluid dynamics of mechanical engineering interest [1, 2, 4, 6, 7]
COURSE OUTCOMES: for each course outcome, links to the Course Objectives are identified in brackets.	1. Compute unsteady, separated laminar flows [1, 2, 3, 4, 5, 7, 8] 2. Compute turbulent flows with and without heat transfer [1, 2, 3, 4, 5, 6, 7, 8] 3. Complex geometry import from CAD packages and mesh generation [1, 2, 3, 4, 5, 7, 8] 4. Optimize the aerodynamics drag on automobiles, SUVs, trucks [1, 2, 3, 4, 5, 6, 7, 8] 5. Compute the aerodynamic drag on an Olympic swimmer [1, 2, 3, 4, 5, 6, 7, 8] 6. Know the main differences between laminar and turbulent flows [1, 2] 7. Know the main strengths and limitations of the modern computational tools of fluid dynamics [2, 3, 6, 7] 8. Analyze a variety of practical fluid-flow problems and utilize fluid mechanics principles in design [1, 2, 3, 4, 5, 6, 7, 8]
ASSESSMENT TOOLS: for each assessment tool, links to the course outcomes are identified	1. Team projects. 2. Homework and a midterm exam.

PREPARED BY: R. Akhavan

LAST UPDATED: K. Oldham – 5/11/2023