ME320 COURSE PROFILE

DEGREE PROGRAM: Mechanical Engineering

COURSE NUMBER: ME320	**COURSE TITLE:** Intro to Fluid Mechanics
REQUIRED COURSE OR ELECTIVE COURSE: Required	**TERMS OFFERED:** Fall, Winter
TEXTBOOK / REQUIRED MATERIAL: Fundamentals of Fluid Mechanics, B.R. Munson, D.F. Young, T.H. Okiishi, (4th edition) 2002, Wiley	**PRE / CO-REQUISITES:** (MATH 215 or 255 or 285), MECHENG 235 (or NAVARCH 235 for non-ME students) & MECHENG 240. I, II (3 credits)
COGNIZANT FACULTY: E. Johnsen **BULLETIN DESCRIPTION:** Fluid statics; conservation of mass, momentum and energy in fixed and moving control volumes; steady and unsteady Bernoulli's equation; differential analysis of fluid flow; dimensional analysis and similitude; laminar and turbulent flow; boundary layers; life and drag; applications to mechanical, marine, biological, environmental, and micro-fluidic systems.	**COURSE TOPICS:** 1. Fluid properties, fluid forces, and flow regimes. 2. Fluid statics. 3. Flow kinematics. 4. Conservation of mass, momentum and energy in fixed, deforming, and moving control volumes. 5. The steady and unsteady Bernoulli equation along and normal to a streamline. 6. Similitude, dimensional analysis, and modeling; important non-dimensional groups in fluid mechanics. 7. Conservation of mass and momentum expressed through differential analysis. 8. Viscous flow in pipes and channels (laminar and turbulent flow regimes, the Moody chart, head-loss equation). 9. External flow boundary layer concept, lift and drag, pressure and friction drag, streamlining and drag reduction. 10. Sample applications to mechanical biological, environmental, and micro-fluidic systems.
COURSE STRUCTURE/SCHEDULE: Lecture: 2 days per week at 1.5 hours	

COURSE OBJECTIVES: for each course objective, links to the Program Outcomes are identified in brackets.	1. To teach basic fluid properties (density, viscosity, bulk modulus), flow forces (pressure, shear stress, surface tension), and flow regimes (laminar/turbulent, compressible/incompressible, steady/unsteady) [1]. 2. To teach how force is transmitted in static fluids [1]. 3. To teach conservation of mass, momentum, and energy in fixed, deforming, and moving control volumes [1]. 4. To teach the use and limitations of steady and unsteady Bernoulli equation along and normal to a streamline [1]. 5. To teach conservation of mass and momentum through differential analysis in simple geometries [1]. 6. To teach techniques of dimensional analysis, similitude, and modeling, and introduce the important non dimensional groups in fluid mechanics [1, 2, 3]. 7. To teach application of the above concepts to internal and external flows, and introduce the boundary layer concept, lift and drag, flow separation, and drag reduction fundamentals [1, 2, 6]. 8. To teach examples of applications of above concepts in mechanical, biological, environmental, and micro-fluidic systems [1, 2, 3, 4, 6].
COURSE OUTCOMES: for each course outcome, links to the Course Objectives are identified in brackets.	1. Ability to identify or predict the flow regime in a given engineering system based on consideration of the governing non-dimensional groups [1, 6, ,8]. 2. Ability to calculate the hydrostatic forces and moments on planar and curved submerged and floating surfaces [1, 2,]. 3. Ability to construct an appropriate (fixed, deforming, or moving) control volume for a given engineering system and apply the principles of conservation of mass, momentum, and energy to this control volume [1, 2, 3]. 4. Ability to decide when appropriate to use ideal flow concepts and the Bernoulli equation [1, 3, 4]. 5. Ability to present data or governing equations in non-dimensional form, design experiments, and perform model studies [6, 1, 7]. 6. Ability to solve for internal flow in pipes and channels through simple solutions of the Navier-Stokes equations, the Moody chart, or the head-loss equation, [5, 6, 7,]. 7. Ability to solve for external flow, evaluate lift and drag, know when there is possibility of flow separation, apply streamlining concepts for drag reduction by using experimental correlations [7,]. 8. An understanding of how fluid mechanics applies to mechanical, biological, environmental, and micro-fluidic systems [8].
ASSESSMENT TOOLS: for each assessment tool, links to the course outcomes are identified	1. Regular homework assignments 2. Exams

PREPARED BY: E. Johnson
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