COURSE #: CHE 341 (4 credits)	**COURSE TITLE:** Fluid Mechanics
TERMS OFFERED: Winter	**PREREQUISITES:** Physics 140: General Physics I, Math 215: Calculus III, preceded or accompanied by CHE 230: Introduction to Material and Energy Balances, and Math 216: Introduction to Differential Equations
TEXTBOOKS/REQUIRED MATERIAL: Fluid Mechanics for Chemical Engineers: with Microfluidics, CFD, and COMSOL Multiphysics 5 (3rd Edition) (Prentice Hall International Series in the Physical and Chemical Engineering Sciences). James O. Wilkes. ISBN-13: 978-0134712826	**COGNIZANT FACULTY:** Burns, Kamcev, Nagrath, Ziff,
INSTRUCTOR: Burns, Ziff	**FACULTY APPROVAL:** 2019-11-05
CoE BULLETIN DESCRIPTION: Fluid Mechanics for chemical engineers. Mass, momentum, and energy balance on finite and differential systems. Laminar and turbulent flow in pipes, equipment, and porous media. Polymer processing and boundary layers. Potential, two-phase, and non-Newtonian flow.	**COURSE TOPICS:** (approximate number of hours in parentheses) 1. Hydrostatics, mass, energy, momentum balances (11) 2. Flow through pipes and chemical engineering equipment (7) 3. Differential equations of fluid mechanics (5) 4. Viscous and potential flow problems (5) 5. Boundary layers, nearly 1-D flows (2) 6. Turbulent flow, non-Newtonian fluids, microfluidics (4) 7. Numerical solutions and dimensionless analysis (4)
COURSE STRUCTURE/SCHEDULE: Lecture 3 per week @ 1 hour; Discussion: 1 per week @ 1 hour	
COURSE OBJECTIVES	Links shown in brackets are to course outcomes that satisfy these objectives. 1. Provide students with a lasting and solid understanding of fluid mechanics. [a-h] 2. Effectively teach fundamental concepts in fluid mechanics, including mass, energy, and momentum balances. [b] 3. Teach students how to properly set up and solve fluid mechanics problems both analytically and numerically where appropriate. [b-h] 4. Introduce students to chemical engineering processes and equipment where fluid flow is involved. [d]
COURSE OUTCOMES	Links shown in brackets are to ABET student outcomes 1-7 a. Knowledge of fundamental concepts in fluids, such as density, viscosity, pressure, stress/strain rate, etc. [1] b. Ability to apply mass, energy, and momentum balances to hydrostatic and fluid flow problems. [1] c. Ability to analyze laminar and turbulent frictional flow in pipes and piping networks. [1,2] d. Ability to analyze fluid flow in chemical engineering equipment. including fluid drag on particles, solid separation systems and packed beds [1,2,7] e. Ability to set up the differential equations of fluid mechanics leading to the Navier-Stokes equations, and use them to solve fluid flow problems both analytically and numerically, as well as using existing CFD software packages. [1] f. Ability to analyze boundary layer flows. [1] g. Ability to solve problems involving Newtonian and non-Newtonian fluids. [1]. h. Ability to analyze micron scale or smaller flows. [1]
ASSESSMENT TOOLS	1. Homework problems assess outcomes a-h. 2. Written examinations assess outcomes a-h. 3. End of term course evaluation provides student self-assessment of outcomes a-h