1. **Course number and name - CHBE 3300 – Chemical Kinetics and Catalysis** ***(required)***

2. **Credits and contact hours** - 2 credit hours, 2 lecture hours (2-0-0-2)

3. **Instructor's or course coordinator's name -** Dr. Michael Filler

4. **Textbook, title, author, and year**
   Chemical Engineering Kinetics and Reactor Design, C. H. Hill and T. W. Root, 2nd ed., John Wiley & Sons, 2014.

5. **Specific course information**
   a. **Catalog Description -** The basic principles of chemical reaction kinetics, including rate laws, mechanisms, and heterogeneous catalysis are introduced.
   b. **Prerequisites or co-requisites** – CHBE 2100 Chemical Process Principles (grade "C" or better); CHEM 1212K Chemical Principles II. Pre-requisite with concurrency: MATH 2552 Differential Equations (grade "C" or better).
   c. **Required, elective, or selected elective course** – Required

6. **Specific goals for the course**
   a. **Specific outcomes of instruction**:
   By the end of this course, a student should be able to:
      1) Understand chemical reactions using microscopic theories and molecular modeling.
      2) Analyze reaction mechanisms for homogeneous, heterogeneous, and biochemical reactions and develop suitable kinetic rate expressions.
      3) Analytically and numerically determine reaction rate laws using data from batch reactors.
      4) Analytically and numerically model batch reactor behavior for single and multiple reactions.

b. **Connection with Student Outcomes**

CHBE 3205							
	Student Outcomes						
Course Outcomes	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Course Outcome 1	**X**						
Course Outcome 2	**X**					**X**	
Course Outcome 3	**X**						
Course Outcome 4	**X**					**X**	

Student Outcomes

(1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
(2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
(3) an ability to communicate effectively with a range of audiences
(4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
(5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
(6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
(7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

7. **Brief list of topics to be covered**
   a. Theories and mechanisms of homogeneous reactions
      1) Molecular collision theory and transition state theory
      2) Reaction intermediates
      3) Steady-state and equilibrium approximations
      4) Kinetic rate expressions derived from reaction mechanisms
      5) Chain and non-chain reactions
      6) Enzyme, photochemical, and electrochemical kinetics
   b. Theories and mechanisms of heterogeneous reactions
      1) Adsorption isotherms
      2) Catalytic and surface deposition mechanisms
      3) Langmuir-Hinshelwood and Eley-Rideal kinetics
   c. Interpreting rate data
      1) Integral and differential methods
      2) Regression methods
   d. Batch reactor modeling
      1) Isothermal material balances
      2) Single and multiple reactions

3) Fractional conversion, yield, and selectivity