1. **Course number and name - CHBE 4412**
   – Process Dynamics and Control Laboratory *(required)*

2. **Credits and contact hours** - 1 credit hour, 3 lab hours (0-0-3-1)

3. **Instructor's or course coordinator's name -** Dr. Ben Galfond

4. **Textbook, title, author, and year**
   Seborg, Edgar, Mellichamp, and Doyle, "Process Dynamics and Control," 4th edition, Wiley, 2016.
   CHBE 4412 Laboratory Manuals to be downloaded from the web.

5. **Specific course information**
   a. **Catalog Description –** Laboratory experiments and projects on the dynamics and control of chemical and biological processes.
   b. **Prerequisites or co-requisites** – CHBE 4411 Transport Phenomena II (grade "C" or better; pre-requisite with concurrency).
   c. **Required, elective, or selected elective course** (as per Table 5-1) – 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 and be able to use the modern hardware and instrumentation needed to implement process control.
      2) Develop mathematical models of chemical and biological processes by writing unsteady-state mass and energy balances.
      3) Recognize and fit various simple empirical models that are used for designing controllers.
      4) Design, implement, and tune feedback controllers on real systems as well as simulated systems.
      5) Work in a team to perform laboratory experiments and write technical reports
   b. **Connection with Student Outcomes**

CHBE 4412							
	Student Outcomes						
Course Outcomes	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Course Outcome 1				**X**		**X**	**X**
Course Outcome 2	**X**	**X**					
Course Outcome 3	**X**	**X**				**X**	
Course Outcome 4	**X**	**X**				**X**	
Course Outcome 5			**X**		**X**	**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**

Topics illustrated by laboratory experiments and simulation projects:

a. System identification, linearization, and modeling
b. Dynamics of interacting systems
c. Dynamics of measurement; noise and filtering
d. Design and tuning of PID feedback control
e. Autotuning of PID control
f. Control of processes with time delays
g. Control of highly non-linear processes
h. Control of multivariable systems