Purdue University
School of Chemical Engineering

ChE Electives - Fall 2019

The 500-level courses that have less than ten students may be cancelled. Students affected by the cancellation will be notified. (S-Science type course, D-Design type course)

SPECIAL PROJECTS COURSES

CHE 41100 CHEMICAL ENGINEERING SCIENCE RESEARCH PROBLEMS (S)
Prerequisites: Junior or senior standing in ChE and consent of Undergraduate Counselor.
(May be repeated for credit.)
Experience in chemical engineering science research or development; either directed or independent work which can be experimental theoretical.

CHE 41200 CHEMICAL ENGINEERING DESIGN RESEARCH PROBLEMS (D)
Prerequisites: Junior or senior standing in ChE and consent of Undergraduate Counselor.
(May be repeated for credit.)
Experience in chemical engineering design research or development.

CHE 49800 RESEARCH IN CHEMICAL ENGINEERING I
Prerequisite: Honors classification
Individual research projects for students with honors classification. Requires prior approval of, and arrangement with, a faculty research adviser.

CLASSES

CHE 33000 (Dou) PRINCIPLES OF MOLECULAR ENGINEERING
Prerequisites: Passing grades in CHE 20500 (Chemical Engineering Calculations), CHE 211 (Introductory Chemical Engineering Thermodynamics), and MA 261 (Multivariate Calculus).
Familiarity with mathematics, algebraic manipulations, derivations, calculus, statistics, general chemistry and physics is essential. I recommend that you keep your old textbooks in these subjects handy as a reference. Develop understanding of how molecular and atomic forces and kinetics determine structure, phase behavior, reaction, catalysis, diffusion, adsorption, and mechanical and electronic properties of materials.

CHE 46300 (Houze/Siirola) APPLICATIONS OF CHEMICAL ENGINEERING PRINCIPLES
Prerequisites: Senior standing and CHE37800
The objective of this course is to provide students with opportunities to apply chemical engineering principles to practical situations to design, analyze operations, or predict operability of systems. Course Outcomes: Apply principles of chemical engineering to design practical systems. Participate in team-based projects to understand team operation and decision-making. Gain experience in and appreciation of the need for individual learning about new systems, equipment, etc. Understand the role of the engineer in promoting safe operation and consideration of environmental

CHE 54300 (Won) POLYMERIZATION REACTION ENGINEERING AND REACTOR ANALYSIS
Prerequisite: CHE 34800
Polymerization kinetics, polycondensation, gelation, radical polymerization, ionic polymerization, co-polymerizations, Ziegler-Natta polymerizations, polymerization in bulk, solution, suspension and emulsion, modeling, stochastic processes, batch, CSTR and tubular reactors, stability analysis, computer control.

CHE 55500 (Reklaitis) COMPUTER INTEGRATED PROCESS OPERATIONS
Computer aided process operations management includes tasks such as process monitoring, regulatory control, data reconciliation, unit and plant-wide optimization, process fault diagnosis, supervisory control, planning and scheduling. Dealing with integration requires a careful choice of problem-solving paradigms, knowledge representation, search and reasoning techniques so as not to burden the individual tasks and at the same time providing a unified framework. In this course, we will address the nature of these operational tasks, the character of integration, the use of artificial intelligence, math programming and nonlinear modeling techniques.

CHE 59700 (Siirola) INDUSTRIAL CHEMICAL TECHNOLOGY
This course will survey key sectors of the chemical processing industries and discuss the structure of the industry and the historical development and evolution of the technologies which have shaped them and the common manufacturing process and flowsheet elements which have proven to be commercially successful. Examples will be drawn from a range of industry sectors, production scales, chemistries, and enabling technologies. The process industries will be examined in light of factors which have most influenced its development including scale of demand, raw materials of choice, energy availability, and the development of new unit operations, as well as those which will influence its future course including advances in science and technology, environmental impact minimization, water availability, and sustainability concerns.

CHE 59700 (Miller) INDUSTRIAL CATALYTIC PROCESSES FOR HYDROCARBONS

Prerequisite: Graduate student or senior standing

The course will focus on: (1) the fundamentals of industrial hydrocarbon conversion for the fuels and petrochemical industry, (2) process design, and (3) the basics of catalyst chemistry. Specific topics will include: Reactor design and operation, process separations, catalytic chemistry and reaction mechanism, effects of feed quality on operations, product specification and plant integration with other units. The course will also include a discussion of emerging technologies which will impact future energy and chemical industries.

CHE 59700 (Agrawal) FOOD AND ENERGY FARMS: CHALLENGES TO SUSTAINABLE PRODUCTION

Food and Energy Farms: Challenge to sustainable production on a crowded planet will introduce both advanced undergraduate and early-stage graduate students to the key concepts and challenges associated with creating sustainable food, energy, and water systems. After providing a big picture overview of the connections, it will cover the topics of food, energy, and water systems independently from a scientific perspective. At the end of the course, students will present recent papers addressing the interactions between two or more of these systems in a meaningful way, followed by their own solutions to address some of these challenges.

CHE 59700 (Caruthers/Switzer) INTRODUCTION TO ENGINEERING MATH

This course will introduce students to ordinary differential equations and linear algebra in an engineering application context. The course will go well beyond the treatment of these topics in the undergraduate curriculum and will be distinguished by the use of chemical engineering examples for teaching the material. The course topics have been chosen for broad usefulness and prevalence in engineering applications. The course should be especially valuable for undergraduates that plan on entering industrial practice after graduation.

CHE 59700 (Mansson) HIGH_RATE COMPOSITE MANUFACTURING: ENGINEERING AND ECONOMY

This course explores the materials science, manufacturing processes, and economic models required for the emerging field of high volume composite manufacture. We establish the interconnection between processing cycle speed and material structure-property relations, with the goal of optimizing process design for required component performance. Tightly coupled with the engineering aspects of composite manufacture, the course also addresses the design and the economic aspects of the new material and manufacturing techniques. Specific emphasis is placed on quantifying the economic implications of material, process, and design choices and their influence on product viability in the marketplace. Applications in the area of automotive, aerospace, sport and consumer electronics are used throughout the course to demonstrate key concepts.

CHE 59700 (Clark) MEDICAL DEVICES: DEVELOPMENT AND CLINICAL APPLICATION

Prerequisite: BIOL 23000 or BCHM 30700 and CHE 37700. This course also has a con-current pre-req of CHE 37800.

This course is an introduction to the medical device field, with emphasis on the ways in which chemical engineering processes provide the foundation for many device-related therapies. The course involves the application of several fundamental chemical engineering principles, including those related to transport phenomena, separations, and fluid flow, to devices used for extracorporeal therapies. Several clinical conditions in which these considerations are relevant are discussed, with a focus on the treatment of renal failure by dialysis. Finally, the vital roles that chemical engineers may play in the various functions comprising a medical device company are highlighted.

CHE 59700
CHE 49700H (Clark) ANALYTICAL APPROACH TO HEALTHCARE DELIVERY

Prerequisite: BIOL 230 or BCHM 307 – Please see Undergraduate Office for Override

Engineers are integral to the healthcare industry in numerous ways and a significant number of engineering graduates enter the healthcare workforce to make important contributions in numerous ways. An understanding of the dynamics of healthcare delivery can provide insights that further enhance the role that engineers play. The overall purpose of this course is to provide a "real world" overview of healthcare delivery in the United States (US). The topics initially covered include the major medical product segments, namely the pharmaceutical and medical devices industries. The structure of companies operating in these sectors along with the regulatory framework which governs them will be discussed. Health economic considerations, including product costs and reimbursement along with issues related to insurance coverage, will also be covered. Following a focused review of relevant physiology and pathophysiology, a series of critical medical conditions having the highest impact on the US healthcare system are discussed. These diseases include coronary artery disease, heart failure, diabetes, cancer, obesity, Alzheimer's disease, chronic kidney disease, stroke, arthritis, sepsis, and acute kidney injury. The final aspect of the course is a team project, in which an engineering solution is proposed to address an unmet clinical need for one of major conditions discussed.

CHE 59700 (Martin) DATA SCIENCE IN CHEMICAL ENGINEERING

Prerequisite: CHE 32000 or Graduate Student Status

This course will introduce students to the fundamentals of data science in the context of chemical engineering. Students will first learn how to utilize the computational infrastructure necessary to implement data science methods, including how to navigate the Linux operating system and how to write programs using Python. The primary focus of this course will then be to teach students modern analytical techniques which generally fall under the umbrella of machine learning. Emphasis will be put on understanding when and how best to apply and implement different methods and experience will be gained using real world chemical engineering data. Other elements of the data science process will also be introduced, such as data processing and visualization. Probability theory will be reviewed and Python will be used extensively.