CHEM 4310 Introduction to Programming for Chemistry (3 semester credit hour) This course will introduce chemistry students to basic computer programming concepts, with an emphasis on topics important for chemistry research such as the retrieval, processing and analysis of chemistry data. The course will primarily use the Python language, due to its availability and current popularity in scientific programming, and a brief overview of other languages will also be included. Students will learn how to programmatically access online chemistry databases such the Protein Data Bank and retrieve data, and use the numpy, scipy and sci-kit learn libraries to analyze chemical data sets and train machine-learning models. Prerequisite: CHEM 3321 or CHEM 3322. (3-0) R

CHEM 4311 Classical Simulations for Biological and Condensed Systems (3 semester credit hour) This course will focus on the application of the classical simulations to investigate and understand bio-related problems. The topics covered in this class include force field development, molecular dynamics (MD) simulations, free energy methods, and hybrid quantum mechanics and molecular mechanics (QM/MM) simulations. Prerequisite: CHEM 3361 or BIOL 3361, CHEM 3321 and CHEM 3322. (3-0) R

CHEM 4332 Total Synthesis of Natural Products (3 semester credit hour) This course covers the reactions, strategies, and tactics needed to tackle the challenge presented by architecturally complex natural products. Examples of cutting-edge methods for bond-forming reactions will be presented, as will the tools necessary to logically analyze and build complex molecular targets. The course covers the principles of retrosynthetic analysis with the goal of teaching the students how to logically analyze complex molecular targets and design a total synthesis, two highly coveted skills in a world where many industries (such as drug discovery and development) are moving toward increasingly complex targets. Prerequisite: CHEM 2325 or CHEM 2328. (3-0) R

CHEM 4342 Nanomedicine: Fundamentals and Applications (3 semester credit hour) Integration of nanotechnology and medicines is revolutionizing disease diagnosis and treatment. In this course, we will discuss nano-bio interactions and transport at the cellular and animal levels and how to use these interactions and transport to address long-standing challenges in cancer and other diseases. Prerequisite: CHEM 2323 or 2327, and CHEM 3472. (3-0) R