PHARMACY—MEDICINAL CHEMISTRY

PHA 6242 Artificial Intelligence in Clinical Toxicology 3 Credits
Grading Scheme: Letter Grade
Provides an in-depth exploration of artificial intelligence (AI) and its applications in clinical toxicology. Students learn the fundamentals of AI, machine learning and programming, deep learning and large language model evaluation and validation, focusing on real-world applications in clinical toxicology. Includes theoretical knowledge and practical skills, preparing students to integrate AI into clinical toxicology practice.

PHA 6354 Natural Medicinal Products 3 Credits
Grading Scheme: Letter Grade
Chemistry of compounds derived from plants and animals.

PHA 6356 Structure Determination of Complex Natural Products 3 Credits
Grading Scheme: Letter Grade
Rigorous structure determination of natural products, using modern spectroscopic methods. Become able to elucidate the structure of any organic small molecule.
Prerequisite: CHM 5235 or consent of instructor.

PHA 6357 Herbal & Dietary Supplements 3 Credits
Grading Scheme: Letter Grade
Herbal Dietary supplements are extensively used by consumers. This course provides an overview of commonly used supplements to assist healthcare practitioners in providing patients with adequate counseling to avoid drug interactions and false claims.

PHA 6416 Pharmaceutical Analysis I 3 Credits
Grading Scheme: Letter Grade
Theory and applications of relevant analytical techniques for analysis of drugs in biological samples. Offered spring term in odd-numbered years.

PHA 6417 Pharmaceutical Analysis II 3 Credits
Grading Scheme: Letter Grade
Absorption, fluorescence, phosphorescence, and spectroanalysis of drugs and related compounds.

PHA 6425 Drug Biotrans and Molecular Mechanisms of Toxicity 3 Credits
Grading Scheme: Letter Grade
Enzymology and mechanisms of drug biotransformation pathways. Examples of drugs and other xenobiotics that exhibit toxicity related to biotransformation.
Prerequisite: introductory organic chemistry, biochemistry.

PHA 6432 Fundamentals of Pharmaceutical Chemistry 1 Credit
Grading Scheme: Letter Grade
This is a foundation course whose aims are providing an introduction to the principles of Pharmaceutical chemistry, including an understanding of drug structure-activity relationships, prediction of the physico-chemical properties of a drug, basic knowledge of the major pathways of drug metabolism, and factors that can contribute to drug-drug interactions.

PHA 6435 Biosynthetic Logic of Medicinal Natural Products 3 Credits
Grading Scheme: Letter Grade
Covers topics of biosynthesis of the major families of medical natural products, structural and biochemical understanding of their biosynthetic logic, gene cluster identification, genome mining, and production of bioactive "unnatural products" for drug discovery and development.
Prerequisite: Students are expected to have the background of Biochemistry, Enzymology, and Bioorganic Chemistry. Or permission of instructors.

PHA 6444 Pharmaceutical Chemistry I 3 Credits
Grading Scheme: Letter Grade
Students are shown how to predict the solubilities, structure-activity relationships, basic synthesis routes for selected structures, metabolism and pharmacological activity/potency of various drug classes. In particular, anticoagulants, ACE inhibitors, glucocorticoid steroids, nitrate esters, adrenergics, cholinergics, diuretics, anesthetics, antihyperlipidemics, muscle relaxants, anxiolytics, antidepressants, sedative hypnotics and vitamins are covered.

PHA 6447 Drug Design 3 Credits
Grading Scheme: Letter Grade
Relevant disciplines and their effect on new drug development, from discovery of a new active lead compound to final refinement as a commercial product.
Prerequisite: organic chemistry, biochemistry, pharmacology, or consent of instructor.

PHA 6452 Metabolic Biochemistry 3 Credits
Grading Scheme: Letter Grade
This course will introduce students to the principles of anabolic and catabolic pathways and cellular energy efficiency. The course also provides an understanding of the biological, physical, and chemical processes for each reaction pathway.

PHA 6460 Principles of Drug Action & Development I 3 Credits
Grading Scheme: Letter Grade
Exploration of the pre-clinical drug development process, including the prediction of solubilities, structure-activity relationships, basic synthesis routes, metabolism and pharmacological activity/potency of select drug classes and individual members of classes based on the contribution of their functional groups to their structures.

PHA 6461 Principles of Drug Action & Development II 3 Credits
Grading Scheme: Letter Grade
Expands on the discussion of the pharmacology and structure-activity relationship of drugs established in PHA 6460. Blockbuster drug classes such as antibiotics, antidiabetic, antiviral, and antineoplastic drugs are covered to illustrate future directions for structural modifications and new applications.

PHA 6467C Drug Design II 3 Credits
Grading Scheme: Letter Grade
Outline of how relevant disciplines impact on the development of a new drug product from the discovery of a new active lead compound to its final refinement as a commercial product. Contributions of Organic Chemistry, Biochemistry, Metabolic Chemistry, Physical Chemistry, Analytical Chemistry, and Pharmacological Chemistry are discussed.
Prerequisite: PHA 6447 Drug Design I.

PHA 6468 Biotransformation Considerations in Drug Design 2 Credits
Grading Scheme: Letter Grade
Explores the importance of considering biotransformation in the process of drug design and discovery. Topics include the major pathways of biotransformation of various functional groups present in drugs and the enzymes involved, including their regulation and factors affecting metabolism and enzyme activity. Other topics are the role of metabolism in drug toxicity and examples from the literature of metabolic activation of drugs and naturally occurring toxic chemicals.
Prerequisite: PHA 6447 and PHA 6467C and an additional undergraduate chemistry or biochemistry class with permission of instructor..

PHA 6471 Synthetic Medicinal Chemistry 3 Credits
Grading Scheme: Letter Grade
Review of acid and base properties of pharmacologically active molecules. Review of mechanisms of synthetic reactions, and their applications.

PHA 6472 Organic Synthesis of Drug Molecules 3 Credits
Grading Scheme: Letter Grade
Covers advanced topics in drug molecule synthesis, including: organic reaction mechanisms, retrosynthetic analysis, asymmetric synthesis, heterocyclic chemistry, natural product synthesis, drug design and synthesis, structure-activity relationships. Secondary topics that will be included in this course include: anticancer/antibacterial agents, screening approaches.
Prerequisite: CHM 5224 or permission of instructor.

PHA 6532 Occupational Toxicology 3 Credits
Grading Scheme: Letter Grade
Focuses on the growing field of occupational toxicology, the specific toxicants encountered in various work environments, and how both acute and chronic exposure can impact health. Symptom presentation, differential diagnosis, and treatment are covered as well as preventive measures that can be implemented to reduce or prevent such exposures.

PHA 6533 Epidemiology & Biostatistics in Clinical Toxicology 3 Credits
Grading Scheme: Letter Grade
Covers principles and applications of epidemiology and biostatistics as they apply to clinical toxicology. Students will learn to critically evaluate and understand data analyses and results presented in the medical literature. Upon completion of this course, students will have the basic knowledge of epidemiological analysis and biostatistical techniques to aid in the interpretation and treatment of the poisoned or overdosed patient.

PHA 6534 Toxicology of Chemical Weapons 3 Credits
Grading Scheme: Letter Grade
Providing healthcare providers, first responders, and others that may be exposed to chemical weapons with an understanding of their toxicology and treatment approaches.

PHA 6535 Principles of Nucleotide Activity 2 Credits
Grading Scheme: Letter Grade
This course will be introducing the students to the chemical structure of DNA and RNA; the synthetic processes for DNA and RNA synthesis; biochemical reactions and pathways for nucleotide synthesis; DNA replication, transcription and translation; covalent and reversible interactions of nucleic acids with small molecules and proteins and an overview of techniques for the analysis of nucleic acids.

PHA 6537 The Toxicology of Licit & Illicit Drugs of Abuse 3 Credits
Grading Scheme: Letter Grade
Recognizing the symptoms of toxidromes early, providing adequate intervention and treatment to the patient, and ensuring the safety of those delivering care are critical components of this course. Following a brief recap of the basics of medical toxicology and toxidromes, the course will focus on the different classes of drugs, their commonly encountered abuse, treatment approaches, and legal components such as drug testing.

PHA 6543 Pharmaceutical Chemistry II 3 Credits
Grading Scheme: Letter Grade
Showing students how to predict the solubilities, structure-activity relationships, basic synthesis routes for selected structures, metabolism and pharmacological activity/potency of various drug classes. In particular antidiabetics, anticonvulsants, H1 and H2 antagonists, analgetics, nonsteroidal antiinflammatory drugs, hormones, antibiotics, antiviral agents, and antineoplastic agents are covered.

PHA 6556 Introduction to Clinical Toxicology 3 Credits
Grading Scheme: Letter Grade
Introducing the basic methods and procedures commonly employed in Clinical Toxicology as well as the concept of Clinical Toxicology as an interdisciplinary science within the field of healthcare.

PHA 6557 Clinical Toxicology 1 3 Credits
Grading Scheme: Letter Grade
Providing students with an understanding of the toxic effects and clinical applications of various therapeutic drug classes including cardiovascular, CNS, analgetic, anesthetic, antineoplastic, and antibiotic drugs.
Prerequisite: VME 6602

PHA 6840 Medicinal Chemistry of Drugs of Abuse 3 Credits
Grading Scheme: Letter Grade
Pharmacological effects of commonly encountered licit and illicit pharmaceutical compounds.

PHA 6850 Principles of Forensic Science 3 Credits
Grading Scheme: Letter Grade
Introducing the basic disciplines of forensic science. The course is composed of twelve modules.

PHA 6851 Forensic Analysis of DNA 3 Credits
Grading Scheme: Letter Grade
Techniques for isolation of DNA from cells. Spectroscopic techniques. Hydrodynamic and electrophoretic separation methods. Sequence determination. Statistical analysis and forensic significance.

PHA 6852 Mammalian Molecular Biology 3 Credits
Grading Scheme: Letter Grade
Focus on the principles of modern molecular biology and biochemistry and expand on the concepts you may have already encountered in other classes in this program. The content will also include the applications of experimental techniques and procedures routinely used in this field.

PHA 6853 Biological Evidence and Serology 3 Credits
Grading Scheme: Letter Grade
Overview of crime scene investigation as it pertains to biological evidence. Crime scene safety. Collecting and preserving evidence. Identifying, analyzing, and interpreting biological stains.

PHA 6854 Forensic Immunology 3 Credits
Grading Scheme: Letter Grade
Antibody formation, antigen structure. Complement mediated reactions. Hypersensitivity. Immunoelectrophoretic techniques in forensic science.

PHA 6855 Forensic Genetics 3 Credits
Grading Scheme: Letter Grade
Principles of inheritance. Genetic polymorphisms and forensic implications, population genetics and paternity testing.

PHA 6856 Bloodstain Pattern Analysis 3 Credits
Grading Scheme: Letter Grade
Blood spatter creation and interpretation. Recording, collection, and processing of bloodstains and blood spatter evidence.

PHA 6857 Forensic Analysis of DNA 2 3 Credits
Grading Scheme: Letter Grade
This course covers how to interpret DNA data to include mixture deconvolution and the statistics that apply to DNA matches/inclusions. Modules guide the student through the basis of Y-STR and Kinship testing statistical applications. Students will learn the report writing, review and testimony skills required of a DNA analyst.
Prerequisite: PHA6851 - Forensic Analysis of DNA

PHA 6861 Intro to Forensic Medicine 2 4 Credits
Grading Scheme: Letter Grade
Forensic medicine is the application of medical knowledge to the investigation of crime. This course gives knowledge and understanding of the application of scientific knowledge to medico-legal problems and legal proceedings, specifically as related to investigating medical crimes as well as the causes of sudden and unexpected deaths.
Prerequisite: VME 6582.

PHA 6905C Research Procedures in Pharmaceutical Sciences 1-4 Credits
Grading Scheme: Letter Grade
Research Procedures in Medicinal Chemistry

PHA 6910 Supervised Research 1-5 Credits, Max 5 Credits
Grading Scheme: S/U
Supervised Research

PHA 6934 Seminar in Medicinal Chemistry 1 Credit, Max 3 Credits
Grading Scheme: Letter Grade
Weekly presentation and discussion of research reports based on college programs or literature.

PHA 6935 Selected Topics in Pharmacy 1-4 Credits, Max 18 Credits
Grading Scheme: Letter Grade
Open to all departments in the College of Pharmacy.

PHA 6936 Advanced Topics in Pharmaceutical Sciences 1-2 Credits, Max 4 Credits
Grading Scheme: Letter Grade
Written and oral presentation of research designs, protocols, papers, and critical appraisals with discussion and critical review of such topics.

PHA 6938 Research Seminar 1 Credit, Max 3 Credits
Grading Scheme: Letter Grade
Seminar required of graduate students in the College of Pharmacy.

PHA 6940 Supervised Teaching 1-5 Credits, Max 5 Credits
Grading Scheme: S/U
Supervised Teaching

PHA 6971 Research for Master's Thesis 1-15 Credits
Grading Scheme: S/U
Research for Master's Thesis

PHA 7979 Advanced Research 1-12 Credits
Grading Scheme: S/U
Research for doctoral students before admission to candidacy. Designed for students with a master's degree in the field of study or for students who have been accepted for a doctoral program. Not appropriate for students who have been admitted to candidacy.

PHA 7980 Research for Doctoral Dissertation 1-15 Credits
Grading Scheme: S/U
Research for Doctoral Dissertation