CLINICAL LABORATORY SCIENCES (CLLS)

CLLS 201. Introduction to Clinical Laboratory Science. 1 Hour.
Semester course; 1 lecture hour. 1 credit. Open to students on the Monroe Park Campus who are interested in clinical laboratory science/ medical technology as a career. Presentation and discussion of clinical laboratory science including an introduction to each of the specific areas of concentration, job opportunities in the profession and a tour of a hospital laboratory. Graded as pass/fail.

CLLS 202. Introduction to Infectious Disease and Societal Impacts. 3 Hours.
Semester course; 3 lecture hours (delivered online). 3 credits. Presentation and discussion of infectious diseases and the impact that these diseases have had on the way that we live. Recent and historical infectious disease outbreaks will be discussed, including transmission, prevention and outcomes. Changes that occurred in society due to these outbreaks will also be discussed.

CLLS 300. Basic Concepts. 1.5 Hour.
Semester course; 1 lecture and 1 laboratory hours. 1.5 credits. An introduction to the basic concepts/techniques applicable to all laboratory science areas. Includes optical physics, quality control, laboratory safety, medical terminology and pipetting techniques along with other basic subjects.

CLLS 301. Hematology. 1.5-3.5 Hours.
Semester course; 2 lecture and 3 laboratory hours. 1-5-3.5 credits. May be repeated for 3.5 credits. Enrollment restricted to CLS majors. Provides a study of the blood and blood-forming tissues. Focuses on basic hematologic techniques and accurate identification of normal and abnormal hematologic cells. Introduces the hemostatic mechanism. Correlates the roles of normal hematologic cells with normal hematologic homeostasis. This course qualifies for the option of proficiency credits for certified medical laboratory technicians.

CLLS 302. Abnormal Hematology. 1.5-4 Hours.
Semester course; 2.5 lecture and 3 laboratory hours. 1.5-4 credits. May be repeated for a total of 4 credits. Prerequisite: CLLS 301. Enrollment restricted to CLS majors. Provides a study of the blood and blood-forming tissues. Focuses on basic hematologic techniques and normal and abnormal cell identification accuracy. Correlates the roles of abnormal cells with pathological conditions. Focuses on abnormal hemostasis. This course qualifies for the option of proficiency credits for certified medical laboratory technicians.

CLLS 304. Urine and Body Fluid Analysis. 1-2 Hours.
Semester course; 1.5 lecture and 1 laboratory hours. 1-2 credits. A study of the principles and practices of urinalysis, kidney function, cerebrospinal fluid and other body fluids.

CLLS 306. Immunohematology. 2.5-4.5 Hours.
Semester course; 2.5 lecture and 4 laboratory hours. 2.5-4.5 credits. Prerequisite: CLLS 310. A study of the theory and principles of blood banking with an emphasis on methods and techniques used in the laboratory for cell typing, cross-matching and antibody identification.

CLLS 307. Introduction to Pathogenic Microbiology. 1-3 Hours.
Semester course; 3 lecture hours. 1-3 credits. May be taken as 1 credit each for study of basic parasitology, mycology or virology. Includes fundamentals of parasites, fungi and viruses as potentially pathogenic microorganisms.

CLLS 308. Pathogenic Bacteriology. 3-5 Hours.
Semester course; 3 lecture hours and 4 laboratory hours. 3-5 credits. Emphasis is placed on pathogenic bacteria, techniques, pathogenesis, epidemiology, isolation and identification, and antimicrobial susceptibility testing.

CLLS 310. Clinical Immunology. 3-4.5 Hours.
Semester course; 3.5 lecture and 2 laboratory hours. 3-4.5 credits. Introduces the basic principles of immunology, serology and molecular diagnostics. Emphasis is placed on laboratory evaluation of the immune response including both cellular and humoral aspects. Serologic techniques are practiced in the laboratory sessions.

CLLS 311. Clinical Chemistry and Instrumentation I. 3-5 Hours.
Semester course; 3 lecture and 4 laboratory hours. 3-5 credits. A study of human physiology and metabolism in health and various disease states. Topics include energy and nitrogen metabolism and proteins in body fluids. Emphasis is placed on the application of quantitative analytical methods and instrumentation for the chemical characterization of body fluids to provide clinically useful information for the diagnosis and treatment of diseases.

CLLS 312. Clinical Chemistry and Instrumentation II. 4-5 Hours.
Semester course; 4 lecture and 2 laboratory hours. 4-5 credits. Prerequisite: CLLS 311 or permission of the instructor. A study of human physiology and metabolism in health and various disease states. Topics include water and ion balance, clinical enzymology, therapeutic drug monitoring, and toxicology. Emphasis is placed on the application of quantitative analytical methods and instrumentation for the chemical characterization of body fluids to provide clinically useful information for the diagnosis and treatment of diseases.

CLLS 337. Clinical Education. 1 Hour.
Semester course; 120 clock hours. 1 credit. Supervised clinical experience in hospitals across the state is designed to give the student a broader clinical education and to provide venipuncture experience. In addition to the application of academically acquired knowledge, this affiliation provides an opportunity for the student to correlate each area of study into one composite picture for final laboratory diagnosis. Closer working relationships with other allied health personnel is an important aspect of this affiliation. Graded as pass/fail.

CLLS 407. Interpretive Immunohematology. 2-2.5 Hours.
Semester course; 2.5 lecture hours. 2-2.5 credits. Prerequisites: CLLS 306 and 310, or permission of instructor. Advanced study of the principles of immunohematology and immunology with major emphasis on blood group systems and blood components. Includes the application of laboratory data and techniques to solve problems in blood banking and immunology.

CLLS 408. Advanced Microbiology. 2 Hours.
Semester course; 2 lecture hours. 2 credits. Prerequisites: CLLS 307 and 308, or permission of instructor. Advanced study of the principles of pathogenic microbiology. Includes the application of laboratory data and techniques to solve problems in the clinical microbiology laboratory.

CLLS 409. Interpretive Hematology. 2 Hours.
Semester course; 2 lecture hours. 2 credits. Prerequisites: CLLS 301-302 and 485, or permission of instructor. Advanced study of the principles of hematopoiesis and their pathophysiological correlation to hematological disorders. Interpretation of morphological findings are correlated with case histories. Includes homeostatic problems.

CLLS 410. Advanced Clinical Chemistry and Instrumentation. 2 Hours.
Semester course; 2 lecture hours. 2 credits. Prerequisites: CLLS 311-312, or permission of instructor. Presents an advanced study of (1) the principles of clinical chemistry as related to intermediary metabolism and pathology and (2) laboratory and hospital information systems. Includes the application of laboratory data and technologies to solve problems in analytical methods and instruments.

CLLS 411. Principles of Education/Management. 2.5-3.5 Hours.
Semester course; 3 lecture hours. 2.5-3.5 credits. Introduces fundamental educational theories and practice, principles of management and employee relations and health-care issues from a global perspective with an emphasis on multicultural diversity. Stresses the application of these theories in the clinical laboratory.

CLLS 412. Senior Seminar. 1 Hour.
Semester course; 1 lecture hour. 1 credit. Seminars are presented on various aspects of professionalism, experimental design and critical evaluation of scientific literature. A simulated registry exam is given at the conclusion. Graded as pass/fail.

CLLS 415. Special Topics in Clinical Laboratory Sciences. 1-6 Hours.
Semester course; 1-6 credits. Course provides for tutorial studies, laboratory experience and/or library assignments in specialized areas for those students who have previous course work or laboratory experience in a specific subject.

CLLS 438. Research Paper. 1 Hour.
Semester course; 1 lecture hour. 1 credit. This course is designed to introduce the student to the fundamentals of scientific writing.

CLLS 483. Biochemistry Practicum. 1-4.5 Hours.
Semester course; 40-180 clock hours. 1-4.5 credits. Prerequisites: CLLS 311-312. Individual participation in hospital chemistry laboratories. Students gain practical experience in the use of procedures and instruments by working with the staff. After gaining competence, students are expected to perform and sign out routine laboratory work under supervision. Graded as pass/fail.

CLLS 485. Hematology Practicum. 1-4.5 Hours.
Semester course; 40-180 clock hours. 1-4.5 credits. Prerequisites: CLLS 301-302. Individual participation in hospital hematology laboratories. Students gain practical experience in the use of procedures and instruments by working with the staff. After gaining competence, the students are expected to perform and sign out routine laboratory work under supervision. Graded as pass/fail.

CLLS 493. Clinical Microbiology Practicum. 1-4.5 Hours.
Semester course; 40-180 clock hours. 1-4.5 credits. Prerequisites: CLLS 307-308. Individual participation in hospital bacteriology laboratories. Students gain practical experience in the performance and use of procedures by working with the clinical staff. After gaining competence, the students are expected to properly perform and sign out routine laboratory work under supervision. Graded as pass/fail.

CLLS 494. Miscellaneous Clinical Practicum. 1-4.5 Hours.
Semester course; 40-180 clock hours. 1-4.5 credits. Prerequisites: CLLS 301-302, 308, 310, 311-312 or permission of instructor. Students gain practical experience in the use of instruments and the performance of procedures by working with the clinical staff. After gaining competence, students are expected to properly perform and sign out routine laboratory work under supervision. Graded as pass/fail.

CLLS 496. Blood Bank Practicum. 1-4.5 Hours.
Semester course; 40-180 clock hours. 1-4.5 credits. Prerequisite: CLLS 306. Individual participation in hospital blood bank laboratories and Virginia Blood Services. Students gain practical experience in the use of procedures and instruments by working with the staff. Donor drawing and component preparation is observed. After gaining competence, the students are expected to properly perform and sign out routine laboratory work under supervision. Graded as pass/fail.

CLLS 500. Concepts and Techniques in Clinical Laboratory Science. 3 Hours.
Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisite: Permission of instructor. Restricted to candidates in the categorical master's program. Presents the basic theoretical concepts, laboratory techniques and skills employed in the areas of clinical chemistry, hematology, immunohematology and microbiology.

CLLS 501. Instrumental Methods of Analysis I. 2-4 Hours.
Semester course; 2 lecture and 4 laboratory hours. 2-4 credits. Prerequisite: Permission of instructor. A study of modern research and clinical laboratory instrumentation and procedures. Principles, theory and comparison of laboratory instruments are discussed along with the factors affecting their operation. Laboratory exercises are designed to demonstrate the practical applications of the instruments in the research and clinical laboratory. Areas covered include basic electronics, principles of photometry, spectrophotometry, fluorometry, flame emission photometry, atomic absorption spectrophotometry and computerized instrumentation.

CLLS 502. Instrumental Methods of Analysis II. 2-4 Hours.
Semester course; 2 lecture and 4 laboratory hours. 2-4 credits. Prerequisite: Permission of instructor. A study of modern research and clinical laboratory instrumentation and procedures. Principles, theory and comparison of laboratory instruments are discussed along with the factors affecting their operation. Laboratory exercises are designed to demonstrate the practical applications of the instruments in research and clinical laboratory. Areas covered include electrophoresis, chromatography, particle counters, radio-isotope counters and clinical laboratory automation.

CLLS 580. Principles of Education/Management. 1-3 Hours.
Semester course; 2 lecture and 2 practicum hours. 1-3 credits. Introduces fundamental educational theories and practice, principles of management and employee relations and health-care issues from a global perspective with an emphasis on multicultural diversity. Stresses the application in the clinical laboratory. Requires a practicum in education and in management following the completion of the didactic portion.

CLLS 595. Clinical Practicum. 1-4 Hours.
Semester course; 80-320 clock hours. 1-4 credits. Prerequisite: At least one of the following: CLLS 301-302, 306 and 310, 307-308, 311-312, or by permission of instructor. Individual participation in a hospital laboratory in a selected specialty area: clinical chemistry, hematology, microbiology or immunohematology. Students gain practical experience in the performance of procedures and use of instruments by working with the clinical staff. After gaining competence, the students are expected to properly perform and sign out routine laboratory work under supervision. Based on adviser's recommendation and student's past experience, the course may be taken for less than four credits. Graded as pass/fail.

CLLS 601. Theoretical Blood Banking. 3 Hours.
Semester course; 3 lecture hours (delivered online). 3 credits. Enrollment requires permission of the instructor. A comprehensive study of the blood groups in man, including biochemistry, genetics and clinical significance. Topics relating to problems with antibodies to the blood group antigens are discussed.

CLLS 602. Molecular Diagnostics in Clinical Laboratory Sciences. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Restricted to students in the M.S. in Clinical Laboratory Sciences' advanced master's track or permission of instructor. Provides the basic principles and techniques of molecular diagnostics and information for establishing a molecular diagnostics laboratory. Examines the utilization of molecular techniques in the clinical laboratory for patient diagnosis and therapy. Emphasizes the use of these techniques in the areas of immunology, microbiology, hematology/oncology, and inherited genetic disorders.

CLLS 605. Advanced Hematology. 2-4 Hours.
Semester course; 2 lecture and 2 laboratory hours. 2-4 credits. Prerequisite: Permission of instructor. Discusses advanced laboratory techniques used to analyze blood dyscrasias and hemostatic disorders. Students also may perform related laboratory tests.

CLLS 608. Laboratory Diagnosis of Infectious Diseases. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: permission of instructor. Applies an organ system approach to the laboratory diagnosis of infectious diseases. Emphasizes diagnostic methods to verify infections because of pathogenic micro-organisms and includes related diagnostic microbiology laboratory issues. Utilizes a distance learning format.

CLLS 610. Interpretative Clinical Hematology. 2 Hours.
Semester course; 2 lecture hours. 2 credits. Prerequisite: Permission of instructor. Principles of hematopoiesis and related pathological and pathophysiological correlation of hematological disorders are discussed.

CLLS 611. Analytical Techniques for Clinical Mass Spectrometry. 2 Hours.
6-week summer session; 12 lecture and 36 laboratory contact hours. 2 credits. Enrollment restricted to student admitted to the M.S. in Clinical Laboratory Sciences program or by permission of the instructor. Focuses on the proper utilization of chemicals and equipment required for the calibration, quality control and operation of clinically relevant mass spectrometry systems. Emphasizes calculations and demonstration of proficiency with quantitative techniques.

CLLS 612. Mass Spectrometry Systems for Clinical Analyses. 4 Hours.
Semester course; 3 lecture and 2 laboratory hours. 4 credits. Prerequisite: CLLS 611 or permission of the instructor. Focuses on the principles of chemical and instrumental analysis relevant to the detection and quantitation of clinically relevant analytes using mass spectrometry systems. Emphasizes the clinical laboratory applications of different types of mass spectrometry systems, preanalytical sample preparation, and integration of chromatography and mass spectrometry.

CLLS 613. Mass Spectrometry Assay Development for In Vitro Diagnostics. 3 Hours.
Semester course; 2 lecture and 2 laboratory hours. 3 credits. Prerequisites: CLLS 611 and CLLS 612 or permission of the instructor. Focuses on the principles of assay development and evaluation of methods for the measurement of clinically relevant analytes using chromatography-mass spectrometry systems. Emphasizes "best practices" as found in CLSI, SOFT and FDA guidance documents.

CLLS 622. Fundamentals of Public Health, Epidemiology and Laboratory Surveillance. 3 Hours.
Semester course; 3 lecture hours (delivered online). 3 credits. Enrollment is restricted to students enrolled in the medical laboratory sciences graduate program. Guided study introducing the mission and essential services of public health; epidemiological concepts, methods and goals; application, evaluation and individual and community considerations of public health interventions; the use of laboratory information management systems and informatics; and the role of the public health laboratory, including surveillance activities.

CLLS 624. Laboratory Techniques and Emergency Response and Preparedness. 3 Hours.
Semester course; 3 lecture hours (delivered online). 3 credits. Enrollment is restricted to students enrolled in the medical laboratory sciences graduate program. Guided study that reviews basic laboratory skills such as statistics, chain of custody and safety. Biological threat agents of public health concern are introduced along with common technologies and practices utilized as part of emerging and emergency preparedness and response technologies.

CLLS 626. Quality and Ethics. 2 Hours.
Semester course; 2 lecture hours (delivered online). 2 credits. Enrollment is restricted to students enrolled in the medical laboratory sciences graduate program. Guided study of quality management systems, nonconforming events, root cause analyses, preventive actions and corrections. Public health laboratory regulatory requirements and ethics involved in associated activities and research are also discussed.

CLLS 627. Advanced Concepts in Immunology and Immunohematology. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisites: CLLS 306, 310 and 496. Presents advanced topics in clinical immunology and immunohematology. Focuses on the integration of advanced concepts in the evaluation of laboratory data and solving clinical and methodological problems related to autoimmune diseases, ABO discrepancies, compatibility testing, hemolytic disease of the fetus and newborn and transfusion reactions.

CLLS 628. Advanced Concepts in Microbiology. 2 Hours.
Semester course; 2 lecture hours. 2 credits. Prerequisites: CLLS 307 and 308; and CLLS 496 or 595. Advances study of pathogenic microbiology principles. Includes application of laboratory data and techniques to solve clinical microbiology problems.

CLLS 629. Advanced Concepts in Hematology. 2 Hours.
Semester course; 2 lecture hours. 2 credits. Prerequisites: CLLS 302, and CLLS 485 or 595. Focuses on developing and expanding the knowledge acquired in the prerequisite courses in hematology and hemostasis. Incorporates case study evaluations, challenging current hematology topics in the literature and the integration of assessing laboratory data and clinical problems. Emphasizes the development of skills in critical thinking and analyzing clinical data.

CLLS 630. Advanced Concepts in Clinical Chemistry and Instrumentation. 2 Hours.
Semester course; 2 lecture hours. 2 credits. Prerequisites: CLLS 311 and 312; and CLLS 483 or 595. Focuses on advanced concepts in clinical chemistry, including endocrinology, measurement of vitamins and tumor markers, method evaluation and laboratory and hospital information systems. Integrates the basic knowledge and skills acquired in the undergraduate sequence of courses with advanced concepts in clinical chemistry/instrumentation to analyze the more complex clinical and analytical problems presented by the aforementioned topics. Includes the design and conduct of library research and laboratory experiments, and data analysis to generate recommendations that are practical and applicable in a real clinical chemistry service.

CLLS 661. Research Methodology in Medical Laboratory Sciences. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to students in the B.S. or M.S. in Medical Laboratory Sciences program. Focuses on the principles of scientific research as applicable to problems encountered in the medical laboratory sciences. Students will develop a draft of a research proposal that would be the foundation of a project that would satisfy the research requirement for the master's degree in medical laboratory sciences.

CLLS 690. Clinical Laboratory Sciences Seminar. 1 Hour.
Semester course; 1 lecture hour. 1 credit. Presentation and discussion of current research and topics of interest by the departmental faculty, graduate students and visiting lecturers.

CLLS 691. Special Topics in Clinical Laboratory Sciences. 1-4 Hours.
Semester course; 1-4 credits. This course provides for lectures, tutorial studies and/or library assignments in specialized areas not available in formal courses or research training.

CLLS 694. Molecular Diagnostic Practicum I. 8 Hours.
Semester course; 640 clock hours. 8 credits. Prerequisite: permission of instructor. Provides direct observation and practice in a molecular diagnostics laboratory with emphasis on nucleic acid extraction and molecular amplification techniques. Develops proficiency at performing, analyzing and reporting test results. Graded as pass/fail.

CLLS 695. Molecular Diagnostic Practicum II. 4 Hours.
Semester course; 320 clock hours. 4 credits. Prerequisite: permission of instructor. Provides direct observation and practice in molecular diagnostics laboratory. Focuses on molecular hybridization and human identity analyses. Develops proficiency at all stages of nucleic acid analyses including performing, analyzing and reporting test results. Introduces practice issues involved in management of a molecular diagnostics laboratory. Graded as pass/fail.

CLLS 696. Advanced Blood Bank Practicum. 2 Hours.
6 laboratory hours. 2 credits. Prerequisite: permission of instructor. A laboratory course with practical experiences in resolving complex blood group serological problems and discussion of these problems. Donor phlebotomy, processing of donor units, component preparation and instruction of undergraduate clinical laboratory sciences students also are performed.

CLLS 761. Research Methodology in Clinical Laboratory Sciences. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Focuses on the principles of scientific research as applicable to problems encountered in the clinical laboratory sciences. Also focuses on developing a draft research proposal that would be the foundation for a project that would satisfy the research requirement for the master's degree in clinical laboratory sciences.

CLLS 790. Research in Clinical Laboratory Sciences. 1-15 Hours.
Semester course; 1-15 credits. Research leading to the M.S. degree.