

# CLINICAL LABORATORY SCIENCE/MEDICAL TECHNOLOGY (CLSM)

## Courses

### **CLSM 105. Procedures in Phlebotomy. 4 Units.**

Training in venipuncture and skin puncture, medical terminology, laboratory safety, CPR, basic anatomy and physiology, specimen-collection techniques, hazards/complications, quality assurance methods, and medicolegal issues of phlebotomy. Clinical rotation arranged at Loma Linda University Medical Center and affiliates. CPR training and certificate arranged for students not already certified. Prerequisite: Current CPR certificate.

### **CLSM 303. Urine and Body Fluid Analysis I. 2 Units.**

Urinalysis screening procedure and its application in the diagnosis of renal, systemic, and metabolic diseases. Analysis and morphology of body fluids. Lecture and laboratory.

### **CLSM 307. Medical Parasitology. 3 Units.**

Medically important parasites: life cycles, clinical features, infective diagnostic stages. Demonstrations, slide studies, and diagnostic procedures. Lecture and laboratory.

### **CLSM 309. Quantitative Analysis (Chemical). 4 Units.**

Provides a rigorous background in chemical principles particularly important to analytical clinical chemistry. Develops an appreciation for the task of judging the accuracy and precision of experimental data and the application of statistical methods. Covers both fundamental and practical aspects of chemical analysis; neutralization titrations; acid-base titrations; spectrophotometric methods; and electrochemical and chromatographic methodologies. Lecture and laboratory.

### **CLSM 315. Physiology. 4 Units.**

Physiology of the human body including cellular, neuromuscular, cardiovascular, respiratory, gastrointestinal, renal, and endocrine systems.

### **CLSM 321. Hematology I. 4 Units.**

Examines normal hematologic physiology, cellular development, and hemostasis in the human. Introduces pathophysiology, with emphasis on clinical and laboratory evaluation of hematologic status. Theory and background of laboratory procedures used in diagnosis and treatment of hematologic and other diseases. Stresses proficiency in evaluation of normal and abnormal cellular morphology. Lecture and laboratory.

### **CLSM 322. Hematology II. 4 Units.**

Theory and background of routine and special laboratory procedures used in diagnosis and treatment of hematologic and other diseases. Emphasizes peripheral blood-cell morphology, hematopoiesis, maturation, and kinetics. Pathophysiology of hematologic disorders, including anemias and hematologic malignancies. Correlation of hemostasis testing with clinical hemostatic disorders. Lecture and laboratory. Prerequisite: CLSM 321.

### **CLSM 325. Clinical Immunology. 3 Units.**

Presents the basic principles of immunology. Topics covered include humoral and cell-mediated immunity, complement, autoimmunity, immunodeficiency, hypersensitivity, tumor immunology, transplant immunology, virology, syphilis serology, and immunologic laboratory techniques. Emphasizes principles, laboratory procedures, and clinical significance. Lecture and laboratory.

### **CLSM 327. Clinical and Pathogenic Microbiology I. 5 Units.**

Introduces microbiological concepts, leading to an in-depth study of the major groups of pathogenic bacteria and their relationship to human disease. Emphasizes clinical laboratory identification methods and procedures. Lecture and laboratory.

### **CLSM 328. Clinical and Pathogenic Microbiology II. 5 Units.**

Nature and control of microorganisms encountered in clinical material and various anatomical sites. Emphasizes antimicrobial agents, mycology, and virology, including hepatic viruses and HIV/AIDS. Lecture and laboratory. Prerequisite: CLSM 327; or consent of instructor.

### **CLSM 331. Biochemistry. 5 Units.**

Chemical structure and metabolism of carbohydrates, amino acids, lipids, and nucleic acids. Protein synthesis, functions, and analysis. Enzymes and their structure, function, kinetics, and regulation. Lecture and laboratory.

### **CLSM 332. Clinical Chemistry I. 4 Units.**

Clinical chemistry procedures and their clinical significance in medicine, with focus on the following areas: fluids and electrolytes, acid-base balance, carbohydrates and diabetes mellitus, and proteins. Presents quality assurance, method evaluation, and establishment of reference ranges. Lecture and laboratory. Prerequisite: CLSM 331; or consent of instructor.

### **CLSM 333. Clinical Chemistry II. 4 Units.**

Clinical chemistry procedures and their clinical significance in medicine, with focus on the following areas: lipids, lipoproteins, cardiovascular disease, enzymes, liver function, the endocrine system; thyroid, parathyroid, adrenal cortex and catecholamines, and steroids; reproduction, pregnancy, and fetal well-being; therapeutic drug monitoring and toxicology. Lecture and laboratory. Prerequisite: CLSM 332.

### **CLSM 341. Immunohematology I. 3 Units.**

Fundamentals of antigen-antibody reactions. Studies major blood-group systems, compatibility testing, and antibody-identification techniques. Clinical analysis of hemolytic disease of the newborn. Lecture and laboratory.

### **CLSM 342. Immunohematology II. 3 Units.**

Blood collection, donor testing, component preparation, and quality management in the collection facility. Identification of multiple antibodies, typing discrepancies, hemotherapy, hazards of transfusion, and investigation of autoimmune hemolytic disease. Lecture and laboratory. Prerequisite: CLSM 341.

### **CLSM 396. CLS Junior Seminar. 1 Unit.**

Prepares student for entry into the senior year clinical practicum. Introduces student to the clinical laboratory and its operations by direct observation and discussions to include pre-analytical, analytical, and postanalytical areas. Students expected to apply knowledge acquired from all disciplines within the junior year curriculum. Visits to off-site locations may be required.

### **CLSM 411. Urine and Body Fluid Analysis II. 1 Unit.**

Correlates theory and clinical experience with and applies them to analytical techniques. Assesses and interprets data. Evaluates and compares methodologies. Urinalysis screening procedures and applications in the diagnosis of renal, systemic, and metabolic diseases. Processing, analysis, and morphologic evaluation of body fluids. Prerequisite: CLSM 303.

**CLSM 413. Diagnostic Microbiology. 6 Units.**

Correlates theory and clinical experience with, and applies them to, analytical techniques. Assesses and interprets data. Evaluates and compares methodologies. Directed study and review of diagnostic bacteriology, mycology and virology. Emphasizes isolation and identification of pathogenic microorganisms. Includes susceptibility testing, instrumentation, and rapid identification methods. Prerequisite: CLSM 307, CLSM 327, CLSM 328.

**CLSM 414. Clinical Parasitology. 2 Units.**

Correlates theory and clinical experience with and applies them to analytical techniques. Assesses and interprets data. Evaluates and compares methodologies. Directed study and review of medical parasitology. Emphasizes testing for and identification of pathogenic parasites. Prerequisite: CLSM 307.

**CLSM 422. Hematology III. 6 Units.**

Correlates theory and clinical experience with and applies them to analytical techniques. Assesses and interprets data. Evaluates and compares methodologies. Directed study and review of hemostasis, cellular quantification and identification techniques, and clinical hematology. Includes white cell, red cell, platelet, and hemostatic disorders. Prerequisite: CLSM 321, CLSM 322.

**CLSM 434. Clinical Chemistry III. 5 Units.**

Correlates and applies theory and clinical experience with analytical techniques. Assesses and interprets data. Evaluates and compares methodologies. Directed study and review include: carbohydrates, proteins, lipids, enzymology, electrolytes, acid-base balance, endocrine system, and therapeutic drug monitoring. Prerequisite: CLSM 333.

**CLSM 435. Immunoassay and Molecular Diagnostic Techniques. 3 Units.**

Reviews common immunoassay and molecular diagnostic assay methodologies utilized in the clinical laboratory. Includes immunoassay technologies (EIA, ELISA, EMIT, FPIA), and chemiluminescence; and, molecular diagnostic techniques (nucleic acid extraction and purification, gel electrophoresis, nucleic acid hybridization and blots, DNA sequencing, and amplification technologies). Examines signal, target amplification, and real-time technologies. Addresses laboratory design and safety issues. Prerequisite: CLSM 325; or consent of the instructor.

**CLSM 442. Immunohematology III. 3 Units.**

Applies theory and techniques routinely used in transfusion medicine. Emphasizes correlation with clinical experience. Directed study and review include type and screen, antibody identification, investigation of hemolytic disease of the newborn, hemotherapy, and hazards of transfusion. Assesses and interprets data. Overview of donor facilities: donor criteria, records management, component preparation, blood storage, and infectious disease testing. Prerequisite: CLSM 341, CLSM 342.

**CLSM 451. Clinical Laboratory Management I. 2 Units.**

Introduces management theory, including: management styles, professional communications, business ethics, group theory, team building, process management, process control, and personnel.

**CLSM 452. Clinical Laboratory Management II. 2 Units.**

Financial management, with emphasis on concepts, tools, and strategies underlying financial decision making. Topics include health-care reimbursement systems, coding, billing, development of operating budgets, and financial reports. Concepts of financial negotiations, inventory management, and financial planning. Integrates and applies analytical techniques used in the service industries.

**CLSM 453. Clinical Laboratory Management III. 2 Units.**

Introduces theories of quality management, organization, strategic planning, and the decision-making process. Reviews and analyzes government agencies, legislation, and regulatory bodies that impact laboratory management. Compares quality systems-management philosophies.

**CLSM 455. Special Procedures. 4 Units.**

Clinical and theory-based assessment and interpretation of data. Evaluation and comparisons of methodologies including immunoassays, thin-layer and high-pressure liquid chromatography, electrophoresis, spectrophotometry, toxicology, amino acids assay, rapid-detection testing for bacteria and viruses, polymerase and ligase chain reactions, Western blot assays, serology, and current immunologic techniques. Prerequisite: CLSM 325, CLSM 333.

**CLSM 471. Clinical Practicum I. 5 Units.**

Thirteen weeks of supervised clinical laboratory experience in selected areas, including parasitology, hematology, urinalysis, and body fluids. Student performs tests routinely done in these areas of the clinical laboratory.

**CLSM 472. Clinical Practicum II. 5 Units.**

Thirteen weeks of supervised clinical laboratory experience in selected areas, including: microbiology and immunohematology, with experience in transfusion services and in a blood-collection facility. Student performs tests routinely done in these areas of the clinical laboratory. Emphasizes clinical-laboratory quality-control procedures and evaluation.

**CLSM 473. Clinical Practicum III. 5 Units.**

Thirteen weeks of supervised clinical laboratory experience in selected areas, including: chemistry and special procedures. Student performs tests routinely done in these areas of the clinical laboratory. Incorporates experience in administrative duties.

**CLSM 474A. Clinical Correlations. 1 Unit.**

Interactively bridges knowledge from textbook to clinical practice and decision making. Stimulates students' intellectual curiosity as it applies to laboratory medicine—including interpretation of laboratory data, case study analysis, impact on patient treatment and prognosis, assessment of validity of laboratory data, and administration of mock board examinations.

**CLSM 474B. Clinical Correlations. 1 Unit.**

Interactively bridges knowledge from textbook to clinical practice and decision making. Stimulates students' intellectual curiosity as it applies to laboratory medicine—including interpretation of laboratory data, case study analysis, impact on patient treatment and prognosis, assessment of validity of laboratory data, and administration of mock board examinations.

**CLSM 474C. Clinical Correlations. 1 Unit.**

Interactively bridges knowledge from textbook to clinical practice and decision making. Stimulates students' intellectual curiosity as it applies to laboratory medicine—including interpretation of laboratory data, case study analysis, impact on patient treatment and prognosis, assessment of validity of laboratory data, and administration of mock board examinations.

**CLSM 496. Clinical Laboratory Science Seminar I. 1 Unit.**

Explores topics such as medical research design and implementation, test method selection and evaluation, and laboratory instrumentation. Prerequisite: Satisfactory completion of Clinical Laboratory Science Program junior-year courses, or consent of instructor.

**CLSM 497. Clinical Laboratory Science Seminar II. 2 Units.**

Continues with test method evaluation and explores each of the method validation experiments from planning through completion. Emphasizes procedures and techniques used to validate the performance of both quantitative and qualitative test methods. Prerequisite: CLSM 496; or consent of instructor.

**CLSM 498. Clinical Laboratory Science Seminar III. 1 Unit.**

Introduces credentialing mechanisms and benefits of membership in professional organizations. Includes other topics such as educational methodologies and professional development. Prerequisite: CLSM 497; or consent of instructor.

**CLSM 499. Clinical Laboratory Science Independent Study. 1-5 Units.**

Project or paper to be submitted on a topic of current interest in an area related to medical technology. Regular meetings provide student with guidance and evaluation. Elected on the basis of need or interest.