

Revised: 2023

MDL 261 Clinical Chemistry I

COURSE OUTLINE

Prerequisites:

CHM 111 or equivalent

Course Description:

Introduces the basic principles of clinical chemistry, including a description of automation in the laboratory, and clinical chemistry techniques and point of care testing. Focuses on amino acids and proteins, enzymes, lipids, carbohydrates, urea nitrogen, and electrolyte measurement. Also introduces molecular techniques in the modern clinical chemistry laboratory.

Semester Credits: 4

Lecture Hours: 3

MDL 261 Clinical Chemistry I

VIRGINIA WESTERN COMMUNITY COLLEGE
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Student Outcomes for the Course:

At the completion of this course, the student should be able to:

- Perform the laboratory mathematics required to prepare solutions and dilutions in the laboratory
- Describe the various types and principles of the automated chemistry analyzers
- Correlate the results of chemistry lab tests to specific disease conditions
- Describe how various enzymes function mechanistically, and which enzymes are associated with various organs in the human body
- Describe the role of various endogenous chemicals in the human body, such as glucose, urea, amino acids, proteins, and electrolytes
- Correlate disturbances in the normal body concentration of electrolytes and endogenous biochemicals (upset of homeostasis) with the onset of pathological states
- Recognize abnormal concentration values for the above substances in a blood sample
- Perform manual and automated test methodologies for select analytes in a blood sample and recognize analytical errors in the generation of results
- Distinguish between normal human physiology and pathological states in the major organ systems

Textbook:

Clinical Laboratory Chemistry 2nd Edition by R. L. Sunheimer and L. Graves
Pearson ISBN: 978-0134413327

Course Outline

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I. Laboratory Basics Chapt. 1

- A. Introduction
- B. Water
- C. Chemicals
- D. Lab Glassware and Plasticware
- E. Measurement of Mass
- F. Centrifuges
- G. Mixing and Solutions
- H. Laboratory Mathematics and Metric System

II. Laboratory Safety Chapt. 2

- A. Proper Use of Lab Equipment
- B. Proper Handling and Storage of Chemicals
- C. OSHA Rules of the Laboratory
- D. Emergency Management/Risk Mitigation

III. Carbohydrates Chapt. 7

- A. Biochemistry of Carbohydrates
- B. Carbohydrate Metabolism
- C. Hormonal Regulation of Carbohydrates
- D. Clinical Significance/Disease States
- E. Specimen Collection and Handling
- F. Glucose Methodologies
- G. Other Carbohydrate Related Methodologies

IV. Lipids and Lipoproteins Chapt. 8

- A. Classification and Biochemistry of Lipids
- B. Lipoprotein Metabolism
- C. Hyperlipidemia
- D. Cholesterol Methodologies
- E. Triglyceride Methodologies
- F. High Density Lipoprotein Methodologies
- G. Low Density Lipoproteins-Calculated and Direct
- H. Metabolic Syndrome
- I. National Cholesterol Education Program (NCEP)

V. Amino Acids and Proteins Chapt. 9

- A. Protein Structure
- B. Protein Metabolism

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- C. Protein Synthesis
- D. Protein Functions
- E. Amino Acidopathies
- F. Plasma Proteins
- G. Hyperproteinemia
- H. Hyperproteinemia
- I. Total Protein Methodologies
- J. A/G Ratio
- K. Urine and CSF Proteins
- L. Albumin Methodologies
- M. Protein Electrophoresis

VI. Enzymes Chapt. 10

- A. Enzyme Biochemistry
- B. Enzyme Kinetics
- C. Factors Influencing Enzyme Action
- D. Diagnostic Enzymology
- E. Enzyme Classification/Isoenzymes
- F. Cardiac Enzymes
- G. Hepatic Enzymes
- H. Biliary Tract Enzymes
- I. Digestive and Pancreatic Enzymes
- J. Other Clinically Significant Enzymes

VII. Non-protein Nitrogen and Renal Function Chapt. 11

- A. Renal Anatomy
- B. Renal Physiology
- C. Analytes Associated With Renal Function
- D. Creatinine
- E. Uric Acid
- F. Assessment of Glomerular Filtration
- G. Screening of Renal Disease
- H. Renal Pathophysiology/Dialysis

VIII. Body Water and Electrolytes Chapt 12.

- A. Body Fluid Composition
- B. Colligative Properties

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- C. Regulation of Water and Electrolytes
- D. Sodium, Potassium, Chloride and Bicarbonate

IX. Blood Gases, pH and Electrolyte Balance Chapt. 13

- A. Importance of Measuring Blood Gases
- B. Blood Gas Imbalances and Human Health
- C. Critical Electrolytes
- D. Control of Electrolytes by the Human Body
- E. Diseases of Electrolyte Imbalance

X. Bone and Mineral Metabolism Chapt. 14

- A. Calcium and the Calcium Homeostasis
- B. Diseases of Hypo- and Hypercalcemia
- C. Calcium and Bone Development
- D. Phosphorus and Phosphorus Homeostasis
- E. Diseases of Phosphorus Imbalance

XI. Laboratory Statistics and Quality Control in the Chemistry Laboratory

- A. Introduction/Review of Statistics for the Laboratory
- B. The Levy-Jennings Plot and its Interpretation
- C. The Westgard Rules of Quality Control

IV. Instrumentation

- A. Absorption Spectroscopy
- B. Atomic Absorption Spectroscopy
- C. Molecular Luminescence Spectroscopy
- D. Chemiluminescence
- E. Light Scatter Techniques
- F. Refractometry
- G. Separation Techniques
- H. Mass Spectrometry
- I. Flow Cytometry
- J. Microscale Techniques

Laboratory Topics

Lab # 1: Introduction to Clinical Chem. Lab, Lab Calculations

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Lab # 2: Total Cholesterol

Lab # 3: Uric Acid

Lab # 4: Total Protein-Biuret

Lab # 5: Western Blotting I

Lab # 6 Western Blotting II

Lab # 7: Magnesium Measurement

Lab # 8: Albumin Assay

Lab # 9: Urea Nitrogen

Lab # 10: Lactate dehydrogenase

Lab # 11: Glucose Analysis

Lab # 12: Electrolyte Measurement

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