

Revised: Fall 2016

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

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Course Outcomes:

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

- Perform laboratory mathematics 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
- Understand how various enzymes function, and which enzymes are associated with various organs in the human body and disease
- Understand the role of various endogenous chemicals in the human body, such as glucose, urea, amino acids, proteins, and electrolytes
- Know how disturbances in the normal body concentration can be an indicator and a cause of various diseases
- 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
- Have a basic understanding of the functions and pathophysiology of the human body's organ systems

Textbook:

Clinical Chemistry: Principles, Techniques and Correlations 7th Edition by M.L. Bishop
ISBN: 978-1-4511-1869-8

Course Outline

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I. Basic Principles and Practices

- A. Units of Measure
- B. Reagents
- C. Clinical Laboratory Supplies
- D. Basic Separation Techniques
- E. Laboratory Mathematics and Calculations
- F. Specimen considerations

II. Laboratory Safety and Regulations

- A. Laboratory Safety and Regulations
- B. Safety Awareness for Clinical Laboratory Personnel
- C. Safety Equipment
- D. Biologic Safety
- E. Chemical Safety
- F. Radiation Safety
- G. Fire Safety
- H. Control of Other Hazards
- I. Disposal of Hazardous Materials
- J. Accident Documentation and Investigation

III. Analytic Techniques

- A. Spectrophotometry
- B. Electrochemistry
- C. Electrophoresis
- D. Osmometry

IV. Chromatography and Mass Spectrometry

- A. Chromatography
- B. Mass Spectrometry
- C. Application of MS in the Clinical Laboratory

V. Principles of Clinical Chemistry Automation

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- A. History of Automated Analyzers
- B. Basic Approaches to Automation
- C. Steps in Automated Analysis
- D. Total Laboratory Automation
- E. Future Trends in Automation

VI. Immunochemical Techniques

- A. Immunoassays

VII. Molecular Theory and Techniques

- A. Nucleic Acid-Based Techniques

VIII. Point of Care Testing

- A. Laboratory Regulations
- B. Implementation
- C. Quality Management
- D. POC Applications
- E. Informatics and POCT

IX. Amino Acids and Proteins

- A. Amino Acids
- B. Proteins
- C. Plasma Proteins
- D. Other Proteins of Importance
- E. Total Protein Abnormalities
- F. Methods of Analysis
- G. Proteins in Other Body Fluids

X. Nonprotein Nitrogen Compounds

- A. Urea
- B. Uric Acid
- C. Creatinine/Creatine
- D. Ammonia

XI. Enzymes



- A. General Properties of Enzymes
- B. Enzyme Classification and Nomenclature
- C. Enzymes of Clinical Significance

XII. Carbohydrates

- A. General Description of Carbohydrates
- B. Hyperglycemia
- C. Hypoglycemia
- D. Role of the Laboratory in Differential Diagnosis and Management of Patients with Glucose Metabolic Alterations

XIII. Lipids and Lipoproteins

- A. Lipid Chemistry
- B. General Lipoprotein Structure
- C. Lipoprotein Physiology and Metabolism
- D. Lipid and Lipoprotein Population Distributions
- E. Diagnosis and Treatment of Lipid Disorders
- F. Lipid and Lipoprotein Analysis
- G. Standardization of Lipid and Lipoprotein Assays

XIV. Electrolytes

- A. Water
- B. The Electrolytes
- C. Anion Gap
- D. Electrolytes and Renal Function

Laboratory Topics

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

Lab # 2: Total Cholesterol

Lab # 3: Uric Acid

Lab # 4: LDH Isozymes by Electrophoresis

Lab # 5: α -1 antitrypsin

Lab # 6: Western Blotting

Lab # 7: Magnesium Measurement

Lab # 8: Total Protein and Albumin

Lab # 9: Urea Nitrogen

Lab # 10: Lactate dehydrogenase

Lab # 11: Glucose Analysis

Lab # 12: Lipids and Lipoproteins + Electrophoresis

Lab # 13: Electrolyte Measurement

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