

Revised: Fall 2016

MDL 262 Clinical Chemistry II

COURSE OUTLINE

Prerequisites:

MDL 261 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 Blood gases, pH and buffer systems, and porphyrins/hemoglobin. Also concentrates on the assessment of organ system functions, including the endocrine system, calcium homeostasis, hepatic functions, cardiovascular system functions, renal function tests, and pancreatic functions. Discusses therapeutic drug monitoring techniques, clinical toxicology, and nutrition assessment.

Semester Credits: 4

Lecture Hours: 3

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Course Outcomes:

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

- Measure and interpret blood gas testing results
- Understand the various organ systems of the human body along with disease states that can affect each system discussed
- Understand the components of the endocrine system and the pathology of endocrine diseases
- Identify normal ranges of hormones in the bloodstream; know the conditions associated with hypo- or hyper secretion of the hormones discussed
- Identify the analytes that can be used as markers of disease states, such as cardiac and liver enzymes
- Understand the concepts of therapeutic drug monitoring (TDM) and how to measure drug metabolites in the clinical laboratory
- Identify toxic substances that are commonly identified in the clinical setting such as illicit drugs and heavy metals, and understand how they are harmful to exposed humans
- Know the various tumor markers and what cancers they are associated with; know how to perform assays for tumor markers in the laboratory
- Have an understanding of nutritional disease states, including diabetes, and assay for specific nutrients critical for normal homeostasis

Textbook:

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

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I. Blood Gases, pH, and Buffer Systems

- A. Acid-Base Balance
- B. Assessment of Acid-Base Hemostasis
- C. Oxygen and Gas Exchange
- D. Measurement
- E. Quality Assurance

II. Porphyrins and Hemoglobin

- A. Porphyrins
- B. Hemoglobin
- C. Myoglobin

III. Hypothalamic and Pituitary Function

- A. Anatomy
- B. Functional Aspects of the Hypothalamic-Hypophyseal Unit
- C. Hypothalamic Hormones
- D. Anterior Pituitary Hormones
- E. Pituitary Tumors
- F. Growth Hormone
- G. Prolactin
- H. Hypopituitarism
- I. Posterior Pituitary Hormones

IV. Adrenal Function

- A. Overview of the Adrenal Gland
- B. Adrenal Cortex Zones
- C. Primary Aldosteronism
- D. Adrenal Cortical Physiology
- E. Addison's Disease
- F. Hypercortisolism
- G. Cushing's Syndrome
- H. Adrenal Androgens
- I. Adrenal Medulla

V. The Thyroid Gland

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- A. The Thyroid
- B. Tests for Thyroid Evaluation
- C. Other Tools for Thyroid Evaluation
- D. Disorders of the Thyroid
- E. Drug-Induced Thyroid Dysfunction
- F. Nonthyroidal Illness
- G. Thyroid Nodules

VI. Calcium Homeostasis and Hormonal Regulation

- A. Calcium Homeostasis
- B. Hormonal Regulation of Calcium Metabolism
- C. Organ System Regulation of Calcium Metabolism
- D. Hypercalcemia
- E. Hypocalcemia
- F. Metabolic Bone Diseases
- G. Secondary Hyperparathyroidism in Renal Failure

VII. Liver Function

- A. Anatomy
- B. Biochemical Function
- C. Liver Function Alterations during Disease
- D. Assessment of Liver Function/Liver Function Tests

VIII. Laboratory Markers of Cardiac Damage and Function

- A. Cardiac Ischemia, Angina, and Heart Attacks
- B. The Pathophysiology of Atherosclerosis
- C. Markers of Cardiac Damage
- D. Cardiac Injury in other Disease Processes
- E. The Use of Cardiac Biomarkers in Heart Failure
- F. Natriuretic Peptides and Troponins
- G. Markers of CHD Risk
- H. Markers of Pulmonary Embolism

IX. Renal Functions

- A. Renal Anatomy and Physiology
- B. Analytic Procedures
- C. Pathophysiology

X. Pancreatic Function and Gastrointestinal Function

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- A. Physiology of Pancreatic Function
- B. Diseases of the Pancreas
- C. Tests of Pancreatic Function
- D. Physiology and Biochemistry of Gastric Secretion
- E. Tests of Gastric Function
- F. Intestinal Physiology
- G. Clinicopathologic Aspects of Intestinal Function
- H. Tests of Intestinal Function

XI. Therapeutic Drug Monitoring

- A. Routes of Administration
- B. Absorption, Distribution, Metabolism, Elimination of Drugs
- C. Free vs. Bound Drugs
- D. Pharmacokinetics
- E. Sample Collection
- F. Cardioactive Drugs
- G. Antibiotics
- H. Antiepileptic Drugs
- I. Psychoactive Drugs
- J. Immunosuppressive Drugs
- I. Antineoplastics

X. Toxicology

- A. Xenobiotics, Poisons, and Toxins
- B. Routes of Exposure
- C. Dose-Response Relationships
- D. Analysis and Toxicology of specific Agents
- E. Toxicology of Therapeutic Drugs and Drugs of Abuse

XI. Circulating Tumor Markers

- A. Types of Tumor Markers
- B. Application of Tumor Marker Detection
- C. Laboratory Considerations for Tumor Marker Measurement
- D. Frequently Ordered Tumor Markers

XII. Nutrition Assessment

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- A. Overview of Nutrition Care Process
- B. Nutrition Assessment
- C. Macronutrient Biochemical Markers
- D. Miscellaneous Biochemical Markers
- E. Micronutrient Biochemical Markers

Laboratory Topics

Lab # 1: Blood gases

Lab # 2: Hemoglobin Variants

Lab # 3: Phosphatases; Acid phosphatases-Total + Prostatic

Lab # 4: Iron and Iron Binding Capacity

Lab # 5: Calcium Measurement

Lab # 6: Bilirubin; Total and Direct

Lab # 7: Creatine kinase (CPK)

Lab # 8: Creatinine and Creatinine Clearance

Lab # 9: Amylase

Lab # 10: Acetaminophen and Salicylate

Lab # 11: Ethanol Measurement

Lab # 12: Ammonia

Lab # 13: Hemoglobin A1C

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