MLT 124 - Clinical Chemistry II Lecture

Approval Date:  Effective Term:

**Department:** MEDICAL LABORATORY TECHNICIAN  
**Division:** Allied Health/Public Safety  
**Units:** 3.00  
**Grading Option:** Letter Grade  
**Transferability:** CSU Transferable  
**Course is:** AA/AS Degree  

**Repeatability:**

**Contact Hours per Term:**  
- Lecture/Discussion: 4.00

**Associate Degree GE Applicability:** No  
**Recommended Class Size:** 15  
- Rationale: Station limitations.

**Discipline/Minimum Qualifications:**

**Catalog Description:**
Second in two part clinical chemistry series, emphasizing the endocrine, liver, kidney, and pancreatic functions. Also includes tumor markers, drug screening, and body fluids.

**Schedule Description:**
Second in two part clinical chemistry series, emphasizing the endocrine, liver, kidney, and pancreatic functions. Also includes tumor markers, drug screening, and body fluids.

**Student Learning Outcome:**
1. Compare and contrast laboratory methods used to test endocrine, liver, kidney, and pancreatic functions as well as drug screening, tumor markers, and body fluids, including the analytical limitations of each method.
2. Correlate clinically significant laboratory results to clinical diagnosis.

**Course Objectives:**
1. Investigate the proteins assayed in the clinical laboratory, identify their common methods of analysis and relate laboratory results to clinical diagnosis.
2. Examine the non-protein-nitrogen substances (NPNS) commonly analyzed in the clinical laboratory, identify clinically significant results, relate laboratory results to metabolism, chemical and physical properties.
3. Summarize the carbohydrates assayed in the clinical laboratory, identify their common methods of analysis and relate laboratory results to clinical diagnosis.
4. Distinguish the heme-derivatives commonly analyzed in the clinical laboratory including their clinical significance, metabolism, chemical and physical properties.
5. Summarize the tests and methods identified as endocrine, including the clinical significance of their assays.
6. Examine the concept and clinical utility of therapeutic drug monitoring and clinical utility of toxicology.
7. Relate the definitions of specific toxicology terminology.
8. Categorize the basic steps of pharmokinetics.
9. Examine the commonly ordered tumor markers assayed in the clinical laboratory.

Course Content Outline:

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6. Glucose levels, glucose tolerance tests, and glycohemoglobin with diabetes mellitus and hypoglycemia.
7. Inborn errors of CHO metabolism and how the laboratory generally tests for these.
8. Lipids assayed in the clinical laboratory, methods of analysis and relationship of laboratory results to clinical diagnosis.
9. Simple and conjugated lipids, lipoproteins, and apolipoproteins.
10. Chemical and physical properties of lipids.
11. Biological functions and hormonal control of lipids.
13. Principle methods for triglycerides, cholesterol, high-density lipoproteins (HDL), lipid profiles and Apolipoproteins.
14. Specimen considerations, interference, and reference ranges for individual lipids.
15. Assessment protocol and correlations for coronary heart disease (CHD) risk.
16. Lipoprotein phenotyping and the tests used to classify phenotypes.
17. Lipid abnormality diseases and their clinical results.
D. Distinguish the heme-derivatives commonly analyzed in the clinical laboratory including their clinical significance, metabolism, chemical and physical properties.
1. Function and structure of the liver to include anatomic and microscopic characteristics.
2. Metabolism of bilirubin and urobilinogen.
3. Types of Bilirubin
4. Classification system for jaundice.
5. Clinical significance of bilirubin, urobilinogen and urine bilirubin in terms of different types of jaundice.
6. Methods for measuring bilirubin, differentiating the types of bilirubin measured.
7. Specimen considerations, interference and reference ranges.
8. Laboratory findings in relation to the pathophysiology of the liver.
E. Tests and methods identified as endocrine, including the clinical significance of laboratory results.
1. Primary endocrine glands
2. Actions of hormones secreted by each gland.
3. Thyroid function tests and laboratory tests and the relation of their results to the clinical conditions.
4. Tests that access ovarian function.
5. Patterns of laboratory results consistent with menopause versus the ovulating female.
6. Hormonal tests associated with infertility.
7. Abnormal results and their relation to clinical conditions and the respective clinical management of the conditions.
8. Hormonal tests associated with invitro fertilization.
9. Enzymes correlated with liver function and indicators of inflammation.
F. Concept and clinical utility of therapeutic drug monitoring (TDM) and clinical utility of toxicology.
1. Common reasons that TDM is indicated.
2. Key factors for consideration when performing TDM.
3. Role of the clinical laboratory in performing toxicology testing.
G. Specific toxicology terminology.
1. Minimum effective concentration and minimum toxic concentration.
2. Peaks and troughs
3. Criteria for requesting STAT testing.
4. Categorization of drugs of abuse
H. Basic steps of pharmokinetics
1. Therapeutic drug monitoring including the reasons for performing the tests.
2. Peak and trough levels and the purpose for evaluating them.
3. Categorization of therapeutic drugs.
4. Immunochemical techniques used for therapeutic drug monitoring.
5. Toxicology testing including substances assayed and the types of situations warranting toxicological analysis..
6. Methodology for ethanol analysis.
7. Methods, including chromatography used in screening and confirmation of drugs of abuse.
8. Colorimetric procedures for salicylate and acetaminophen quantitation.
I. Tumor markers assayed in the clinical laboratory.
1. Correlation of tumor marker test results with clinical diagnosis.
2. Technology for tumor marker testing.

A. Proteins assayed in the clinical laboratory, common methods of analysis and the relationship of laboratory results to clinical diagnosis.
1. Simple and conjugated proteins.
2. Chemical and physical properties of amino acids and proteins.
3. Categorizing proteins by their type of structure.
4. Biological functions of proteins.
5. Separation techniques for proteins.
6. Principal methods for albumin, total protein and urine proteins.
7. Specimen considerations, interference and reference ranges.
8. Electrophoresis and clinical application of immunoglobulin results.
9. Electrophoretic mobility and function relative to electrophoresis methods.
10. Diseases that cause hypoproteinemia and hyperproteinemia.
11. Urine and cerebrospinal fluid protein testing.
12. Quantization of protein in other body fluids.
B. Non-protein-nitrogen substances (NPNS) commonly analyzed in the clinical laboratory, clinically significant results, laboratory results related to metabolism, chemical and physical properties..
1. Principal methodologies of renal function tests.
2. Mayor physiologic functions that the kidney employs during renal function tests.
3. Kidney function
4. Specimen considerations, interference and reference ranges.
5. The purpose, principle and technique of creatinine clearance testing.
6. Calculating 24-hour creatinine excretion.
7. Urine osmolality, specific gravity and urinary protein and renal concentrating ability.
C. Carbohydrates assayed in the clinical laboratory, common methods of analysis and the relationship of laboratory results to clinical diagnosis.
1. Simple and complex carbohydrates.
2. Chemical and physical properties of carbohydrates.
3. Biological functions of carbohydrates including the hormonal regulation.
5. Specimen considerations, interference and reference ranges for glucose and keto

**Methods of Instruction:**
Lecture:

**Methods of Evaluation:**
Exams/Tests/Quizzes
Case studies

**Typical Assignments:**

**Reading:**
Textbook chapter assignments Supplemental reference books

**Writing, Problem Solving or Performance:**
Problem solving for chapter study questions Short essay answers for some exam questions Some calculations

**Other:**
Case studies

**Required Materials Examples:**

**Book 1**
Author: Bishop, Michael L., Edward P. Fody, & Larry E. Schoeff
Title: Clinical Chemistry: Principals, Procedures, Correlations
Publication Date: 2004
Publisher: Lippincott, Williams & Wilkins
Edition: 5th

**Book 2**
Author: Burtis, Carl A. & Edward R. Ashwood
Title: Tietz Fundamentals of Clinical Chemistry
Publication Date: 2007
Publisher: Saunders
Edition: 5th

**Course Preparation:**
Prerequisite(s):
MLT 120
MLT 120L
Co-Requisite(s): MLT 124L

Recommended: None

**Document Content Review**

**Target Course Skills**

**Condition on Enrollment**
Established

**Faculty**
Sue Albert Donna Berardo

**Basic Content Review**
In MLT 120, Clinical Chemistry I Lecture students learn to use basic supplies and equipment correctly. They learn quality control and quality assurance as it applies to the chemistry department. They learn the basic laboratory methods including the mechanism of measurement and analytical limitations associated with the methods. They learn the basic electrolyte measurement methodologies used in the clinical laboratory and the clinical significance of laboratory results. They learn about acid-base balance and trace elements. In MLT 124, Clinical Chemistry II Lecture they use this knowledge as they learn about proteins to be assayed and methods to do them. They are now learning about carbohydrates and their methods of analysis. They are learning about heme-derivatives. They learn about toxicology, drug monitoring, pharmakinetics and tumor markers. These all are built on the basic knowledge of electrolytes, acid-base balance and trace elements.

**Condition on Enrollment**
Established

**Faculty**
Sue Albert Donna Berardo

**Basic Content Review**
In MLT 120L, Clinical Chemistry I Laboratory students learn to use chemistry laboratory instrumentation correctly. They learn the difference in specimen types. They develop a working knowledge of basic laboratory mathematics. They learn quality assurance and quality control. They learn the basic laboratory methods including the mechanism of measurement and analytical limitations associated with the methods. They learn about normal and control ranges. They learn the biochemical physiologic changes through the age continuum. These are all necessary beginning steps to move into MLT 124, Clinical Chemistry II Lecture where this information is applied to protein, carbohydrates, heme-derivatives, endocrine, and toxicology.

**Condition on Enrollment**
Established

**Faculty**
Sue Albert Donna Berardo

**Basic Content Review**
In MLT 124, Clinical Chemistry II Lecture the students are learning about common methods of analysis and
relating lab results to clinical diagnosis. They are learning about carbohydrate assays, heme-derivatives, endocrine testing, therapeutic drug monitoring, toxicology and pharmacokinetics. They are introduced to tumor marker assays. In MLT 124L, Clinical Chemistry II Laboratory students learn to actual do the tests, do the assays for the proteins, do the dilution preparation for these tests. They work with hemoglobin A1c one of the heme-derivatives. They are introduced to the chemistry analyzer that runs all of these tests.