

I. OVERVIEW

A course designed for students in nursing to develop an appreciation for the utility of the objective data generated by the clinical chemistry laboratory. Students should gain insight into the relationship between various common diseases, the underlying biochemistry and the clinical tests used in their diagnosis and therapeutic monitoring.

II. COURSE OBJECTIVES

An appreciation of the practice of laboratory medicine and an understanding of clinical chemistry provides valuable information that can be used in nursing practice. The objective of this course is to enable you to begin to relate a client's clinical signs and symptoms to underlying biochemical and physiological phenomena and these in turn to results provided by the clinical laboratory. Concepts relating to structure, properties and function of the major biological molecules are developed in sufficient detail to permit a qualitative understanding of these substances and their behavior in living organisms.

COURSE CONTENT

MODULE 1 - Fundamentals of Clinical Chemistry I

DESCRIPTION

This module focuses on the role of the laboratory in the patient care cycle and includes an extensive overview of the fundamental principles behind laboratory testing, including the biochemistry of common lab tests. Also discussed are the areas of fluid and electrolyte balance, acid and base balance, and the interplay between the endocrine system and common diseases. Renal issues and Therapeutic drug monitoring are also discussed. This module is taught with the assumption that the student has a working knowledge of normal human anatomy and physiology, although pertinent review of the systems will occur on a regular basis.

Unit 1 - Introduction to Clinical Chemistry & Evidence-based Laboratory Medicine

Learning Objectives

- Outline the factors involved in acquiring objective data
- Describe and employ the statistical techniques used to ensure quality control
- Discuss the role of the laboratory in effective patient care
- Explain and demonstrate the factors used in assessing biochemical data
- Discuss the role of the laboratory in therapy and evaluation

Unit 2 - Endocrine Function and Dysfunction**Learning Objectives**

- Review and discuss the structure and function of the endocrine system
- Discuss special considerations in diagnosing endocrine disorders
- Examine in detail conditions and biochemical tests involving the hypothalamus and pituitary gland
- Examine in detail conditions and biochemical tests involving the thyroid gland
- Examine in detail conditions and biochemical tests involving the adrenal glands
- Examine in detail conditions and biochemical tests involving the gonads

Unit 3 - Metabolic Disorders and Nutrition**Learning Objectives**

- Examine the complex fashion in which carbohydrates are processed and utilized in the human body
- Describe the laboratory measurement for glucose concentration
- Discuss the diagnosis, management, and laboratory involvement in the treatment of diabetes
- Examine the metabolic complications of diabetes and related comorbidities
- Discuss the root cause of a variety of inherited metabolic disorders
- Examine the role of the clinical laboratory in the assessment and planning of treatment for patients with specific nutrition requirements

Unit 4 - Renal Management of Fluid, Electrolyte, Acid, and Base Balance**Learning Objectives**

- Discuss the homeostasis of water and sodium and the consequences of breakdown in this system
- Outline and discuss the laboratory testing employed in the assessment of sodium and water excess and depletion
- Discuss the homeostasis of potassium and the consequences of breakdown in this system
- Outline and discuss the laboratory testing employed in the assessment of potassium excess and depletion
- Discuss the homeostasis of calcium, phosphate, and magnesium and the consequences of breakdown in this system
- Outline and discuss the laboratory testing employed in the assessment of calcium, phosphate, and magnesium
- Discuss the buffering of solutions in the human body
- Describe the tests employed in assessing the acid/base status of a patient
- Outline the common tests in the biochemical investigation of renal function
- Determine the effect of a variety of renal disorders on the maintenance of fluid, electrolyte, acid, and base balance

Unit 5 - Drug Monitoring and Toxicology**Learning Objectives**

- Examine the role and special considerations of the clinical laboratory in therapeutic drug monitoring
- Discuss the vital role of the clinical lab in the monitoring of a variety specific therapeutic drugs
- Examine and discuss the concept of poisoning and the role of the lab in the assessment of common drug toxicology
- Discuss the usefulness and special considerations involved in drug screening

MODULE 2 - *Fundamentals of Clinical Chemistry II***DESCRIPTION**

The second module in CHMI 2220 examines the role of the laboratory in the diagnosis and treatment of cardiovascular disorders, nervous and musculoskeletal disorders, and cancer. Lab considerations in hepatic and biliary diseases are also examined. The course concludes with a discussion of the variation in reference intervals for the extremely young and aged. Relevant background information will be presented prior to a detailed discussion of each topic.

Unit 1 - Metabolic Aspects of Malignant Disease**Learning Objectives**

- Review the general pathophysiology of malignant cellular changes
- Describe the pathophysiological changes occurring in paraneoplastic endocrine syndromes and familial endocrine syndromes
- Discuss the biochemical changes that can be detected in malignant endocrine syndromes
- Discuss the presence and detection of tumour markers as a means of diagnosing a variety of malignant conditions

Unit 2 - Musculoskeletal and Nervous System Disorders**Learning Objectives**

- Discuss the relevant pathophysiology underlying a variety of metabolic bone diseases and articular diseases
- Describe the relevant biochemical indicators of bone and arthritic conditions and the usefulness of the clinical lab in the diagnosis of these conditions
- Discuss the relevant pathophysiology underlying a variety of muscle diseases

- Describe the relevant biochemical indicators of muscle conditions and the usefulness of the clinical lab in the diagnosis of these conditions
- Discuss the relevant pathophysiology underlying a variety of nervous system disorders
- Discuss the biochemical investigations that are commonly employed in the detection and management of a variety of nervous system disorders

Unit 3 - Hepatic, Biliary and Gastrointestinal Considerations

Learning Objectives

- Describe the most common disease processes affecting the liver
- Discuss the potential for icterus and bilirubin measurements as a diagnostic indicator of liver disorder
- List and describe the tests most commonly utilized in the biochemical assessment of liver function
- Describe the biochemical impact of a variety of biliary tract/liver dysfunctions
- Describe the common biochemical tests used in the investigation of gastric disorders
- Describe the common biochemical tests used in the investigation of pancreatic disorders
- Describe the common biochemical tests used in the investigation of enteric disorders

Unit 4 - Lipids, Diagnostic Enzymes, and Cardiovascular Disease

Learning Objectives

- Discuss the importance of plasma protein homeostasis and the biochemical means by which it can be evaluated
- Examine in detail a variety of plasma proteins for function, diagnostic, and pathophysiological considerations
- Describe the major types of plasma lipids, their sources, metabolism, and physiological role
- Examine the diagnostic potential of plasma lipids and plasma enzymes in cardiovascular disease
- Describe the role of hemoproteins, porphyrins, and iron in the homeostasis of blood-oxygen
- Discuss the laboratory involvement in the detection and monitoring of haemoglobin deficiencies, porphyrias, and iron deficiencies.

Unit 5 - Clinical Chemistry at the Extremes of Age**Learning Objectives**

- Describe the unique challenges to diagnosis and therapy that arise in the very young and elderly
- Discuss the considerations that must be made with respect to reference ranges when testing on patients at the extremes of age
- List and describe some common biological variations that may occur in children and the elderly

III. TOPICS SUMMARY:

1. Unit One: Introduction to Clinical Chemistry & Evidence-based Laboratory Medicine
2. Unit Two: Endocrine Function and Dysfunction
3. Unit Three: Metabolic Disorders and Nutrition
4. Unit Four: Renal Management of Fluid, Electrolyte, Acid, and Base Balance
5. Unit Five: Drug Monitoring and Toxicology
6. Unit One: Metabolic Aspects of Malignant Disease
7. Unit Two: Musculoskeletal and Nervous System Disorders
8. Unit Three: Hepatic, Biliary and Gastrointestinal Considerations
9. Unit Four: Lipids, Diagnostic Enzymes, and Cardiovascular Disease
10. Unit Five: Clinical Chemistry at the Extremes of Age

IV. TEXT(S):

Marshall, W.J., and Bangert, S.K. (2012) Clinical Chemistry. (7 ed.). Toronto: Mosby Elsevier.

Mazzuchin, A. (2006). Clinical Chemistry Resource Package. (available electronically via D2L)

REFERENCE(S):

Tortora, G., & Derrickson, thB. (2011). Principles of anatomy and physiology. (13 ed.). New York: Wiley.

Fischbach, F. (2005). Nurses' quick reference to common laboratory and diagnostic tests. (4th ed.). Philadelphia: Lippincott

R.S. Porter, J.L. Kaplan, B.P. Homeier, & M.H. Beers (Eds.) The Merck manual of diagnosis and therapy online. <http://www.merck.com/mmpe/index.html>

Sault College D2L (course notes, important announcements)

Any Med Surg text; Pathophysiology text

V. EVALUATION PROCESS/GRADING SYSTEM:

The passing grade for this course is a "C" (60%). All evaluation strategies must be submitted in order to receive a credit for the course.

Students will be evaluated on the following basis:

<u>DESCRIPTION</u>	<u>MARKS</u>
Tests (3)	30%
Midterm Exam	25%
Final Exam	35%
Assignment	10%

Students missing the tests for any reason will not be able to write them at any other date. Students missing the midterm exam or final exam because of illness or other serious reason must email the professor before the exam to inform her/him. Those students who have notified the professor of their absence, according to policy, will be eligible to arrange an opportunity as soon as possible to write the exam at another time. Those students who do not notify the professor will receive a zero for that exam.

<u>Grade</u>	<u>Definition</u>	<u>Grade Point Equivalent</u>
A+	90 - 100%	4.00
A	80 - 89%	4.00
B	70 - 79%	3.00
C	60 - 69%	2.00
D	50 - 59%	1.00
F (Fail)	49% and below	0.00

CR (Credit)	Credit for diploma requirements has been awarded.
S	Satisfactory achievement in field /clinical placement or non-graded subject area.
U	Unsatisfactory achievement in field/clinical placement or non-graded subject area.
X	A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.
NR	Grade not reported to Registrar's office.
W	Student has withdrawn from the course without academic penalty.

VI. SPECIAL NOTES:

Attendance: Sault College is committed to student success. There is a direct correlation between academic performance and class attendance; therefore, for the benefit of all its constituents, all students are encouraged to attend all of their scheduled learning and evaluation sessions. This implies arriving on time and remaining for the duration of the scheduled session. It is the departmental policy that once the classroom door has been closed, the learning process has begun. Late arrivals may not be granted admission to the room.

VII. COURSE OUTLINE ADDENDUM:

The provisions contained in the addendum located on the portal form part of this course outline.
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