



**OVERVIEW**

A course designed for students in nursing to develop an appreciation for the usefulness 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.

**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 cancer 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 weekly basis.

**REFERENCES**

**As distributed in class or via LMS**

**Unit 1 - Introduction to Clinical Chemistry and Evidence-based Laboratory Medicine****Learning Objectives**

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

**Unit 2 - Basic Biochemistry****Learning Objectives**

- 2.1 List the major categories of organic molecules in the human body.
- 2.2 Identify the monomer units for proteins, carbohydrates, lipids and nucleic acids
- 2.3 Describe the essential properties of proteins, carbohydrates and lipids and nucleic acids.
- 2.4 Describe the steps in the replication of DNA.
- 2.5 Describe the key steps in protein synthesis.
- 2.6 List the functions of proteins
- 2.7 List the types of mutations that can affect a physiological outcome.
- 2.8 Assess the biological and physiological impact of a single base substitution

**Unit 3 - Metabolic Aspects of Malignant Disease****Learning Objectives**

- 3.1 Describe the role of membrane proteins in the transport of molecules in and out of cells as well as receptors for regulation extracellular molecules such as hormones.
- 3.2 Review the general pathophysiology of cellular changes
- 3.3 Describe the pathophysiological changes occurring in paraneoplastic endocrine syndromes
- 3.4 Discuss the biochemical changes that can be detected in malignant endocrine syndromes
- 3.5 Discuss the presence and detection of tumour markers as a means of diagnosing a variety of malignant conditions

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

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

**Unit 5 - Endocrine Function and Dysfunction****Learning Objectives**

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

**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. 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. The course will also examine drug monitoring if time permits. Relevant background information will be presented prior to a detailed discussion of each topic.

**REFERENCES**

As distributed in class or via LMS

**Unit 6 - Lipids, Diagnostic Enzymes, and Cardiovascular Disease****Learning Objectives**

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

**Unit 7 - Metabolic Disorders and Nutrition****Learning Objectives**

- 7.1 Describe the various metabolic pathways
- 7.2 Identify the nutrients associated with human nutritional requirements and manifestations associated with their deficiency and/or toxicity
- 7.3 Describe the laboratory measurement of the various nutrients
- 7.4 Examine the complex fashion in which carbohydrates are processed and utilized in the human body
- 7.5 Describe the laboratory measurement for glucose concentration
- 7.6 Discuss laboratory involvement in the diagnosis, management, and treatment of diabetes
- 7.7 Examine the metabolic complications of diabetes and related comorbidities
- 7.8 Discuss the root cause of a variety of inherited metabolic disorders

**Unit 8 – Gastrointestinal, Hepatic, and Biliary Considerations****Learning Objectives**

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

**Unit 9 -Musculoskeletal and Nervous System Disorders****Learning Objectives**

- 9.1 Discuss the relevant pathophysiology underlying a variety of metabolic bone diseases and articular diseases
- 9.2 Describe the relevant biochemical indicators of bone and arthritic conditions and the usefulness of the clinical lab in the diagnosis of these conditions
- 9.3 Discuss the relevant pathophysiology underlying a variety of muscle diseases
- 9.4 Describe the relevant biochemical indicators of muscle conditions and the usefulness of the clinical lab in the diagnosis of these conditions
- 9.5 Discuss the relevant pathophysiology underlying a variety of nervous system disorders
- 9.6 Discuss the biochemical investigations that are commonly employed in the detection and management of a variety of nervous system disorders

**III. TOPICS:**

1. Unit One: Introduction to Clinical Chemistry and Evidence-based Laboratory Medicine
2. Unit Two: Basic Biochemistry
3. Unit Three: Metabolic Aspects of Malignant Disease
4. Unit Four: Renal Management of Fluid, Electrolyte, Acid, and Base Balance
5. Unit Five: Endocrine Function and Dysfunction

**Christmas Break**

6. Unit Six: Lipids, Diagnostic Enzymes, and Cardiovascular Disease
7. Unit Seven: Metabolic Disorders and Nutrition
8. Unit Eight: Hepatic, Biliary and Gastrointestinal Considerations
9. Unit Nine: Musculoskeletal and Nervous System Disorders

**IV. Recommended Texts:**

Marshall, W.J., and Bangert, S.K. (2012) *Clinical Chemistry*. (7<sup>th</sup> ed.). Toronto: Mosby Elsevier.

Tortora, G., & Derrickson, B. (2011). *Principles of anatomy and physiology*. (13<sup>th</sup> ed.). New York: Wiley.

Pagana & Pagana. (2013). *Mosby's Canadian Manual of Diagnostic and Laboratory Tests*. (1<sup>st</sup> ed). Toronto: Elsevier

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>

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

Sault College D2L (course notes, online quizzes, 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:

DESCRIPTION	MARKS
Quizzes (3)	30%
Midterm Exam	25%
Final Exam	35%
Assignment / paper	10%

Students missing the quizzes or the final exam because of illness or other serious reason must inform the professor at least one hour **before** (759-2554, Ext. 2635 OR via email/LMS). Those students who have notified the professor of their absence, according to policy, must, **as soon** as they return to school (or clinical) make arrangements to write the test. Those students who **do not notify** the professor will receive a zero for that evaluation. Students that miss a quiz/exam and wish to write the quiz/exam will be asked to provide documentation for their absence. See Student Success Guide for further information

The following semester grades will be assigned to students in postsecondary courses:

<u>Grade</u>	<u>Definition</u>	<u>Grade Point Equivalent</u>
A+	90 – 100%	
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.	

If a faculty member determines that a student is at risk of not being successful in their academic pursuits and has exhausted all strategies available to faculty, student contact information may be confidentially provided to Student Services in an effort to offer even more assistance with options for success. Any student wishing to restrict the sharing of such information should make their wishes known to the coordinator or faculty member.

#### **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 in D2L and on the portal form part of this course outline.