

I. COURSE DESCRIPTION:

A course designed for students in Nursing to develop an appreciation, largely on the basis of case studies, for the relationship between various common diseases, the underlying biochemistry and the clinical tests used in their diagnosis.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

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 aim 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 behaviour in living organisms.

Unit 1 :

In this unit the student will develop an understanding of :

- The role of the laboratory in the patient care cycle;
- The pre-analytical, analytical and post-analytical criteria considered in the evaluation of appropriateness of patient's test result;
- The Internal Quality Control process within the clinical laboratory and analytical variation;
- Test characteristics such as sensitivity, specificity, efficiency, predictive value of positive and negative results, False positive rate etc;
- Definitions of reference interval, discriminator values, critical values;
- The statistical methods for establishing reference values, discriminator values;
- Decision trees;

Unit 2 :

Upon completion of this unit the student will be able to :

- List the major categories of organic molecules in the human body.
- Identify the monomer units for proteins, carbohydrates and nucleic acids
- Define the terms primary, secondary, tertiary and quaternary structure of proteins.
- List the three weak forces that determine the three dimensional structure of proteins.
- Determine the net change in the charge of a protein due to amino acid substitution.
- Describe some of the essential properties of carbohydrates and lipids.
- Explain how physical properties of triglycerides are affected as a function of increasing numbers of double bonds.
- Describe the double helical structure of DNA.
- Describe the structural and functional differences between DNA and RNA.
- Assess the biological impact of a single base substitution in a codon.
- Describe the steps in the replication of DNA.
- Describe the key steps in protein synthesis.
- List the types of mutations that can affect a physiological outcome.
- Be capable of assessing the physiological impact of a single base substitution.

Unit 3 :

Topics covered in this section include:

- Cell structure and function in which the basic cell organelles are discussed with particular attention to the plasma membrane.
- 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.
- Cell compartmentalization
- Organization of cells into organ systems and tissues
- Cell injury and death
- Cancer

Unit 4 :

When the student has completed this unit they will be able to do the following:

- Define the term metabolism.
- Define what is meant by a catabolic or anabolic process.
- Explain the biological role of ATP.
- Demonstrate an understanding of the interaction between pathways by explaining how the end-product of one pathway is the initial substrate for another.
- Define each of the pathways as to the initial substrate, final product, and its overall function as catabolic or anabolic.
- List the regulatory mechanisms that help regulate metabolism.

Unit 5 :

When the student has completed this unit, they will be able to do the following:

- Identify three categories of enzymes in serum with an example of at least one enzyme in each category.
- Explain why intracellular enzymes may be elevated in serum and how this may be useful in the diagnosis of disease.
- Describe at least two properties of CK isoenzymes that can be used for their identification and quantitative determination.
- Name the CK isoenzymes, at least one tissue that is a major source of each of these, and five clinical conditions in which CK is elevated.
- Explain the pathophysiology of myocardial infarction.
- Illustrate diagrammatically the changes of at least three cardiac markers over the time course of a week following the onset of symptoms of MI.
- Explain the inadequacy of CK-MB as a marker for MI in the first few hours after the onset of MI.
- Interpret clinical enzyme data with respect to the diagnosis of MI.
- List suggested Enzyme Profiles for various organ systems.

Unit 6 :

When you have completed this unit, you will be able to do the following:

- Identify the major endocrine glands in the body.
- Explain how hormone secretion is regulated.
- Identify the different type of hormones and their mode of action.
- Explain the concept of negative feedback in the hypothalamus-pituitary-endocrine gland axis.
- List the metabolic functions that the endocrine system helps to regulate.

- Describe the general characteristics of hormones.
- Describe the functions of either the thyroid or adrenal glands.
- Identify the hormones produced by the thyroid and adrenal glands.
- Describe the signs and symptoms associated with either thyroid or adrenal disease.
- List the tests that aid in the diagnosis of hyper and hypothyroid disease.
- List the tests that aid in the diagnosis of hyper and hypoadrenal disease.
- Apply the knowledge to problem solving case test results.

Unit 7 :

When you have completed this unit, you should be able to do the following:

- Summarize diagrammatically the metabolic pathways affecting carbohydrate metabolism
- Outline the metabolic response of carbohydrate, lipid and protein metabolism to the following clinical situations:
 - Well-fed state
 - Fasting state between meals
 - Starvation.
- Specify the hormones that regulate glucose metabolism, their sites of origin, and their actions on metabolic pathways.
- Describe the classifications of diabetes mellitus.
- List the laboratory tests that are useful in determining the status of glucose metabolism.
- Specify the criteria required for establishing the diagnosis of diabetes mellitus.
- Explain the laboratory tests most suited to monitor diabetic therapy in the known diabetic.
- Explain the pathophysiology of diabetic nonketonic hyperglycemic coma, diabetes Type 1 or insulin-dependent diabetes mellitus (IDDM), diabetes Type 2 or non-insulin-dependent diabetes mellitus (NIDDM), diabetic ketoacidosis and galactosemia.
 - a) List the signs and symptoms of hypoglycemia and hyperglycemia.
 - b) Provide a differential diagnosis (list of conditions) for hypoglycemia and hyperglycemia.
- Describe the most common clinical signs and symptoms associated with glycogen storage diseases.
- Describe the enzyme defect and the clinical consequences of at least two glycogen storage diseases.
- Outline the three forms of galactosemia.
- Discuss lactose intolerance in the infant.
- Describe the three enzyme defects contributing to fructose intolerance.

Unit 8 :

- Name the principal food components within the average diet.
- List 8 of the 15 essential trace elements.
- Explain why it is difficult to determine minimal nutrient requirements.
- Specify the recommended dietary allowances for fats, carbohydrates, and protein in a daily diet in percentage terms.
- Explain why carbohydrates are not considered essential food nutrients.

- Describe the role of fibre in the diet.
- Name the essential fatty acids and the importance of unsaturated fats in the diet.
- List the 10 amino acids which are essential for life.
- Define the term "biological value" of a protein.
- Describe the clinical signs and symptoms of mineral deficiencies with particular attention to calcium, magnesium, iodine, and iron.
- Name the nine water-soluble and the four fat-soluble vitamins.
- Describe the clinical signs and symptoms of deficiencies in the fat-soluble vitamins.
- Define the equation for the estimation of basal energy expenditure for men and women.
- Describe the functions of the digestive organs in the digestion and absorption of nutrients
- List and describe the tests used in the laboratory to assess gastrointestinal function
- Discern what pattern of test(s) or test results might be expected to differentiate between the digestive disorders
- List the most common clinical signs and symptoms associated with several digestive disorders
- Describe the causative factors in several digestive disorders
- Describe the exogenous transport of lipids.

Unit 9 :

When you have completed this unit, you will be able to do the following:

- Describe the functional anatomy of the liver.
- Summarize the metabolic functions of the liver and the laboratory tests used to monitor and assess those functions.
- Explain the test selection strategies used in the differentiation of jaundice
- Explain the metabolic disturbances in the various disease entities
- Describe the enterohepatic circulation of the bile pigments, bilirubin and bile acids
- Demonstrate an understanding of the role the liver plays in the exogenous and endogenous handling of lipids.
- Explain the test selection in the differentiation of different types of hepatitis
- Identify terminologies associated with blood cells and blood cell disorders

Unit 10 :

When you have completed this unit, you will be able to do the following:

- Describe the gross anatomy of the kidney and the component parts of the nephron.
- Specify the prerenal, renal and postrenal factors that affect the glomerular filtration rate.
- List the main functions of the kidney and the laboratory tests to monitor and assess those functions.
- Name the major substances that are distributed between the different fluid compartments.
- Explain the transport mechanisms for solutes.
- Recite the formula used to determine serum or plasma osmolality.

- Explain how the concentration of serum sodium is a function of total body sodium, potassium, and water.
- Determine the fluid changes in the separate fluid compartments caused by water and electrolyte imbalances.
- Outline diagrammatically the renal handling of water and electrolytes.
- Describe the relationship of GFR to urine formation.
- Explain how the renin-angiotensin-aldosterone system helps regulate sodium and water balance.
- Show diagrammatically the relationship that exists between ADH and the renin-angiotensin-aldosterone system.
- Explain the compensatory mechanisms in various clinical conditions involving water and sodium imbalances.
- Identify the essential metabolites that are reabsorbed by the kidney tubules.
- Describe the hormonal functions of the kidney.
- Describe the role of the lungs in acid-base regulation.
- Describe the role of the kidneys in acid-base regulation.
- Outline the tests that assess kidney function
- Specify the impact of decreased or increased GFR on renal function tests.
- Interpret acid-base disorders.

III. TOPICS:

1. Unit One: Patient Care Cycle
 2. Unit Two: Important Biochemical Molecules and Macromolecules
 3. Unit Three: Cell Structure and Function
 4. Unit Five: Enzymes and their Application to the Diagnosis of Disease
 5. Unit Ten: Function and Diseases of the Kidney
- Christmas Break**
6. Unit Four: Metabolism and Metabolic Regulation
 7. Unit Seven: Carbohydrate Metabolism: Regulation and Clinical Application
 8. Unit Eight: Nutrition, Digestion, Absorption
 9. Unit Nine: Liver and Biliary Tract Disease
 10. Unit Six: Endocrine System

IV. RECOMMENDED RESOURCES / TEXTS / MATERIALS:

Required - Marshall, W. & Bangert, S., Clinical Chemistry 6th ed. Mosby

Mazzuchin, A. (2005). *Clinical Chemistry Student Resource Package & Case History Manual*.

Tortora, G.J., & Grabowski, S.R. (2003). *Principles of Anatomy and Physiology* (10th ed. slipcase edition). New York: John Wiley & Sons, Inc. (from Year 1)

Fischbach, F. (2002). *Nurses' quick reference to common laboratory and diagnostic tests* (3rd ed.). Philadelphia: Lippincott Williams & Wilkins. (from Year 1)

Sault College LMS (course notes, online quizzes, important announcements)

Any Med Surg text; Pathophysiology text

V. EVALUATION PROCESS/GRADING SYSTEM:

Semester 3 and 4

Tests (2 – 1 from fall, 1 from winter)	30%
Mid year (from fall)	25%
Unit review quizzes (online)	15%
Final	30%

1. **The pass mark for this course is 60%.** It is composed of mid-semester tests, online tests, a Mid-year exam and a Final exam.
2. **Optional assignment:** students can opt to write an assignment worth 7.5%. This would then make the online quizzes worth 7.5%.
3. Students missing the Unit tests for any reason will **not** be able to write them at any other date. Students missing the mid-term exam or final exam because of illness or other serious reason must phone the professor **before** the exam to inform her/him (759-2554, Ext. 2635). 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.

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%	4.00
A	80 – 89%	3.00
B	70 - 79%	2.00
C	60 - 69%	1.00
D	50 – 59%	0.00
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. www.mysaultcollege.ca