Course Documentation Outline

School of Business, Biosciences and Justice Studies

SECTION I

1. Program (s): Biofood, Biotechnology, Chemical, Environmental

2. Course Name: Instrumentation 1 Theory

3. Course Code: CHEM 2001

4. Credit Value: 3 Course Hours: 45

Class	Lab	Field	Other	Total
45				45

5. Prerequisites/Co-requisites/Equivalent Courses

PR/CO/EQ	Course Code	Title
PR	CHEM1003	General Chemistry 2
PR	MATH1004	Math 2

6. **Faculty:** Elinor Brunet **Date:** Jun 8, 2010 **Effective Date:** Sept 7, 2010

7. **Dean/Chair Approval:** *Jim Whiteway* **Date: August 2010**

9. **Revision Number:** **Date:** **Effective Date:**

10: **Notes**

Section II

11. **Calendar Description:**

This course stresses the basic concepts and techniques of chromatography (thin layer, column, gas, liquid and ion), spectroscopy i.e. ultraviolet (UV), Visible (Vis), Infra-red (IR), Flame and Furnace Atomic Absorption, conductivity, and specific ion electrodes i.e. fluoride.

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12. **Provincial Context:**
This course meets the following Ministry of Education and Training requirements:

a). **Prior Learning Assessment (PLA)**
Students may apply to receive credit by demonstrating achievement of the course learning outcomes through previous life and work experiences.

This course is eligible for challenge through the following method(s) indicated by *

Challenge Exam	Portfolio	Interview	Other	Not Eligible
*	*	*		

PLAR Contact:

13. **Employability Skills emphasized in this course**

	communication - written		communication - visual		communication - oral
*	analytical		creative thinking	*	decision making
*	interpersonal	*	numeracy	*	organizational
*	problem solving	*	technological		other (specify)

14. **Required Texts, Materials, Resources or Technical Materials Required:**

Lab manual produced at the college, lab coat and safety eyewear (CSA approved) with colourless lenses, as well as a scientific calculator capable of linear regression. A formal textbook is not required for this course.

15. **Evaluation Plan**

Students will demonstrate learning in the following ways:

Assignment Description	Evaluation Methodology	Due Date
Assignments	30 %	On going
Quizzes	20 %	On going
Midterm	15 %	Oct 2010
Final Test	35 %	Dec 2010

16. **Other**

Policy for missed tests/work and submission of assignments:
Students are expected to make every reasonable effort not to miss tests and to submit all assigned work on time. Students must advise the instructor **in advance** if they are unable to meet scheduled deadlines, **otherwise late assignments will not be accepted for evaluation and a grade of zero will be assigned**. Every effort will be made to accommodate students unable to meet specified deadlines as a result of extenuating circumstances; however, the instructor reserves the right to refuse late assignments and to refuse to reschedule assessments.

All students must pass the final test with a 50% or better mark

The total of the marks for the quizzes, midterm, assignments and final test must be equal to or greater than 60% to obtain a pass in this course

The midterm test will cover material from the beginning of the semester to that point. The final test will cover material from the entire semester. The style of the questions will be exactly the same as those contained in the assignments and quizzes.

Loyalist College has a Violence Prevention policy:

All College members have a responsibility to foster a climate of respect and safety, free from violent behavior and harassment.
Violence (e.g. physical violence, threatening actions or harassment) is not, in any way, acceptable behavior.
Weapons or replicas of weapons are not permitted on Loyalist College property.
Unacceptable behavior will result in disciplinary action or appropriate sanctions.
More information can be found in the “Student Manual and Guide - Rights & Responsibilities”.

Contact Information for Elinor Brunet:

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Section III

17. **Curriculum Delivery, Learning Plan and Learning Outcomes:**

Course Components/Content	**Related Learning Outcomes**	**Learning Activities/Resources**
Spectroscopy EMR	Discuss the regions of the EMR and differentiate between the UV, VIS and IR regions with respect to what part of the atom or molecule is reacting with energy Explain why we see objects as coloured	Curriculum objectives will be achieved through a combination of the following teaching strategies: 1. Lecture 2. Laboratory activities (guided and discovery) 3. Cooperative study 4. Independent study (i.e. required readings and exercises)
Beer's Law	Be adept at rearranging the Beer's Law equations regardless of which concentration units or constant are involved to calculate whatever parameter is desired Explain the significance of λ_{max} Measure %Transmittance or Absorbance Convert %Transmittance to Absorbance or convert Absorbance to % Transmittance Plot Absorbance vs. Concentration Perform linear regression on Absorbance and Concentration data to obtain the absorptivity or molar absorptivity constant Discuss the limitations to Beer's Law Understand the impact of wavelength of light, solvent and other conditions on absorbance Be able to convert a peak height obtained from a wavelength scan to an absorbance value to be used in a linear regression calculation to quantify the anayte present in an unknown	

Instrument Design Spec 20, Scanning Spec., IR, Flame and Furnace AA	Identify the parts and their position in a single and double beam instrument Compare the uses for single and double beam instruments Discuss: types of energy sources (effective region), wavelength selectors (filters, prisms, gratings), sample holder (materials available), and detectors (their effective region)	
Organic Nomenclature	Identify the functional groups present in a compound Identify functional groups that would cause a compound to be polar Compare relative polarities of various compounds	
Chromatography (thin layer, column, gas, liquid, ion)	Describe the difference between separation performed using the processes of adsorption and partition and identify which one is happening in a specified environment Define and give examples of stationary and mobile phases Describe how to start up, calibrate, and introduce a sample to a GC, LC, and IC Discuss the form a GC, LC and IC chromatogram will take Be able to calculate the retention time of compounds Be able to use the retention time to identify the components present in an unknown	
Stereo Isomerism Polarimeter	Be able to recognize the different types of isomers Be able to identify chiral carbons Be able to calculate a specific rotation from an observed rotation and use it to determine the concentration of a compound in an unknown	

Linear Regression	Use linear regression on the results of a Beer's Law determination (absorbance vs. concentration) to calculate the concentration of an unknown	
Fluorometry, conductivity	Be able to prepare standards for a fluorometric analysis Be able to use a mV meter equipped with a combination fluoride specific ion electrode/reference electrode to measure the potential of a series of fluoride standards and an unknown Be able to plot the mV measurements for the standards on semi-log paper vs. concentration and determine the concentration of the unknown from the plot Understand how to plot a set of conductivity data (concentration vs. conductivity on log-log paper) and use the plot to determine the concentration of an unknown	
WHMIS, MSDS, Other Reference Materials	Demonstrate a working knowledge of these subjects	

<u>Upon successful completion of this course, the student will be able to:</u>

Discuss how to prepare standards and samples accurately by dilution or dissolution

Discuss how to set up and calibrate the instruments:GC (gas chromatograph), HPLC (high pressure liquid chromatograph), Flame and Furnace AA (atomic absorption spectrophotometer), polarimeter, refractometer, and spectrophotometer

Discuss the following topics for the instruments listed above:
- Types of samples analyzed
- Parts of the instrument, and their purpose
- Design of the instrument
- Path of the light or mobile phase
- What happens to the sample during analysis
- What form the instrumental output can take
- How the samples are introduced to the instrument

Discuss what is happening (adsorption and partition processes) during a thin layer or paper or column chromatography analysis

Demonstrate a working knowledge of stereo isomers and chirality in organic compounds and their effect on the observed angle of rotation measured on the polarimeter

Demonstrate a working knowledge of basic nomenclature of organic compounds and the effect of polarity of the various classes of compounds on their chromatographic separation

Manipulate the quantitative data obtained using graphing and linear regression techniques and interpret the results

Express the results of **all** calculations to the appropriate number of significant figures or decimal places **with** the appropriate units

Demonstrate a working knowledge of Beer's Law. Manipulate both forms of the Beer's Law equation. Use linear regression on the results of a Beer's Law determination to calculate the concentration of an unknown.

Demonstrate a working knowledge of WHMIS, MSDS and labels