

Course Documentation

School of Biosciences



Program: Biotechnology Technician, Chemical

Academic Year: 2011-12 Fall [x] Winter [] Spring []

Program Year: 3 **Program Semester:** 5

Course Name: Analytical Instrumentation

Course Code: CHEM 3003 **Course Hours:** 70 **Credit Value:** 5

Faculty: Elinor Brunet

| Class | Lab | Field | Other | Total |
|-------|-----|-------|-------|-------|
| 28 | 42 | | | 70 |

Prerequisites/Corequisites/Equivalent Courses

| PR/CO/EQ | Course Code | Course Name | Conditions |
|----------|------------------------|---|------------|
| PR | CHEM 2000 CHEM 2002 | Analytical Chemistry 1 Instrumentation 2 | |
| CO | | | |
| EQ | | | |

This Course is A Prerequisite For:

| Course Code | Course Name |
|-------------|------------------------------|
| BIOS 3004 | Good Manufacturing Practices |

Dean/Chair Approval:

Date: 9/23/201

1. Calendar Description

This course deals with methods of instrumental analysis. Spectrophotometric techniques (absorption and emission) are discussed. Gas, high pressure liquid and ion chromatography are reviewed. BOD, COD and Kjeldahl determinations are introduced. Where possible commercially available products are used as samples in the corresponding labs and different methods of sample preparation are emphasised.

2. Course Learning Outcomes: Upon successful completion of the course, the student will be

- 1 Discuss the types of samples analysed, the parts of the instrument and their purpose, the path of the light or mobile phase, what happens to the sample during the instrumental analysis, and what form the instrumental output can take
- 2 Calibrate the instrument, prepare the sample and the standards and introduce them to the instrument, manipulate and evaluate the qualitative and quantitative data obtained, by using standard addition, internal standards, graphing and linear regression
- 3 Perform a selective extraction of organic compounds (acids, bases and neutrals) from a water sample using the standards method or a dissolution test as per the USP (reference material – United States Pharmacopeia)
- 4 Interpret the results of a liquid-liquid extraction of the unknown organics from a water sample and identification using a GC by comparison to the retention times of some standards or the results of a Kjeldahl test on a water sample
- 5 Show a familiarity with the determination of COD (chemical oxygen demand) by both the open reflux and titration method or the closed reflux and spectrophotometric method, BOD (biochemical oxygen demand), Karl Fisher moisture analysis, and Total Solids analysis
- 6 Perform calculations to determine percent by weight composition of a sample that has undergone thermogravimetric analysis
- 7 Review the data from a potentiometric titration and from the second derivative plot of E (potential) versus volume of titrant, in order to accurately determine the endpoint volume of the titration. Relate this to a pH titration
- 8 Express the results of all calculations to the appropriate number of significant figures or decimal places with the appropriate units

3. Essential Employability Skills Outcomes: This course will contribute to the achievement of the following essential employability skills

- ☒ 1. communicate clearly, concisely and correctly in the written, spoken, and visual form that fulfills the purpose and meets the needs of the audience.
- ☒ 2. respond to written, spoken, or visual messages in a manner that ensures effective communication.
- ☒ 3. execute mathematical operations accurately.
- ☒ 4. apply a systematic approach to solve problems.
- ☒ 5. use a variety of thinking skills to anticipate and solve problems.
- ☒ 6. locate, select, organize, and document information using appropriate technology and information systems.
- ☒ 7. analyze, evaluate, and apply relevant information from a variety of sources.
- ☐ 8. show respect for the diverse opinions, values, belief systems, and contribution of others.
- ☐ 9. interact with others in groups or team in ways that contribute to effective working relationships and the achievement of goals.
- ☒ 10. manage the use of time and other resources to complete projects.
- ☐ 11. take responsibility for one's own actions, decisions, and consequences.

4. General Education:

Indicate if this course is identified as a General Education course in the program of study.

☐ Yes

☒ No

If yes, indicate which General Education theme this course addresses.

- ☐ 1. Arts in Society
- ☐ 2. Civic Life
- ☐ 3. Social and Cultural Understanding
- ☐ 4. Personal Understanding
- ☐ 5. Science and Technology

5. Prior Learning Assessment and Recognition:

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

| | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Challenge Exam | Portfolio | Interview | Dual Credit | Other | Not Eligible |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

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6. Required Texts, Materials, Resources or Technical Materials Required**7. Evaluation: Students will demonstrate learning in the following ways**

| Assessment Description | Course Learning Outcome(s) | Assignment Weighting |
|------------------------|----------------------------|----------------------|
| Assignments | 1,2,3,4,5,6,7,8 | 25 % |
| Quizzes | 1,2,3,4,5,6,7,8 | 10 % |
| Midterm | 1,4,5 | 10 % |
| Final Exam | 1,4,5,6,7,8 | 30 % |
| Lab reports | 2,3,4,8 | 25 % |

8. Other:**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".

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.

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 from both the theory class and calculations performed in the lab. The style of the questions will be exactly the same as those contained in the assignments and quizzes.

All labs must be performed and the data recorded and initialled before leaving the lab. A lab report must be submitted for each lab, one week after the lab is completed.

The lab mark will include a 10% assessment mark that will reflect attendance, lab technique, neatness, safe working habits etc.

9. Curriculum, Delivery, Learning Plan and Learning Outcomes:

| Course Components/Course Learning Outcomes | Related Elements of Performance | Learning Activities/Assessment/Resources |
|--|--|--|
| Spectroscopy | Discuss the parts and their purpose in both single and double beam | Lab: Cyclohexanone in cyclohexane by IR |

| | | |
|---|--|--|
| a)review instruments •parts and their purpose •single and double beam instruments •IR (infrared) •AA (atomic absorption) b)Beer's Law •single component mixture | instruments, e.g. IR & AA Discuss the process of the analysis and types (qualitative and quantitative) Define the parameters in the equation Rearrange the equation to solve problems Convert the units of mol/L to mg/L or L/mg•cm to L/mol•cm given enough information | |
| Dissolution | Discuss the parameters that affect the results of a dissolution determination based on the USP lab protocol | Group Lab: Aspirin |
| Standard Addition Technique | Learn how and when to use the technique of standard addition to compensate for interferences in the solution (matrix effects) | Lab: Manganese in steel by AA and Methyl Lab: Salicylate in Rubbing Alcohol by GC |
| Internal Standard Technique | Learn how and when to use the technique of internal standards | Lab: Acetaminophen in Cough Syrup by HPLC |
| Turbidity | Discuss the theory of the instrument and technique and its applications Perform a sample preparation, instrument calibration, introduction of the sample to the instrument and obtaining a reading Determine the concentration of sulfate in an unknown water sample | Lab: Sulfate in Water |
| Chemical Oxygen Demand COD | Discuss the purpose of all of the reagents Practice calculating the COD of an unknown by the open reflux method (followed by a titration) Practice calculating the COD of the same unknown by the closed reflux method (spectrophotometric determination) | Group Lab: COD |
| Ion Chromatography | Identify the parts and their purpose and the purpose of the instrument Sample preparation and introduction | Lab: Chloride, nitrate, sulfate and oxalate anions |
| Kjeldahl Total Nitrogen Analysis | Discuss the process of the analysis Perform sample preparation and introduction Practice calculating the TKN, % w/w N and % w/w protein in the cereal. | Lab: Determine Protein in a Cereal Sample |