Instrumental Analysis
The University of Toledo
Department of Chemistry and Biochemistry
CHEM 4300-001, 091 (CRN: 42011, 42021)

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Email: Dragan.Isailovic@utoledo.edu
Office Hours: M, W: 3-4 PM or by appointment
Office Location: BO 1086F
Instructor Phone: 419-530-5523
Term: Fall 2019

Class Location: Bowman Oddy 2059
Class Day/Time: T, R: 11:30 AM - 12:25 PM
Lab Location: NA
Lab Day/Time: NA
Credit Hours: 2

CATALOG/COURSE DESCRIPTION
An introduction to modern chemical instrumentation and applications to chemical analysis. Topics include electrical, magnetic, nuclear, and spectroscopic instrumentation.

COURSE OVERVIEW
In Instrumental Analysis, you will be exposed to a wide variety of analytical instrumentation and techniques. We will focus on and discuss multiple instruments for chemical analyses. Students should compare and contrast different instruments and understand why different components are necessary to produce the desired measurement. It is the goal of the lecture portion to introduce students to how the instrumentation has been developed and why a particular instrument is useful for a specific type of analysis. Advanced Lab provides hands on experience with modern analytical instrumentation.

STUDENT LEARNING OUTCOMES
Upon completion of this course, the student will be able to:
1. Describe the different components of analytical instrumentation
2. Discuss the operation of the instrument for measurement
3. Define the applications for all instrumentation covered in this course
4. Appraise the limitations and advantages of the different instruments

TEACHING STRATEGIES
This face-to-face course is designed to stimulate student learning though readings, homework exercises and in course lectures.

PREREQUISITES AND COREQUISITES
Prerequisite: (Undergraduate level CHEM 3310 Minimum Grade of C- and Undergraduate level CHEM 3360 Minimum Grade of C-) and Undergraduate level CHEM 3710 Minimum Grade of C- or Undergraduate level CHEM 3730 Minimum Grade of C- or Undergraduate level CHEM 4570 Minimum Grade of C-

REQUIRED TEXTS AND ANCILLARY MATERIALS
Blackboard (https://blackboard.utdl.edu/webapps/login/) is the course website featuring: (1) all course materials (syllabus, assignments, lecture outlines, other handouts) so that a student can print out a copy; (2) announcements; and (3) students’ current course grade points (see details about points later).

UNIVERSITY POLICIES

Policy Statement on Non-Discrimination on the basis of Disability (ADA). The University is an equal opportunity educational institution. Please read The University’s Policy Statement on Nondiscrimination on the Basis of Disability Americans with Disability Act Compliance.

Academic Accommodations
The University of Toledo is committed to providing equal access to education for all students. If you have a documented disability or you believe you have a disability and would like information regarding academic accommodations/adjustments in this course please contact the Student Disability Services Office.

ACADEMIC POLICIES

Students are expected to follow the guidelines of student conduct as outlined in the Student Handbook (http://www.utoledo.edu/student affairs/pdfs/studenthandbook.pdf)

Academic Dishonesty: The academic honesty policies, as stated in the 2017-2018 UT Catalog will be strictly enforced. Any student found violating the UT academic honesty policies will be penalized in accordance with these policies.

Drop, Withdrawal, and Incomplete Grades: Course drop and withdrawal procedures have been set by the University faculty. Pay attention to those add/drop dates as they pass very quickly during the semester. For both dropping the course or withdrawing you should go to Rocket Solution Central in Rocket Hall. You do not need your instructor’s permission for either process. Please note that course registration changes might change your financial aid. A course grade of incomplete is given only to those who have completed all but a small percentage of course requirements for an unexpected and acceptable reason.

Special Needs: The University is an equal opportunity educational institution. If you have special needs with respect to your participation in this course, please make an appointment to discuss this matter with me as soon as possible. I will work with you and the Office of Accessibility to make appropriate accommodations for your needs.

COMMUNICATION GUIDELINES
You are urged to communicate with me about any aspect of the course with concerns you have or any item that might limit your success. All email communications need to be addressed to Dr. Isailovic and contain the course name and your name in the email. E-mails will generally be answered within 24 hours.
STUDENT SUPPORT SERVICES
Please contact me with any concerns or support needs. Students who will not be able to take an exam at
the scheduled time due to an irresolvable conflict with a major responsibility must provide some written
documentation to verify the conflict. This situation may occur for student on official university business,
including athletes. The exam will be given at another arranged time. Approval must be obtained before
the scheduled test date.

Students who do not take an exam due to illness, car accident or similar extreme circumstance should
inform their instructor of their difficulties as soon as possible. These difficulties must also be documented
by a physician’s note, an accident report, etc. A telephone call within 24 hours of the exam is expected to
Chemistry Department (419-530-2698). Students must complete an Absence Report Form in all cases of
missed examinations. These can be obtained from the secretary in the Chemistry Office, BO2022.
Documentation supporting your excuse must be attached to the form. In all other circumstances, a
missed exam will result in a grade of 0. If an excuse is acceptable, missed exam grade will be computed
based on the average of the hour exams.

The students are urged to refer to the university’s policy on Academic Dishonesty found at
http://www.utoledo.edu/dl/students/dishonesty.html. Violation of this policy can result in a course grade of
F with additional university sanctions possible.

COURSE EXPECTATIONS
Lecture sessions are designed to clarify the concepts covered and provide examples of what is expected of
you in this course. Attendance is required and you are responsible for all material and problems covered
in the class. Lecture Outlines will be posted on blackboard and used in class to help with note taking. Please
arrive on time and silence your cell phone. Cell phones are not permitted during lecture or exams. Exams
will be taken during lecture time. The recommended textbooks and scientific papers are also an important
part of this course. It is recommended that you read them before the lecture.

Examination dates are given on the schedule. Make-up for the exams will not be given at any
circumstance. Excused absences will be given only to students who miss an exam under the conditions
mentioned above. You may use a non-programmable calculator. Use of programmable calculators and cell
phones is not allowed during exams.

Attendance is mandatory. A student must notify me prior to the start of the class by email or voicemail for
an absence to be excused in accordance with the University Missed Class Policy. Please arrive on time as
there would be no excuses for tardiness.

OVERVIEW OF COURSE GRADE ASSIGNMENT
Three exams will be given in the course. Each of these exams will count for 30% of student’s final grade.
All exams will be based on the lecture notes, assigned problems, and readings (textbooks and journal
articles). Homework will be regularly assigned and account for 10% of student’s final grade. Homework
will be due at the time of class. If turned late, two points will be deducted per day, including weekend days.

A written paper describing a specific instrument, methodology, and the results will need to be written by
honors student and submitted before a deadline. The instructions and the deadline will be provided to
honors students.
The following is the distribution of possible points in the course:

- Exams, 3 @ 100 point each: 300 pts. (90.0%)
- Homework Assignments: 10.0%
- Total: 100.0%

**Grade Scale** These are the percentages of total points needed to receive the indicated grade.

- A 90%  A- 86%
- B+ 82%  B 78%  B- 74%
- C+ 70%  C 66%  C- 62%
- D+ 58%  D 54%  D- 50%

**COURSE SCHEDULE (Make sure that your travel and business plans do not interfere with this schedule)**

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
<th>Chapter (Skoog et al.)</th>
<th>Chapter (Harris)</th>
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<tbody>
<tr>
<td>1</td>
<td>08/27</td>
<td>Instrumental Analysis: Introduction</td>
<td>1</td>
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<td>08/29</td>
<td>Instrumental Analysis, Signals and Noise</td>
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<td>0-5</td>
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<td>2</td>
<td>09/03</td>
<td>Signals and Noise</td>
<td>5</td>
<td>0-5</td>
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<td></td>
<td>09/05</td>
<td>Mass Spectrometry (MS)</td>
<td>11,20</td>
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<td>3</td>
<td>09/10</td>
<td>Ion Sources</td>
<td>11,20</td>
<td>22</td>
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<td>09/12</td>
<td>Mass Analyzers and Detectors</td>
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<td>09/17</td>
<td>Tandem MS (MS/MS) and MS^n</td>
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<td>18-20</td>
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<td>09/19</td>
<td>Introduction to Spectroscopy</td>
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<td>18-20</td>
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<td>5</td>
<td>09/24</td>
<td>Review</td>
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<td>09/26</td>
<td>Exam 1</td>
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<td>10/01</td>
<td>Components of Optical Instruments</td>
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<td></td>
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<td>Electronic Absorption Spectroscopy, UV-VIS</td>
<td>13,14</td>
<td>18-20</td>
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<td>7</td>
<td>10/08</td>
<td>IR Spectroscopy</td>
<td>16,17</td>
<td>18-20</td>
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<td>10/10</td>
<td>Fall Break (no class)</td>
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<td>8</td>
<td>10/15</td>
<td>Raman Spectroscopy</td>
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<td>10/17</td>
<td>Fluorescence Spectroscopy</td>
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<td>18-20</td>
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<td>9</td>
<td>10/22</td>
<td>Atomic Spectroscopy</td>
<td>8-10</td>
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<td>10/24</td>
<td>Separations theory and terms</td>
<td>26</td>
<td>23</td>
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<td>10</td>
<td>10/29</td>
<td>Gas Chromatography (GC)</td>
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<td>10/31</td>
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<td>11/05</td>
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<td>High-performance LC (HPLC)</td>
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<td>GC-MS and LC-MS</td>
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<td>22,25,26</td>
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<td>11/14</td>
<td>Electrophoresis, Gel Electrophoresis</td>
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<td>13</td>
<td>11/19</td>
<td>Capillary Electrophoresis</td>
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<td>11/21</td>
<td>Nuclear Magnetic resonance (NMR)</td>
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<td>11/26</td>
<td>1H NMR</td>
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<td>11/28</td>
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<td>12/03</td>
<td>13C NMR</td>
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<td>12/05</td>
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