Course: Instrumental Methods of Analysis Lecture (CHEM-4233) 3 credits
Level: Undergraduate
Instructor: Dr. Arthur R. Murphy
Office: Dickinson Hall Room 4413
Phone Number: (201)-692-2322
e-mail: arthur_murphy@fdu.edu
Office Hours: M F 11:00AM-11:50AM, F 12:30 PM – 1:30 PM and by appointment.
Semester: Fall 2014
Classroom, Day and time: Room TBA, Monday 2:00 PM – 4:30 PM

2008 – 2010 Catalog Description:
Theory and applications of absorption, emission and interpretative spectroscopy, electrochemistry and chromatography to problems of chemical analysis. Introduction to interfacing, data acquisition and data manipulations.

Intended Audience:
This course is designed for students majoring in chemistry. Students majoring in other Natural Sciences may also find the course of interest.

Teaching Methodologies:
The course employs both traditional lectures involving board work and overheads as well as microcomputers presentations. WEB resources will also be utilized where appropriate.

Course Objectives and Outcomes:
Objective 1: Students should understand the principles and applications of atomic and molecular spectroscopy.

Outcome 1.1: Students should know the various regions of the electromagnetic spectrum and the instruments, techniques, and major applications used in these areas. They should have a firm foundation in visible, UV, and IR spectroscopy
Outcome 1.2 Students should understand the instrumentation, techniques, and applications of fluorescence spectroscopy.
Outcome 1.3 Students should understand the instrumentation, techniques, and applications of Atomic Absorption spectroscopy.

Objective 2: Using computer software and WEB resources, the principles of Interpretive Spectroscopy will be reviewed and broadened.

Outcome 2.1 Students should know how to interpret elementary IR, NMR, and Mass Spectral data.

Objective 3: The principles of Instrumental Measurements will be presented.

Outcome 3.1 Students should have an appreciation of electronic components and basic circuits.
Outcome 3.2 Students should understand digital and analogue signals, and they should have an introductory knowledge of digital electronic, operational amplifiers, as well as signals and noise.
Objective 4: Usually students learn about electroanalytical methods in their Analytical Chemistry course, this section will be skipped in favor of Miscellaneous Instrumental Analysis Techniques. (see objective 6 below). If this is not the case, aspects of Electroanalytical Chemistry will be presented, reviewed and broadened.

Outcome 4.1 Students should understand the basic principles of potentiometry.
Outcome 4.2 Students should understand the basic principles of Coulometry and Voltammetry

Objective 5: Separation methods are usually presented in an Analytical Chemistry course and thus this material will be omitted in favor of miscellaneous Instrumental Analysis Techniques (see objective 6 below).

Outcome 5.1 Students should understand the basic principles of simplex methods.
Outcome 5.2 Students should be understand the basic principles of Higher Derivative Spectroscopy.

Objective 6: Various miscellaneous topics in Instrumental Analysis will be presented. Possible topics may include Higher Derivative Spectroscopy, Simplex Methods, radiochemical methods, thermal methods, Scanning Tunneling Microscopy, or

Outcome 6.1 Students should become familiar with the instrumentation, and applications of the chosen method(s).

Tentative Lecture Schedule (Fall 2014)

<table>
<thead>
<tr>
<th>Week #</th>
<th>Date</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aug. 25</td>
<td>Chapters 6,7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electromagnetic Radiation and Introduction to Optical Spectroscopy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Components of Optical Instruments)</td>
</tr>
<tr>
<td>2</td>
<td>Sept. 1</td>
<td>Labor Day Recess</td>
</tr>
<tr>
<td>3</td>
<td>Sept. 8</td>
<td>Chapters 13 and 14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>UV/Vis and Applications</td>
</tr>
<tr>
<td>4</td>
<td>Sept. 15</td>
<td>Chapter 15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fluorescence and Applications</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chapters 8, 9, 10, and 12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intro to Optical Atomic Spectroscopy and Atomic Absorption and Applications, Atomic X-Ray Spectroscopy.</td>
</tr>
<tr>
<td>5</td>
<td>Sept. 22</td>
<td>Chapter 16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Miscellaneous Methods</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Perhaps Higher Derivative Spectroscopy, Simplex Methods, etc.</td>
</tr>
<tr>
<td>6</td>
<td>Sept. 29</td>
<td>Exam #1</td>
</tr>
<tr>
<td>7</td>
<td>Oct. 6</td>
<td>Interpretive IR.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ATR Theory</td>
</tr>
<tr>
<td>8</td>
<td>Oct. 13</td>
<td>Spring Recess</td>
</tr>
<tr>
<td>9</td>
<td>Oct. 20</td>
<td>Chapters 17 and 19</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Interpretive NMR (HMR)</td>
</tr>
<tr>
<td>10</td>
<td>Oct. 27</td>
<td>Interpretive CMR</td>
</tr>
<tr>
<td>11</td>
<td>Nov. 3</td>
<td>Exam #2</td>
</tr>
<tr>
<td>12</td>
<td>Nov. 10</td>
<td>Chap. 20 Mass Spectroscopy</td>
</tr>
<tr>
<td>13</td>
<td>Nov. 17</td>
<td>Highlights of Chapters 2,3,4,5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Basic Measurements – Some analogue and digital electronics</td>
</tr>
<tr>
<td>14</td>
<td>Nov. 24</td>
<td>TBA_ Perhaps Multidimensional NMR</td>
</tr>
<tr>
<td>15</td>
<td>Dec. 8</td>
<td>TBA</td>
</tr>
<tr>
<td>16</td>
<td>Dec. 5</td>
<td>Final Exam</td>
</tr>
</tbody>
</table>

Procedures, Policies, and Expectations
1) The last day for withdrawing from the course with a grade of "W" is Oct. 31. 1, 2014
2) All homework assignments must be submitted on time. Late assignments will not be accepted.
3) All cell phones and pagers must be turned off during lecture. Students are expected to arrive for class on time so as not to disrupt a class in session. Chatting during class is discourteous to your classmates, and your instructor. Such behavior is not allowed. During an exam no ear buds, headphones, tablets, or phones are allowed.

4) Cheating will not be tolerated. Anyone caught cheating will be dealt with very severely. Students should read the Academic Integrity Policy that appears on FDU’s web site. A copy of FDU’s Academic Integrity Policy appears at the end of this syllabus.

Grading Policy

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exams</td>
<td>50%</td>
</tr>
<tr>
<td>Homework</td>
<td>50%</td>
</tr>
</tbody>
</table>

Academic Integrity Policy

Students enrolled at Fairleigh Dickinson University are expected to maintain the highest standards of academic honesty. Students have the responsibility to each other to make known the existence of academic dishonesty to their course instructor, and then, if necessary, the department chair, or the academic dean of their College. Course instructors have the added responsibility to state in advance in their syllabi any special policies and procedures concerning examinations and other academic exercises specific to their courses. Students should request this information if not distributed by the instructor.

Academic dishonesty includes, but is not necessarily limited to, the following:

1. **Cheating**—Giving or receiving unauthorized assistance in any academic exercise or examination. Using or attempting to use any unauthorized materials, information, or study aids in an examination or academic exercise.

2. **Plagiarism**—Representing the ideas or language of others as one's own. A more complete description is listed below in the section titled “Plagiarism Described.”

3. **Falsification**—Falsifying or inventing any information, data, or citation in an academic exercise.

4. **Multiple Submission**—Submitting substantial portions of any academic exercise more than once for credit without the prior authorization and approval of the current instructor.

5. **Complicity**—Facilitating any of the above actions or performing work that another student then presents as his or her assignments.

6. **Interference**—Interfering with the ability of a student to perform his or her assignments.

**Plagiarism Described**

As defined by the Council of Writing Program Administrators, plagiarism “occurs when a writer deliberately uses someone else’s language, ideas, or other original (not common-knowledge) material without acknowledging its source.” (“Defining and Avoiding Plagiarism: The WPA Statement on Best Practices.”<http://www.wpacouncil.org/positions/WPAPlagiarism.pdf>)}

Plagiarism can occur in the following ways:**
• Using text from another source (e.g. websites, books, journals, newspapers, etc.) without documenting the source;
• Using direct quotation from a text without quotation marks, even if the source has been cited correctly;
• Paraphrasing or summarizing the ideas or text of another work without documenting the source;
• Substituting a word or phrase for the original while maintaining the original sentence structure or intent of the passage;
• Using graphics, visual imagery, video or audio without permission of the author or acknowledgment of the source;
• Translating text from one language to another without citing the original work;
• Obtaining packaged information, foreign language translation or a completed paper from an online source and submitting it as one’s own work without acknowledgment of the source; and
• Presenting the work of another student as one’s own.

Fairleigh Dickinson students are responsible for authenticating any assignment submitted to an instructor should the instructor request it. Students must be able to produce proof that the assignment they submit is actually their own work. Therefore, students must engage in a verifiable work process on all assignments:
• Keeping copies of all drafts of work;
• Making photocopies of research materials (including downloads from websites);
• Writing summaries of research materials;
• Keeping Writing Center receipts;
• Keeping logs or journals of their work on assignments and papers; and
• Saving drafts or versions of assignments under individual file names on a computer, external drive or other source.

In addition to requiring students to authenticate their work, Fairleigh Dickinson University instructors may employ various other means of ascertaining authenticity—such as using search engines to detect plagiarism, using external plagiarism detection services, creating quizzes based on student work, and requiring students to explain their work and/or process orally. The inability to authenticate work is sufficient grounds for a charge of plagiarism.

If subsequent evidence of plagiarism should be found after a grade has already been assigned, instructors have the right to lower the grade and/or apply one of the sanctions listed below.

Sanctions: Any student violating academic integrity will, for the first offense, receive one or a combination of the following penalties imposed by the faculty member:

1. No credit (0) or Failure for the academic exercise.

2. Reduced grade for the course.

3. Failure in the course.
4. Recommendation for Academic Probation to the dean of the college in which the student is registered.

   The instructor shall file a notice of the penalty in the student’s file maintained in the campus Office of Enrollment Services.

   In cases of interference and complicity, whether or not the student is registered in the affected course, the incident and penalty shall be recorded in the student's file maintained in the campus Office of Enrollment Services.

   For a subsequent violation of academic integrity, a student will be subject to any combination of the above sanctions, and, after due review by the academic dean according to the procedure below, one of the following:

   1. Suspension from the University for one year. Readmission will be contingent upon the approval of the academic dean.

   2. Dismissal from the University.

   3. Dismissal from the University identified on the student’s academic transcript as a result of a violation of the Academic Integrity Policy.

**Procedure:** When a faculty member believes that a student has violated the Academic Integrity Policy, the faculty member shall discuss the incident with the student as soon as possible. If after the conference, the faculty member determines that an act of academic dishonesty has occurred, the faculty member may impose the appropriate sanctions. Within five days of the faculty member’s action, the faculty member shall notify his or her department chair/school director in writing of the circumstances of the violation and the imposed sanctions. Within five days the academic department/school shall notify the student via certified mail/return receipt of the sanctions and the appeals’ procedures. Copies of the notice shall be sent to the chair of the department or director of the school of the student's major, the dean of the college in which the course is offered and the campus Office of Enrollment Services. The student may appeal the instructor’s decision as outlined below. Upon completion of the appeals process, the dean shall notify the student of the final disposition of the matter and the sanctions to be imposed, if any, via certified mail with copies to the faculty member, the department chair/school director and the campus director of enrollment services.

**Appeals Process:** A student who is charged with violating the Academic Integrity Policy by an instructor may appeal in writing to the chair of the department or the director of the school in which the alleged incident took place. The letter must state the specific grounds for the appeal. The student must submit a written appeal to the department chair or school director within 14 days of the receipt of the notification of the imposed sanctions. Failure to make an appeal within this 14-day period shall constitute a waiver of the appeal right. Within 10 working days of the receipt of the student’s appeal, the chair/director will review the circumstances of the alleged violation with the student and the instructor and recommend upholding, modifying, or dismissing the sanctions imposed by the instructor. The chair/director, within five working days, shall notify the student in writing via certified mail of the outcome, with copies to the instructor, the chair/director of the student’s major, the academic dean of the college in which the course is taught and the campus director of enrollment services. If it is determined that a violation of academic integrity did not
occur, the student’s final grade in the course cannot be based on the assumption of such violation. If the differences between the instructor and the student are not resolved by this review, the student may appeal the outcome to the dean of the college in which the course is offered.

Within 10 working days of the department chair/school director’s notification, the student may submit a written appeal to the dean of the college in which the alleged dishonesty took place. The letter must state the specific grounds for the appeal. Upon receipt of the student’s appeal, the dean shall provide the faculty member and his or her chair/director with a copy of the student’s appeal. Within 10 working days the dean shall convene a five-person hearing committee consisting of a faculty member at large from the college in which the course is offered, the dean or his or her designee, the campus dean of students or his or her designee, a faculty member from the department or school of the student’s major, and a student, selected by the campus dean of students, from the college in which the alleged dishonesty took place. The hearing will be chaired by the college dean or his or her designee. The role of the appeals committee is to review the record of the matter and determine whether a finding of academic dishonesty is founded and whether a sanction is consistent with the terms of this policy. The committee shall base its decision upon a review of the record but may meet with the student and the faculty member to secure additional information to help it in making a determination about the merits of the appeal. The committee can uphold, modify or dismiss the sanction imposed by the instructor. The college dean shall notify the student of the committee’s decision within five working days of the hearing. For a second offense of academic dishonesty, the academic dean can suspend or dismiss the student as indicated above.

For a sanction of suspension or dismissal imposed by the academic dean, the student may file a written appeal to the University Provost/Senior Vice President for Academic Affairs within 10 working days of receiving the notification of the dean's decision. The University Provost, or his or her designee, shall review the case within 10 working days of the receipt of the appeal. The University Provost shall make the final decision, using any appropriate resource to assist in deciding the appeal. The University Provost shall then notify all parties in writing of his or her final decision within five working days of his or her decision.

Reviewed: August 2011