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: 10:00 AM – 10:50 AM
W: 10:00 AM – 10:50 AM
F: 10:00 AM – 10:50 AM and appointment.
Semester: Fall 2010
Classroom, Day and time: EWC 202, Monday 5:25 PM – 8:00 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. 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 a signals and noise.
Objective 4: If students already have good backgrounds in Electrochemistry from their Analytical Chemistry course, this section will be skipped in favor of Miscellaneous Instrumental Analysis Techniques. (see objective 6 below). Otherwise, aspects of Electroanalytical Chemistry will be 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: If students already have good backgrounds in Separation methods from their Analytical Chemistry course, that material will be omitted in favor of miscellaneous Instrumental Analysis Techniques (see objective 6 below). Otherwise, aspects of Chromatography will be reviewed and broadened.

Outcome 5.1 Students should understand the basic principles of Chromatographic separations.

Outcome 5.2 Students should be familiar with the instrumentation used for Chromatographic methods.

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 2010)**

<table>
<thead>
<tr>
<th>Week #</th>
<th>Date</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>Sept. 1</td>
<td>Chapters 6,7 Electromagnetic Radiation and Introduction to Optical Spectroscopy (Components of Optical Instruments)</td>
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<tr>
<td>2</td>
<td>Sept. 8</td>
<td>Chapters 13 and 14 UV/Vis and Applications</td>
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<tr>
<td>3</td>
<td>Sept. 15</td>
<td>Chapter 15 Fluorescence and Applications Chapters 8, 9, and 12 Intro to Optical Atomic Spectroscopy and Atomic Absorption and Applications, Atomic X-Ray Spectroscopy.</td>
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<td>4</td>
<td>Sept. 22</td>
<td>Chapter 16 Interpretive IR</td>
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<td>5</td>
<td>Sept. 29</td>
<td>Exam #1</td>
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<tr>
<td>6</td>
<td>Oct. 6</td>
<td>Chapters 17 and 19 Interpretive NMR</td>
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<td>7</td>
<td>Oct. 13</td>
<td>Interpretive NMR (continued) Chap. 20 Mass Spectroscopy. Student presentation topics must be selected.</td>
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<tr>
<td>8</td>
<td>Oct. 20</td>
<td>Spring Recess</td>
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<tr>
<td>9</td>
<td>Oct. 27</td>
<td>Miscellaneous Methods Perhaps Higher Derivative Spectroscopy, Simplex Methods,etc.</td>
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<tr>
<td>10</td>
<td>Nov. 3</td>
<td>Exam #2</td>
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<tr>
<td>11</td>
<td>Nov. 10</td>
<td>Highlights of Chapters 2,3,4,5 Basic Measurements – Some analogue and digital electronics</td>
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<tr>
<td>12</td>
<td>Nov. 17</td>
<td>Highlights of Chapters 22,23,24,25 Electroanalytical Chemistry. (perhaps radiochemical methods – Chap 32)</td>
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<tr>
<td>13</td>
<td>Dec. 1</td>
<td>Highlights of Chapters 22,23,24,25 Electroanalytical Chemistry (continued)</td>
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Procedures, Policies, and Expectations
1) The last day for withdrawing from the course with a grade of "W" is Nov. 2, 2010
2) All homework assignments must be submitted on time. Late assignments will not be accepted.
3) During lecture all cell phones and pagers must be turned off.

Grading Policy

Exams - 50%
Homework - 50%