CAMPBELLSVILLE UNIVERSITY

COURSE SYLLABUS

PLEASE TYPE. DATE 29 December 2015

ACADEMIC UNIT Natural Science Division FACULTY Elizabeth Sutton

Discipline	Course # Section	Title of Course	Credit Hours	Cross Reference (if applicable)
CHE	350-01/350-91	Instrumental Methods of Analysis With lab	4.0	

TEXTBOOK [X] Required [ ] Not Required

Author Skoog, Holler, Crouch Title "Principles of Instrumental Analysis", 6th ed.

Publisher Saunders College Publishing/HBJ Date of Publication 2007

WORKBOOK [ ] Required [ ] Not Required

Author Title

Publisher Date of Publication

PLEASE ANSWER THE FOLLOWING QUESTIONS ON A SEPARATE SHEET OF PAPER AND ATTACH TO THIS FORM

1. DESCRIPTION OF COURSE: Develop a brief description of the course as it will appear in the Catalog.

2. COURSE OBJECTIVES: List the objectives of the course, **both** general and specific. Please relate these objectives to the mission and goals of the University and the Academic Unit.

3. COURSE OUTLINE: Outline the topics/units that are to be taught.

4. EVALUATION: How do you plan to determine the grade in the course. Please include grading scale.

5. REQUIREMENTS

   a. Examinations: State when tests are to be administered, including unit, mid-term, and final examinations.

   b. Reports: How many, length required, and what type (oral, term and/or research, book critiques).

   c. Supplemental reading assignments or outside work required.

   d. Supplemental instruction aids: Audio visual aids, **field** trips, guest speakers, etc.

6. BOOKLIST

DEAN Date Copy Received

VICE PRESIDENT FOR ACADEMIC AFFAIRS Date Copy Received

CAMPBELLSVILLE UNIVERSITY **E. K. Sutton**
NATURAL SCIENCE DIVISION **SSC 206**
COURSE SYLLABUS **Spring 2016**

I. **TITLE**: **CHE 350 Instrumental Analysis**, four credit hours.

II. **COURSE DESCRIPTION**: Instrumental analysis is the study of the modern chemistry laboratory involving sophisticated instrumentation. The course will provide the student with an introduction to instrumental methods of analysis. The following methods will be included various types of spectroscopy (absorption, infrared, nuclear magnetic resonance, mass); photometric methods, gas chromatography, and atomic absorption. **Three lecture hours and <u>one three-hour laboratory</u> per week. Prerequisites:** CHE 321 with a grade of C or better.

III. **COURSE OBJECTIVES**:

A. **General Education Curriculum Objectives (GECO):** (numbered to correspond to the objectives listed in the University catalog.)

2. Critical Thinking: Students will demonstrate the ability to reflect on theories and issues in a systematic fashion.
4. Ethics: Students will demonstrate an understanding of Christian values and ethical standards in order to make mature and informed decisions concerning moral issues.
5. Oral and Written Communication: Students will demonstrate the ability to express ideas, beliefs, and information in an organized, precise, and persuasive manner.
6. Quantitative Literacy: Students will demonstrate the ability to understand and utilize mathematical and/or logical relationships to analyze data, to construct and assess arguments, and to make sound judgments in quantitative situations that arise in daily life.
7. Social Responsibility and Citizenship: Students will demonstrate an understanding of personal and social responsibility in a changing global environment so that students can make contributions to their respective discipline and to society as a whole.

B. **Student Learning Outcomes (SLO)**: (Numbered to correspond to the pertinent General Education Curriculum Objective [GECO]).

1. Students will understand and be able to explain the basic principles of instrumental methods of analysis. (GECO 2, 6)
2. Students will execute calculations related to quantitative aspects in instrumental methods of analysis. (GECO 2, 6)
3. The student will recognize how chemistry provides solutions to contemporary, historical, technological, and societal issues. (GECO 2, 4, 6, 7)
4. Students will develop an awareness of how a basic understanding of chemistry, the proper application of that knowledge, and the interaction between chemistry and other fields of study and careers is important to personal and social issues. (GECO 4, 6, 7)
5. Students should be able to read, understand, and apply scientific information through thinking more critically, discussing more meaningfully, arguing more persuasively, and writing more effectively. (GECO 2,5**)**

C. **Program Learning Outcomes (PLO):** (numbered to correspond to the listing in the program assessment document)

1. The student will be able to demonstrate a solid understanding of the core principles in the traditional subdivisions of chemistry: Analytical, Inorganic, Organic, and Physical.
2. The student will be able to perform qualitative/quantitative chemical analyses/syntheses through the use of the appropriate laboratory techniques/equipment, experimental design, data acquisition, interpretation of data, and relevant instrumentation.
4. The student will be able to articulate chemical information/data/ideas clearly and effectively in speech and in writing in an acceptable presentation format.
6. The student will demonstrate critical thinking skills in chemistry: interpretation, evaluation, explanation, and scientific inquiry; how to ask appropriate questions, gather relevant information effectively and creatively, and reason logically from this information to make reliable conclusions.

D. **Course Specific Objectives (CSO)**: The student is expected to recognize and apply the fundamental and practical aspects of the following concepts and apply the concepts to problem solving: (numbered to correspond to the pertinent program learning outcome [PLO])

1. The student will demonstrate an understanding of the principles of gas, liquid, and ion chromatography. (PLO 1,2,6)
2. The student will illustrate an understanding of the principles of UV-visible, infrared, nuclear magnetic resonance, and Raman spectroscopy. (PLO 1,2,6)
3. The student will demonstrate the concepts involved in atomic absorption spectroscopy. (PLO 1,2,6)
4. The student will demonstrate an understanding of the fundamentals of flame and graphic furnace atomic absorption spectroscopy and how they are related to analytical chemistry. (PLO 1,6)
5. The student will be able to illustrate the fundamentals of electrochemistry that relate to voltaic cells, electrolytic cells, and half-cell reactions. (PLO 1,2,6)
6. The student will demonstrate an understanding of the fundamentals of electrochemical analysis, including polarography, voltammetry, potentiometry and coulometry. (PLO 1,6)
7. The student will demonstrate the ability to interpret a given problem and decide which instrumental method(s) best apply. (PLO 4,6)
8. The student will be able to assess sources of error in chemical and instrumental analysis and account for errors in data analysis. (PLO 1)
9. The student will recognize interferences in chemical and instrumental analysis. (PLO1)
10. The student will comprehend the concept of and perform instrument and method calibration.(PLO 1)
11. The student will integrate a fundamental understanding of the underlining physics principles as they relate to specific instrumentation used for atomic, molecular, and mass spectrometry, magnetic resonance spectrometry and chromatography. (PLO1)
12. The student will distinguish between qualitative and quantitative measurements and be able to effectively compare and critically select methods for elemental and molecular analyses. (PLO 4)

IV. COURSE OUTLINE

A. Introduction to Instrumental Methods
B. Signals and Noise
C. Electromagnetic Radiation
D. Molecular Ultraviolet/Visible and Near-Infrared Spectroscopy
E. Infrared Spectroscopy
F. Raman Spectroscopy
G. Nuclear Magnetic Resonance Spectroscopy
H. Mass Spectroscopy
I. Atomic Spectroscopy
J. Emission Spectroscopy
K. Electroanalytical Chemistry
L. Potentiometric Methods
M. Chromatographic Separations
N. Gas Chromatography
O. High Performance Liquid Chromatography

V. COURSE EVALUATION:

The evaluation for the course will be distributed as follows:

Homework	10%
Hourly Exams (three)	35%
Final (comprehensive)	25%
Lab Analysis/Projects	30%

Course grades will be assigned as follows: (A=91-100, B=81-90, C=71-80, D=61-70, F=below 60). If, for any reason, you cannot continue to attend this class, be certain you DROP IT OFFICIALLY. Otherwise you will automatically receive a failing grade.

VI. **COURSE REQUIREMENTS:**

A. **Numbers to Remember:**

1. **Campus Security Cell Phone: 270-403-3611**
2. **Campus Security Office Phone: 270-789-5555**
3. **Natural Science Division Office Phone: 270-789-5065**

Dates to Remember:			
M. L. King, Jr Day-No Class	Jan 18	First Bi-term ends	Mar 12
Evening classes begin	Jan 19	Spring Break-No Classes	Mar 13-18
Day classes begin	Jan 20	Second Bi-term begins	Mar 21
Last day add/register for Spring term	Jan 22	Easter Holiday-No Classes	Mar 25-28
Last day to drop 1st Bi-term class with W	Feb 20	Last day to drop a semester class with W	Apr 15
Midterm Week	Mar 7-11	Finals Week	May 9-13

B. **Examinations**

1. Three or four hourly exams (100 points each) will be given throughout the semester, with exam dates being announced in class approximately a week in advance. A COMPREHENSIVE two-hour final valued at 100-400 points will be given at the end of the semester according to the exam schedule furnished by the Academic Dean's office. NO MAKE-UP EXAMS WILL BE GIVEN. If an exam is missed throughout the semester, the value of the final exam will increase in proportion to the number of exams missed. The maximum number of hourly exams that may be missed is two. (The final exam may not be missed.) Cases of prolonged absence, severe illness, or death in the immediate family will be handled on an individual basis.
2. Students will be administered the American Chemical Society (ACS) standardized exam at the end of the semester meant to aid in the assessment of the chemistry program. It will be 50 multiple choice questions to be taken in 100 minutes. Each student that scores above 65% will receive 20 points, students scoring above 50% will receive 10 points added to their final exam score. The following is a breakdown of topics to aid you in preparing for the exam:

I. General Principles of Analytical Chemistry
   A. Quantitation methods: calibration curves, internal standardization, standard addition method, signal vs. noise
   B. Simple electronics: operational amplifiers, electrical components and circuits in chemical instrumentation
   C. Chemometrics: use of linear relationships, curve fitting methods simplex optimization

II. Spectrochemical Analysis: know the terminology, basic instrumental components, advantages, disadvantages, and applications (qualitative or quantitative technique, useful concentration range, etc.) of the following techniques:
   A. Molecular spectroscopy: uv/visible absorption, IR absorption, Raman scattering fluorescence, phosphorescence, NMR, mass spectrometry, surface characterization
   B. Atomic spectroscopy: AAS (flame and furnace), ICP, neutron activation, X-ray and particle techniques(ESCA, SEM)

III. Electroanalytical Chemistry: know the terminology, electrochemical cells, cell potentials, types of electrodes, basic instrumental components, advantages, disadvantages, and applications of the following techniques:
   A. Potentiometric methods (pH, ISE)
   B. Voltammetry (DC Polarography, Pulsed polarography, Stripping analysis)
   C. Coulometry

IV. Chemical Separations: know the terminology, basic instrumental components, advantages, disadvantages, applications, and be able to predict elution characteristics for the following techniques:
   A. HPLC
   B. GC
   C. TLC (or planar chromatography)
   D. CE and CEC
   E. Extraction

V. Miscellaneous:
A. Thermal analysis (TG, DTA, DSC, etc.)
B. Radiochemical methods

C. **Calculator:** A scientific calculator *with an equation solver* is required. I recommend a Texas Instruments model TI-83 or higher.

D. **Homework:** A homework assignment consisting of chapter-end problems will be given as we begin each new chapter. Each student is required to purchase and **USE A BOUND, PAGE-NUMBERED NOTEBOOK** (see the instructor for details, **SPIRAL NOTEBOOKS THREE-RING BINDERS, AND OTHER NOTEBOOKS THAT ARE DESIGNED TO ALLOW PAGE REMOVAL ARE NOT ACCEPTABLE**) to record all homework problem solutions. The first two pages of the notebook must be left blank initially, and used only to record a table of contents that states the page number on which the homework for each chapter begins. Although many problems may be assigned for each chapter, the instructor will select only a few of the problems for actual grading. However, the problems that are specifically graded will not be made known in advance, so all assigned problems should be worked out. When recording a solution to a problem in your notebook, you must write neatly, show all work, and draw a box around your final answer(s) for full credit. Homework is the single most crucial part of the learning process in this class, so quizzes will usually include problems to solve that are related to current or past homework assignments. Because homework grades are assigned individually, homework must be worked out individually, therefore asking for, offering, receiving, or giving help to or from other students on the homework is strictly forbidden (see the section below on Academic Misconduct). We will decide on due dates for each assignment and assignments are due at the start of class on the due date. Each non-spreadsheet assignment is worth 20 points: Two problems will be graded at 5 points each, and 10 points will be given for completion of the entire assignment. Spreadsheet problems are worth 10 points each. NO LATE ASSIGNMENTS WILL BE ACCEPTED.

E. **Laboratory Analyses**
During the semester, the student will perform various laboratory experiments/projects illustrating topics discussed in lecture. Students will keep a lab notebook and submit write-ups of the lab experiments performed. The laboratory experiments and projects are taken from Chemistry Experiments for Instrumental Methods by Donald T. Sawyer; John Wiley & Sons (1984), JCE Software by Journal of Chemical Education, as well as other sources.

F. **Seminar Attendance:** The chemistry department has introduced a seminar attendance policy in each of its courses. Each student in a chemistry course is required to attend a certain number of natural science seminars. The actual number is determined by the course instructor. **For this course you will be expected to attend two (2) natural science seminars this semester.** Be sure that your attendance at the seminar is recorded. After attending the seminar, you will write and turn in a one-page typewritten critique/summary of the seminar. The format of the critique/summary will be discussed in lecture. Each seminar will count as a part of your homework grade (25 points each).

G. **Attendance/Absences:** The attendance policy of the University will be strictly enforced in this class. An attendance sheet will be passed around at each class meeting, and each student is responsible for initialing the sheet appropriately to record attendance. Students arriving to class more than 5 minutes late to class (by my watch) will be counted as a late arrival. Two late arrivals count as a full absence. After **four** absences, the student will be turned in to the Office of Academic Support. After **eight** absences (the equivalent of four weeks of class), the student will be dropped from the course with a 'WA', this counts like an 'F' in grade-point average computation.

If a student misses the final exam for a documented emergency (traveling early for Christmas vacation or Spring Vacation does not count as an emergency), then a grade of 'X' will be assigned for the course, and a special exam must be taken within one month after the student re-enters the University (contingent on approval by the course instructor and the Vice President for Academic Affairs), otherwise, the 'X' becomes a failing grade and is so recorded.

Each student is responsible for all material covered in class, whether or not the student is in attendance, so always keep up with what was done during an absence by borrowing notes from other students and/or speaking with the instructor. Medical absences will be excused based on written advice from the campus

nurse or a health-care provider (based upon clinical findings and prescribed treatment recommendations). The medical document must specifically indicate that you were unable to attend class/recitation. All excused absences require written documentation and will be verified by the chemistry department staff. **No verbal or email excuses will be accepted**.

H. **Classroom Behavior:**

1. **Your basic responsibilities include:**
   a. Attend all lectures, recitations and exams and bring a scientific calculator.
   b. Read the assigned material prior to class.
   c. Study your lecture notes and assigned text reading.
   d. Do assigned homework problems on time and review them before exams.
   e. Do not fall behind!
   f. Take all examinations!
   g. All students are expected to behave in a manner that is conducive to a learning/teaching environment. This includes begin respectful to fellow students, guest speakers, and me. Students who engage in behavior that is disruptive to the learning environment will be asked to leave for the remainder of the class period.
2. Guests are only allowed in class at the discretion of and with prior approval from the instructor.
3. Electronic recording devices of any kind are not permitted except in special circumstances and with the specific permission of the instructor.
4. While you are expected to attend and participate in this class, your cell phone, computer, and MP3 players are **not**. Pagers, cell phones, and similar items are disruptive to the entire class and **must be turned off** during class. **The owner of any such device that activates during class will be immediately excused from class and counted as absent for the entire period.**
5. **USE OF CELL PHONES, COMPUTERS, AND MP3 PLAYERS DURING EXAMINATIONS AND QUIZZES WILL BE CONSIDERED ACADEMIC DISHONESTY, WHICH WILL RESULT IN A ZERO BEING AWARDED FOR THE QUIZ OR EXAMINATION (NO EXCEPTIONS!).**
6. Hats and caps are to be removed prior to entering the classroom.
7. Take care of any physiological needs *before* coming into the classroom.
8. Unacceptable student behaviors:
   a. Sleeping during class
   b. Chronic tardiness. Be here ready to learn when class begins.
   c. Reading, studying or working on materials for other classes.
   d. Chatting with your classmates when the instructor or other classmates are speaking.
   e. Prematurely packing up your books and bags before class has been dismissed.

I. **Academic Misconduct/Integrity:** Students in this course will be working toward mastery of the material to satisfy the course objectives. ***This class is held to an honor system, meaning that cheating, allowing someone to cheat, or failing to report known cases of cheating are all considered academic misconduct***. Cheating includes, but is not limited to, any attempt to present the work of another as your own; discussing or copying exams, quizzes, or homework with students who have not yet completed them; using "cheat sheets" on exams or quizzes; altering a test for re-grade, plagiarism of primary or secondary sources of information or using programmable calculators to store and/or recall prohibited information for an exam. Any student who refuses to allow a calculator to be inspected by the instructor upon request will not be allowed to use that calculator on the exam/quiz. Be aware that aggressive methods are used to protect the majority of you who are honest. **Students caught cheating or plagiarizing will receive a grade of zero for that test or assignment and may be given an F for the course.** A copy of the Division of Natural Sciences (DNS) policy on Academic Integrity is available on the course TigerNet page. Please read this policy and take it very seriously.

For information about plagiarism and how to avoid it, consult the following websites:

- Plagiarism? It's your call (Western Michigan University/Stanford University, 2008) http://www.wmich.edu/library/searchpath/module6
- The Plagiarism Court: You Be the Judge (Islam,2007, Fairfield University) http://www.fairfield.edu/library/lib_plagiarismcourt.html)
- What is Plagiarism? (Pearson/Prentice-Hall)

http://wps.prenhall.com/hss_understand_plagiarism_1/

- Indiana University Bloomington, School of Education (accessed 16May2012) http://www.indiana.edu/~istd/.

Students will be asked to sign an integrity statement on each assignment/examination/quiz. The following statement reads as follows:

"I pledge on my honor that on this assignment/examination/quiz I have neither received nor given nor have I seen any dishonest work.
Signature _____ Date _____"

J. **Teaching Methods**

The lecture method will be used as well as a hands-on laboratory experience in instrumental methods. In addition to hands-on laboratory work, computer simulation programs will be used to provide the student with experience in generation and interpretation of several instrumental methods.

VII. **BOOK LIST:**

1. Clough, Fred W., Introduction to Spectroscopy, version 2, Trinity Software, 1993
2. Journal of Chemical Education: Software, Vol. V B, #1, Division of Chemical Education of the American Chemical Society (1992).
3. Journal of Chemical Education: Software, Vol. IV B, #2, Division of Chemical Education of the American Chemical Society (1991).
4. Journal of Chemical Education: Software, Vol. IV B, #1, Division of Chemical Education of the American Chemical Society (1991).
5. Journal of Chemical Education: Software, Vol. I B, #2, Division of Chemical Education of the American Chemical Society (1988).
6. Pavia, Donald L., Spectral Interpretation, Trinity Software, 1989
7. Sawyer, Donald T., Heineman, William R., and Beebe, Janice M.; Chemistry Experiments for Instrumental Methods; John Wiley & Sons (1984).
8. Schatz, Paul, IR Simulator Software, COMPress, Wadsworth, Inc. (1986).
9. Schatz, Paul, NMR Simulator Software, COMPress, Wadsworth, Inc. (1987).
10. Silverstein, Bassler and Morrill, Spectrometric Identification of Organic Compounds, 4th ed., Wiley (1983).
11. Shapiro and Depuy, Exercises in Organic Spectroscopy, 2nd ed., Holt, Rinehart, and Winston, (1977).
12. Strobel, Howard A, and Heineman, William R.; Chemical Instrumentation: A Systematic Approach, 3rd edition; John Wiley & Sons (1989).
13. William and Fleming, Spectroscopic Methods in Organic Chemistry, 2nd ed., McGraw Hill, (1980).
14. Yost, Ettre, and Conlon, Practical Liquid Chromatography: An Introduction, Perkin-Elmer Co., (1980).

VIII. **ACADEMIC SUPPORT**

The Academic Support area, located in the Badgett Academic Support Center (BASC), exists to help students. At certain times, most students need some help with studying, choosing a career, major/minor, or assistance in a difficult course. The following services are available Career Services, Disability Services, tutoring, and the Citizens Bank & Trust Writing Center. *These services are provided at no extra cost to the student.* Space is also available for individual and group study, and laptop computers are available for students to check-out and use within the building. Information about these services is accessible by clicking on the "Current Students" tab on the University website at www.campbellsville.edu. Information is also available by calling the Office of Academic Support at (270) 789-5064.

IX. **DISABILITIES:**

Campbellsville University is committed to reasonable accommodations for students who have documented physical and learning disabilities, as well as medical and emotional conditions. If you have a documented disability or condition of this nature, you may be eligible for disability services. Documentation must be from a licensed professional and current in terms of assessment. Please contact the Coordinator of Disability Services at 270-789-5192 to inquire about services.

X. **TITLE IX**

Campbellsville University and its faculty are committed to assuring a safe and productive environment for all students. In order to meet this commitment and to comply with Title IX of the Education Amendments of 1972 and guidance from the Office of Civil Rights, the University requires all responsible employees, which includes faculty members, to report incidents of sexual misconduct shared by students to the University's Title IX Coordinator.

Title IX Coordinator:
Terry VanMeter
1 University Drive — Administration Office 8A
UPO Box 944 — Phone: 270-789-5016
Campbellsville, KY 42718 — Email: twvanmeter@campbellsville.edu

Information regarding the reporting of sexual violence and the resources that are available to victims of sexual violence is set forth at: www.campbellsville.edu/titleIX

TENTATIVE CHE 350 LECTURE COURSE SCHEDULE--SPRING 2016

WEEK #		TOPIC	READING ASSIGNMENT
JAN	21(1)	Introduction	1,5
		Signals and Noise	
	25(2)	Electromagnetic Radiation	6,7
FEB	1(3)	Atomic Spectroscopy	8-10
		Emission Spectroscopy	
	8(4)	Molecular Ultraviolet/Visible and	13,14
		Near-Infrared Spectroscopy	
	15(5)	Molecular Ultraviolet/Visible and	14
		Near-Infrared Spectroscopy	
		EXAM 1	
	22(6)	Infrared Spectroscopy	16,17
	29(7)	Infrared Spectroscopy	16,17
		Raman Spectroscopy	18
MAR	**7(8)**	**MIDTERM WEEK**	
		Nuclear Magnetic Resonance Spectroscopy	19
		EXAM 2	
	14(9)	**SPRING VACATION--NO CLASS**	
	21(10)	Mass Spectroscopy	20
	28(11)	Mass Spectroscopy	20
APR	4(12)	Chromatographic Separations	26
		Gas Chromatography	27
	11(13)	High Performance Liquid Chromatography	28
		EXAM 3	
	18(14)	Electroanalytical Chemistry	22
		Potentiometric Methods	
	25(15)	Electroanalytical Chemistry	22
		Potentiometric Methods	
MAY	2(16)	General Review	23
		ACS Instrumental Exam	
	9(17)	**Finals Week- FINAL will be at 8:00 AM on Tuesday, May 10, 2016**	

In the event of class cancellation for any reason (weather, instructor illness, etc.) exams or other scheduled activities will be administered in the next active class period.

CHE 350-91 TENTATIVE LABORATORY SCHEDULE

Week #	Date	Topic	Experiment
1	**1/21/2016**	**No Lab**	
2	**1/28/2016**	Statistics in Instrumental Analysis	Chen: Exp. 1A, 1B, 1C
3	**2/4/2016**	UV-VIS Spectroscopy Absorption Spectra, Beer's Law, Analysis of a Two-Component Mixture	Sawyer: Exp. 6-1 Parts I-IV
4	**2/11/2016**	UV-VIS Spectroscopy Absorption Spectra, Beer's Law, Analysis of a Two-Component Mixture	Sawyer: Exp. 6-1 Parts I-IV
5	**2/18/2016**	UV-VIS Spectroscopy Determination of Caffeine in Beverage Using Standard Addition Calibration	Chen: Exp. 3B
6	**2/25/2016**	Infrared Spectroscopy Infrared Spectrophotometry	Sawyer: Exp. 8-1 Exp. 8-2
7	**3/3/2016**	Infrared Spectroscopy Infrared Absorption Spectrometry of Organic Compounds	Chen: Exp. 5A
8	**3/10/2016**	Infrared Spectroscopy Infrared Simulator	Handout
9	**3/17/2016**	**Spring Break—No Lab**	
10	**3/24/2016**	Molecular Fluorescence Spectroscopy Fluorescence Spectroscopy of Quinine in Tonic Water	Chen: Exp. 4A
11	**331/2016**	NMR Spectrometry NMR Simulator	Handout
12	**4/7/2016**	Mass Spectrometry Mass Spec Simulator	Handout
13	**4/14/2016**	Gas Chromatography	Handout
14	**4/21/2016**	Liquid Chromatography—Kool-Aid Expt. High Pressure Liquid Chromatography (HPLC) HPLC Lab Simulator	Handout Handout
15	**4/28/2016**	Potentiometric/Electrochemistry pH Titration of Phosphoric Acid	Chen: Exp. 2A
16	**5/5/2016**	ACS Standardized Exam; Check out.	
17	**5/12/2016**	**Finals Week—No Lab**	

In the event of class cancellation for any reason (weather, instructor illness, etc.) exams or other scheduled activities will be administered in the next active class period.

CHE 350 INSTRUMENTAL ANALYSIS Suggested/Supplemental Homework Problems
SPRING 2016

Chapter 1: Introduction	1-12, 1-10
Appendix A1: Evaluation of Analytical Data	a1-10a,c; a1-14; a1-16
Chapter 6: An Introduction to Spectrometric Methods	6-2, 6-6
Chapter 7: Components of Optical Instruments	7-15c,d,e
Chapter 13: An Introduction to Ultraviolet/Visible Molecular Absorption Spectrometry	13-8; 13-13b,c,e
Chapter 14: Applications of Ultraviolet/Visible Molecular Absorption Spectrometry	14-11; 14-7
Chapter 16: An Introduction to Infrared Spectrometry	16-2; 16-7a,e,g; 16-6
Chapter 17: Applications of Infrared Spectrometry	17-2; 17-4; 17-5; 17-6
Chapter 18: Raman Spectroscopy	18-3
Chapter 19: Nuclear Magnetic Resonance Spectroscopy	19-26; 19-27a; 19-29bc; 19-31; 19-35
Chapter 15: Molecular Luminescence Spectrometry	15-4; 15-7a,d; 15-13
Chapter 20: Molecular Mass Spectrometry	20-11a,b,c; 20-17
Chapter 8: An Introduction to Optical Atomic Spectrometry	
Chapter 9: Atomic Absorption and Atomic Fluorescence Spectrometry	9-13; 9-22
Chapter 10: Atomic Emission Spectrometry	10-8; 10-10
Chapter 22: An Introduction to Electroanalytical Chemistry	22-1; 22-8
Chapter 23: Potentiometry	*23-16; 23-19; 23-20*
Chapter 25: Voltammetry & Polarography	
Chapter 26: An Introduction to Chromatographic Separations	26-14; 26-16
Chapter 27: Gas Chromatography	27-24; 27-27a,c,e
Chapter 28: High-Performance Liquid Chromatography	28-1a,c,d,g; 28-18 a,b,c

CHE 350-01: Instrumental Methods Lecture

Student's Acceptance of Course Policies

Please fill out and sign the following form and to the instructor. **Use a blue or black pen (no pencil).**

I, _____, have read the entire syllabus describing the course
(Print your name neatly)
policies for CHE 350, Instrumental Methods, taught by Ms. E. Kay Sutton. I fully understand these policies and I agree to comply with them during the entire _____ term.

Signature: _____ Date: _____

CHE 350-91: Instrumental Methods Lab

Student's Acceptance of Course Policies

Please fill out and sign the following form and to the instructor. **Use a blue or black pen (no pencil).**

I, _____, have read the entire syllabus describing the course
(Print your name neatly)

policies for CHE 350, Instrumental Methods Lab, taught by Ms. E. Kay Sutton. I fully understand these policies and I agree to comply with them during the entire _____ term.

Signature: _____ Date: _____