Texas A&M University
TEXARKANA

Syllabus for CHEM 440 (Spring 2018)

Class: Instrumental Analysis (4 sch)
Room: SCIT 201
Time: TR 9:00-10:45 am
lab F 4:00-6:45 pm

Instructor: Greg Hogan, Ph.D.
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Office Hrs: TBD
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COURSE DESCRIPTION

This course focuses on the theory and application of instrumental methods, such as high performance liquid chromatography (HPLC), gas chromatography (GC), infrared (IR) spectroscopy, nuclear magnetic resonance (NMR) spectroscopy, atomic absorption (AA) spectroscopy, and mass spectroscopy (MS)
Prerequisite: CHEM 340

COURSE DELIVERY METHODS

- Web enhanced
- Face-to-face lecture
- Laboratory experimentation

TEXTBOOKS/RESOURCES:

Required:

1. *Principles of Instrumental Analysis* by D. A. Skoog, F. J. Holler and T. A. Nieman *(5th Edition), Thomson Publishing, 1998. (ISBN-10: 0030020786)*

2**.** *A scientific calculator will be needed for this course*. (The library will have some calculators available for use on a first-come, first-served basis.)

Supplemental (not required):

1. *Organic Structural Spectroscopy* by J. B. Lambert, S.Gronert, H. F. Shurvell, and D. A. Lightner *(2nd edition), Pearson, 2011. (ISBN-13: 9780321592569)*

STUDENT/PROFRAM LEARNING OUTCOMES (PLO)

A student graduating with a BS in chemistry degree is expected to demonstrate that (s)he is able to:

1. Explain atomic & molecular structures, bonding, stoichiometry, and periodic properties of representative elements
2. Apply the concepts and fundamental principles of thermodynamics, chemical equilibria, and chemical kinetics to solve chemistry-related problems.
3. Write and explain organic reactions, stereochemistry, and processes in biological and environmental systems
4. Perform selected chemistry experiments using required instruments/equipment in the laboratory
5. Apply scientific method in designing experiments and analyzing experimental data
6. For *ONLY* the BS in Chemistry with Grades 7-12 Chemistry Certification: Demonstrate the skills and knowledge required to enter the teaching profession as a highly-qualified, certified teacher (according to the Texas Educator Standards).

COURSE LEARNING OBJECTIVES

At the end of this course, a student should be able to

A. Demonstrate knowledge of sampling methods for all states of matter.
B. Assess sources of error in chemical and instrumental analysis and account for errors in data analysis.
C. Recognize interferences in chemical and instrumental analysis.
D. Comprehend the concept of and perform instrument and method calibration.
E. Apply and asses concepts of availability and evaluation of analytical standards and formulate standardization methodology.
F. Integrate a fundamental understanding of the underlying physics principles as they relate to specific instrumentation used for atomic, molecular, and mass spectrometry, magnetic resonance spectrometry and chromatography.
G. Understand and be able to apply the theory and operational principles of analytical instruments.
H. Distinguish between qualitative and quantitative measurements and be able to effectively compare and critically select methods for elemental and molecular analyses.

This course is designed to fulfill PLO 2, 4 and 5

COURSE OUTLINE

I. Measurement Principles and Electronics
- a. Introduction to the analytical process (2 lecture) Chapter 1
- b. Basic electronics (1 lectures) Chapter 2, 3, 4
- c. Signals and noise (2 lectures) Chapter 5

II. Basics of Spectroscopy
- a. Introduction to Spectroscopic Methods (2 lecture) Chapter 6
- b. Components of Optical Systems (2 lecture) Chapter 7

III. Atomic Spectroscopy
- a. An Introduction to Optical Atomic Spectroscopy (2 lectures) Chapter 8
- b. Atomic absorption spectroscopy (2 lecture) Chapter 9
- c. Atomic Emission Spectroscopy (2 lecture) Chapter 10

End of Material for First Exam (tentatively scheduled for February 17)

IV. Molecular Spectroscopy – Electronic transitions
- a. Introduction to UV-Vis molecular spectroscopy (2 lectures) Chapter 13
- b. Applications of UV-Vis spectroscopy (2 lecture) Chapter 14
- c. Fluorescence, phosphorescence and chemiluminescence (2 lectures) Chapter 15

V. Molecular Spectroscopy – Vibrational excitation
- a. IR absorption spectroscopy (2 lectures) Chapter 16
- b. Applications of Infrared Spectrometry (2 lectures) Chapter 17

VI. Molecular Spectroscopy – Nuclear transitions
- a. NMR (3 lectures) Chapter 19

End of Material for Second Exam (tentatively scheduled for March 28)

VII. Additional Instrumental Methods for Organic Structural Analysis
- a. Mass Spectrometry (3 lecture) Chapter 20

VIII. Separation Science
- a. Fundamentals of chromatographic separations (3 lectures) Chapter 26
- b. Gas chromatography (2 lectures) Chapter 27
- c. High performance liquid chromatography (2 lectures) Chapter 28

End of Material for Third Exam (tentatively scheduled for April 25)

Final Exam (Comprehensive Exam) Tuesday, May 8 from 8:00 – 10:00 am

Communication

E-Mail (preferred)

All emails should have a subject, appropriate greeting, and signature. Additionally, you should identify yourself and the class in which you are enrolled. **Proper spelling and grammar is expected.** If no response is received within two business days, either resend your email or contact me by phone.

- The subject section of your email will always be **CHEM 44340-01**
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Telephone

If you leave a phone message, please speak slowly and clearly. Identify yourself and the class in which you are enrolled and state your phone number slowly twice. If I cannot understand your message, I cannot reply.

METHODS OF EVALUATION

- Examinations
- Lab Reports
- Assignments
- Quizzes

Examinations

There will ***four in-course*** examinations and a comprehensive final examination. **NO MAKE-UP EXAMS WILL BE GIVEN (with some exceptions.)** It will be used for the assessment of SLO 2.

Graded Components	Points
Take Home Problems	**100**
Unit Exams (3 @ 100 points each)	**300**
Final Exam	**100**
Total Possible Points	**500**

GRADING SCALE

A = 90-100%, B = 80-89%, C = 70-79%, D = 60-69%, F = 0-59%

N.B.: A student may request for an 'incomplete' grade, ***only*** *if (s)he completes all the course requirements except fourth exam due to extra-ordinary circumstance(s). If you are in such situations, you are advised to contact me as soon as possible.*

STUDENT PARTICIPATION

a. **Participation Policy:** Students are always encouraged to participate in class discussion in lecture sessions and form group to solve assigned problems. Students will participate in team work in groups.

b. **Course Etiquette:** Use of cell phones (for any purpose) is prohibited. Please turn the cell phone off. Observing safety rules is a MUST for all present in the class.

DISABILITY ACCOMMODATIONS

Students with disabilities may request reasonable accommodations through the A&M-Texarkana Disability Services Office by calling 903-223-3062.

ACADEMIC INTEGRITY

Academic honesty is expected of students enrolled in this course. Cheating on examinations, unauthorized collaboration, falsification of research data, plagiarism, and undocumented use of materials from any source constitute academic dishonesty and may be grounds for a grade of 'F' in the course and/or disciplinary actions. For additional information, see the university catalog.

A&M-TEXARKANA EMAIL ADDRESS

Upon application to Texas A&M University-Texarkana an individual will be assigned an A&M-Texarkana email account. This email account will be used to deliver official university correspondence. Each individual is responsible for information sent and received via the university email account and is expected to check the official A&M-Texarkana email account on a frequent and consistent basis. Faculty and students are required to utilize the university email account when communicating about coursework.

DROP POLICY

To drop this course after the census date, a student must complete a *Drop/Withdrawal Request Form*, located on the University Registrar's webpage or obtained in the Registrar's Office. The student must submit the signed and completed form to the instructor of each course indicated on the form to be dropped for his/her signature. The signature is not an "approval" to drop, but rather confirmation that the student has discussed the drop/withdrawal with the faculty member. The form must be submitted to the Registrar's office for processing in person, email Registrar@tamut.edu, mail (7101 University Ave., Texarkana, TX 75503) or fax (903-223-3140). Drop/withdraw forms missing any of the required information will not be accepted by the Registrar's Office for processing. It is the student's responsibility to ensure that the form is completed properly before submission. If a student stops participating in class (attending and submitting assignments) but does not complete and submit the drop/withdrawal form, a final grade based on work completed as outlined in the syllabus will be assigned.

CLASS PARTICIPATION

Students are responsible for beginning their participation on the FIRST CLASS DAY by logging on and completing assignments according to the COURSE CALENDAR. Failure to submit online assignments between the first day of classes and the University census date (according to the University schedule) will result in an ADMINISTRATIVE DROP from the course.

STUDENTS WITH FEDERAL LOANS AND/OR GRANTS

Students who have federal loans and grants must be aware that participation is monitored in online courses. In the event a student withdraws from a course the student will be required to refund all federal funds prorated from the last date of participation. A student's last access to Blackboard would not suffice as participation. The required weekly activity could include a comment to a blog, a discussion board posting, a journal entry, a quiz or exam, a submitted assignment, or other measurable and tracked activity.

STUDENT TECHNICAL ASSISTANCE

Solutions to common problems and FAQ's for your web-enhanced and online courses are found on the Online Student Training page on our website.

If you cannot find your resolution there, you can submit a support request by contacting the IT HelpDesk:

Email: helpdesk@tamut.edu

Phone: 903-334-6603

Submit a Support Request Ticket

Additional student help for Blackboard can be found here:

Blackboard Help for Students

TECHNICAL REQUIREMENTS

The following are the minimum computer requirements for online learning:

A computer capable of handling streaming video. A mid-range multi-core CPU should be adequate.

A sound card.

A high speed internet connection preferably directly connected to the computer via a hard-wired Ethernet connection rather than wirelessly connected.

Virus and adware protection software.

Microsoft Word, minimum version 2007 or above.

Mozilla Firefox browser available free.

The most recent versions of Java, Flash, QuickTime, Adobe Reader, and Shockwave. You can check this in the Firefox browser by visiting:

Firefox Plugin Check Tool

Please note: some instructors may require the use of a headset with microphone and/or a webcam. If so, the cost of these items is not included in your course fees and will need to be acquired at your own expense.

BLACKBOARD MOBILE FOR IOS AND ANDROID DEVICES

Android and iOS devices are currently supported using the Blackboard Mobile App, available for free from your App Store or scan the code below:

The Blackboard Mobile App provides limited access to courses, including the ability to read and contribute to discussions, check grades and announcements, access content, read and comment on blogs, reflect in journals, link to your personal Dropbox, and receive push notifications when courses are updated. Limited course features may also be available via your mobile device's browser; however, your mobile device does not replace your personal computer and should not be used as a substitute for one. High stakes assignments, tests, etc. should be completed on your personal computer, and not on your mobile device.