

Brazosport College

Syllabus for CTEC 1441 – Applied Instrumental Analysis I

Instructor:
Office Phone:
Alt. Phone:

Office:
Email:

I. COURSE DESCRIPTION

CTEC 1441 - Applied Instrumental Analysis I. CIP 4103010003

Overview of instrumental chemical analysis. Topics include statistical analysis, sampling, analytical separations, gravimetric and titrimetric analysis, gas chromatography, on-line process analyzers, and/or electroanalytical chemistry. **Credit Hours:** 4 (3 lecture, 3 lab)

- A. **Prerequisite:** A grade of “C” or better in CHEM 1311 and CHEM 1111 or CHEM 1305 and CHEM 1105.

Required skill level: College-level reading, writing and math.

II. COURSE OBJECTIVES

At the completion of CTEC 1441 the student should be able to:

Understand and apply basic statistical methods used in analytical labs.

1. Perform gravimetric analysis calculations and analyze unknowns using gravimetric techniques.
2. Perform volumetric calculations necessary in the preparation of standard solutions.
3. Apply and understand standardization methods used in titrimetric analysis, such as the use of primary standards, indicators, and the titration curve.
4. Understand the various methods of analytical separation, such as distillation, extraction and chromatography.
5. Understand the theory and operation of the gas chromatograph.
6. Receive a grade of D or better in the laboratory portion of the course.

III. STUDENT LEARNING OUTCOMES

At the completion of CTEC 1441 the student should be able to:

OUTCOMES	METHOD OF ASSESSMENT
1. Understand and apply basic statistical methods used in analytical labs.	Student's success on the following questions on the final exam which relate to basic statistical methods used in analytical labs will be evaluated: 6, 7.
2. Perform volumetric calculations necessary in the preparation of standard solutions.	Student's success on the following questions on the final exam which relate to volumetric calculations necessary in the preparation of standard solutions will be evaluated: 15, 25.
3. Apply and understand standardization methods used in titrimetric analysis, such as the use of primary standards, indicators, and the titration curve.	Student's success on the following questions on the final exam which relate to standardization methods used in titrimetric analysis, such as the use of primary standards, indicators, and the titration curve will be evaluated: 11, 19.
4. Understand the various methods of analytical separation, such as distillation, extraction and chromatography.	Student's success on the following questions on the final exam which relate to the various techniques of analytical separation, such as distillation and solvent – solvent extraction will be evaluated: 33, 34.
5. Understand the theory and operation of the gas chromatograph.	Student's success on the following questions on the final exam which relate to the theory and operation of the gas chromatograph, including the various analytical techniques used in GC analysis such as the internal standard method will be evaluated: 29, 36, 47, 29, 36, 47.
6. Receive a grade of D or better in the laboratory portion of the course.	Students' success will be measured from their grade from the lab section of the course.

IV. TEXTBOOK OR COURSE MATERIAL INFORMATION

A. Textbook

1. Organic Chemistry Lab Notebook, CER, 1998, Publisher Cengage/Thomson. ISBN: 978-0-87540-249-9 (required)
2. CTEC 1441, Applied Instrumental Analysis I Class Notes, by Dr. Judy Chu, BC Custom Publisher, May 2019. (required)
3. Scientific Calculator T130XA (required)
4. Visorgogs safety glasses (required)

Required course materials are available at the Brazosport College bookstore, on campus or online at <http://brazosport.edu/bookstore/home.html>. Students are not under any obligation to purchase a textbook from the college bookstore. The same textbook is/may also be available from an independent retailer, including an online retailer.

For Distance Education Courses include the following: Contact the Brazosport College Bookstore with a credit card for course materials. Phone: 979.230.3651. Fax: 979.230.3653. Email: bookstore@brazosport.edu. Website: <http://brazosport.edu/bookstore/home.html>

B. Course Outline

This is a sample outline which may vary with individual instructors. It will also vary based on whether the course is a summer course or a fall/spring course. Students should contact their instructor for the outline of the course they are taking.

WEEK	Date	LECTURE TR 5:35 – 6:50 PM	LAB Tuesday 7 – 9:50 PM
1	8/26	Chapter 1 – Introduction to Analytical Science	Safety and check-in. Exp. 1 – Excel Spreadsheet
2	9/2	Chapter 2 – Sampling Chapter 3 – Gravimetric Analysis	Exp. 2 – Gravimetric Sulfate
3	9/9	Chapter 3 – Gravimetric Analysis Exam 1 - Thursday	Exp. 2 – Gravimetric Sulfate (Cont.)
4	9/16	Chapter 6 – Introduction to Instrumental Analysis	Exp 3a – GC of Beer
5	9/23	Chapter 11 – Analytical Separations	Exp 3a – GC of Beer
6	9/30	Chapter 12 – Gas Chromatography	Exp. 3b- GC of Gasoline
7	10/7	Exam 2 – Tuesday Chapter 4– Introduction to Titrimetric Analysis	Exp. 4 – Esterification (Synthesis)
8	10/14	Chapter 4– Introduction to Titrimetric Analysis Chapter 5 – Applications of Titrimetric Analysis	Exp. 4 – Esterification (Extraction and Analysis)
9	10/21	Chapter 5 – Applications of Titrimetric Analysis Chapter 5.2 – Acid –Base Titrations	Exp. 5a – Titration (Standardization of NaOH)

WEEK	Date	LECTURE TR 5:35 – 6:50 PM	LAB Tuesday 7 – 9:50 PM
10	10/28	Chapter 5.2 – Acid –Base Titrations Exam 3 - Thursday	Exp. 5b – Standardization of HCl
	10/31	Last Day to Drop	
11	11/4	Chapter 5 – (5.3 – Complex Ion Formation Reactions)	Exp. 5c – KHP unknown
12	11/11	Chapter 5 – (5.3 – Complex Ion Formation Reactions) Chapter 5 – (5.4 – Oxidation-Reduction Reactions)	Exp. 5d – Soda Ash unknown
13	11/18	Chapter 5 – (5.4 – Oxidation-Reduction Reactions)	Exp. 6 – Water Hardness
14	11/25	Thanksgiving Holiday	No Lab (Thanksgiving)
15	12/2	Exam 4 Review for Final Exam – Thursday	Clean-up
16		Final Exam – Tuesday, Dec.10, 5-7 PM	

Homework Assignments: A maximum homework grade of 10 points will be assigned to completed homework assignments handed in on time (prior to the start of the exam). These points will be added to the corresponding exam grade as bonus points.

For Exam 1: Due before Exam 1

1 (1, 4, 6, 8, 20, 22, 24, 27, 28, 30, 31)

2 (3, 5, 18)

3 (10, 13, 16, 19, 23, 25, 27, 29, 37, 39)

For Exam 2: Due before Exam 2

6 (6, 9, 23, 25, 27, 28, 29, 39, 45, 47, 51)

11 (7, 9, 11, 14, 16, 24, 27, 28, 39, 41, 49, 50)

12 (1, 6, 10, 11, 13, 17, 26, 29, 31, 43, 45)

For Exam 3: Due before Exam 3

4 (5, 7, 9, 11, 12, 19, 22, 32, 33, 43)

5 (7, 10, 11, 13, 18, 27)

For Final Exam: Due before Final Exam

5 (37, 40, 41, 46, 50, 54a, 54g, 55a)

5 (57, 66, 68[q-u], 75)

Important Semester Dates:

Last Day to Withdraw from Classes– Check BC Academic Calendar -

<http://catalog.brazosport.edu/index.php>

Office Hours:

For fulltime faculty, office hours may change from semester to semester. Current faculty office hours are included on the syllabus, see link: <https://brazosport.edu/faculty-and-staff/resources/course-syllabi-instructor-information/>

For an adjunct faculty, no office hours are required, and they are not assigned an office. To set up an appointment with an adjunct, contact the instructor as per the email address on the syllabus, see link: <https://brazosport.edu/faculty-and-staff/resources/course-syllabi-instructor-information/>

V. LAB REQUIREMENTS

1. Visorgogs or safety goggles, must meet ANSI Z87.1-1989 certification.

A. Experiments for Applied Instrumental Analysis Lab

- 1) Graphing using Excel spreadsheet. (Handout)
- 2) The Gravimetric Determination of Sulfate in a Commercial Unknown (Kenkel, page 57)GC - Gas Chromatography
 - a) Experiment 42: Determination of Ethanol in Wine (or Beer) by Gas Chromatography and the Internal Standard Method. (Kenkel, page 359, and Handout)
 - b) Experiment 45: The Gas Chromatography Determination of a Gasoline Component by the Method of Standard Additions and the Internal Standard Method. (Kenkel, page 361, and Handout)
- 3) Esterification Pilot Process
 - a) Synthesis of methyl and isopropyl benzoate (Handout)
 - b) Determination of the relative yields of methyl and isopropyl benzoate using the GC (Handout)
- 4) Titrations Using the pH Probe
 - a) Experiment 8: Standardization of NaOH solution against Potassium Phthalate. (Kenkel, page 92, and Handout)
 - b) Experiment 8: Standardization of HCl solution against NaOH. (Kenkel, page 92, and Handout)
 - c) Experiment 10: Titrimetric Analysis of a Commercial KHP Unknown for KHP. (Kenkel, page 135, and Handout)
 - d) Experiment 11: Titrimetric Analysis of a commercial Soda Ash Unknown for Sodium Carbonate. (Kenkel, page 135, and Handout)
- 5) EDTA Titration
 - a) Experiment 14: Determination of Water Hardness (Kenkel, page 138)

B. Safety:

1. Safety goggles must be worn at all times in the laboratory.
2. Know the locations of eyewashes, showers, fire extinguishers and exits.
3. Use common sense.
4. Bare feet are NOT allowed into the laboratory. Open sandals and shoes are discouraged.

C. Laboratory Housekeeping:

1. Arrange apparatus neatly and compactly. Keep all books except the laboratory manual and laboratory notebook off the laboratory workbench.
2. Do not throw paper or solid materials into the water troughs or sinks.
3. Keep all reagent bottles clean (especially acids and bases).
4. Keep the lab bench area clean. Pay particular attention to keeping the balances clean and in order. If you spill chemicals, clean them up immediately. Put caps back on reagent containers.
5. At the end of the laboratory period, clean off your workspace with a sponge or wet paper towel. Perform proper shutdown of the instruments. Check to see that the gas and water have been turned off. You are responsible for keeping the area neat. Repeated failure to do so may result in loss of credit.

Clean Up And Instrument Shutdown Starts 10 Minutes Before The Official End Of The Class Period. When the time is up, you are supposed to be out of the laboratory. Failure to properly budget your time is presumptive of poor planning and your grade may suffer.

D. Grading:

1. Come prepared to the lab. The introduction (objective, discussion), safety, material and apparatus, should be written in the Laboratory Notebook prior to the beginning of the experiment. The format for the lab notebook is described in detail in the handout (Report Format for CTEC 1441). This pre-lab write-up (30 points) must be checked and initialed by me prior to the start of each experiment.
2. Experimental data and observations must be recorded in the Laboratory Notebook. The data sheets and observations (20 points) must be completely filled out in ink and initialed by me before you leave the lab. When you make an error, cross it out with a single line. Do not use liquid paper or obliterate the error. For example: error error
3. After a lab is finished, write the date that you finished the lab on the lab sign-up sheet. This signifies that your lab report will be due one week from that date.
4. Analysis of the data, calculations, including any tables and graphs, and summaries and conclusions (50 points) are due one week after the conclusion of the experiment.
5. Carbon copies of the complete experimental write-up are due the week after you finish the experiment.
6. Grading will be based on completeness of the experiments and the submitted report write-up.

VI. STUDENTS WITH DISABILITIES

Brazosport College is committed to providing equal education opportunities to every student. BC offers services for individuals with special needs and capabilities including counseling, tutoring, equipment, and software to assist students with special needs. For student to receive any accommodation, documentation must be completed in the Office of Disability Services. Please contact Phil Robertson, Special Populations Counselor at 979-230-3236 for further information.

VII. TITLE IX STATEMENT

Brazosport College faculty and staff are committed to supporting students and upholding the College District's non-discrimination policy. Under Title IX and Brazosport College's policy FFDA (Local), discrimination based on sex, gender, sexual orientation, gender identity, and

gender expression is prohibited. If you experience an incident of discrimination, we encourage you to report it. While you may talk to a faculty or staff member at BC, please understand that they are “Responsible Employees” and must report what you tell them to college officials. You can also contact the Title IX Coordinators directly by using the contact information below. Additional information is found on the Sexual Misconduct webpage at www.brazosport.edu/sexualmisconduct.

Alex Crouse, Director of Student Life and Title IX Coordinator
979-230-3355; alex.crouse@brazosport.edu

Mareille Rolon, HR Coordinator and Deputy Title IX Coordinator
979-230-3303; mareille.rolon@brazosport.edu

VIII. ACADEMIC HONESTY

Brazosport College assumes that students eligible to perform on the college level are familiar with the ordinary rules governing proper conduct including academic honesty. The principle of academic honesty is that all work presented by you is yours alone. Academic dishonesty including, but not limited to, cheating, plagiarism, and collusion shall be treated appropriately. Academic dishonesty violates both the policies of this course and the Student Code of Conduct. In this class, any occurrence of academic dishonesty will be referred to the Dean of Student Services for prompt adjudication, and may, at a minimum, result in F, in this course. Sanctions may be imposed beyond your grade in this course by the Dean of Student Services. Please refer to the Brazosport College Student Guide for more information. This is available online at <http://brazosport.edu/students/for-students/student-services/>.

IX. ATTENDANCE AND WITHDRAWAL POLICIES

Class attendance contributes to your final grade, but you must attend class to successfully complete the course. If you are unable to complete this course, you must complete and submit a withdrawal form with the registrar’s office. If the student decides to drop out of the class, it is the responsibility of the student to initiate a withdrawal before the withdrawal deadline in order to get a “W” on their transcript. If this is not done the student will receive a grade based on test grades and class grades earned during their attendance and absence (i.e., zeros on all missed materials, exams, skills tests, and final exam).

X. COURSE REQUIREMENTS AND GRADING POLICY

For this class you complete the following:

Exams: There will be a total of four exams. Each exam will last approximately one hour during class. The exact date of each Exam will be announced in class prior to the actual date of the exam. Students are allowed to bring a one-page, hand written notes containing equations, etc., to the exams.

Homework: As assigned by the instructor. A maximum homework grade of 10 points will be awarded as bonus points to the exam for homework assignments handed in on time.

Due date for homework is the day of the exam. **All work must be shown to obtain full credit for the homework assignments.**

Lab: The laboratory portion of the course consists of weekly 3 hour labs which the student must attend. **To pass the course, the student must successfully complete the laboratory experiments with a grade of D or better.**

Final Exam: The final will be given at the end of the course. The final exam is comprehensive.

Each of the above requirements counts toward your final grade as follows:

A. Grading

Exams	40%
Attendance	5%
Lab	40%
Final	15%

B. Testing

See the class calendar for the chapters and dates of the tests. Students are allowed to bring one page of hand written notes, containing equations, etc., to the exams.

The material to be covered on each exam is as follows:

<u>Exam</u>	<u>Chapters</u>
1	Intro to Analytical Science, Sampling, Gravimetric Analysis
2	Intro to Instrumental Analysis, Analytical Separations, GC
3	Titrimetric Analysis, Acid-Base Titrations
4	Complex Ion Formation, Redox Reactions and Titrations
Final	Comprehensive Exam

C. Make-Up Policy

There will be no make-up exams. The lowest exam grade will be replaced by the final exam grade, if higher. The final exam grade will replace **one** missed exam grade.

XI. STUDENT CONDUCT STATEMENT

Students are expected to be aware of and follow the Brazosport College Student Code of Conduct. Students have violated the Code if they “fail to comply with any lawful directions, verbal or written, of any official at BC.” Lawful directions include precautions and requirements taken to prevent the spread of COVID-19 at Brazosport College. Students who do not follow safety requirements, including the wearing of a mask, may be removed from class by their instructor and referred to the Dean of Student Services.

XII. CAMPUS CLOSURE STATEMENT

Brazosport College is committed to the health and safety of all students, staff, and faculty and adheres to all federal and state guidelines. The College intends to stay open for the duration of the semester and provide access to classes and support services on campus in the safest way possible. The College will also comply with lawful orders given by applicable authorities, including the Governor of Texas, up to and including campus closure. It is possible that on campus activities may be moved online and/or postpone if such orders are given.

XIII. STUDENT RESPONSIBILITIES

Students are expected to fully participate in this course. The following criteria are intended to assist you in being successful in this course:

1. Understand the syllabus requirements

2. Use appropriate time management skills
3. Communicate with the instructor
4. Complete course work on time, and
5. Utilize online components (such as Desire2Learn) as required.

XIV. OTHER STUDENT SERVICES INFORMATION

Information about the Library is available at <http://brazosport.edu/students/for-students/places-services/library/about-the-library/> or by calling 979-230-3310.

For assistance with online courses, an open computer lab, online and make-up testing, audio/visual services, and study skills, visit Learning Services next to the Library, call 979-230-3253, or visit <http://brazosport.edu/students/for-students/places-services/learning-services/>

For drop-in math tutoring, the writing center, supplemental instruction and other tutoring including e-tutoring, visit the Student Success Center, call 979-230-3527, or visit <http://brazosport.edu/students/for-students/student-success-center/>

To contact the Physical Sciences and Process Technology Department call 979-230-3618.

The Student Services provides assistance in the following:

Counseling and Advising	979-230-3040
Financial Aid	979-230-3294
Student Activities	979-230-3355

To reach the Information Technology Department for computer, email, or other technical assistance call the Helpdesk at 979-230-3266.



Get the information you need – when you need it. Click <http://geni.us/BRAZO> to install **BC Connect** on your mobile device to receive reminders, explore careers, map your educational plan, be in the know about events, find out about scholarships, achieve your goals and much more.