Course Description: Individual study and/or laboratory research.

Number of Credit Hours: 1 – 4 semester hours

Course Prerequisites and Corequisites: Prerequisite: CHE 275 and consent of the instructor. Pass-Fail grading.

Program Learning Outcomes:
1. The student will perform qualitative/quantitative chemical analyses/syntheses using modern instrumentation.
2. The student will articulate scientific information through oral communication. (depending on instructor or project)
3. The student will articulate scientific information through written communication.
4. The student will demonstrate ability to integrate knowledge content, laboratory skill, critical thinking and problem solving, and communication skills via participation in research projects.

General Education Core Curriculum Objectives: There are no specific general education core curriculum objectives in this course. This course is not a general education core curriculum course.

Course Objective: The student should demonstrate their ability to conduct independent research.

Student Learning Outcomes: Upon completion of this course, students will be able to:
- apply the chemistry knowledge obtained during the college career. (PLO 3, 6)
- analyze experimental results based upon trends in data. (PLO 5)
- practice the safe use/handling of chemicals and their proper storage. (PLO 3)

Outline of Topics (approximate course time):
Variable: dependent on instructor and selected course content.
Starting Fall 2019 all students planning on taking Chemistry 470 (the required seminar course for chemistry and biochemistry majors) will turn in a written report each fall. This report will serve as a complete draft of your chemistry 470 final paper. Chemistry 470 is only offered in the spring of each year; moreover, experience has taught the department that students who have a complete draft at the beginning of the 470 course are most successful (and less stressed out). I strongly suggest each semester you update your living document with the most recent experiments. Reread the introduction—does it need changes? If so make them. If you changed direction, go ahead and find a few references for the change in direction. Add a paragraph or two about the changes.

Text and Materials:
Lab notebook (provided by Fry) and 3 ring binder for literature pertaining to research topic.

COURSE CALENDAR:
Student will conduct an independent research project under the guidance of the professor. The student will adhere to an agreed timeline between the student and professor.

GRADING POLICY:
This is a pass fail course which consists of seven essential components—which are listed below with due dates. Failure to do the 7 minimum components satisfactorily will result in failing the course. The components are described below.

1) Agree upon meeting time(s) by the end of the 1st week of class.
2) Experiment in the laboratory correctly documented by the end of the 2nd week of class.
3) Experiment in the laboratory correctly documented by the end of the 3rd week of class.
4) Experiment in the laboratory correctly documented by the end of the 5th week of class.
5) Experiment in the laboratory correctly documented by the end of the 7th week of class.
6) Experiment in the laboratory correctly documented by the end of the 9th week of class.
7) Turn in files of
   a. Living document with updated introduction, materials and methods, results, discussion and conclusion. In general, you should add about 2-3 paragraphs each semester in the introduction; update your materials and methods to reflect the experiments you carried

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out; update the results, etc…. This is due the Monday after finals. You living document will be shared within the department and may be used to determine (or recommend) scholarships. Moreover, faculty may use your updated progress report for evaluation letters.

b. Living Powerpoint with updated introduction, materials and methods, results, discussion and conclusion. In general you should add 4-6 slides each semester.

c. In the drop box for your course, add the files that you generated for the semester. This includes all Excel files, Word documents, and raw data files, etc…. This will serve as a back-up and the appropriate research documentation.

A correctly documented experiment will follow be setup as follows in the laboratory notebook.

1) **Purpose statement.** State what you will be doing, why and how. This can be several sentences long. The purpose statement will help you formulate your hypothesis and help you to articulate how your hypothesis will be tested. This is a very important statement—it forces you to think through what may happen and why.

2) **Proposed Procedure.** In numbered or bullet form describe what how the experiment will be conducted. Include a materials section: which materials and chemicals will be using? Do you have access to them? I suggest that you get some lab time by gathering this material PRIOR to executing the experiment. Again, this section is meant to force you to think through what you will be doing.

3) **Materials.** Include the specific instrument and the instrument settings, chemicals used and where they were purchased from. Go ahead and write the description that will appear in your living document. For a guide see JJ Odeja’s master’s thesis in the laboratory. His is well written.

4) **Observations.** Include the location and full filename of all files generated. The more observant your observations the easier it will be to repeat an experiment and the more you will learn from the experience.

5) **Raw data files location**
6) **Processed Data**—graphs, charts or tables to summarize your data. Include file names and location of files.

7) **Discussion**- discuss the results. The closer to the time of the experiment that your sit down and think about what the experiment tells us, then the more useful the entire experience will be. With this in mind, take the time to make a thoughtful and complete discussion. This will save you time in Chem 470.

8) **Next Experiment**-Propose the next experiment and briefly describe what it will tell you.

Dr. Fry strongly suggest using the last 2-3 pages of your lab notebook as another listing of your files. Include the complete file name and a cross reference to your pages in the lab notebook.
ATTENDANCE POLICY:
The student will work a minimum of 3 hours in the laboratory. The instructor must be informed and approve of the student's hours that he/she will work.

ACADEMIC INTEGRITY (A-9.1):
Academic integrity is a responsibility of all university faculty and students. Faculty members promote academic integrity in multiple ways including instruction on the components of academic honesty, as well as abiding by university policy on penalties for cheating and plagiarism.

Definition of Academic Dishonesty
Academic dishonesty includes both cheating and plagiarism. Cheating includes but is not limited to (1) using or attempting to use unauthorized materials to aid in achieving a better grade on a component of a class; (2) the falsification or invention of any information, including citations, on an assigned exercise; and/or (3) helping or attempting to help another in an act of cheating or plagiarism. Plagiarism is presenting the words or ideas of another person as if they were your own. Examples of plagiarism are (1) submitting an assignment as if it were one's own work when, in fact, it is at least partly the work of another; (2) submitting a work that has been purchased or otherwise obtained from an Internet source or another source; and (3) incorporating the words or ideas of an author into one's paper without giving the author due credit.

Please read the complete policy at http://www.sfasu.edu/policies/academic_integrity.asp

Any student found cheating will be subject to the penalties as stated in the Student Code of Conduct handbook; including but not limited to a score of zero on exam, expulsion from the class or expulsion from the University.

WITHHELD GRADES SEMESTER GRADES POLICY (A-54):
Ordinarily, at the discretion of the instructor of record and with the approval of the academic chair/director, a grade of WH will be assigned only if the student cannot complete the course work because of unavoidable circumstances. Students must complete the work within one calendar year from the end of the semester in which they receive a WH, or the grade automatically becomes an F. If students register for the same course in future terms the WH will automatically become an F and will be counted as a repeated course for the purpose of computing the grade point average.

The circumstances precipitating the request must have occurred after the last day in which a student could withdraw from a course. Students requesting a WH must be passing the course with a minimum projected grade of C.

STUDENTS WITH DISABILITIES:
To obtain disability related accommodations, alternate formats and/or auxiliary aids, students with disabilities must contact the Office of Disability Services (ODS), Human Services Building, and Room 325, 468-3004 / 468-1004 (TDD) as early as possible in the semester. Once verified, ODS will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided. Failure to request services in a timely manner may delay your accommodations. For additional information, go to http://www.sfasu.edu/disabilityservices/.
1.) **Title Page**
Include the description living document last updated on __________. Save your past documents so that you can refer to them later.

2.) **Abstract**
This is a short, quantitative discussion of the main purpose and findings of the experiment. It should be stated clearly and briefly. What was done and what results were obtained. This will have to be updated each semester.

3.) **Introduction/Literature Review/Objective(s)**
In general, the section will consist of a brief review of the major field, and a more intensive coverage of the specific topic at hand. You want to give the background of the project which will help define your purpose.

Your introduction should grow by 2-3 full paragraphs each semester.

End with your three objectives and a time line for the project. Briefly describe progress to date including when the progress had taken place (consider recycling your previous abstracts in this portion).

4.) **Experimental**
Should begin with a listing of where the chemicals used were obtained, what the purity was, and any prior purification of the starting material. The manufacturer and model number of all major equipment should be listed. The manner in which spectra were obtained should be included. The experimental equipment and glassware should be described, with a diagram if necessary. All diagrams should be labeled and numbered. All steps performed in the experimental procedure should be listed in the order that they were performed, in exactly the manner in which you performed them. Observations as to physical and chemical changes should be included.

5.) **Results**
List all data obtained with information provided as to how the data was obtained, as well as the experimental accuracy of all measurements. The data should be compiled into tables or graphs if appropriate. All figures, spectra, and tables should be labeled, contain important parameters, and numbered. Only significant results should be presented.

6.) **Discussion**
Data should be discussed and evaluated, both positively and negatively towards meeting your objectives. Do not try to twist the data to fit the results you think should be obtained. Let the data "speak for itself", and evaluate the data fairly, even if the data seem to contradict theory you may have been expecting the data to follow. If theory predicted a straight line and your results confirmed the theory, then say so, remembering that the slope and the intercept may be of importance also. If the anticipated straight line was not obtained, say so, and give reasons why it was not obtained. Explain why or why the data does not agree with the theory. Bear in mind that the Discussion is the building block for the Conclusions. One should be able to read your discussion without making undue reference to your results section. Quite often the results of an experiment do not confirm theory. The reader will be interested in why the discrepancy
exists, and it is the function of the writer to supply the information. Use the discussion section for comparison, generalizations, and other relations. Don’t describe your graphs verbally; discuss their significance. A discussion of possible sources of error should be included as well as any limitations which may have affected the validity, and/or application of the results.

7.) **Conclusion**
The conclusions are deductions from the results, not statements of the results. The conclusions should be limited to the experimental work at hand, but if the work confirms or is contrary to accepted theory, a conclusion may be written based on that fact. Purely personal opinions or general statements should not be written. In a well-written report, the reader will have been led to the point where the writer’s conclusions seem obvious and inevitable.

8.) **Recommendations**
This section should include recommendations for changes in equipment or procedure to improve accuracy or usefulness of the results for future work. The basis for these recommendations should have been developed in the discussion section. You should state the problem; describe the effect it has on the results, and how to fix the problem.

9.) **Reference (Do not use only web address references – report requires over 50% grounded references)**
*The majority of references must be journal articles and not websites or textbooks. Papers with an inappropriate reference section will not be giving a passing grade.* All materials that were used in writing the laboratory report or to gather background material should be listed. References should be consecutively numbered, as encountered in the lab report. The reference number should be superscripted following the phrase or idea that is being referenced.

   Journal citation: authors (last name first), title of journal (usually abbreviated, in italics), year of publication (boldface), volume number (italics), and page number.


   Book citation: authors (last name first), title of book (italics), edition (if other than first), publisher (followed by colon), city (and state if the city is small) of publication, and the year of publication.


10.) **Appendices**

   **Note:** Report must be typed in 12 pt font, 1 in. margins