Course Syllabus
Fall 2019
CHE 476-030
Special Supervised Problems
“Emerging Pollutants in Wastewater”

Course Description: Individual study and/or laboratory research.

Number of Credit Hours: 1 – 4 semester hours.

Course Prerequisites and Corequisites: Permission of 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 chemical 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)
Class Syllabus  
Fall 2019  
CHE 476-030  
Special Supervised Problems  
Emerging Pollutants in Wastewater

Instructor: Dr. Kefa K. Onchoke  
Office: NM-118
Phone: 936-468-2386  
e-mail: onchokekk@sfasu.edu

Office Hours: M 12-2; W 11-1; R 4 – 5 p.m.; F 4 - 5
Class meeting time and place: TBD; in Rm. C-305

Research hours: T 9.30 – 12; Th 9.30 - 12 in Rm. C-305

CATALOG DESCRIPTION: A, B, C, D. Chemistry Practicum: 1- 4 semester hours. May be repeated for a total of four credit hours. Undergraduate only. Individual research.

PREREQUISITES: Consent of instructor

CO-REQUISITES: must have done CHE 275 to be enrolled in CHE 475/476

REQUIRED TEXTS AND OTHER MATERIALS: Laboratory notebook

REQUIRED SUPPLEMENTARY READINGS: Literature pertaining to research topic. Modeling software (Gaussssian, Chem Sketch etc).

COURSE OBJECTIVES: The student will develop an understanding of the basic concepts, laws and theories of chemistry and apply them to chemistry problems through research techniques. The student should learn the skills needed to demonstrate competency in chemical research and be proficient in the use of instruments.

STUDENT LEARNING OUTCOMES: Upon completion of this course, students are expected to:
1.) Apply chemistry concepts to problem solving,
2.) Analyze experimental results based upon the trends in the data
3.) Demonstrate the knowledge of issues facing modern science, and
4) Have the confidence and laboratory skills needed to complete research experiments,
5.) Demonstrate the knowledge of the influence of modern technology on chemistry by using instrumentation to collect data during laboratory experiments.

COURSE REQUIREMENTS:
Conduct experiments – Lab Reports. Accurate Lab reports will be maintained whenever experiments are conducted. Data, data generated must be entered into the lab notebook. This constitutes personal a personal record of what has been done. We will be writing lab reports every 2 weeks following a proper scientific style
- Introduction
- Experiments
- Results
- Discussion (interpretation of results)
- Conclusion
- Acknowledgments
An ACS style guide should be used in writing Reports.

**LAB NOTEBOOK:**

The laboratory notebook must be a permanently bound book. If needed carbon copies may be part of the notebook.

**RULES FOR LAB NOTEBOOK**

a.) Must obtain Professor's initials in notebook before leaving lab each day. All Lab reports that must have initials.

b.) ALL DATA IS TO BE RECORDED IN BLACK INK DIRECTLY IN THE NOTEBOOK!!!!

c.) Label and date all entries.

d.) An error should be lined through with a single horizontal line, initialed and briefly explained.

e.) A single diagonal line should be drawn across any page that is to be ignored, initialed and briefly explained. This includes completely blank pages.

f.) The backs of the pages may be used for scratch work BUT, measurements and readings are to be recorded as DATA.

g.) Number all the pages in the notebook in the upper right hand corner of the page. The carbon copies must bear the same number as the white originals.

h.) Use page 1 for a TABLE OF CONTENTS. This should be maintained on a current basis at all times.

i.) Use page 2 for a PREFACE and a table of abbreviations. Include your name, classification, major, course title, number, section, semester, year, and instructor.

**NOTEBOOK FORMAT** - Begin each experiment on a new page.

1.) **Title and Introduction**
   Give the title of the experiment and a 1 or 2 sentence description of the experiment. Important chemical reactions should also be included here.

2.) **Experimental Plan**
   Provide a summary of the experimental procedure. Think of what you will be doing before coming into the lab. Be familiar with what will be happening. Summarize the steps in your own words.

3.) **Procedure and Data**
   This section is the laboratory "diary" in which you write a step-by-step description of what you do in the lab. Enter data as it is collected. Any observations are to be recorded here also (colors, odors, temp., apparatus used, amounts of reagents, etc.). Draw pictures if appropriate, use tables, graphs, equations, etc. Record details such as Instrument name and maker, model number and serial number, chemical manufacturer, grade, lot number and expiration date, etc.

4.) **Calculations**
   Whenever appropriate give calculation used in the experiment that has not been included in the previous section. Be sure to include a set-up with all appropriate units. Whenever multiple samples of the unknown are analyzed, the average and the standard deviation (s) should be calculated.

5.) **Discussion**
   This section includes all relevant results and supporting chemical theories and concepts pertaining to the experiment. You must be able to convey your
understanding of what went on in the experiment. Any deviation of results from the expected results must be addressed and explained. Sometimes it involves the comparison of the student's experimentally derived answer to a known literature value. Objectively evaluate the results in terms of their precision/accuracy. Speculate as to any sources of error.

6.) **Conclusion**
Report unknown number and final results. Final results will be graded on quantitative/qualitative basis.

Note: (1) Always write in the "third person." Never use "I."

(2) Each week summarize the experiment in a report form.

An ACS style guide should be used in writing Reports.

<table>
<thead>
<tr>
<th><strong>Core Objective</strong>-description of objective</th>
<th><strong>Topic to address objective</strong></th>
<th><strong>Assessment of Objective</strong></th>
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</thead>
<tbody>
<tr>
<td>Critical Thinking Skills-To include creative thinking, innovation, inquiry, and analysis, evaluation and synthesis of information.</td>
<td>Assessed in lecture</td>
<td>475 Assessment in class</td>
</tr>
<tr>
<td>Communication Skills-To include effective development, interpretation and expression of ideas though written, oral, and visual communication.</td>
<td>Assessed in lecture</td>
<td>In class &amp; Lab Reports</td>
</tr>
<tr>
<td>Empirical and Quantitative Skills-To include the manipulation and analysis of numerical data or observable facts resulting in informed conclusions.</td>
<td>Assessed in lecture</td>
<td>475 Assessment via Lab reports (including Final Lab report)</td>
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<tr>
<td>Teamwork-To include the ability to consider different points of view and to work effectively with others to support a shared purpose or goal.</td>
<td>Not assessed</td>
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<tr>
<td>Personal Responsibility-To include the ability to connect choices, actions and consequences to ethical decision-making.</td>
<td>Not Assessed</td>
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<tr>
<td>Social Responsibility-To include intercultural competence, knowledge of civic responsibility, and the ability to engage effectively in regional, national, and global communities.</td>
<td>Assessed in lecture</td>
<td>Assessed via Lab reports and Final report.</td>
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### COURSE CONTENT:

| Wk 1/2 | Mon./Aug. 26-30 | - Lab introduction, safety video, assignment |
| Wk 2 Sept. 2 | | Introduction into the Lab and experiments to be done this semester. |
| | | Introduction into what to do in this semester research. Planning the experiment for next week. **Review of previous (Summer I and II Data)** |

| Wk 3 Mon./Sept. 9 | - Lab report format & pertaining to planning the experiment |
| Wk 4 Mon./Sept. 16 | - Plan on the Literature interrogation of emerging pollutant concentrations |
| | - Go over procedures on Conc. determinations |
| | Start the experiment - with correct Literature methods for selected pollutants |

| Wk 4 Fri./Feb.11 | Comparison of Various methods known (Dr. Onchoke) |
| Wk 5 Mon./Sept.21 | Running experiments with GC. **Calibration curves to be drawn and conclusions** |

| Wk 5 Mon. / Sept. 30 | - Acquire some FTIR data |
| | - Continue with GC/GC-MS training for the separation of pollutants – use the data acquired so far and reflect on the data of the pollutants analyzed. |
| | - Use the data compound selected as models for method development, and to illustrate the separation on a columns |
| | - Further training on HPLC/GC and chromatographic techniques |
| | - Compute frequencies and physical-chemical properties of the selected pollutants (Dr. Onchoke) |

| Wk 6 Mon./Oct. 7 | - Use of GC, GC-MS to assess the purity, retention times, molecular ion peaks of the pollutants |
| Wk 7 Mon./Oct. 21 | - Separation from other polycyclic aromatic compounds/pesticides from the pollutants |
| Wk 8 Mon./Oct. 14 | Draft procedures for the **separations procedures** |
| Mon./Oct.28 | - Write up the procedure |
| | - Order the chemicals |
| | 1. Order the chemicals |
| | 2. Look through literature for the their separation on different columns |
| | 3. Literature spectra –UV-Vis, NMR (1H/13C), HPLC, FT-IR/Raman (if available) |

| Wk 7 Mon./Oct. 28 | 1. Calculation of UV-Vis (singlet excited states of the pollutants using the B3LYP/6-311G**. |
| Mon./Nov. 4 | Compare to experiment wherever appropriate |
| | 2. HPLC/GC chromatograms of a mixture of two to 5 mixtures. |
| Wk 8 Mon./Nov. 11 | - Trouble shooting the instrument |

| Wk 8 Mon./Nov. 25 | Acquisition of IR spectra of compounds with: |
| Wk 9 Mon./Nov. 18 | - ATR and FT-IR spectrometers |
| Mon./Nov. 25 | Calibration curves and determinations of concentrations - comparisons between theory and experiment; |

| Wk 10 Mon./Nov 25 | UV-Vis comparisons between theory and experiment; |
| Wk 10 Mon./Nov 25 | Assigning of the singlet and excited states |
| | Electronic spectra of compounds; LUMO energies and HOMO energies comparisons made |

| Wk 11 Mon./Dec. 2 | NMR experiments- Assigning the peaks from 13C NMR, HMQC, HMBC /HSQC. |

| Wk 11 Fri./Dec. 2 | Write the research reports from the synthesis in this seminar (For student) |

| Wk 12 Mon./Dec. 9 | Make draft copies of the write-up in preparation for a journal (e.g. Journal of vibrational Spectroscopy, journals of hazardous materials etc) |
| Wk 13-14 Dec 9-23 | Preparation of Reports and manuscript |
| | - Submission |
Notes: In weeks 16-18, Dr. Onchoke will work on the results as shown in above schedule

Presentation: A presentation of the work done in the semester must be done. The date for the presentation is Friday of the dead week. The schedule is to be arranged depending on the faculty and student’s availability. The length of the presentation for the CHE275/276 is ~ 10-15 minutes. The length of the presentation for the CHE 475/476 is 20 minutes.

Standard Operating Procedures (SOP)/Professionalism
1. The laboratory area must be kept clean.
2. All safety rules must be followed
3. All the equipment must be used properly
4. Any time any absence is necessary, the student is to notify the instructor ahead of time and arrangements for make up to be made

METHOD OF EVALUATION:
The course is Pass/Fail; however I do keep grades for my records. The point total for the semester is 300 points.

- Lab notebook - 100 points
- Report -100 points
- SOP/professionalism -75 points
- Presentation - 25 points

Grading scale - A \geq 270; B \geq 240 - 269.99; C \geq 210 – 239.99; D \geq 180 - 209.99; F < 179.99.

MAKE-UP POLICY & ATTENDANCE: There student will work about three hours per week for each credit hour. A regularly scheduled time will be arranged. See SOP/Professionalism.

ACADEMIC HONESTY POLICY: CHEATING OR SCHOLASTIC DISHONESTY WILL NOT BE TOLERATED AND WILL RESULT IN AN F IN THE COURSE AND FURTHER ACTION BY THE UNIVERSITY. 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 or laboratory experiment, expulsion from the class or expulsion from the University.

SEMESTER WITHDRAWALS: Last day to withdraw from the course without obtaining WP or WF grade is March 23.

ACADEMIC DISABILITIES POLICY: Students with Disabilities – To obtain disability – related accommodations and/or auxiliary aids, students with disabilities must contact the Office of Disability Services, Human Services Building, Room325,468-3004/ 468-1004 (TDD) as early as possible in the semester. Once verified, DS will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided.

CLASSROOM BEHAVIOR POLICY: To ensure a classroom environment conducive to learning, any forms of classroom disruptions will not be tolerated (examples but not limited to – talking, use of cell phones/beepers, sleeping, reading other material, eating/drinking). Students who violate these rules will be asked to leave. Repeat offenders will be subject to disciplinary action in accordance with University policies as described in the Code of Student Conduct.
STATEMENTS OF CONCERN:
1) Students are expected to be prepared for every class, which includes having the following items done before they arrive for class:
   a) read the experiment to be performed that day
   b) have the first two parts of your notebook completed (title/introduction, experimental plan)
   c) turn in the lab report for the previous week

2) THERE IS NO FOOD, DRINK, CHEWING OF ANYTHING, SHORTS/SKIRTS, OR OPEN ENDED SHOES ALLOWED IN THE LAB!!!!!!!!!!!

3) APPROVED SAFETY GOGGLES ARE TO BE WORN AT ALL TIMES IN THE LAB.

4) Infractions of any safety regulations will result in one warning being issued. If a second infraction occurs, the student will be asked to leave the lab for that day and will be assigned an unexcused “0” for the experiment.
CHEMISTRY - UNDERGRADUATE RESEARCH REPORT

1.) Title Page

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.

3.) Introduction/Literature Review
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.

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. 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