Agenda Item #15-126
Effective Spring 2016

Eastern Illinois University
Revised Course Proposal
CHM 1415, General Chemistry Laboratory II

Banner/Catalog Information (Coversheet)

1. **___New Course or _X___Revision of Existing Course**

2. **Course prefix and number:** ____CHM 1415

3. **Short title:** _____General Chemistry Lab II

4. **Long title:** ___General Chemistry Laboratory II

5. **Hours per week:** _0__ Class _3__ Lab _1__ Credit

6. **Terms:** _X_ Fall _X__ Spring ___ Summer ___ On demand

7. **Initial term**: ___ Fall _X__ Spring ___Summer Year: _2016__

8. **Catalog course description:** _Experimental work illustrating chemical principles and concepts described in the companion lecture course, including intermolecular forces, solutions, chemical kinetics, equilibrium, thermodynamics, and acid-base reactions. Also includes an introduction to inorganic qualitative analysis. BIO 907; CHM 912; NUR 907.

9. **Course attributes:**

   General education component: ___Not applicable

   ___ Cultural diversity ___Honors ____Writing centered ___ Writing intensive _X_Writing active

10. **Instructional delivery**
    Type of Course:

    ___ Lecture _X_ Lab ___ Lecture/lab combined ___ Independent study/research

    ___ Internship ___ Performance ___ Practicum/clinical ___Other, specify: _____

    Mode(s) of Delivery:

    _X__ Face to Face ___Online ___Study Abroad

    ___ Hybrid, specify approximate amount of on-line and face-to-face instruction_____

    Course(s) to be deleted from the catalog once this course is approved. ___NONE

11. **Equivalent course(s):** ____NONE

    a. Are students allowed to take equivalent course(s) for credit? ___ Yes ___ No

12. **Prerequisite(s):** __A grade of C or better in both CHM 1310G and 1315G

    a. Can prerequisite be taken concurrently? ___ Yes __X_ No

    b. Minimum grade required for the prerequisite course(s)? _C___

    c. Use Banner coding to enforce prerequisite course(s)? _Y_ Yes ___ No

d. Who may waive prerequisite(s)?

___ No one __X__ Chair ___ Instructor ___ Advisor ___Other (specify)

13. Co-requisite(s): __Must be taken concurrently with CHM 1410.

14. Enrollment restrictions

a. Degrees, colleges, majors, levels, classes which may take the course: ____All_____

b. Degrees, colleges, majors, levels, classes which may not take the course: ___None_____

15. Repeat status: _X__ May not be repeated ___ May be repeated once with credit

16. Enter the limit, if any, on hours which may be applied to a major or minor: _1___

17. Grading methods: _X_ Standard ___ CR/NC __ Audit ___ ABC/NC

18. Special grading provisions:

_n/a_ Grade for course will not count in a student's grade point average.

_ n/a _Grade for course will not count in hours toward graduation.

_ n/a _ Grade for course will be removed from GPA if student already has credit for or is registered in: _____

_ n/a _ Credit hours for course will be removed from student's hours toward graduation if student already has credit for or is registered in: _____

19. Additional costs to students:
Supplemental Materials or Software: _Students purchase (~$10) a copy of a locally produced lab manual – handled through approval by Textbook Rental Service.

Course Fee ___No _X__Yes, Explain if yes__$32 fee covers consumable materials/normal breakage loss/replacement and/or repair of commonly used apparatus – this already has President's Council Approval.

20. Community college transfer:

_X__ A community college course may be judged equivalent.

_____ A community college may not be judged equivalent.

Note: Upper division credit (3000+) will not be granted for a community college course, even if the content is judged to be equivalent.

Rationale, Justifications, and Assurances (Part I)

1. _X_ Course is required for the major(s) of __BS in Chemistry (all concentrations); BA in Chemistry; BS in Biological Sciences; Family and Consumer Science (Dietetics Option BS); BS in Clinical Lab Sciences; BS in Geology; BS in Physics (including Applied Physics Option, Pre-Engineering Physics, Radiation Physics Option); BS Engineering; BS in Science Teacher Licensure (Biological Sciences Specialization, Chemistry Specialization, Physics Specialization, Earth Sciences Specialization) plus any "Pre-Health" Curriculum.

   _X_Course is required for the minor(s) of ____Chemistry_____

   ___Course is required for the certificate program(s) of _____

   ___ Course is used as an elective

2. **Rationale for proposal**: This revised course proposal is being submitted to comply with the new course proposal guidelines as set forth by CAA in 2014. The previous CHM 1415 course proposal could not be located; therefore this new course proposal will be suitable for publication in the EIU electronic course library and for submission to the Illinois Articulation Initiative (IAI).

3. **Justifications for (answer N/A if not applicable)**

   Similarity to other courses: N/A

   Prerequisites: As noted in the IAI guidelines, General Chemistry is almost universally regarded as a sequential two-semester, lecture and lab experience. Success in General Chemistry Laboratory II therefore naturally relies on successful completion of General Chemistry I (both lecture and lab). Therefore, the prerequisites of a grade of C in both CHM 1310G (General Chemistry I – lecture) and CHM 1315G (General Chemistry Laboratory I) are necessary to maximize the probability of success in General Chemistry Laboratory II.

   Co-requisites: Success in the laboratory (CHM 1415) is predicated on understanding of the fundamental concepts presented in the corresponding lecture (CHM 1410). Therefore, CHM 1410 is a co-requisite.

   Enrollment restrictions: N/A

   Writing active, intensive, centered: The laboratory reports will use a preprinted form from the lab manual which will require students to accurately record detailed observations and clearly present the treatment of acquired data. The "writing active" designation is justified from the writing required in the lab reports and quizzes/final exam.

4. **General education assurances (answer N/A if not applicable)**

   General education component: N/A

   Curriculum: N/A

   Instruction: N/A

   Assessment: N/A

5. **Online/Hybrid delivery justification & assurances (answer N/A if not applicable)**

   Online or hybrid delivery justification: N/A

   Instruction: N/A

   Integrity: N/A

   Interaction: N/A

Model Syllabus (Part II)

Please include the following information:

1. **Course number and title:** CHM 1415 (General Chemistry Laboratory II)

2. **Catalog description:** Experimental work illustrating chemical principles and concepts described in the companion lecture course, including intermolecular forces, solutions, chemical kinetics, equilibrium, thermodynamics, and acid-base reactions. Also includes an introduction to inorganic qualitative analysis. BIO 907; CHM 912; NUR 907.

3. **Learning objectives:**

Course-Specific Learning Objectives *At the end of this course, students will be able to…*	**Corresponding Undergraduate University Learning Goals**
Effectively collect, tabulate, organize, and record data from controlled experiments; understand how to prepare graphical depictions of collected data using standard software such as Excel™.	QR-1. Performing basic calculations and measurements. QR-2. Applying quantitative methods and using the resulting evidence to solve problems. QR-3. Reading, interpreting, and constructing tables, graphs, charts, and other representations of quantitative material. QR-4. Critically evaluating quantitative methodologies and data. QR-5. Constructing cogent arguments utilizing quantitative material. QR-6. Using appropriate technology to collect, analyze, and produce quantitative materials. WR-3. Producing documents that are well-organized, focused, and cohesive. WR-4. Using appropriate vocabulary, mechanics, grammar, diction, and sentence structure. WR-5. Understanding, questioning, analyzing, and synthesizing complex textual, numeric, and graphical sources.

Effectively analyze and interpret data from controlled experiments.	QR-1. Performing basic calculations and measurements. QR-2. Applying quantitative methods and using the resulting evidence to solve problems. QR-3. Reading, interpreting, and constructing tables, graphs, charts, and other representations of quantitative material. QR-4. Critically evaluating quantitative methodologies and data. QR-5. Constructing cogent arguments utilizing quantitative material. QR-6. Using appropriate technology to collect, analyze, and produce quantitative materials. WR-3. Producing documents that are well-organized, focused, and cohesive. WR-4. Using appropriate vocabulary, mechanics, grammar, diction, and sentence structure. WR-5. Understanding, questioning, analyzing, and synthesizing complex textual, numeric, and graphical sources.
Understand the proper and safe use of basic chemical glassware and handling of hazardous materials such as acids, bases, oxidizing and reducing agents, and some organic solvents.	CT-3. Understanding, interpreting, and critiquing relevant data, information, and knowledge.
Understand how to carry out proper techniques for separating and identifying the components of both homogeneous and heterogeneous mixtures.	CT-4. Synthesizing and integrating data, information, and knowledge to infer and create new insights.
Apply standards of scientific honesty and integrity.	RC-2. Applying ethical reasoning and standards in personal, professional, disciplinary, and civic contexts. WR-7. Collecting and employing source materials ethically and understanding their strengths and limitations.

4. Course materials:

Lab Manual: Locally produced lab manual *General Chemistry Laboratory II – CHM 1415*.

5. Weekly outline of content:

Week #	Experiment
1	• Lab Check-In (inventory of assigned lab locker; cleaning of glassware, etc.) • Orientation including lab safety review.
2	Protein Extraction and Folding • Extraction of a protein into solution/separation of solid residue by filtering • Monitor effect of ionic strength, pH, organic solvents, temperature on protein folding • Use fluorescence to monitor status of protein (folded vs. unfolded)
3	Vapor Pressure and Heat of Vaporization • Determine the vapor pressure of isopropyl alcohol at four different temperatures • Graph data (ln P vs. 1/T) using Excel™ and, using Clausius-Clapeyron equation, determine ΔH_{vap} and the normal boiling point of isopropyl alcohol.

4	<u>Solutions and Solution Concentrations</u> Students work in small groups and, in consultation with the instructor, devise methods (and carry out the procedures) for the preparation of a saturated solution of potassium dihydrogen phosphate. The group uses this prepared solution to: • Experimentally determine and report the density of this solution. • Experimentally determine and report the mass percent of potassium dihydrogen phosphate in this solution. • Determine and report the mole fraction, molality, and molarity of potassium dihydrogen phosphate in the prepared saturated solution. The results are compared to density and mass percent measurements on a stock saturated solution of potassium dihydrogen phosphate.
5	<u>Chemical Kinetics</u> • Experimentally determine rate law for reaction of Fe^{3+} with I^- in presence of starch ("iodine clock") using systematically varying concentrations of Fe^{3+} and I^- and the Method of Initial Rates. • Determine rate constant for the reaction
6	<u>Chemical Equilibrium</u> • Determine the equilibrium constant for the reaction: Fe^{3+} (aq) + HSCN (aq) $\Leftrightarrow$ $Fe(SCN)^{2+}$ (aq) + H^+ (aq). • Students use spectrophotometric methods to monitor [$Fe(SCN^{2+}$] as a function of systematically varying initial concentrations of Fe^{3+} and HSCN in the presence of a constant [H^+].
7-12	<u>Qualitative Analysis (6-weeks):</u> • Students learn separation and identification techniques for cations of Group I (Ag^+, Hg_2^{2+}, Pb^{2+}), Group II (Hg^{2+}, Pb^{2+}, Bi^{3+}, Cu^{2+}), Group III (Fe^{3+}, Al^{3+}, Mn^{2+}, Zn^{2+}), and Group 4 (NH_4^+, Na^+, K^+, Ca^{2+}, Mg^{2+}). • Weeks 1-4 involve separation and identification of cations in each individual group (Group I = week 1; Group II = week 2, etc.) in both a known and in an unknown containing (typically) two of the cations. • Weeks 5-6 are either devoted to separation and identification of cations in a "general unknown" (containing cations from any or all of Groups 1-4) <u>or</u> one week of identification of anions ($C_2H_3O_2^-$, Br^-, Cl^-, CO_3^{2-}, I^-, NO_3^-, PO_4^{3-}, S^{2-}, SO_3^{2-}, SO_4^{2-}) and one week on identification of an unknown containing one or two salts. • Students are graded on their ability to use previous information and techniques from lecture and lab involving solubility properties, acid-base interactions, and separation techniques, to identify their assigned unknowns. • Students are expected to write net-ionic equations for the reactions used in the analyses.
13	<u>Buffer Solutions</u> • Students prepare an acetic acid/acetate buffer of two different concentrations (ratio of acid form to base form stays constant). • Students monitor pH as a function of addition of strong acid or strong base to both buffers. • The mechanism of buffer operation, optimum buffer pH, and buffer capacity are illustrated.

14	Electrolysis Students set up two separate electrolytic cells and determine the gram atomic weight of copper and zinc using the mass loss on these electrodes (anodes). Current is measured by a separate, in series, reduction of $2H^+$ to H_2, conversion of volume of H_2 to moles H_2, giving information to measure the electron flow correlating with the mass loss of the anode.
15	Lab Check-Out (final inventory of assigned lab locker, cleaning of glassware, etc.)
16	Final Exam Week

6. Assignments and evaluation, including weights for final course grade:

Lab Reports (70%): The locally produced CHM 1415 Lab Manual has report sections (containing space for data recording, calculations, and discussion questions). These reports are handed in weekly, graded, and returned the following week. Discussion questions assess the students' progress on drawing conclusions from data and reinforcing chemical principles presented in the lecture class CHM 1410. It should be noted that the lab report forms become less structured later in the semester to encourage students to develop judgement about organization and presentation of scientific data.

Quizzes and/or Final Exam (30%): Short quizzes are typically given either just before or just after pre-lab lectures. They are designed to encourage students to reflect on the chemical principles being illustrated in the laboratory. When employed, a final exam will assess a student's ability to interpret and analyze experimental data and explain the chemical principles behind a selection of experiments performed during the semester.

7. Grading scale: Standard grading scale: A, B, C, D, F

8. Correlation of learning objectives to assignments and evaluation.

Learning Objective	**Lab Reports (70%)**	**Quizzes and/or Final Exam (30%)**
Effectively collect, tabulate, organize, and record data from controlled experiments; understand how to prepare graphical depictions of collected data using standard software such as Excel™.	X	
Effectively analyze and interpret data from controlled experiments.	X	X
Understand the proper and safe use of basic chemical glassware and handling of hazardous materials such as acids, bases, oxidizing and reducing agents, and some organic solvents.	X	X

Understand how to carry out proper techniques for separating and identifying the components of both homogeneous and heterogeneous mixtures.	X	X
Apply standards of scientific honesty and integrity.	X	X

Date approved by the department or school: August 28, 2015

Date approved by the college curriculum committee: September 4, 2015

Date approved by the Honors Council *(if this is an honors course):*

Date approved by CAA: September 17, 2015 CGS: Not Applicable