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SENATE COUNCIL

3/31/16

1. General Information

1a. Submitted by the College of: ARTS & SCIENCES

Date Submitted: 5/2/2016

1b. Department/Division: Chemistry

1c. Contact Person

Name: Arthur Cammers

Email: a.cammers@uky.edu

Phone: 8593238977

Responsible Faculty ID (if different from Contact)

Name: Mark Meier

Email: mark.meier@uky.edu

Phone: 8592573837

1d. Requested Effective Date: Semester following approval

1e. Should this course be a UK Core Course? No

2. Designation and Description of Proposed Course

2a. Will this course also be offered through Distance Learning?: No

2b. Prefix and Number: CHE 567

2c. Full Title: Organic Materials: Fabrication Laboratory

2d. Transcript Title: Organic Materials: Fab. Lab.

2e. Cross-listing:

2f. Meeting Patterns

LABORATORY: 6

2g. Grading System: Letter (A, B, C, etc.)

2h. Number of credit hours: 2

2i. Is this course repeatable for additional credit? No

If Yes: Maximum number of credit hours:

If Yes: Will this course allow multiple registrations during the same semester?

2j. **Course Description for Bulletin:** A laboratory course focused on the fabrication and characterization of organic and organic – inorganic hybrid electronic devices. Although a stand-alone course, the laboratory will cover practical aspects related to topics covered in CHE 536 and 566, including processing methods and characterization of optical and electronic properties of organic materials and thin films. Prerequisites: CHE 536 or CHE 566, and PHY 213 or 232, or permission of the instructor

2k. **Prerequisites, if any:** CHE 536 or CHE 566, and PHY 213 or PHY 232, or permission of the instructor.

2l. **Supplementary Teaching Component:**

3. **Will this course be taught off campus?** No

If YES, enter the off campus address:

4. **Frequency of Course Offering:** Spring,

Will the course be offered every year? Yes

If No, explain:

CHE 536 SCOV ✓
CHE 566 SCOV ✓

5. **Are facilities and personnel necessary for the proposed new course**

If No, explain:

6. **What enrollment (per section per semester) may reasonably be expected?**

7. **Anticipated Student Demand**

Will this course serve students primarily within the degree program?:

Will it be of interest to a significant number of students outside the degree program?:

If Yes, explain:

8. **Check the category most applicable to this course:** Not Yet Found in Many (or Any) Other Universities

If No, explain:

9. **Course Relationship to Program(s).**

a. **Is this course part of a proposed new program?** No

If YES, name the proposed new program:

b. **Will this course be a new requirement for ANY program?** Yes

If YES, list affected programs: BACHELOR of SCIENCE in CHEMISTRY- Materials Chemistry Option

10. **Information to be Placed on Syllabus.**

a. **Is the course 400G or 500?** Yes

b. **The syllabus, including course description, student learning outcomes, and grading policies (and 400G-/500-level grading differentiation if applicable, from 10.a above) are attached:** Yes

Distance Learning Form

Instructor Name:

Instructor Email:

Internet/Web-based: No

Interactive Video: No

Hybrid: No

1. How does this course provide for timely and appropriate interaction between students and faculty and among students? Does the course syllabus conform to University Senate Syllabus Guidelines, specifically the Distance Learning Considerations?

2. How do you ensure that the experience for a DL student is comparable to that of a classroom-based student's experience? Aspects to explore: textbooks, course goals, assessment of student learning outcomes, etc.

3. How is the integrity of student work ensured? Please speak to aspects such as password-protected course portals, proctors for exams at interactive video sites; academic offense policy; etc.

4. Will offering this course via DL result in at least 25% or at least 50% (based on total credit hours required for completion) of a degree program being offered via any form of DL, as defined above?

If yes, which percentage, and which program(s)?

5. How are students taking the course via DL assured of equivalent access to student services, similar to that of a student taking the class in a traditional classroom setting?

6. How do course requirements ensure that students make appropriate use of learning resources?

7. Please explain specifically how access is provided to laboratories, facilities, and equipment appropriate to the course or program.

8. How are students informed of procedures for resolving technical complaints? Does the syllabus list the entities available to offer technical help with the delivery and/or receipt of the course, such as the Information Technology Customer Service Center (<http://www.uky.edu/UKIT/>)?

9. Will the course be delivered via services available through the Distance Learning Program (DLP) and the Academic Technology Group (ATL)? NO

If no, explain how student enrolled in DL courses are able to use the technology employed, as well as how students will be provided with assistance in using said technology.

10. Does the syllabus contain all the required components? NO

11. I, the instructor of record, have read and understood all of the university-level statements regarding DL.

Instructor Name:

SIGNATURE|YATES|S W Yates|CHE 567 NEW Dept Review|20150702

SIGNATURE|ACSI222|Anna C Harmon|CHE 567 NEW College Review|20151019

SIGNATURE|JMETT2|Joanie Ett-Mims|CHE 567 NEW Undergrad Council Review|20160310

SIGNATURE|ZNNIKO0|Roshan N Nikou|CHE 567 NEW Graduate Council Review|20160331

SIGNATURE|JEL224|Janie S Ellis|CHE 567 NEW Senate Council Review|20160427

SIGNATURE|MEIER|Mark S Meier|CHE 567 NEW Approval Returned to Dept|20160502

New Course Form

<https://myuk.uky.edu/sap/bc/soap/rfc?services=>

[Open in full window to print or save](#)

Generate R

Attachments:

ID	Attachment
Delete 6417	CHE 567 OrganicMaterials-FabLab_Syllabus UPDATED.p

(*denotes required fields)

1. General Information

- a. * Submitted by the College of: Submission Date:
- b. * Department/Division:
- c.
- | | | | |
|---|---|--|--|
| * Contact Person Name: | <input type="text" value="Arthur Cammers"/> | Email: <input type="text" value="a.cammers@uky.edu"/> | Phone: <input type="text" value="8593238977"/> |
| * Responsible Faculty ID (if different from Contact): | <input type="text" value="Mark Meier"/> | Email: <input type="text" value="mark.meier@uky.edu"/> | Phone: <input type="text" value="8592573837"/> |
- d. * Requested Effective Date: Semester following approval OR Specific Term/Year¹
- e. Should this course be a UK Core Course? Yes No
- If YES, check the areas that apply:
- | | |
|---|---|
| <input type="checkbox"/> Inquiry - Arts & Creativity | <input type="checkbox"/> Composition & Communications - II |
| <input type="checkbox"/> Inquiry - Humanities | <input type="checkbox"/> Quantitative Foundations |
| <input type="checkbox"/> Inquiry - Nat/Math/Phys Sci | <input type="checkbox"/> Statistical Inferential Reasoning |
| <input type="checkbox"/> Inquiry - Social Sciences | <input type="checkbox"/> U.S. Citizenship, Community, Diversity |
| <input type="checkbox"/> Composition & Communications - I | <input type="checkbox"/> Global Dynamics |

2. Designation and Description of Proposed Course.

- a. * Will this course also be offered through Distance Learning? Yes⁴ No
- b. * Prefix and Number:
- c. * Full Title:
- d. Transcript Title (if full title is more than 40 characters):
- e. To be Cross-Listed² with (Prefix and Number):
- f. * Courses must be described by at least one of the meeting patterns below. Include number of actual contact hours³ for each meeting pattern type.
- | | | | |
|-----------------------------------|--|---------------------------------|---------------------------------|
| <input type="text"/> Lecture | <input type="text" value="6"/> Laboratory ¹ | <input type="text"/> Recitation | <input type="text"/> Discussion |
| <input type="text"/> Indep. Study | <input type="text"/> Clinical | <input type="text"/> Colloquium | <input type="text"/> Practicum |
| <input type="text"/> Research | <input type="text"/> Residency | <input type="text"/> Seminar | <input type="text"/> Studio |
| <input type="text"/> Other | If Other, Please explain: | | |
- g. * Identify a grading system:
- Letter (A, B, C, etc.)
- Pass/Fail
- Medicine Numeric Grade (Non-medical students will receive a letter grade)
- Graduate School Grade Scale
- h. * Number of credits:
- i. * Is this course repeatable for additional credit? Yes No
- If YES: Maximum number of credit hours:
- If YES: Will this course allow multiple registrations during the same semester? Yes No

j. * Course Description for Bulletin:

A laboratory course focused on the fabrication and characterization of organic and organic - inorganic hybrid electronic devices. Although a stand-alone course, the laboratory will cover practical aspects related to topics covered in CHE 536 and 566, including processing methods and characterization of optical and electronic properties of organic materials and thin films. Prerequisites: CHE 536 or CHE 566, and PHY 213 or 232, or permission of the instructor

k. Prerequisites, if any:

CHE 536 or CHE 566, and PHY 213 or PHY 232, or permission of the instructor.

l. Supplementary teaching component, if any: Community-Based Experience Service Learning Both3. * Will this course be taught off campus? Yes No

If YES, enter the off campus address: _____

4. Frequency of Course Offering.

a. * Course will be offered (check all that apply): Fall Spring Summer Winter

b. * Will the course be offered every year? Yes No

If No, explain: _____

5. * Are facilities and personnel necessary for the proposed new course available? Yes No

If No, explain: _____

6. * What enrollment (per section per semester) may reasonably be expected? 15

7. Anticipated Student Demand.

a. * Will this course serve students primarily within the degree program? Yes No

b. * Will it be of interest to a significant number of students outside the degree pgm? Yes No

If YES, explain: _____

8. * Check the category most applicable to this course:

- Traditional – Offered in Corresponding Departments at Universities Elsewhere
 Relatively New – Now Being Widely Established
 Not Yet Found in Many (or Any) Other Universities

9. Course Relationship to Program(s).

a. * Is this course part of a proposed new program? Yes No

If YES, name the proposed new program: _____

b. * Will this course be a new requirement ⁵ for ANY program? Yes No

If YES ⁵, list affected programs: _____

BACHELOR of SCIENCE in CHEMISTRY- Materials Chemistry Option

10. Information to be Placed on Syllabus.

a. * Is the course 400G or 500? Yes No

If YES, the *differentiation for undergraduate and graduate students must be included* in the information required in 10.b. You must include: (i) identify additional assignments by the graduate students; and/or (ii) establishment of different grading criteria in the course for graduate students. (See SR

b. * The syllabus, including course description, student learning outcomes, and grading policies (and 400G-/500-level grading differentiation if apply 10.a above) are attached.

⁵ Courses are typically made effective for the semester following approval. No course will be made effective until all approvals are received.
⁶ The chair of the cross-listing department must sign off on the Signature Routing Log

^[1] In general, undergraduate courses are developed on the principle that one semester hour of credit represents one hour of classroom meeting per week for a semester, exclusive of any laboratory meeting. Laboratory meeting, generally, is two hours per week for a semester for one credit hour. (from SR 5 2.1)

^[2] You must also submit the Distance Learning Form in order for the proposed course to be considered for DL delivery.

^[3] In order to change a program, a program change form must also be submitted.

Rev 8/09

UK Department of Chemistry, CHE 567
Organic Materials: Fab Lab
Spring 2018 Course Description and Syllabus

Meeting Times: TR 2:00 - 4:50 pm.

Classroom: CP-302

Instructor: Kenneth Graham, CP-110, 218-3736

Office Hours: TR 1:00 – 2:00 p.m.

CHE 567 home page: [http://www.chem.uky.edu/courses/CHE 567](http://www.chem.uky.edu/courses/CHE%20567)

Course Description:

A laboratory course focused on the fabrication and characterization of organic and organic – inorganic hybrid electronic devices. Although a stand-alone course, the laboratory will cover practical aspects related to topics covered in CHE 536 and 566, including processing methods and characterization of optical and electronic properties of organic materials and thin films. Prerequisites: CHE 536 or CHE 566, and PHY 213 or 232, or permission of the instructor.

Student Learning Outcomes:

After completing this course, the student will be able to:

1. Fabricate and characterize several basic electronic and optoelectronic devices based on organic and hybrid organic-inorganic materials
2. Make connections between the electronic and optical properties of organic and hybrid organic-inorganic materials and the real-world fabrication, characterization, and operation of organic electronic, photonic, and energy storage devices
3. Test a scientific hypothesis regarding the effects of material or device structure modification on the properties of an organic or hybrid electronic device

Course Goals/Objectives:

The goal of this course is to learn the fabrication methods required to make organic and hybrid organic-inorganic electronic devices, and in doing so gain a better fundamental and practical understanding of how these various devices function. An additional goal of this course is to highlight the relevance of chemistry and physics to modern, cutting-edge, electronic devices that are becoming prevalent in the modern world (e.g. OLED displays and electrochromic windows).

Required Materials:

Lab handouts, to be provided for each laboratory experiment, and access to the chemical literature (Advanced Materials, Nature Materials, Chemistry of Materials, Accounts of Chemical Research)

Laboratory Experiments:

Each laboratory experiment will take two weeks, which is four laboratory periods. Each group will carry out a different experiment over each two-week time period, as indicated on the schedule at the end of this syllabus. The first laboratory period of each experiment will be used for discussion and experiment planning; the second laboratory period will typically involve device fabrication; the third laboratory will typically be used for device testing and characterization; and the fourth laboratory period will be devoted to discussing and working up experimental data. These

laboratory experiments are designed to involve more independent experimental planning, which is what the first laboratory period of each new experiment is reserved for. Each written laboratory report will be due at the beginning of class on the Thursday after the laboratory experiment is completed.

Lab 1: Electrochromic devices – Fabrication of polymer based electrochromic devices using spray casting and characterization using spectroelectrochemistry.

Lab 2: Hybrid devices: Perovskite solar cells – Fabrication of organometal halide perovskite solar cells using spin casting and vapor deposition of metal contacts. Measurement of solar cell performance based on current-voltage characteristics under solar simulated irradiation

Lab 3: Polymer transistors – Fabrication of transistors utilizing spin casting of polymer films followed by characterization of electronic properties.

Lab 4: Small-molecule organic light-emitting diodes – Fabrication of organic light-emitting diodes through thermal vapor deposition followed by characterization of spectral and efficiency characteristics.

Lab 5: Organic battery technology – Fabrication and characterization of aqueous based batteries containing organic electrolytes and binders.

Lab 6: Independent Project – Students will be split into small groups and will need to modify a previous lab in some manner to test a hypothesis regarding how modifications to the electroactive material or device structure will influence device performance. The results of the work will be presented to the class in a 15-minute seminar.

Each student is required to turn in their own written lab report. Students may share data and references, but each student's lab report must be written independently.

Late reports will be assessed a penalty of 10 pts/day.

Literature Presentation (graduate students only):

Prepare a 10 – 12 min presentation detailing recent progress directly related to one of the laboratory experimental topics. The presentation will be given after the laboratory experiment of relevance has been completed, and should therefore include minimal background information. Thus, the presentation should focus on recent (past 2-3 years) literature and should teach the class about a current topic or study of relevance.

Grading:

Undergraduate Students:

Lab reports: 5 x 15 pts each = 75 pts

Independent Project = 25 pts

Pre-lab: 5 pts

Report: 15 pts

Presentation: 5 pts

Graduate Students:

Lab reports: 5 x 12 pts each = 60 pts

Independent Project = 25 pts

Pre-lab: 5 pts

Report: 15 pts

Presentation: 5 pts

Literature Presentation = 15 pts

Grades will be assigned according to the following tentative scheme. Ranges may be lowered but will not be raised.

Undergraduate students: A: 85-100%; B: 75-84%; C: 60-74%; D: 50-59%; E: <50%

Graduate students: A: 85-100%; B: 75-84%; C: 60-74%; E: <60%

Midterm Grades (for undergraduates):

Mid-term grades will be posted in myUK by the deadline established in the Academic Calendar (<http://www.uky.edu/Registrar/AcademicCalendar.htm>)

Course Policies:

Make-up Presentations or Lab Experiments: *It is extremely important to complete presentations and experiments when scheduled.* Formal written excuses consistent with University regulations will be required for each absence before a make-up can be scheduled. Make-up experiments and presentations for students with excused absences will be scheduled in accordance with the student's schedule. Failure to provide a formal written excuse consistent with University regulations will result in 0 credit for that assignment. Notice of intended absence due to a religious holiday must be presented in writing two weeks before the scheduled absence is to occur.

Attendance: Attendance is mandatory. For excused absences, a time period will be scheduled during which the missed laboratory experiment can be made up. Unexcused absences will result in a 0 for that particular experiment.

Excused Absences:

Students need to notify the professor of absences prior to class when possible. *Senate Rules 5.2.4.2* defines the following as acceptable reasons for excused absences: (a) serious illness, (b) illness or death of family member, (c) University-related trips, (d) major religious holidays, and (e) other circumstances found to fit "reasonable cause for nonattendance" by the professor.

Students anticipating an absence for a major religious holiday are responsible for notifying the instructor in writing of anticipated absences due to their observance of such holidays no later than the last day in the semester to add a class. Two weeks prior to the absence is reasonable, but should not be given any later. Information regarding major religious holidays may be obtained through the Ombud (859-257-3737), http://www.uky.edu/Ombud/ForStudents_ExcusedAbsences.php.

Students are expected to withdraw from the class if more than 20% of the classes scheduled for the semester are missed (excused) per University policy.

Per *Senate Rule 5.2.4.2*, students missing any graded work due to an excused absence are responsible: for informing the Instructor of Record about their excused absence within one week following the period of the excused absence (except where prior notification is required); and for making up the missed work. The professor must give the student an opportunity to make up the work and/or the exams missed due to an excused absence, and shall do so, if feasible, during the semester in which the absence occurred.

Verification of Absences

Students may be asked to verify their absences in order for them to be considered excused. *Senate Rule 5.2.4.2* states that faculty have the right to request "appropriate verification" when students claim an excused absence because of illness, or death in the family. Appropriate notification of absences due to University-related trips is required prior to the absence when feasible and in no case more than one week after the absence.

Academic Integrity

Per University policy, students shall not plagiarize, cheat, or falsify or misuse academic records. Students are expected to adhere to University policy on cheating and plagiarism in all courses. The minimum penalty for a first offense is a zero on the assignment on which the offense occurred. If the offense is considered severe or the student has other academic offenses on their record, more serious penalties, up to suspension from the University may be imposed.

Plagiarism and cheating are serious breaches of academic conduct. Each student is advised to become familiar with the various forms of academic dishonesty as explained in the Code of Student Rights and Responsibilities. Complete information can be found at the following website: <http://www.uky.edu/Ombud>. A plea of ignorance is not acceptable as a defense against the charge of academic dishonesty. It is important that you review this information as all ideas borrowed from others need to be properly credited.

Senate Rules 6.3.1 (see <http://www.uky.edu/Faculty/Senate/> for the current set of *Senate Rules*) states that all academic work, written or otherwise, submitted by students to their instructors or other academic supervisors, is expected to be the result of their own thought, research, or self-expression. In cases where students feel unsure about a question of plagiarism involving their work, they are obliged to consult their instructors on the matter before submission.

When students submit work purporting to be their own, but which in any way borrows ideas, organization, wording, or content from another source without appropriate acknowledgment of the fact, the students are guilty of plagiarism.

Plagiarism includes reproducing someone else's work (including, but not limited to a published article, a book, a website, computer code, or a paper from a friend) without clear attribution. Plagiarism also includes the practice of employing or allowing another person to alter or revise the work, which a student submits as his/her own, whoever that other person may be. Students may discuss assignments among themselves or with an instructor or tutor, but when the actual work is done, it must be done by the student, and the student alone.

When a student's assignment involves research in outside sources or information, the student must carefully acknowledge exactly what, where and how he/she has employed them. If the words of someone else are used, the student must put quotation marks around the passage in question and add an appropriate indication of its origin. Making simple changes while leaving the organization, content, and phraseology intact is plagiaristic. However, nothing in these Rules shall apply to those ideas, which are so generally and freely circulated as to be a part of the public domain.

Please note: Any assignment you turn in may be submitted to an electronic database to check for

plagiarism.

Accommodations due to disability

If you have a documented disability that requires academic accommodations, please see me as soon as possible during scheduled office hours. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center (DRC). The DRC coordinates campus disability services available to students with disabilities. It is located on the corner of Rose Street and Huguelet Drive in the Multidisciplinary Science Building, Suite 407. You can reach them via phone at (859) 257-2754 and via email at drc@uky.edu. Their web address is <http://www.uky.edu/StudentAffairs/DisabilityResourceCenter/>.

Dropping the Course: The last day to drop this course without it appearing on your transcript is XXXXXX. The last day to withdraw from this course is XXXXX, except for urgent non-academic reasons related to extended illness or equivalent distress.

Course Schedule:

Week beginning	Group 1	Group 2	Group 3	Group 4	Group 5
1/8	Introduction	Introduction	Introduction	Introduction	Introduction
1/15	Electrochromics	Hybrid PVs	OFETs	OLEDs	Batteries
1/22	Electrochromics	Hybrid PVs	OFETs	OLEDs	Batteries
1/29	Hybrid PVs	OFETs	OLEDs	Batteries	Electrochromics
2/5	Hybrid PVs	OFETs	OLEDs	Batteries	Electrochromics
2/12	OFETs	OLEDs	Batteries	Electrochromics	Hybrid PVs
2/19	OFETs	OLEDs	Batteries	Electrochromics	Hybrid PVs
2/26	OLEDs	Batteries	Electrochromics	Hybrid PVs	OFETs
3/5	OLEDs	Batteries	Electrochromics	Hybrid PVs	OFETs
3/12	Spring Break				
3/19	Batteries	Electrochromics	Hybrid PVs	OFETs	OLEDs
3/26	Batteries	Electrochromics	Hybrid PVs	OFETs	OLEDs
4/2	IP	IP	IP	IP	IP
4/9	IP	IP	IP	IP	IP
4/16	IP	IP	IP	IP	IP
4/23	IP presentations and written reports due for all groups in lieu of a final exam				

All lab reports are due on Thursday of the week following completion of that particular laboratory. For example, Group 1 members will turn in their electrochromics lab report on Thursday, February 1.

Abbreviations used in table:

- Electrochromic devices – **Electrochromics**
- Hybrid devices: Perovskite solar cells – **Hybrid PVs**
- Polymer transistors – **OFETs**
- Small-molecule organic light-emitting diodes – **OLEDs**
- Organic battery technology – **Batteries**
- Independent Project – **IP**