NEW COURSE FORM

(*denotes required fields)

1. General Information

a. * Submitted by the College of:

COLLEGE OF ARTS & SCIENCES Today's Date: 3/5/2012

b. * Department/Division:

Chemistry

c.

* Contact Person Name:	Mark Meier	Email: meier@uky.edu Phone: 257-7082
* Responsible Faculty ID (if different from Contact)	Dong-Sheng Yang	Email: dyang0@uky.edu Phone: 257-4622

d. * Requested Effective Date: ◉ Semester following approval OR ○ Specific Term/Year [1]

e.

Does the change make the course a UK Core course? ○ Yes ◉ No

If YES, check the areas that apply:

☐ Inquiry - Arts & Creativity	☐ Composition & Communications - II
☐ Inquiry - Humanities	☐ Quantitative Foundations
☐ Inquiry - Nat/Math/Phys Sci	☐ Statistical Inferential Reasoning

☐ Inquiry - Social Sciences	☐ U.S. Citizenship, Community, Diversity
☐ Composition & Communications - I	☐ Global Dynamics

2. Designation and Description of Proposed Course.

a. * Will this course also be offered through Distance Learning? ○ Yes [4] ◉ No

b. * Prefix and Number:
CHE 668

c. * Full Title:
Symmetry and Chemical Applications

d. Transcript Title (if full title is more than 40 characters):

e. To be Cross-Listed [2] with (Prefix and Number):

f. * Courses must be described by at least one of the meeting patterns below. Include number of actual contact hours[3] for each meeting pattern type.

3	Lecture	Laboratory[1]	Recitation	Discussion
	Indep. Study	Clinical	Colloquium	Practicum
	Research	Residency	Seminar	Studio
	Other	If Other, Please explain:		

g. * Identify a grading system: ◉ Letter (A, B, C, etc.) ○ Pass/Fail

h. * Number of credits: 3

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:

An integrated treatment of fundamentals, techniques, and chemical applications of molecular symmetry and group theory

k. Prerequisites, if any:

A physical chemistry course at the 400-level, or consent of instructor

l. Supplementary teaching component, if any: ○ Community-Based Experience ○ Service Learning ○ Both

3. * 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:

Insufficient faculty resources

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? 10

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:

Symmetry and group theory are useful in all branches of molecular sciences from physics to biochemistry

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::

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) identification of additional assignments by the graduate students; and/or (ii) establishment of different grading criteria in the course for graduate students. (See SR 3.1.4.)

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.

[1] Courses are typically made effective for the semester following approval. No course will be made effective until all approvals are received.

[2] The chair of the cross-listing department must sign off on the Signature Routing Log.

[3] 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, represents at least two hours per week for a semester for one credit hour. (from SR 5.2.1)

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

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

Rev 8/09

Graduate Council 5/3/12 Brian Jackson

CHE 668
SYMMETRY AND CHEMICAL APPLICATIONS

Day(s)/Time TBD

Instructor:	Dong-Sheng Yang
Office Address:	09 Chemistry-Physics Building
Email:	dyang0@uky.edu
Office Phone:	257-4622
Class Hours:	Tuesday and Thursday, 11:00 am to 12:15 pm, CP-103
Office Hours:	Monday and Wednesday, 4:00 to 5:00 pm, CP-09

Bulletin Description

An integrated treatment of fundamentals, techniques, and chemical applications of molecular symmetry and group theory.

Course Description

This course teaches students how to use the power and beauty of molecular symmetry arguments in treating research problems. The subject matter of the course will likely be encountered in the daily research activity of many chemists and other molecular scientists. The course is divided into two parts. The first part covers the fundamental concepts and techniques of molecular symmetry, which include symmetry elements, operations, and point groups; representations of groups; direct products of representations; and symmetry-adapted linear combinations and operators. The second part of the course applies the symmetry arguments to problems in chemical bonding, molecular structures, spectroscopy, and chemical reactions.

Prerequisites

A physical chemistry course at the 400 level or above or consent of instructor.

Student Learning Outcomes

On completion of this course, a successful student will be able to use molecular symmetry and group theory to solve following specific problems:

1. Identify symmetry elements and point groups of inorganic and organic molecules
2. Write out matrix and character representations of symmetry operations and point groups
3. Work out character and correlation tables for commonly used symmetry point groups
4. Predict electronic, infrared, and Raman spectral activity
5. Work out molecular orbital compositions, symmetries, and interaction diagrams for molecular systems with reasonably high symmetries.
6. Predict possible electronic symmetry and electron-spin multiplicity of ground-state transition metal complexes by combining with molecular orbital and ligand-field theory
7. Work out symmetries of vibrational normal modes and calculate vibrational force constants for small molecules

Course Materials

Text	Cotton, F. A., *Chemical Applications of Group Theory* (3rd Ed.; Wiley: New York, 1990).
Optional	Robert L. Carter, *Molecular Symmetry and Group Theory* (Wiley: New York, 1998).
Molecular Model (Optional)	1006 Research Inorganic Chemistry D-Set http://www.maruzenusa.com/hgs/

Course Activities and Assignments

This course will be conducted by lectures and classroom discussion. Problem sets will be assigned for each chapter. Students are expected to make a serious attempt at every assigned homework problem before consulting with peers or instructor. Solutions must show the details of work, and correct answers without details receive no credit. In addition to the regular homework assignments, there will be midterm and final examinations. Students are expected to attend all lectures and show honesty in the homework assignments and examinations. The minimum penalty for a first offense is zero on the assignment or examination.

Homework assignments, midterms, and final exam will contribute 20%, 50%, and 30% of the total score, respectively.

Course Grading

Letter grades will be assigned according to the following scheme:

Final Average	Course Grade
90 – 100 %	A
80 – 89	B
70 - 79	C
	no D for Graduate level coursework
Below 69	E

Midterm and Final Exam Information

Two midterms

October 7, 2010, Thursday, 11:00 am - 1:00 pm, CP-103

November 9, 2010, Thursday, 11:00 am - 1:00 pm, CP-103

Final exam

December 13, 2010, Monday, 11:00 am -1:00 pm, CP 103

Course Policies

Submission of Assignments

Student solutions will be collected during the lecture one week from the day of assignment distribution and will not be accepted late.

Attendance Policy

Students are expected to attend all classes.

Excused Absences
Students need to notify the professor of absences prior to class when possible. S.R. 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. Information regarding dates of major religious holidays may be obtained through the religious liaison, Mr. Jake Karnes (859-257-2754).

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

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.

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.

Part II of *Student Rights and Responsibilities* (available online http://www.uky.edu/StudentAffairs/Code/part2.html) states that all academic work, written or otherwise, submitted by students to their instructors or other academic supervisors, and is expected to be the result of their own thought, research, or self-expression. In cases where students feel unsure about the question of plagiarism involving their own 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 anything else from another source without appropriate acknowledgement of the fact, the students are guilty of plagiarism. Plagiarism includes reproducing someone else's work, whether it be a published article, chapter of a book, a paper from a friend or some file, or something similar to this. 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 of information, the student must carefully acknowledge exactly what, where and how he/she 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 (Section 6.3.1).

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 (Room 2, Alumni Gym, 257-2754, email address: jkarnes@email.uky.edu) for coordination of campus disability services available to students with disabilities.

Course Outline and Tentative Schedule

Chapter 1	Symmetry Elements, Operations, and Point Groups (Week 1-2)
Chapter 2	Representations of Groups (Week 3 -5)
Chapter 3	Direct Products (Week 6)
Chapter 4	Symmetry-Adapted Linear Combinations and Projection Operators (Week 7-8)
Chapter 5	Symmetry and Chemical Bonding in Organic Systems (Week 9-10)
Chapter 6	Symmetry and Bonding in Inorganic and Organometallic Systems (Week 11-12)
Chapter 7	Transition Metal Complexes and Ligand Field Theory (week 13-14
Chapter 8	Vibrational Spectroscopy (week 15-16)