LSC Use Only No: LSC Action-Date:	UWUCC USE Only No. 02-60i UWUCC Action-Date: App 3/25/03 Senate Action Date: App 4/29/03

Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

Contact Person: **Wendy Elcesser**	Email Address: **endyw@iup.edu**
Proposing Department/Unit: **Chemistry**	Phone: **7-2362**

Check all appropriate lines and complete information as requested. Use a separate cover sheet for each course proposal and for each program proposal.

1. Course Proposals (check all that apply)

_____New Course _____Course Prefix Change _____Course Deletion

__X__Course Revision ___Course Number and/or Title Change __X__Catalog Description Change

CHEM 411 – Advanced Inorganic Chemistry	
***Current* Course prefix, number and full title**	***Proposed* course prefix, number and full title, if changing**

2. Additional Course Designations: check if appropriate

_____ This course is also proposed as a Liberal Studies Course.

_____ This course is also proposed as an Honors College Course.

_____ Other: (e.g., Women's Studies, Pan-African)

3. Program Proposals

_____Catalog Description Change _____Program Revision

_____New Degree Program _____Program Title Change _____Other

_____New Minor Program _____New Track

***Current* program name**	***Proposed* program name, if changing**

4. Approvals		**Date**
Dept Curriculum Committee Chair	Rubel F. Sa	2/3/03
Department Chair	Burton Landsberger Ramsey	2/5/03
Coll. Curriculum Committee Chair		2/10/03
College Dean	John D. Ede	2/11/03
Director of Liberal Studies *		
Director of Honors College *		
Provost *		
Additional signatures as appropriate: (include title)		
UWUCC Co-Chairs	Gail S. Sechrist	3/25/03

* where applicable

Part II. 1. New Syllabus of Record

I. Catalog Description

Course Title: Advanced Inorganic Chemistry
Prefix: CHEM
Number: 411
Hours: 3c-0l-3sh
Prerequisites: CHEM 341
Description: Study of advanced principles of inorganic chemistry including atomic structure, symmetry, advanced bonding theories, acids and bases, coordination chemistry, and organometallic chemistry

II. **Course Objectives:** Upon successful completion of this course, the student will be able to:

1) Assign point groups and use character tables.
2) Use symmetry concepts to construct molecular orbital diagrams for diatomic and polyatomic molecules.
3) Describe and identify acids and bases under various definitions.
4) Compare the relative strengths of acids and bases in aqueous and non-aqueous solvents.
5) Describe bonding models for coordination compounds.
6) Recognize isomerism in coordination compounds.
7) Predict and explain the magnetic and spectroscopic properties of coordination compounds.
8) Describe the kinetics and mechanisms of reactions of coordination compounds.
9) Describe the chemistry of metal carbonyls, metal-olefin complexes and the metallocenes.
10) Use the principles of oxidative addition and reductive elimination to describe examples of homogeneous and heterogeneous catalysts.
11) Describe the role of metal ions in biological systems.

III. Detailed Course Outline: (allows 2 hours for exams)

1) Review of Atomic Structure (2 hours)
   a) Spectra and orbitals
   b) Electronegativity
   c) Ionization energy, electron affinity, shielding and effective nuclear charge.
2) Symmetry (6 hours)
   a) Symmetry operations
   b) Point groups
   c) Character tables
   d) Irreducible representations
3) Covalent Molecular Substances (5 hours)
   a) Review of Lewis structures and Valence Shell Electron Pair Repulsion Theory
   b) Deviations from Ideal Geometries
   c) Valence Bond Theory and Hybridization
   d) Ligand Close-Packing Model
4) Molecular Orbital Theory (5 hours)
   a) Review of diatomic molecules
   b) Polyatomic molecules
   c) Band Theory of Solids
5) Acids and Bases (4 hours)
   a) Acidic, basic, and amphoteric substances

b) Bronsted-Lowry
c) Lewis
d) Hard-soft acid base theory
e) Solvent system
f) Non-aqueous solvents.

6) Coordination Chemistry (8 hours)
   a) Coordination numbers
   b) Isomerism
   c) Stereochemistry and Nomenclature
   d) Optical activity
   e) Stability constants
   f) Ligand Field theory
   g) Ligand Field Stabilization energies
   h) Molecular orbital theory
   i) Angular overlap model
   j) Magnetic properties
   k) Mechanisms of Substitution Reactions
   l) Mechanisms of electron transfer reactions
   m) Spectral Properties
7) Organometallic Chemistry (6 hours)
   a) Eighteen electron rule (EAN)
   b) Metal carbonyls
   c) Metal olefin complexes
   d) Metallocenes
   e) Homogeneous catalysis
   f) Heterogeneous catalysis
   g) Clusters
8) Bioinorganic Chemistry (4 hours)
   a) metalloporphyrins
   b) vitamin B12 and cobalamines
   c) nitrogen fixation
   d) mellatoenzymes

IV. Evaluation Methods.

3 exams including final @ 100 pts	300 pts.(66.7%)
Selected Assignments (problem sets and in-class activities)	100 pts(22.2%)
Literature presentation of an article from a modern chemistry journal	50 pts.(11.1%)
Total points	450 pts.

Exams will consist of problems and short-answer questions based on the selected assignments. The selected assignments include problem sets and in-class activities that allow the student to build on their previous knowledge base of physical inorganic chemistry.

V. **Example Grading Scale**

A: ≥90% B: 80-89% C: 70-79% D: 60-69% F: <60%

VI. Attendance Policy:
The attendance policy for this course will be consistent with the university undergraduate attendance policy as described in the current catalogue.

VII. Special Resource Requirements:
None

VIII. **Required Textbooks, Supplemental Books and Readings:**
D.F. Shriver and P. W. Atkins Inorganic Chemistry. 3rd Edition, W.H. Freeman and Company: New York, 1999.

IX. **Bibliography:**

1) *Inorganic Chemistry*, Gary L. Miessler and Donald A. Tarr, 2nd. Ed.;Prentice Hall: Upper Saddle River, NJ, 1999.
2) *Inorganic Chemistry - Principles of Structure and Reactivity*, J.E. Huheey, E.A. Keiter, R.L. Keiter, 4th ed., Benjamin Cummings: New York , 1993.
3) *Chemical Bonding and Molecular Geometry*, R.J. Gillespie, P.L.A. Popelier, Oxford University Press: New York, 2001.
4) *Advanced Inorganic Chemistry*, F. Albert Cotton, Geoffrey Wilkinson, Carlos A. Murillo, Manfred Bochmann, 6th Edition, Wiley: New York, 1999.
5) *Inorganic Chemistry*, Catherine E. Housecroft and Alan G. Sharpe, Prentice Hall: Upper Saddle River, NJ, 2001.
6) *Molecular Symmetry and Group Theory*, Alan Vincent, 2nd Ed. John Wiley & Sons: New York, 2001.
7) *Chemical Applications of Group Theory*, F. A. Cotton, 3rd Ed. John Wiley & Sons: New York, 1990.
8) *Concepts and Models of Inorganic Chemistry*, Bodie Douglas, Darl McDaniel, and John Alexander, 3rd Ed. John Wiley & Sons: New York, 1994.
9) *Modern Inorganic Chemistry*, W.L. Jolly, 2nd Ed. McGraw-Hill: New York, 1991.

Part II. 2. Summary of the proposed revisions.

Old Catalogue Description: CHEM 411 Advanced Inorganic Chemistry (3c-0l-3sh)
Gives understanding of advanced theories of atomic structure, chemical bonding, acids and bases, coordination compounds, and selected topics.
New Catalogue Description: CHEM 411 Advanced Inorganic Chemistry (3c-0l-3sh)
Study of advanced principles of inorganic chemistry including atomic structure, symmetry, advanced bonding theories, acids and bases, coordination chemistry, and organometallic chemistry
The course outline has been updated to reflect modern trends in inorganic chemistry.

Part II. 3. Justification/rationale for the revision.

The course outline in the old syllabus of record is outdated.

Part II. 4. Old syllabus of record.

SYLLABUS
CH 411 - Inorganic Chemistry
3 credits, non-laboratory

DESCRIPTION: Application of theories and facts to inorganic chemistry for senior students in chemistry. General topics include atomic theory, bonding, group theory applications and coordination chemistry.

COURSE OUTLINE:

I. Atomic Theory
   A. Early contributions to Planck, Hertz, Einstein, Bohr, Rutherford, etc.
   B. Parallel development of quantum theory by deBroglie, Schrodinger, Bohr, etc.
   C. Particle in a box problems
   D. Electronic structure and spectral team symbols
   E. Discussion of atomic properties of ionization, electron affinity and application to oxidation - reduction potentials

II. Bonding and Molecular Properties
   A. Ionic - to include theoretical aspects of Born and Von Laue
   B. Covalent - to include valence bond and molecular orbital theories
   C. Electronegativity
   D. Dipole Moments
   E. Group Theory Applications
      1. Classification of point groups
      2. Use of character tables
      3. Valence bond hybridization and molecular orbital theory in bonding

III. Coordination Chemistry
   A. Bonding Theories
      1. Electrostatic
      2. Valence bond
      3. Crystal field
      4. Ligand Field

   B. Spectra
      1. Orgel diagrams
      2. Charge transfer spectra

   C. Reactions
      1. Substitution reactions
      2. Trans-effect

   D. Magnetic properties of transition metal ions and lanthanide ions

REFERENCES

1. Advanced Inorganic Chemistry by Cotton and Wilkenson, 3rd ed.
2. Concepts and Models of Inorganic Chemistry by Douglas, McDaniel and Alexander, 2nd ed.
3. Inorganic Chemistry by Huheey, 3rd ed.
4. Chemical Applications of Group Theory by Cotton
5. Symmetry, Orbitals and Spectra by Orkin and Jaffe
6. Mechanisms of Inorganic Reactions by Basolo and Pearson
7. Introduction to Modern Physics by Richtmeyer, Kennard and Lauritsen
8. Valence by Coulson