COURSE SYLLABUS

Course Number: CHM 2211
Prerequisite(s): CHM 2210 with passing grade.
Course Title: Organic Chemistry II
Course Credit: 3
Course Hours: 3 per week

College: Arts and Sciences
Department: Chemistry

Supplementary textbooks:
Others:
Prentice Hall Molecular Model Set or any other brand of molecular models set.

Faculty Name: Dr. Christopher Ikediobi
Term and Year: Spring 2010
Place and Time: DRS Rm 204  T/R 12:30-1:45 pm
Telephone: 850-599-8422
e-mail: christopher.ikediobi@famu.edu

Office Location: FHS (Science Research Building) RM117

Office Hours
Monday 9:30-11:00
Tuesday
Wednesday
Thursday
Friday 9:30-11:00
Saturday

Web site: http://famu.blackboard.com

Course Description
Study of nomenclature and fundamental chemistry of aromatics compounds and aliphatic hydrocarbon derivatives other than halides. Cursory coverage of biomolecules: Fats, carbohydrates, amino acids and proteins, including introductory IR and NMR theory and practice in compound identification.

Course Purpose
Required course for science, engineering, and pre-health professions majors.
Conceptual Framework

The Conceptual Framework in the Professional Education Unit (PEU) at Florida A&M University is an integrated approach to providing educational experiences that result in exemplary professional educators. The Framework is comprised of six themes with the mission of developing high quality classroom teachers, administrators and support personnel. The term “exemplary” refers to the kind of graduates the PEU strives to produce. The figure below provides a diagram of the Exemplary Professional Conceptual Framework:

TECHNOLOGY

• CF 2
  • Through this focal area, the FAMU professional education candidate will:

<table>
<thead>
<tr>
<th>CF:</th>
<th>Use of available technology and software to support student learning.</th>
<th>F: 2, 4, 12</th>
<th>I: 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF: 2.1 (S)</td>
<td>Use fundamental concepts in technology.</td>
<td>F: 12</td>
<td>I: 6</td>
</tr>
<tr>
<td>CF: 2.7 (S)</td>
<td>Facilitate the use of technology by students.</td>
<td>F: 4, 12</td>
<td>I: 6</td>
</tr>
</tbody>
</table>

VALUES

• CF 3
  • Through this focal area, the FAMU professional education candidate will:

<table>
<thead>
<tr>
<th>CF:</th>
<th>Recognize the importance of peer relationships in establishing a climate for learning.</th>
<th>F: 2, 7, 11</th>
<th>I: 5, 10</th>
</tr>
</thead>
</table>

CRITICAL THINKING

• CF 4
  • Through this focal area, the FAMU professional education candidate will:

<table>
<thead>
<tr>
<th>CF:</th>
<th>Value critical thinking and self-directed learning as habits of mind.</th>
<th>F: 4</th>
<th>I: 1, 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF: 4.3 (D)</td>
<td>Demonstrate the use of higher order thinking skills.</td>
<td>F: 8</td>
<td>I: 4</td>
</tr>
</tbody>
</table>
PROFESSIONALISM

- CF 5
- Through this focal area, the FAMU professional education candidate will:

| CF: 5.1 (K) | Know the content | F: 8 | I: 1 |

National and State Standards Addressed in the Course

**Interstate New Teacher Assessment and Support Consortium (INTASC) Standards**

**Standard 1: Subject Matter:** The teacher understands the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and can create learning experiences that make these aspects of subject matter meaningful for students.

1.10 Knowledge
1.12 The teacher understands how students' conceptual frameworks and their misconceptions for an area of knowledge can influence their learning.

1.13 The teacher can relate his/her disciplinary knowledge to other subject areas.

1.20 Dispositions
1.24 The teacher is committed to continuous learning and engages in professional discourse about subject matter knowledge and children's learning of the discipline.

1.30 Performances
1.35 The teacher develops and uses curricula that encourage students to see, question, and interpret ideas from diverse perspectives.

**Standard 4: Instructional Strategies:** The teacher understands and uses a variety of instructional strategies to encourage students' development of critical thinking, problem solving, and performance skills.

4.10 Knowledge
4.11 The teacher understands the cognitive processes associated with various kinds of learning (e.g. critical and creative thinking, problem structuring and problem solving, invention, memorization and recall) and how these processes can be stimulated.

4.12 The teacher understands the principles and techniques, along with advantages and limitations, associated with various instructional strategies (e.g. cooperative learning, direct instruction, discovery learning, whole group discussion, independent study, interdisciplinary instruction).

4.13 The teacher knows how to enhance learning through the use of a wide variety of materials as well as human and technological resources (e.g. computers, audio-visual technologies, videotapes and discs, local experts, primary documents and artifacts, texts, reference books, literature, and other print resources).

4.20 Dispositions
4.21 The teacher values the development of students' critical thinking, independent problem solving, and performance capabilities.
4.23 The teacher values the use of educational technology in the teaching and learning process.

4.30 Performances
4.31 The teacher carefully evaluates how to achieve learning goals, choosing alternative teaching strategies and materials to achieve different instructional purposes and to meet student needs (e.g. developmental stages, prior knowledge, learning styles, and interests).

4.33 The teacher constantly monitors and adjusts strategies in response to learner feedback.

4.34 The teacher varies his or her role in the instructional process (e.g. instructor, facilitator, coach, audience) in relation to the content and purposes of instruction and the needs of students.

4.36 The teacher uses educational technology to broaden student knowledge about technology, to deliver instruction to students at different levels and paces, and for advanced levels of learning.

Standard 5, Learning Environment
The teacher uses an understanding of individual and group motivation and behavior to create a learning environment that encourages positive social interaction, active engagement in learning, and self-motivation.

5.10 Knowledge
5.11 The teacher can use knowledge about human motivation and behavior drawn from the foundational sciences of psychology, anthropology, and sociology to develop strategies for organizing and supporting individual and group work.

5.12 The teacher understands how social groups function and influence people, and how people influence groups.

5.13 The teacher knows how to help people work productively and cooperatively with each other in complex social settings.

5.14 The teacher understands the principles of effective classroom management and can use a range of strategies to promote positive relationships, cooperation, and purposeful learning in the classroom.

5.15 The teacher recognizes factors and situations that are likely to promote or diminish intrinsic motivation, and knows how to help students become self-motivated.

5.20 Dispositions
5.21 The teacher takes responsibility for establishing a positive climate in the classroom and participates in maintaining such a climate in the school as a whole.

5.22 The teacher understands how participation supports commitment, and is committed to the expression and use of democratic values in the classroom.

5.23 The teacher values the role of students in promoting each other's learning and recognizes the importance of peer relationships in establishing a climate of learning.

5.24 The teacher recognizes the values of intrinsic motivation to students' life-long growth and learning.
5.25 The teacher is committed to the continuous development of individual students' abilities and considers how different motivational strategies are likely to encourage this development for each student.

5.30 Performances
5.31 The teacher creates a smoothly functioning learning community in which students assume responsibility for themselves and one another, participate in decision making, work collaboratively and independently, and engage in purposeful learning activities.

5.32 The teacher engages students in individual and group learning activities that help them develop the motivation to achieve, by, for example, relating lessons to students' personal interests, allowing students to have choices in their learning, and leading students to ask questions and pursue problems that are meaningful to them.

5.33 The teacher organizes, allocates, and manages the resources of time, space, activities, and attention to provide active and equitable engagement of students in productive tasks.

5.34 The teacher maximizes the amount of class time spent in learning by creating expectations and processes for communication and behavior along with a physical setting conducive to classroom goals.

5.35 The teacher helps the group to develop shared values and expectations for student interactions, academic discussions, and individual and group responsibility that create a positive classroom climate of openness, mutual respect, support, and inquiry.

5.36 The teacher analyzes the classroom environment and makes decisions and adjustments to enhance social relationships, student motivation and engagement, and productive work.

5.37 The teacher organizes, prepares students for, and monitors independent and group work that allows for full and varied participation of all individuals.

**Standard 6, Communication**
The teacher uses knowledge of effective verbal, nonverbal, and media communication techniques to foster active inquiry, collaboration, and supportive interaction in the classroom.

6.10 Knowledge
6.11 The teacher understands communication theory, language development, and the role of language in learning.

6.12 The teacher understands how cultural and gender differences can affect communication in the classroom.

6.13 The teacher recognizes the importance of nonverbal as well as verbal communication.

6.14 The teacher knows about and can use effective verbal, nonverbal, and media communication techniques.

6.20 Dispositions
6.21 The teacher recognizes the power of language for fostering self-expression, identity development, and learning.

6.22 The teacher values many ways in which people seek to communicate and encourages many modes
of communication in the classroom.

6.23 The teacher is a thoughtful and responsive listener.

6.24 The teacher appreciates the cultural dimensions of communication, responds appropriately, and seeks to foster culturally sensitive communication by and among all students in the class.

**6.30 Performance**

6.31 The teacher models effective communications strategies in conveying ideas and information and in asking questions (e.g. monitoring the effects of messages, restating ideas and drawing connections, using visual, aural, and kinesthetic cues, being sensitive to nonverbal cues given and received).

6.32 The teacher supports and expands learner expression in speaking, writing, and other media.

6.33 The teacher knows how to ask questions and stimulate discussion in different ways for particular purposes, for example, probing for learner understanding, helping students articulate their ideas and thinking processes, promoting risk-taking and problem-solving, facilitating factual recall, encouraging convergent and divergent thinking, stimulating curiosity, helping stimulate students to question.

6.34 The teacher communicates in ways that demonstrate a sensitivity to cultural and gender differences (e.g. appropriate use of eye contact, interpretation of body language and verbal statements, acknowledgment of and responsiveness to different modes of communication and participation).

6.35 The teacher knows how to use a variety of media communication tools, including audio-visual aids and computers, including educational technology, to enrich learning opportunities.

**Standard 10: Collaboration, Ethics, and Relationships:** The teacher communicates and interacts with parents/guardians, families, school colleagues, and the community to support students’ learning and well-being.

**10.10 Knowledge**

10.11 The teacher understands schools as organizations within the larger community context and understands the operations of the relevant aspects of the system(s) within s/he works.

10.12 The teacher understands how factors in the students' environment outside of school (e.g. family circumstances, community environments, health and economic conditions) may influence students’ life and learning.

10.13 The teacher understands and implements laws related to student's rights and teacher responsibilities (e.g. for equal education, appropriate education for students with disabilities, confidentiality, privacy, appropriate treatment of students, reporting in situations related to possible child abuse).

**10.20 Dispositions**

10.21 The teacher values and appreciates the importance of all aspects of a child's experience.

10.22 The teacher is concerned about all aspects of child's well-being (cognitive, emotional, social, and physical), and is alert to signs of difficulties.

10.23 The teacher respects the privacy of students and confidentiality of information.

10.24 The teacher is willing to consult with other adults regarding the education and well-being of her/his students.
10.25 The teacher is willing to work with other professionals to improve the overall learning environment for students.

10.30 Performances
10.31 The teacher participates in collegial activities designed to make the entire school a productive learning environment.

10.32 The teacher makes links with the learners’ other environments on behalf of students, by consulting with parents, counselors, teachers of other classes and activities within the schools, and professionals in other community agencies.

10.33 The teacher can identify and use community resources to foster student learning.

10.34 The teacher establishes respectful and productive relationships with parents and guardians from diverse home and community situations, and seeks to develop cooperative partnerships in support of student learning and well being.

10.35 The teacher talks with and listens to the student, is sensitive and responsive to clues of distress, investigates situations, and seeks outside help as needed and appropriate to remedy problems.

10.36 The teacher acts as an advocate for students.

Florida Educator Accomplished Practices (FEAP)

Accomplished Practice #2: COMMUNICATION
2.1 The preprofessional teacher recognizes the need for effective communication in the classroom and is in the process of acquiring techniques which she/he will use in the classroom.
2.2 STANDARD: Communication -- Uses effective communication techniques with students and all other stakeholders.
2.a Establishes positive interactions in the learning environment that uses incentives and consequences for students.
2.b Establishes positive interactions between the teacher and student that are focused upon learning.
2.c Varies communication (both verbal and nonverbal) according to the nature and needs of individuals.
2.d Encourages students in a positive and supportive manner.
2.e Communicates to all students high expectations for learning.
2.h Practices strategies that support individual and group inquiry.
2.j Identifies communication techniques for use with colleagues, school/community specialists, administrators, and families, including families whose home language is not English.

Accomplished Practice #4: Critical-thinking
4.1 The pre-professional teacher is acquiring performance assessment techniques and strategies that measure higher order thinking skills in students and is building a repertoire of realistic projects and problem-solving activities designed to assist all students in demonstrating their ability to think creatively. (A) Uses appropriate techniques and strategies which promote and enhance critical, creative, and evaluative thinking capabilities of students.
1. Uses assessment strategies (traditional and alternate) to assist the continuous development of the learner. ASSESSMENT
4.2. Uses appropriate techniques and strategies which promote and enhance critical, creative, and evaluative thinking capabilities of students.
4.a Provides opportunities for students to learn higher-order thinking skills.
4.b Identifies strategies, materials, and technologies that she/he will use to expand students’ thinking abilities.
4.g Demonstrates and models the use of higher-order thinking abilities.

**Accomplished Practice #7: HUMAN DEVELOPMENT AND LEARNING**
7.1 Drawing upon well established human development/learning theories and concepts and a variety of information about students, the preprofessional teacher plans instructional activities.
7.a Recognizes developmental levels of students and identifies differences within a group of students.
7.d Communicates with students effectively by taking into account their developmental levels, linguistic development, cultural heritage, experiential background, and interests.
7.e Varies activities to accommodate different student learning needs, developmental levels, experiential backgrounds, linguistic development, and cultural heritage.
7.h Develops short-term personal and professional goals relating to human development and learning.

**Accomplished Practice #8: KNOWLEDGE OF SUBJECT MATTER**
8.2 Demonstrates knowledge and understanding of the subject matter.
8.b Increases subject matter knowledge in order to integrate the learning activities.
8.f Develops short- and long-term personal and professional goals relating to knowledge of subject matter.

**Accomplished Practice #11: ROLE OF THE TEACHER**
11.1 The preprofessional teacher communicates and works cooperatively with families and colleagues to improve the educational experiences at the school.
11.2 STANDARD: Role of the Teacher -- Works with various education professionals, parents, and other stakeholders in the continuous improvement of the educational experiences of students.
11.b Provides meaningful feedback on student progress to students and families and seeks assistance for self and families.

**Accomplished Practice #12: TECHNOLOGY**
12.b Uses technology tools on a personal basis.
12.c Demonstrates awareness of and models acceptable use policies and copyright issues.
12.d Identifies and uses standard references in electronic media.
12.i Selects and utilizes educational software tools for instructional purposes based upon reviews and recommendations of other professionals.
12.j Uses digital information obtained through intranets and/or the Internet (e.g., e-mail and research).
12.k Uses technology to collaborate with others.
12.l Develops professional goals relating to technology integration.

**National Science Teachers Association Standards (NSTA)**

**Standard 1: Content**

Teachers of science understand and can articulate the knowledge and practices of contemporary science. They can interrelate and interpret important concepts, ideas, and applications in their fields of licensure; and can conduct scientific investigations. To show that they are prepared in content, teachers of science must demonstrate that they:
a. Understand and can successfully convey to students the major concepts, principles, theories, laws, and interrelationships of their fields of licensure and supporting fields as recommended by
the National Science Teachers Association.
b. Understand and can successfully convey to students the unifying concepts of science
delineated by the National Science Education Standards.
c. Understand and can successfully convey to students important personal and technological
applications of science in their fields of licensure.
d. Understand research and can successfully design, conduct, report and evaluate investigations
in science.
e. Understand and can successfully use mathematics to process and report data, and solve
problems, in their field(s) of licensure.

B.4. To create interdisciplinary perspectives and to help students understand why science is
important to them, elementary/middle level science specialists should have all of the
competencies described for the elementary generalist, but also should be prepared to lead
students to understand:

33. Use of technological tools in science, including calculators and computers.

C.3.a. Core Competencies. All teachers of chemistry should be prepared lead students to
understand the unifying concepts required of all teachers of science, and should in addition be
prepared to lead students to understand:
10. Functional and polyfunctional group chemistry.

C.3.b. Advanced Competencies. In addition to the core competencies, teachers of chemistry as a
primary field should also be prepared to effectively lead students to understand:
14. Molecular orbital theory, aromaticity, metallic and ionic structures, and correlation to
properties of matter.
21. Chemical reactivity and molecular structure including electronic and steric effects.
22. Organic synthesis and organic reaction mechanisms.
26. How to design, conduct, and report research in chemistry.

Standard 10: Professional Growth
Teachers of science strive continuously to grow and change, personally and professionally, to
meet the diverse needs of their students, school, community, and profession. They have a desire
and disposition for growth and betterment. To show their disposition for growth, teachers of
science must demonstrate that they:
a. Engage actively and continuously in opportunities for professional learning and leadership that
reach beyond minimum job requirements.
b. Reflect constantly upon their teaching and identify ways and means through which they may
grow professionally.
c. Use information from students, supervisors, colleagues and others to improve their teaching
and facilitate their professional growth.

Professional Organization/Learned Society Standards

National Society of Science Teachers Association
Florida Teacher Certification Examination (FTCE) Subject Area Examination (SAE) Competencies and
Skills
Professional Organization/Learned Society Standards

National Society of Science Teachers Association
Florida Teacher Certification Examination (FTCE) Subject Area Examination (SAE) Competencies and Skills

Professional Society / National and State Standards Addressed in the Course
American Chemical Society (ACS) Expected Outcomes:
This course should ensure that students know basic chemical concepts such as stoichiometry, states of matter, atomic structure, molecular structure and bonding, thermodynamics, equilibria, and kinetics. Students need to be competent in basic laboratory skills such as safe practices, keeping a notebook, use of electronic balances and volumetric glassware, preparation of solutions, chemical measurements using pH electrodes and spectrophotometers, data analysis, and report writing.

Course Artifacts

<table>
<thead>
<tr>
<th>*Standards</th>
<th>Name of the Artifact 1</th>
<th>Name of the Artifact 2</th>
<th>Name of the Artifact 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PEU CF</strong></td>
<td>Reactions of alcohols, ethers, epoxides, sulfur-containing compounds, and organometallic reagents: Methods commonly used for activating alcohol before they can be substituted or eliminated</td>
<td>Aromaticity. Reactions of benzene: Electrophilic Aromatic Substitution Reactions: Halogenation, Nitration, Sulfonation, Acylation and Alkylation of benzene</td>
<td>Chemistry of carbonyl compounds III: Reactions at the alpha-carbon: Halogenation, Alkylation Acylation of the alpha-carbon of aldehydes and ketones</td>
</tr>
<tr>
<td><strong>FEAP</strong></td>
<td>2.1, 2.5, 2.7, 4.3, 4.5, 5.1</td>
<td>2.1, 2.5, 2.7, 4.3, 4.5, 5.1</td>
<td>2.1, 2.5, 2.7, 4.3, 4.5, 5.1</td>
</tr>
<tr>
<td><strong>INTASC</strong></td>
<td>1, 4, 5, 6, 10</td>
<td>1, 4, 5, 6, 10</td>
<td>1, 4, 5, 6, 10</td>
</tr>
<tr>
<td><strong>FTCE</strong></td>
<td>3.2, 3.4, 3.10, 3.11, 3.15, 4.1, 4.2, 4.10, 4.13, 5.3</td>
<td>2.6, 3.5, 3.6, 3.7, 4.2, 4.7, 4.8, 4.16, 5.11, 6.3, 6.5, 6.7, 6.11, 8.5</td>
<td>3.4, 3.5, 3.15, 4.2, 4.13, 5.3, 5.5, 5.11</td>
</tr>
<tr>
<td><strong>NSTA</strong></td>
<td>1; 1.B.4.33; 1.C.3.a.10; 1.c.3.b.14, 1.C.3.b.21,22,26; 10.a, 10.b, 10.c.</td>
<td>1; 1.B.4.33; 1.C.3.a.10; 1.c.3.b.14, 1.C.3.b.21,22,26; 10.a, 10.b, 10.c.</td>
<td>1; 1.B.4.33; 1.C.3.a.10; 1.c.3.b.14, 1.C.3.b.21,22,26; 10.a, 10.b, 10.c.</td>
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</tbody>
</table>

**Assignment**
Selected biochemistry problems from the textbook and additional instructor

**Behavioral Objectives**
1. Demonstrate knowledge of the lecture material, and
2. Develop and enhance

**INTASC Standards**
1, 4, 5, 6, 10

**FTCE SAE**
3.2, 3.3, 3.4, 3.10, 3.11, 3.15, 4.1, 4.2, 4.10, 4.13, 5.3

**FEAP**
2, 4, 7, 8, 11, 12

**NSTA**
1; 1.B.4.33; 1.C.3.a.10; 1.c.3.b.14, 1.C.3.b.21,22,26; 10.a, 10.b, 10.c.

**PEU Conceptual Framework**
2.1, 2.5, 2.7, 4.3, 4.5, 5.1

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*INTASC = Interstate New Teacher Assessment and Support Consortium; FTCE = Florida Teacher Certification Examination; SAE = Subject Area Examination; FEAP = Florida Education Artificial Performance; NSTA = National Science Teachers Association; PEU = Professional Education Unit.
<table>
<thead>
<tr>
<th>Addendums</th>
<th>The skill of analytical analysis and problem solving</th>
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</thead>
<tbody>
<tr>
<td>Each homework assignment will address course content and is aimed at development of problem solving skills.</td>
<td>2.6, 3.5, 3.6, 3.7, 4.7, 4.8, 4, 16, 5.5, 5.11, 6.3, 6.5, 6.7, 6.11, 8.5</td>
</tr>
<tr>
<td></td>
<td>10.b, 10.c.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Quizzes</th>
<th>Develop critical thinking and written communication skills</th>
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</thead>
<tbody>
<tr>
<td>Selected biochemistry problems from the textbook and additional instructor addendums. Each homework assignment will address course content and is aimed at development of problem solving skills.</td>
<td>1, 4, 5, 6, 10, 3.2, 3.3, 3.4, 3.10, 3.11, 3.15, 4.1, 4.2, 4.10, 4.13, 5.3</td>
</tr>
<tr>
<td></td>
<td>2.6, 3.5, 3.6, 3.7, 4.7, 4.8, 4, 16, 5.5, 5.11, 6.3, 6.5, 6.7, 6.11, 8.5</td>
</tr>
<tr>
<td></td>
<td>2, 4, 7, 8, 11, 12, 10.a, 10.b, 10.c.</td>
</tr>
<tr>
<td></td>
<td>1: 1.B.4.33; 1.C.3.a.10; 1.c.3.b.14, 1.C.3.b.21, 22, 26; 10.a, 10.b, 10.c.</td>
</tr>
<tr>
<td></td>
<td>2.1, 2.5, 2.7, 4.3, 4.5, 5.1</td>
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<table>
<thead>
<tr>
<th>Exams:</th>
<th>Develop critical thinking and written communication skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Four one-hour tests, each test covering specific chapters. Final exam is comprehensive and will cover the material of Chapters 1-21.</td>
<td>1, 4, 5, 6, 10, 3.2, 3.3, 3.4, 3.10, 3.11, 3.15, 4.1, 4.2, 4.10, 4.13, 5.3</td>
</tr>
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**Overall Goals of the Course**

Specific topics to be covered include free radical chemistry; reactions of alcohols, ethers, epoxides; aromaticity; reactions of benzene; chemistry of carbonyl compounds; spectroscopy; nucleophilic aliphatic substitution reaction mechanisms (SN2, SN1); elimination reaction mechanisms (E1 and E2); electrophilic addition reaction mechanism, reactions of carbon-carbon multiple bonds and demonstrate general familiarity with spectroscopic methods for structure)

**Academic Learning Compact (ALC) / Expected Outcome**

Students enrolled in this course are expected upon completion of the course to grasp the following skills known collectively as Academic Learning Compact:

1. **Communication**
   
   Demonstrate the ability to effectively communicate chemical concepts and principles in oral (e.g., class participation, seminars) and written (e.g., homework, quiz, exams) formats.

2. **Content knowledge**

   Identify and apply the principles and concepts of the basic and subfields of chemistry, including organic chemistry, analytical chemistry, physical chemistry, inorganic chemistry and biochemistry.
3. **Critical Thinking**
   Analyze and solve chemical problems using sound scientific theory
   Design and conduct independent research projects
   Evaluate the design of chemical experiments

4. **Information Resources**
   Demonstrate the ability to make effective use of information resources and the ability to use computers in chemistry

**Specific Behavioral Objectives**

When you have attended this lecture, you should be able to:

**Chapter 11:** Free radical chemistry: radical reactions of alkanes (FTCE 3.2, 3.6, 3.9, 4.2; 4.9; ACS)
1. Define reactions and mechanisms of halogenation of alkanes
2. Identify all the bonds broken and made in the reaction.
3. Calculation of the products percentages or proportions in monohalogenation of alkanes based on reactivity and Selectivity principle
4. The Stereochemistry of the product from radical substitution and addition reaction
5. Relative ease of halogenation and stabilities of radicals
6. Reaction involving radical substitution of benzylic and allylic hydrogens

**Chapter 10:** Reactions of alcohols, ethers, epoxides, sulfur-containing compounds, and organometallic reagents (FTCE 3.2, 3.3, 3.4, 3.10, 3.11, 3.15, 4.1, 4.2, 4.10, 4.13 & 5.3)
1. Discuss SN1, E1, SN2 and E2 reactions.
2. Know methods commonly used for activating alcohol before they can be substituted or eliminated
3. Distinguish alcohol type using chemical reagents e.g. Lucas test, chromic acid etc.
4. The reaction of alcohol, ether and epoxides.
5. The chemistry of Crown ethers.
6. Comparison of the reaction of thiols, sulfides, thio ethers and sulfonium salts with those of alcohol and ether
7. The preparations and reactions of organometallic compounds.

**Chapter 14:** Aromaticity. Reactions of benzene (FTCE 2.6, 3.5, 3.6, 3.7, 4.2, 4.7, 4.8, 4.16, 5.11, 6.3, 6.5, 6.7, 6.11, 8.5; ACS)
1. Distinguish between the term aromaticity and anti-aromaticity
2. Determination and application of the Criteria for aromaticity
3. Resonance structures for aromatic heterocyclic compounds
4. Molecular orbital description of aromaticity and anti-aromaticity
5. Nomenclature of monosubstituted benzenes

**Chapter 15:** Reactions of substituted benzenes (FTCE 3.11, 3.14, 4.11, 5.3, 5.4, 5.11, 6.12; ACS)
1. Nomenclature of disubstituted and polysubstituted benzenes
2. Know how inductive, hyperconjugation and resonance are used to explain the relative rate of electrophilic aromatic substitution.
3. Relative reactivity of substituted benzenes (Learn and know the category of substituents, i.e. Ortho-Para director & Meta director)
4. The Effect of substituent on Orientation and pKa
5. Designing a Synthesis - Synthesis of monosubstituted and disubstituted benzenes.

Chapter 16: Chemistry of carbonyl compounds I (carboxylic acids and derivatives)

Nucleophilic"acyl substitution reaction (FTCE 3.4, 3.5, 3.15, 4.2, 4.13, 5.3, 5.5, 5.11; ACS)
1. Structure, nomenclature and physical properties of carboxylic acid and derivatives
2. Relative reactivities of carboxylic acids and derivatives
3. Classification of carbonyl compounds: Class I, II and III.
4. Distinguish between Nucleophile and electrophile
5. The reactions and mechanisms for carboxylic acid and derivatives

Chapter 17: Chemistry of carbonyl compounds II (aldehydes and ketones)-More reactions of carboxylic acids derivatives (FTCE 3.4, 3.5, 3.15, 4.2, 4.13, 5.3, 5.5, 5.11; ACS)
1. Reactions of α,β-unsaturated carbonyl compounds
2. Determination of the relative reactivities of aldehydes and ketones
3. How Carbonyl compounds reacts: Nucleophilic addition reactions and Nucleophilic acyl substitution
4. Reactions of aldehydes and ketones with the following reagents: Grignard, acetylide ions, hydride ion, hydrogen cyanide, amines and derivatives, water, alcohols
5. Methods for protecting carbonyl group in organic synthesis
6. Wittig reaction reactions and Wolff-Kishner reduction
7. Stereochemistry of nucleophilic addition reactions
8. Nucleophilic addition reaction to α, β-unsaturated carboxylic acid and derivatives
9. Designing a synthesis: - disconnections, synths and synthetic equivalents

Chapter 18: Chemistry of carbonyl compounds III: Reactions at the α-carbon (FTCE 3.4, 3.5, 3.15, 4.2, 4.13, 5.3, 5.5, 5.11; ACS)
1. Acidity of α-hydrogen (pka and Ka value)
2. The concept of tautomerism and Enolate ion formation
3. Keto-enol tautomers for ketone, β-diketone and phenol
4. Mechanism for base- and acid-catalyzed keto-enol interconversion
5. The reactions of enol and enolate via acid- or base-catalyzed α-substitution reaction
6. Halogenation, Alkylation Acylation of the α-carbon of aldehydes and ketones
7. Know these reactions and there application in designing synthesis: Hell-Volhard-Zelinski reaction, Michael reaction, Stork enamine reaction, Aldol addition, Mixed Aldol addition reaction, Claisen condensation, Mixed Claisen condensation, Dieckmann condensation, intramolecular Aldol addition reaction. Robinson Annulation reaction, Malonic ester synthesis, Decarboxylation reaction and acetoacetic ester synthesis.

Chapter 19: Oxidation-Reduction reaction in organic chemistry Oxidation-Reduction reaction (FTCE 1.1, 1.6, 3.3, 3.4, 3.5, 3.6, 3.11, 4.2, 4.17, 4.18, 4.20, 5.11; ACS)
1. Terminologies: redox reactions, oxidizing and reducing agents
2. Distinguish between reduction and oxidation reactions
3. Know the following reaction and their application in synthesis: Catalytic hydrogenation of double bond and triple bond, reduction of alkynes to alkenes, reduction of carbonyl compounds, oxidation of alcohols (swern oxidation), oxidation of aldehydes and ketone (tollen test, haloform test, Baeyer-Villiger oxidation), oxidation of alkenes (using ozone or potassium permanganate), oxidation of 1,2-diol, oxidation of alkenes, and epoxidation.

Chapter 20: Chemistry of Amines and Heterocyclic compounds (FTCE 1.6, 3.2, 3.3, 3.4, 3.5, 3.6, 3.10, 3.11, 3.14, 3.15, 4.2, 4.17, 4.18, 5.11; ACS)

1. Nomenclature of Amines
2. Classification of amine as primary, secondary and tertiary or Aliphatic and aromatic compounds
3. Acid-base properties and reactivity of Amines
4. Reactions (alkylation, acylation, nucleophilic addition-elimination reaction, oxidation of amines and hofmann elimination reaction) and synthesis of amines (Gabriel synthesis, reduction of alkyl azide or nitrile and reduction of nitroalkane or nitrobenzene)
5. The structures and reactivity of four, five and six-membered-ring heterocyclic compounds
6. Electrophilic aromatic substitution reactions of heterocyclic compounds

Florida Teacher Certification Examination (FTCE) Subject Area Examination (SAE)
Competencies and Skills

1. Knowledge of the nature of matter
   1. Differentiate between pure substances, homogeneous mixtures, and heterogeneous mixtures.
   2. Determine the effects of changes in temperature, volume, pressure, or quantity on an ideal gas.
   3. Apply units of mass, volume, and moles to determine concentrations and dilutions of solutions.
   4. Analyze the effects of physical conditions on solubility and the dissolving process.
   5. Evaluate problems relating colligative properties, molar mass, and solution concentrations.
   6. Analyze the effects of forces between chemical species on properties (e.g., melting point, boiling point, vapor pressure, solubility, conductivity) of matter.
   7. Solve problems involving an intensive property (e.g., density, specific heat) of matter.
   8. Differentiate physical methods (e.g., chromatography, filtration, extraction) for separating the components of mixtures.

2. Knowledge of energy and its interaction with matter
   1. Distinguish between different forms of energy (e.g., thermal, electrical, nuclear).
   2. Relate temperature and heat to kinetic molecular theory.
   3. Interpret a phase diagram of a pure substance.
   4. Interpret a heating/cooling curve of a substance.
   5. Calculate thermal changes in chemical reactions, such as heats of reaction, heats of formation, and/or heats of combustion, from data.
   6. Analyze entropy changes during solution formation, phase changes, and chemical reactions.
   7. Predict spontaneity of chemical process given initial and final values of free energy, temperature, enthalpy, and/or entropy.
   8. Relate regions of the electromagnetic spectrum to the energy, wavelength, and
9. Relate regions of the electromagnetic spectrum to their effect on chemical or physical properties of matter.
10. Analyze energy transformations in physical and biological systems (e.g., energy from the Sun to electricity, from food consumption to physical activity).

3. Knowledge of bonding and molecular structure
1. Identify the basic theory and applications of spectroscopy (e.g., MRI, x-ray, mass spectrometry, UV, microwave, NMR, IR).
2. Identify types and examples of metallic, ionic, and covalent (polar and nonpolar) bonds.
3. Apply electronegativity to bond type.
4. Identify characteristics of simple organic compounds.
5. Given the structural formula for a simple organic compound, identify the hybridization of the atoms.
6. Identify sigma and pi bonds in a compound.
7. Interpret the information derived from the following models: Lewis electron dot structures, valence shell electron pair repulsion (VSEPR) theory, and molecular orbital (M/O) theory.
8. Select the most probable Lewis electron dot structure for an ionic or covalent formula (e.g., \( \text{CO}_2 \), \( \text{Na}_2\text{CO}_3 \)) that follows the octet rule.
9. Predict geometry of simple molecules (e.g., symmetry elements).
10. Predict polarity of simple compounds.
11. Predict physical or chemical properties based upon the type of bonding involved.
12. Identify an inorganic chemical formula (ionic or molecular), given the name.
13. Select the name of an inorganic chemical compound (ionic or molecular), given its formula.
14. Identify properly named formulas for simple organic compounds.
15. Identify common organic functional groups.
16. Differentiate between the structures of common biochemical compounds, such as lipids, amino acids, carbohydrates, and nucleic acids.

4 Knowledge of chemical reactions and stoichiometry
1. Balance chemical equations.
2. Given common chemical species and reaction conditions, predict probable reaction products.
3. Solve mass-mass stoichiometry problems.
5. Solve solution stoichiometry problems.
7. Determine empirical formulas from experimental data.
8. Analyze the effects of concentration, temperature, pressure, surface area, and the presence or absence of catalysts on the rates of reaction.
9. Assess the effects of changes in concentration, temperature, or pressure on a state of a system initially at equilibrium (Le Chatelier's principle).
10. Determine rate laws from concentration and rate data.
11. Calculate either the equilibrium constant or concentration of a reaction species at equilibrium (e.g., \( K_a, K_b, K_{sp} \text{, } K_w \text{, } K_{eq} \)).
12. Identify the characteristics of a chemical system in dynamic equilibrium.
13. Identify major characteristics of strong and weak acids or bases.
14. Evaluate the properties of buffer systems.
15. Interpret graphical and numerical titration data.
17. Balance incomplete redox equations in acidic and basic solutions.
18. Determine the spontaneity of a chemical reaction using standard reduction potentials.
19. Identify the characteristics of biochemical and fossil fuel combustion reactions.
20. Solve problems related to pH of strong acids or bases.
21. Analyze electrolytic and/or voltaic cells.

5. Knowledge of atomic theory and structure
1. Using the periodic table, determine the number of protons, neutrons, and electrons in a specific isotope of an atom or ion.
2. Using the periodic table, relate the physical properties of atoms and ions to the elements' positions on the table.
3. Using the periodic table, relate the chemical reactivity of elements to their positions on the table.
4. Using the periodic table, determine electron configurations for main group and transition elements.
5. Relate chemical activity to electron configuration.
6. Identify characteristics of the wave and particle nature of matter.
7. Identify characteristics of unstable nuclei and the particles and energies emitted.
8. Given measurable quantities, calculate parameters of radioactive decay.
10. Analyze the processes of nuclear fission and fusion, including interconversion of mass and energy.
11. Identify electron density distribution diagrams and characteristics for s, p, and d orbitals (e.g., nodes).

6. Knowledge of the nature of science
1. Identify the characteristics and components of scientific inquiry.
2. Identify how the characteristics of scientific research differ from those of other areas of learning.
3. Identify variables in a given experimental design.
4. Identify bias in an experimental design.
5. Evaluate, interpret, and predict from empirical data.
6. Interpret graphical data.
7. Analyze the relationship between experimental observations and underlying assumptions, hypotheses, conclusions, laws, or theories.
8. Relate experimental evidence to models.
9. Differentiate between the uses of qualitative and quantitative data.
10. Analyze the relationship between basic scientific research and applied research, technology, the economy, or the public good.
11. Identify how science and society influence each other.
12. Identify evidence of the progressive development of science.
<table>
<thead>
<tr>
<th>Topic</th>
<th>Chapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free radical chemistry: radical reactions of alkanes</td>
<td>11</td>
</tr>
<tr>
<td>Reactions of alcohols, ethers, epoxides, sulfur-containing compounds, and organometallic reagents.</td>
<td>10</td>
</tr>
<tr>
<td>Aromaticity. Reactions of benzene</td>
<td>14</td>
</tr>
<tr>
<td>Reactions of substituted benzenes</td>
<td>15</td>
</tr>
<tr>
<td>Chemistry of carbonyl compounds I (carboxylic acids and derivatives) Nucleophilic“acyl substitution reaction.</td>
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<td>Chemistry of carbonyl compounds II (aldehydes and ketones)-More reactions of carboxylic acids derivatives. Reactions of α, β-unsaturated carbonyl compounds</td>
<td>17</td>
</tr>
<tr>
<td>Chemistry of carbonyl compounds III: Reactions at the α-carbon.</td>
<td>18</td>
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<tr>
<td>Mass spectrometry, Infrared spectrometry, and UV-Vis spectroscopy</td>
<td>12</td>
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<tr>
<td>NMR spectroscopy</td>
<td>13</td>
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<tr>
<td>Oxidation-Reduction reaction in organic chemistry Oxidation-Reduction reaction</td>
<td>19</td>
</tr>
<tr>
<td>Chemistry of Amines and Heterocyclic compounds</td>
<td>20</td>
</tr>
</tbody>
</table>

**Teaching Methodology**

Lecture Style, Use of Overheads, and Powerpoint, Web-Based Instruction (Course Compass, Blackboard, etc.)

**Course Schedule**

<table>
<thead>
<tr>
<th>WEEK</th>
<th>DATE</th>
<th>TENTATIVE TOPICS</th>
<th>READING REFERENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>01-11-10</td>
<td>Alkanes in nature, Formation and reaction of C radicals. Radical Halogenation of Alkanes</td>
<td>PYB 481-500, FW115-118; 352-361.</td>
</tr>
<tr>
<td>2</td>
<td>01-18-10</td>
<td>Synthetic applications of halogenation.</td>
<td>PYB 500-507, FW 455-456, 705</td>
</tr>
<tr>
<td>3</td>
<td>01-25-10</td>
<td>$\text{SN}_2, \text{SN}_1, \text{E}_2, \text{E}_1$ reactions of alcohols.</td>
<td>PYB 429-445, FW 120-121, 384-387</td>
</tr>
<tr>
<td>4</td>
<td>02-01-10</td>
<td>Dehydration of alcohols, $\text{E}_2, \text{E}_1, \text{SN}_2, \text{SN}_1$ reactions of ethers, opening of Epoxides, introduction to organometallics.</td>
<td>PYB 429-445, 445-455, FW 119-121, 426-428, 496-498, FW 396-406, PYB 465-469</td>
</tr>
<tr>
<td>5</td>
<td>02-08-10</td>
<td>Aromaticity, Mechanism of Electrophilic aromatic substitution (EAS)</td>
<td>PYB 640-655, FW 67-72, 524-526</td>
</tr>
<tr>
<td>6</td>
<td>02-15-10</td>
<td>Five major reactions of aromatic based on EAS mechanism, coupling reactions.</td>
<td>PYB 655-670, 469-472, FW 525-534, 620-621</td>
</tr>
<tr>
<td>7</td>
<td>02-22-10</td>
<td>Reactions of substituted Benzenes, Diazo coupling, synthetic applications</td>
<td>PYB 677-706, FW 525-559</td>
</tr>
</tbody>
</table>
**Course Evaluation**

Written quizzes and exams, homework

**Examinations:**
Three examinations and Quizzes given to assess student's understanding and application of concepts covered in class. Questions may involve multiple choice, essays, definitions, short answers and true/false responses. Your two best performances in the three exams and the grade for the quizzes and the final exam (ACS Organic) will be used in computing your course grade (Note: all exams carry equal weight). A comprehensive final exam covering both CHM 2210 and CHM 2211 materials constitutes the ACS test. This exam is also known as the ACS national Organic Chemistry Qualifying test. Students are advised to continue reviewing their CHM 2210 material throughout the semester. The instructor will provide further details of how to prepare for the ACS organic final exam.

**Grading**

<table>
<thead>
<tr>
<th>Event</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 03-01-10 Nucleophilic Aromatic substitution; Synthetic applications continued.</td>
<td>PYB 707-710 FW 446-448</td>
</tr>
<tr>
<td>9 03-08-10 SPRING BREAK</td>
<td></td>
</tr>
<tr>
<td>10 03-15-10 Chemistry of carbonyl compounds – Nucleophilic Acyl Substitution reaction mechanism</td>
<td>PYB 722-778 FW 599-612</td>
</tr>
<tr>
<td>11 03-22-10 Chemistry of Carbonyl compounds – Nucleophilic Addition to Aldehydes and Ketones</td>
<td>PYB 788-840 FW570-598, 613-629</td>
</tr>
<tr>
<td>12 03-29-10 Chemistry of Carbonyl Compounds Continued. Alpha – Beta unsaturated Carbonyls</td>
<td>PYB 788-840</td>
</tr>
<tr>
<td>13 04-05-10 Chemistry of Carbonyl Compounds: Acidity of alpha hydrogens, Énols, Enolates, Alkylation, aldol reactions, Claisen condensation, Michael addition, Robinson annulation etc.</td>
<td>PYB 850-898 FW 638-673</td>
</tr>
<tr>
<td>14 04-12-10 Oxidation – Reduction reactions, synthetic applications</td>
<td>PYB 908-935 FW 103-107, 129-130, 323-324, 720-722,722, 730</td>
</tr>
<tr>
<td>15 04-19-10 Chemistry of Amines and Heterocycles; Chemistry of amino acids and peptides</td>
<td>PYB 943-972, 1017-1045 FW 846-860, 133-137</td>
</tr>
<tr>
<td>16 04-26-10 FINAL EXAMS</td>
<td></td>
</tr>
</tbody>
</table>
Three Exams @100 points each (drop one, lowest) | 200 points
ACS -Final Exam | 100 points
Quizzes | 50 points

Examination Schedule

<table>
<thead>
<tr>
<th>EXAM</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>Feb. 11</td>
</tr>
<tr>
<td>#2</td>
<td>Mar. 18</td>
</tr>
<tr>
<td>#3</td>
<td>Apr. 15</td>
</tr>
</tbody>
</table>

Exams to be given on Thursdays in the evenings from 6.00 to 8.30 P. M.
(Please adjust your work schedule, travel and study plans accordingly)

NOTE: NO MAKEUP EXAMS WILL BE GIVEN.

* The instructor before the exam will announce exact coverage of each exam. All continuous assessment exams will be given on a Thursday evening on the indicated dates from 6.00-8.30 PM. Venues and exact coverage of the exams will be announced.

Please check the famu.blackboard.com constantly (at least twice daily for announcements). To assist you in studying for an exam, study guide will be posted on famu.blackboard.com. IF A STUDENT MISSES AN EXAM, THIS WILL COUNT AS THE DROP GRADE.

No early or late final exams will be given. The time of the final exam is determined by the Florida A & M University administration, not your teacher.

Grading Scale
The instructor reserves the right to adjust the grading scale so as to conform to the performance of the class. Students will be informed when and if any adjustments are made to the grading scale.
The following scale should serve as a guide to how your grade will be arrived at. The instructor reserves the right to alter this scale usually to the student's advantage.

Aggregate Score (%):
88 – 100 (A) 78 – 87 (B) 65 – 77 (C) 55 – 64 (D) <55 (F)

Course Policies

Cell phone:
Once a class period has begun cell phones are not to be seen or heard in the classroom. Students will be warned about violation of this request. A persistent disregard for this request will result in a student being asked to leave the classroom and will be considered absent.
Class demeanor:
If you disrupt the class in any way or show disrespect to the professor and/or fellow student, you will receive an F in the course.

Missed Exams: It is your responsibility to notify me promptly if you miss a test (exam) in which case an arrangement will be made for you to write the test before the schedule time. If a student misses an exam, this will count as the drop grade. UNDER NO CIRCUMSTANCE WILL MAKE-UP EXAMS OR QUIZZES WILL BE GIVEN.

Attendance Policy:
ATTENDANCE IS TAKEN DURING EACH CLASS MEETING. IT IS YOUR RESPONSIBILITY TO WRITE YOUR SIGNATURE NEXT TO YOUR NAME ON THE DAILY ROLL SHEET. IF YOU FAIL TO DO THIS, YOU ARE ABSENT—No exception. TWO (2) UNEXCUSED ABSENCES FOR THE CLASS WILL RESULT IN A LOWERING OF YOUR GRADE. A STUDENT EXCEEDING THE NUMBERED OF UNEXCUSED ABSENCES MAY BE DROPPED FROM THE COURSE AND ASSIGNED THE GRADE OF “F”. STUDENT MAY BE READMITTED TO THE CLASS WITH THE DEAN’S AND INSTRUCTOR’S PERMISSION. These regulations are fully given on page 31 of the 2007-2008 General Catalog.

Tutorial session:
I will notify you when this session will commence. Tutorial sessions will be held outside of class on a routine basis. While attendance at these sessions would be taken, I strongly encourage you to take advantage of the opportunity to receive additional help. Do not wait until you are struggling to request help!!

Final exam: A comprehensive final exam (ACS EXAM) covering both CHM 2210 and CHM 2211 materials. The format of the final exam is multiple-choice questions.

Academic honesty (Cheating Policy):
It is the aim of the faculty of Florida A & M University to foster a spirit of complete honesty and high standard of integrity. Any one caught cheating in any manner is awarded the grade of “F” (No warnings will be given). It is your responsibility to do your own work. The use of textbooks, notes, pagers, cell phones, and calculators are not allowed in any quiz or exam. Any person(s) collaborating by cheating will receive the Final grade of “F” with offenders also liable to serious consequences, possibly academic suspension.
Please read the university’s policy on academic/intellectual dishonesty (Section 6C3-2.012(10)(s) of the FAMU Student Handbook)

Students with disabilities: All students with disabilities should notify me immediately or at the latest before the beginning of the third week of classes. At that time, you should bring the appropriate signed paperwork from the disabilities office so that I can help you. Official Statement: Any student whose disability falls within the American Disabilities Act (ADA) and requires accommodations should contact the Office of Services for Students with Disabilities. The office is located in the Student Service Building Room 204. You may also reach the office by phone at 259-6035

Non-discrimination policy statement: It is the policy of the University to assure that each student is permitted to attend classes in an environment free from any form of discrimination, including race, religion, color, age, handicap, sex, marital status, national origin and veteran status.
**Procedure for Resolving Faculty-Student Conflict:**
- Student first attempts to resolve issue with instructor
- Student submits written notification of problem to chair.
- Chair forwards student letter to instructor.
- Instructor responds in writing to chair.
- Chair meets with instructor and/or student if necessary.
- Chair forwards response/recommendation to Dean’s office.
- Dean decides what further course of action is available to the student.

**REFERENCES**
5. *Organic Chemistry* by John McMurry (7e, 2008),