

## MISSISSIPPI COLLEGE

**CHE 5402 - Advanced Organic Chemistry (Graduate credit)**

**Fall, 2003**

**Course Credit:** 4 Semester Hours

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**Prerequisites for the Course.** Organic Chemistry CHE303/304 and Laboratory CHE313/314 or equivalent; Chemical Dynamics CHE317 or equivalent.

**Course Description.** Reactions and mechanism, separation science, serial syntheses and instrumental methods of compound identification.

**Rationale for the Course.** Introductory organic chemistry is a survey course. This advanced course is intended to deepen significantly the student's knowledge of the mechanisms of organic reactions, the means by which they are established, and the application of the methods to organic synthesis. From the standpoint of theory, the mechanisms of condensation reactions, photolysis reactions, concerted reactions, methods of organic resolutions, and Hammett relationships will be covered. The laboratory component includes detailed kinetic reaction measurements, serial syntheses, separations of chemical mixtures, instrumental methods of analysis, quantitation and structure assignment. Access to and use of the chemical literature, including on-line search methods will be covered.

**Student Objectives and Outcomes.** Students will demonstrate competency in library resource accession, the interrelation of chemical kinetic information and organic reaction mechanisms, explication of concerted organic reaction mechanisms, and application of instrumental techniques to organic structure determination. Additionally, students will demonstrate competence in laboratory practice through quantitative analysis, serial synthetic competence, and procedures for separation and purification of organic substances. Students will demonstrate knowledge and application of safe and environmentally sound handling, use, treatment and disposal of materials involved in organic chemical transformations.

**Academic Integrity Statement.** Students are expected to conduct themselves in this course with integrity and honesty. In all matters of individual assessment (examinations, individual assignments and laboratories), students will respond and participate without outside help or collaboration. The university policy on academic integrity is part of the statement of this course's procedures and expectations (see *Policies and Procedures 2.19*; the *Mississippi College Undergraduate Catalog*, and the *Tomahawk*). These provide definitions of cheating and plagiarism, and provide procedures for reporting, as well as for discipline and appeal processes.

**Outline of Topics to be Covered in the Course.** (See attached detailed course outline.)

**Methods of Instruction.** Students will work closely with the instructor in covering materials described in lecture-style settings, and then extend the concepts in detailed problem-solving exercises. Students will work with each other, and closely with the instructor in the design and implementation of experimental schemes. Detailed reports will be literature-style writeups with references to the primary literature, adequate experimental descriptions, and intelligent discussions. These will be improved by the corrected draft methods within the time constraints set for the laboratory writing components. Skill-proficiency in instrumental use will be inculcated by closely supervised experiences on the analytical equipment.

**Required Practices (Assignments).** Assignments from the required texts will be made with due-dates. Additional instructor-distributed assignments will also be made, with due-dates.

**Instructional Materials.** “Organic Chemistry”, Morrison & Boyd, 6th Edition; “Advanced Organic Chemistry”, Bernard Miller, 1st Edition, 1998 are required. Other Library reference materials; instructor notes and materials will be assigned or distributed. Additional Sources: “Advanced Organic Chemistry” (March) “Spectrophotometric Identification of Organic Compounds” (Silverstein & Bassler), “Modern Experimental Organic Chemistry” (Roberts, *et al.*)

**Evaluation (Testing & Grading).** Assignments and Problem Solving will contribute 5% to the grade. A written Library and/or Literature Report will contribute 5%. An oral/visual presentation of the literature report is part of this assignment. Four Hour Exams, each contributing 10% to the grade, will in aggregate contribute 40% to the grade. These will be of two kinds: take-home, due-date certain, and classroom, time-certain. Five Laboratory Projects, each contributing 5% to the grade, will in aggregate contribute 25% to the grade. Reports for laboratories are due 2 weeks after completion of the laboratory (except for the last laboratory which is due on the last day of final examinations); grades on late reports will be decreased by 1% per day late. One Comprehensive Final, contributing 25% to the grade, will be given; mandatory, no exclusions for graduating seniors. This exam is closed book and closed notes. The Final exam is mandatory, and cannot be missed without the course grade reverting to “F” (see *Mississippi College Undergraduate Catalog*). If an Hour exam/deadline is missed, an average of all remaining exams (including final) will be used for one missed hour exam/deadline. A second or subsequent missed hour exam/deadline will receive a grade of 0. Unweighted cumulation of assessments will be converted in to a final (letter) grade. Letter grades: 100-89.5(A); 85.0-89.4(B+); 79.5-84.5 (B); 79.4-75.0 (C+); 69.5-74.5 (C); 65.0-69.5 (D+); 59.5-64.5 (D); below 59.5 (F).

**Other information.**

The course time will be divided such that there will be a Lecture two hours per week. Class meets at hours arranged. Laboratory will meet for six hours per week, but at flexible hours arranged so as to accomplish its goals. Safety goggles or eye-protection must be provided by the student and used in the laboratory.

**Course Description:** A course in advanced subjects in organic chemistry including reaction mechanisms, kinetics, structure-reactivity (Hammett) relationships, rearrangements, molecular orbital theory, organic resolutions, and applications of chemical technology to structural questions in organic chemistry. Instrumental approaches will include uv-visible and ir spectroscopy, nmr spectroscopy, gas chromatography and gc-mass spectroscopy, polarimetry and diffraction analysis.

(Tentative - Detailed Course Outline)

CHE 5402 - Advanced Organic Chemistry Tentative Schedule

Fall, 2003

<i>Week</i>	<i>Activity</i>
1	Introduction (Chapter 1, Miller): Malonic Ester Library Resources
1	Introduction; Library resources, continued
2,3	Library Project assigned. Malonic Ester synthesis Unsaturated carbonyl compounds
Lab 1 - Serial synthesis: Special project and/or Michael-addition / active methylene compounds Synthesis of a diethylmalonate derivative	
3,4	Rearrangements; Chapter 6(Miller) First Exam (distributed Tuesday, due following Tuesday)
Lab 2 - Photochemistry & Rearrangments: synthesis of a pinacol, then its rearrangement	
4,5	Rearrangements, Chapter 7,8(Miller) continued
5,6	Kinetics in Organic Chemistry, Notes provided Second Exam (distributed Tuesday, due Friday)
Lab 3 - Kinetics: oxidation of 2° alcohols, or kinetics of hydrolysis of p-methoxyphenylethyne, riigorous kinetics mathematical treatment.	
6,7	Linear Free-energy (Hammett) Relationships Notes provided; Ch. 5 (Miller)
8	Organic Resolutions
Lab 4 - Synthesis and Resolution by classical means, optical rotation and optical purity	
9	Organic Resolutions Third Exam (distributed Tuesday, due Friday)
10	Molecular Orbital Theory, Chapter 2(Miller)
11	Molecular Orbital Theory, Ch. 3-4 (Miller).
Lab 5 - Serial Synthesis of Medicinal Agents. Lidocaine; Special Project; Other Serial Synthesis	
12	Instrumental Methods: Uv-vis, fluorimetry & Infrared spectroscopy
13	Instrumental Methods, Gas chromatography/mass spectroscopy Fourth Exam (distributed Tuesday, due Friday)
14	Instrumental Methods, NMR Spectroscopies
15	Heterocyclic Compounds; Ch. 10,11 (Miller)
16	Heterocyclic Compounds; Ch. 10,11 (Miller) Library/Literature Report Due Laboratory Cleanup

**Final Examination: TBA: Week of Dec. 7, 2002 COMPREHENSIVE**