BSA Food Science

Information obtained from last year’s graduates were as follows:

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<th>Degree</th>
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<th>Grad School</th>
<th>Govt/Edu</th>
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Our primary concern continues to be recruitment and retention in our undergraduate program. Enrollment has increased to 30 due to an aggressive recruitment of First Year students and a greater than expected number of transfer students. Retention and graduation of juniors and seniors is high, but many who enter the program as freshmen and sophomores drift away from the major before taking their first course in Food Science. A limiting factor in retaining underclassmen is performance in the sciences, particularly CHEM 2211/L and PHYS111/L. A disturbing trend is that many of these students who encounter difficulty in the sciences transfer into the Prebusiness program and are still able to keep their HOPE scholarships.

The major change in the curriculum this year is the approval of FDST 4055/L (Food Calculations) to improve the quantitative skills of those students enrolled in our Science, Technology and Engineering Area of Emphasis. The course is being offered for the first time in Spring Semester 2003.

To address the concerns about previous assessment reports and to prepare for a review of our undergraduate curriculum by our national organization (Institute of Food Technologists), we did a complete review of the curriculum. The planning process culminated in a retreat that involved all members of the faculty in the Department with a Teaching appointment. Dr. William Jackson spoke to the Department at the beginning of the process on developing learning outcomes. The course instructor developed learning outcomes for each undergraduate course taught in the Department. These outcomes were then reviewed by a panel within the Department and classified using Bloom's taxonomy. Method of assessment for each outcome was also identified. In addition, learning outcomes for the entire curriculum were developed. At present the learning outcomes are being assessed within individual courses by the course instructor(s). This assessment is supplemented by an exit interview by the Department Head. One of our main goals for the coming year is to develop better assessment tools for the overall curriculum. Assessment techniques will be incorporated on an experimental basis into FDST 4200 (Food Science Forum - a one-hour course for graduating Seniors). First, students will develop portfolios of their activities in Food Science courses. Second, they will be asked to assess the degree of confidence they have in their own abilities to master the stated learning outcomes. Finally an experienced moderator will conduct a focus group to assess the strengths and weaknesses of the current curriculum. In addition, a survey of graduates in the last five years containing these learning outcomes will be conducted to assess past effectiveness.
FDST Curriculum

Upon successful completion of a degree in Food Science with an emphasis in Science, Technology and Engineering a graduate should have the ability to

- identify and access valid sources of technical information of foods. (Knowledge)* [Test questions; class discussions; lab reports]**
- define key terms related to food processing, chemistry, microbiology, engineering and related areas (Knowledge) [Test questions]
- recognize the complexity of the food processing, packaging, and distribution system (Comprehension) [Test questions; class discussions; field trip and lab reports]
- describe key principles and basic concepts in all the subdisciplines of food science. (Comprehension) [Test questions; class discussion]
- summarize the responsibilities and importance of the federal agencies that regulate food products (Comprehension) [Test questions; class discussion]
- solve mathematical and hypothetical problems related to all areas of food science (Application) [Test questions; homework; class discussion; lab reports; team project reports]
- apply basic scientific principles to the development of new products, processes and packages (Application) [Class discussions; lab reports; team project reports]
- communicate orally and in writing an understanding of basic principles in food science and their applications (Synthesis) [Test questions; homework; class discussion; lab reports; team project reports]
- organize and plan projects effectively as part of a team. (Synthesis) [Team project reports]
- design flow diagrams combining unit operations related to safety, quality and product stability of food products (Synthesis) [Lab reports; homework; team project reports]
- test hypotheses, evaluate data and implement appropriate measures to study food-related topics (Application, Analysis, Synthesis, Evaluation) [Lab reports; team project reports]
- determine appropriate formulations for existing products and create new food products and packages (Application, Analysis, Synthesis) [Lab reports; homework; class discussions; team project reports]
- design and evaluate HACCP programs. (Synthesis, Evaluation) [Test questions; homework; lab reports; field trip reports; team project reports]
- judge and critique scientific and popular sources about food. (Evaluation) [Test questions; class discussions; oral reports]

* corresponding element in Bloom's taxonomy is given in parentheses
** method of assessment for the outcome is given in brackets
FDST 3000 Introduction to Food Science and Technology  
(core requirement)

Upon successful completion of this course students should have the ability to
• identify the mission of the various regulatory agencies related to foods. (Knowledge) [Test questions - short essay]
• recognize the various disciplines that are part of food science. (Comprehension) [Test questions - short essay]
• recognize the complexity of the food production, from the concept of new product development to manufacturing, quality control, distribution and consumer acceptance (Comprehension) [Test questions - short essay]
• recognize the complexity of food formulation from nutritional to quality aspects. (Comprehension) [Test questions - short essay]
• differentiate between scientific knowledge and popular opinion on current topics related to foods – and compare their personal opinion with the official position of regulatory agencies and official professional organizations such as the Institute of Food Technology. (Analysis) [Test questions - short essay]
• use the general concepts taught in the course to understand key principles as they relate to specific products (Application) [Homework]
• differentiate between nutritious products and convenience foods. (Analysis) [Test questions - short essay; Homework]

FDST 4000 Seminar in Food Science  
(core requirement)

Upon successful completion of this course students should have the ability to
• describe methods of preparing visual aids for scientific presentations (Comprehension) [in-class discussion] *
• use library resources available on campus. (Application) [written submission of sources accompanying presentation]
• plan, organize and present a seminar on a topic related to food science. (Application, Analysis and Synthesis) [faculty evaluation of student's seminar]
• observe and critique different presentation styles and techniques. (Analysis and Evaluation) [written reports on other seminars both in and out of class]

FDST 4010/L Principles of Food Processing/ Laboratory  
(core requirement)

Upon successful completion of this course students should have the ability to
• define key terms related to food processing, preservation and deterioration of foods. (Knowledge) [test questions – short essay] *
• identify unit operations of food processes. (Knowledge) [test questions – short essay]
• identify physical and chemical properties of raw food materials that control deterioration, quality and safety of foods. (Knowledge) [test questions – short essay]
• summarize the basic principles of sensory analysis. (Comprehension) [test questions – short essay]
• write a concise summary of relevant information collected in the laboratory. (Comprehension, Analysis and Synthesis) [lab report executive summary]
- plan pilot plant laboratory experiments, assemble materials and supplies, reserve equipment and rooms and develop data sheets for laboratories (Application, Analysis and Synthesis) [team preparation of laboratory exercises, handouts and data sheets]
- use basic sensory principles to design and implement them in their team project (Application and Synthesis) [lab plan, human subjects proposal and lab report]
- write a comprehensive report with other team members that describes background, methods, data analysis, literature review and hypothesis. (Analysis and Synthesis) [lab reports]
- generate a process flow diagram to convert raw materials into finished food products. (Synthesis) [test questions – short essay]

FDST 4030/L  Principles of Food Microbiology/ Laboratory (core requirement)

Upon successful completion of this course students should have the ability to
- define key terms used in food microbiology. (Knowledge) [test questions – short answer and brief essay; Class discussions]
- identify the types of microorganisms (pathogens and nonpathogens) found in food. (Knowledge) [Test questions - short answer, matching, multiple choice]
- describe the key principles of food microbiology. (Comprehension) [Test questions - short answer and brief essay; Class discussions]
- describe the significant public health aspects of food microbiology. (Comprehension) [Test questions – short answer, brief essay; Class discussions; Case studies]
- compare and contrast the significance of specific microorganisms in food and food processing environments based on the knowledge of the organisms involved, the product, the processing practices applied, and the processing environment (Analysis) [Test questions - short answer and brief essay; Class discussions; Case studies; Laboratory reports]
- implement experiments that emphasize the principles of food microbiology. (Application) [Lab exercises; Hands-on experiments; Lab reports]
- evaluate the effect of different environmental conditions on microbial presence in foods and food processing environments. (Evaluation) [Test questions- short answer and brief essay; Class discussions; Case studies; Laboratory reports]

FDST 4040/L  Food Chemistry/ Laboratory (core requirement)

Upon successful completion of this course students should have the ability to
- define key terms used in food chemistry. (Knowledge) [test questions – short essay]
- paraphrase the key principles of food chemistry. (Comprehension) [test questions – short essay]
- recognize the role of chemicals in foods including both beneficial and detrimental aspects. (Comprehension) [homework and test questions – short essay]
- implement experiments that emphasize key principles described in class lectures in laboratory section. (Application) [laboratory exercises – experiments and reports]
• solve specific problems in food chemistry for a wide variety of important topics. (Application) [homework assignments and test questions – short essay]
• point out the structural/functional relationships of food chemicals in the roles of ingredients. (Analysis) [in-class presentation of a Molecule of the Day]
• distinguish the specific attributes of a specific food product based on general principles taught in class lectures. (Analysis) [final exam question on a specific product – essay]
• discriminate the strengths and limitations of proximate analysis of food products. (Analysis) [complete proximate analysis on a personally selected food product – report]

FDST 4090/L  Food Quality Control/ Laboratory  (core requirement)

Upon successful completion of this course students should have the ability to
• define key terms used in Statistical Quality Control. (Knowledge) [test questions – short essay]
• summarize the benefits of Statistical Process Control techniques to improve product safety and quality. (Comprehension) [test questions – short essay]
• recognize probability distributions and their relationship to control charts. (Comprehension) [homework problems and test questions – short essay, problems]
• compare graphical tools for collecting and interpreting quality control data. (Analysis) [computer laboratory -- essay questions]
• design and analyze control charts for measurement and attribute data. (Application) [homework problems - test problems – short essay]
• create control charts with computer software given a variation of process data. (Synthesis) [computer lab problems]
• generate a SPC program for a commercial food plant using key principles learned in class. (Synthesis) [lab experiments and reports]
• critique several SQC programs (computerized and non-computerized) operating in commercial food plants (Evaluation) [field trip reports; class discussions]

FDST 4250/L  New Food Product Development (core requirement / capstone course)

Upon successful completion of this course students should have the ability to
• define key terms used in food product development. (Knowledge) [test questions -- short essay]*
• recognize key principles of the product development process. (Comprehension) [test questions -- short essay]
• summarize the importance of food processing, chemistry and microbiology in developing a new food product. (Comprehension) [test questions -- short essay]
• determine the functionality of food components and selection of ingredients for a safe, wholesome product. (Application) [test questions -- short essay]
• distinguish new ideas from prototypes and prototypes using critical thinking and other problem solving schemes (Analysis) [test questions; class discussions]
• design a food formulation and optimize the process (Synthesis) [computer lab exercise]
• create a new food product, as part of a team, to meet market needs. (Synthesis) [class discussion; written report]
• evaluate and critique new food products developed by other teams in the class. (Evaluation) [team project reports; class discussion]

**FDST 4050/L  Food Engineering Fundamentals (Technology, Science and Engineering Emphasis)**

Upon successful completion of this course students should have the ability to
• define fundamental components of a food product based on nutritional, sensory, and safety requirements. (Analysis) [test questions, homework problems, laboratory report]
• examine fluid conveying systems consisting of pumps, pipes and fittings and process connections and determine type and size of pump, pressure, source elevation to avoid priming and fluid flow velocities in the system. (Application)[submitted problem sets, laboratory reports, test questions]
• solve heating rate problems and determine size of equipment appropriate for a heating or cooling application. (Application)[submitted problems sets, test questions, laboratory reports]
• compare different raw materials and decide on type and levels needed in a formulation to meet stated specifications (Analysis) [test questions, homework problems, laboratory report]
• analyze a process and compare processing steps for their effect on process yields (Analysis)[Problem sets submitted, test questions]
• distinguish differences in quality of fluid foods using quantitative measures of flow, learn to make flow measurements using various rheometers and analyze results. (Analysis)[Problem sets submitted, test results, and laboratory reports]
• compare energy transfer rates in different systems operated under different modes of heat transfer, design heat exchange systems needed to heat or cool food products at designated rates, and selection of appropriate heat transfer equipment for an operation. (Analysis) [Submitted problem sets, test questions, laboratory reports]
• determine quantitatively, kinetics of thermal inactivation of microorganisms thermal degradation of food components and evaluate optimal thermal processes to obtain a safe product that possess superior quality attributes (Application, Evaluation)[Submitted problem sets, test questions, laboratory report]

**FDST 4060/L  Food Engineering Fundamentals II (Science, Technology, and Engineering Emphasis)**

Upon successful completion of this course students should have the ability to
• describe the differences between food engineering and processing. (Comprehension) [exams, in-class discussion]
• describe the basic principles of unit operations that transform foods including refrigeration, freezing, drying, freeze drying, extrusion, evaporation, membrane processing. (Comprehension) [homework, lab reports, discussions]
• apply the basic laws of physics and thermodynamics to food engineering operations. (Knowledge, Application) [homework, lab reports, exams]
• compare design criteria and make calculations that predict processing times, energy efficiency and waste reduction in engineering operations. (Comprehension, Application, Analysis) [homework, lab reports, exams, in-class discussions]
• solve basic mass and heat transfer problems. (Comprehension, Application, Analysis) [homework, lab reports, exams, in-class discussions]
• use, operate and clean equipment associated with fundamental unit operations. (Application) [lab exercises and reports]
• point out how engineering operations affect safety and quality of processed foods. (Analysis) [laboratory measurements of processed products]

FDST 4070  Nutritional Quality and the Effect of Technology (Science, Technology, and Engineering Emphasis)

Upon successful completion of this course students should have the ability to:
• identify the role of the food industry in maintaining a safe and nutritious food supply. (Knowledge)
• recognize the interface between nutrition and food science. (Comprehension)
• describe the role of fortification in improving world health. (Comprehension)
• describe routes of nutrient loss in food delivery. (Comprehension)
• describe technological advances in improvement of nutritional quality. (Comprehension)
• summarize the basic concepts of nutritional quality measurement (Comprehension)
• compare physical and chemical mechanisms leading to nutrient loss. (Analysis)
• differentiate conventional foods, functional foods and supplements. (Analysis)
• critique the impact of functional foods on the consumer and the food industry. (Evaluation)

FDST 4080/L  Instrumental Methods of Food Analysis (Science, Technology, and Engineering Emphasis)

Upon successful completion of this course students should have the ability to:
• describe the basic principles of instruments used in food analysis (Comprehension) [test questions]
• search the scientific literature and find appropriate instrumental analytical procedures for analysis of food products (Application) [library search, report]
• develop analytical procedures for determination of common food components and ingredients (Application) [test questions, lab reports]
• operate instruments (visible, UV, IR, NMR, MS, fluorescence, AA, GLC, HPLC) used in food and nutrient analysis (Application) [test questions, lab reports]
• implement appropriate statistical techniques to analyze experimental data (Application and Analysis) [test questions, lab reports]
• evaluate and interpret data generated by these instruments (Evaluation) [test questions, lab reports]

FDST 4110/L  Food Packaging  (Science, Technology, and Engineering Emphasis)
Upon successful completion of this course students should have the ability to
• define key food packaging terms. (Knowledge)
• list the steps required to develop packaging to include primary and secondary packages as well as packaging equipment. (Knowledge)
• identify major package structures (Knowledge)
• describe the rationale for major packaging structures (Comprehension)
• describe the reasons for packaging each food (Comprehension)
• describe shelf life, its measurement and prediction (Comprehension)
• describe “non-technical” packaging variables such as graphics economics, legal/regulatory aspects and environmental concerns (Comprehension)
• summarize the indispensable roles played by packaging in protecting food products from inception through consumption. (Comprehension)
• develop skills to communicate effectively with packaging and marketing professionals (Application)
• design alternative packaging systems and evaluate each in the perspective of the food product and its concept. (Synthesis)
• design a packaging system for a new product as part of a team (Synthesis)
• evaluate the interrelationship of food with processing, packaging and distribution (Evaluation)

Evaluation of these outcomes is determined by take-home midterm and final exams which present challenge problems to be answered by essay after much research and thinking. The term project is the development of a packaging system for a food product, which is judged by a panel of food packaging industry experts. In-class dialog tests the students comprehension of what they have seen on field trips to food packaging industry facilities, read in food packaging periodicals or learned from guest lectures from leading industry experts.

FDST 2010 Food Issues and Choices (survey course for non-majors / elective)

Upon successful completion of this course students should have the ability to
• identify the major chemical compounds and microbes associated with commercial foods. (Knowledge) [test questions – multiple choice]
• describe the difference between food science and nutrition. (Comprehension) [final exam question – essay]
• realize that there are not always simple scientific answers to popular questions about food. (Comprehension) [test questions – true/ false/ depends (if depends, why)]
• recognize the complexity of the production, manufacturing and distribution pattern of the modern food supply. (Comprehension) [homework assignments-- short essay]
• describe the cultural factors that affect food choices that we make and the nutritional consequences of these choices (Comprehension) [homework assignments and in-class discussion - short reports based on reading or interviews and group projects]
• apply general concepts taught in the course to understanding the specific aspects of a personally selected food product. (Application) [ homework assignments and in-class discussions -- short reports and group projects]
• discriminate scientific from popular aspects of contemporary food issues. (Analysis) [final exam question – short essay]
FDST 3910  Food Science Internship  (elective)

Upon successful completion of this course students should have the ability to
- identify unit operations of laboratory routine in a food company. (Knowledge)
- describe the technology and marketing aspects of a food company. (Comprehension)
- implement the knowledge and skills learned in class in the food industry setting. (Application)
- compare university pilot plant and commercial production equipment and facilities. (Analysis)
- write a report on all aspects of the internship experience. (Synthesis)
- appraise the working environment and technology used in the food company. (Evaluation)

Outcomes are assessed from a written report by the intern, an evaluation by the intern's sponsor and an oral report to the Food Science Club the semester following the internship.

FDST 4100  Governmental Regulation of Food Safety and Quality  (elective)

Upon successful completion of this course students should have the ability to
- identify the agencies and groups (primarily federal, but also some state and international) that are involved in evaluating our food supply for safety, wholesomeness, and nutritional reasons. (Knowledge) [test questions -- identify]
- recognize the historical basis for the development and implementation of food laws and regulations. (Comprehension) [test questions-- short answer; class discussion]
- describe the function and activities of the various agencies involved with food safety and quality. (Comprehension) [test questions -- short answer]
- describe the process by which laws and regulations related to food are developed. (Comprehension) [test questions -- short answer]
- point out other major laws involving food safety and quality. (Analysis) [test questions -- short answer and brief discussion; homework assignments involving the Web; class discussions]
- use resources (printed and web-based) concerning food safety and quality that are used in the regulatory decision-making process. (Application) [test questions -- short answer and brief discussion; homework assignments involving the Web; class discussions]
- critique current issues involving the legal aspects of food safety and quality. (Evaluation) [class discussions; group projects -- written and oral reports]
- evaluate the meaning of the Federal Food Drug and Cosmetic Act. (Evaluation) [test questions -- short answer and brief discussion; homework assignments involving the Web; class discussions]
FDST 4120/L  Food Fermentations  (elective)

Upon successful completion of this course students should have the ability to

- identify microorganisms involved in the fermentation of specific food commodities including dairy, meat, grain, and vegetable. (Knowledge)
- list the properties of microorganisms involved in food fermentations that are associated with specific desirable and undesirable product characteristics. (Knowledge)
- identify the biochemical origin of microbial metabolites produced in fermented foods. (Knowledge)
- describe the mechanisms by which pathogenic and spoilage bacteria are inhibited by food fermentations. (Comprehension)
- describe the influence of the food environment on the food fermentation process and how this environment can be controlled to achieve the desired product. (Comprehension)
- distinguish and recognize through taste or aroma metabolites of microorganisms that contribute to the flavor and aroma fermented foods. (Analysis)
- compare possible causes of flavor and texture defects that may occur in fermented foods. (Analysis)
- develop and plan strategies for controlling the occurrence of microbial-induced defects in fermented foods. (Application and Synthesis)

Outcomes are assessed by using written examinations and a term paper. Written examinations are a mixture of short answer, multiple choice and matching questions. About 10% of the questions require problem solving skills. The term paper requires the student to search and select for the appropriate scientific literature including book chapters, review papers, and research papers. This information must then be synthesized into a detailed description of a biochemical or microbial physiological aspect of food fermentations.

FDST 4130  Food Biotechnology  (elective)

Upon successful completion of this course students should have the ability to

- define terms used in food biotechnology. (Knowledge) [Test questions - short essay]
- paraphrase the key principles in genetic engineering. (Comprehension) [Test questions -- short essay]
- recognize the role of recombinant DNA technology in the production of novel food ingredients or new food products. (Comprehension) [Test questions -- short essay]
- recognize the role of enzymes in food bioprocessing and in value-added products. (Comprehension) [Test questions -- short essay]
- solve specific problems about applications of biotechnology in the fats and oils industry. (Application) [Test questions]
- distinguish the specific roles of tissue culture, microbial transformations and microbial synthesis in the production of important flavors, vitamins and value-added products (Analysis) [Test questions -- short essay]
- evaluate the role of regulatory agencies and consumers in the successful use or introduction of genetically modified products. (Evaluation) [Class discussion; Test questions - short essay]
FDST 4200  Food Science Forum  (elective)

Upon successful completion of this course students should have the ability to

- recognize day-to-day opportunities and challenges facing someone in the food industry. (Comprehension) [report from the student and electronic mentor on their interaction]
- recognize the diversity of food in culture. (Comprehension) [foreign graduate student mentor and student prepare an item from that culture for a pot-luck luncheon]
- develop and prepare a resume’ suitable for employment. (Application and Analysis) [homework analyzed by instructor and career services personnel]
- distinguish between the opportunities offered by graduate school and immediate employment upon graduation. (Analysis) [homework]
- develop interview skills that emphasize job skills learned as an undergraduate (Application, Analysis and Synthesis) [video-taped mock interview evaluated by career services personnel]
- generate a career plan. (Synthesis) [homework]
- critique job search and interview techniques. (Evaluation) [Class discussion of approaches used by classmates in mock and actual interview situations]

FDST 4320/L  Microbiology of Food Sanitation  (elective)

Upon successful completion of this course students should have the ability to

- identify the specific characteristics of each food-borne pathogen (Knowledge) [test questions - short essay]
- recognize the primary sources of microbial contamination of foods, their mechanisms for spoilage, and the preservation methods to ensure food safety and quality (Comprehension) [test questions - short essay]
- recognize the role of facility and equipment design in proper cleaning and sanitizing (Comprehension) [test questions - short essay]
- distinguish the basic chemistry and appropriate application of cleaning and sanitizing agents (Analysis) [test questions - short essay]
- compare conventional and rapid microbial technology with respect to effectiveness in implementing a sanitation program. (Analysis) [lab exercise -- short essay]
- design a HACCP program for a food product or industry. (Synthesis) [test questions - homework - lab experiments]
- evaluate ways in which HACCP plans are used in the food industry (Evaluation) [class discussion, test question -- long essay]
- critique an existing sanitation program in a food science facility and food processing plant (Evaluation) [field trip report]
- select laboratory techniques to identify presence of pathogens in foods. (Evaluation) [student oral/ written presentation - lab experiments]
Additional Measures Independent from the Course Assessments

We are looking at four additional means to assess the curriculum:

1. In FDST 4200 (a 1-hour elective taken by almost all of our 4th year students) we are developing student portfolios that incorporate activities from all food science courses that make that student more marketable. This is the second year that the course has been offered and the first time we have included portfolio development as part of the class requirements. Portfolio development is being done in conjunction with our career counselor from Clark Howell. While each student is not graded on the quality of the portfolio, it is a requirement that they produce one and the instructor and the career counselor critique the portfolios. The students benefit by the increased personal marketability upon graduation. The Department then uses the information derived from the portfolio to assess the aspects of the curriculum that provide marketable skills.

2. During the last semester before graduation, the Department Head interviews each graduating student to determine which courses and other activities contributed to their education at UGA and what courses and activities could be modified to provide a more meaningful experience. Additional comments are solicited for improvements in the curriculum. These comments are then discussed with the specific instructors during the annual evaluations. Comments that go beyond individual courses are brought up for discussion at one of the monthly Department meetings.

3. Every semester, the instructor of FDST 2010 (an introduction for non-majors) brings in two recent graduates (6 months-5 years) to talk to his class about food science in the real world. We also have former students come back to the Department to deliver seminars. We are instituting this semester an interview of these former students with the Undergraduate Coordinator and Department Head to determine their perception of the curriculum from the standpoints of (a) practicing food scientist, (b) a potential employer of our future graduates, and (c) an educated person who considers the impact of the education on the non-professional aspects of life.

4. Last year we conducted a program review of the undergraduate curriculum as part of an accreditation process with our national organization, Institute of Food Technologists. The highlight of that process was a day's retreat to evaluate the current curriculum, which included the entire teaching faculty, selected students and the Department Head. The retreat was so successful, that we agreed to conduct these retreats each year to assess our curriculum. In even years we will focus on the undergraduate curriculum and in odd years we will focus on the graduate curriculum.