University of Cincinnati  
Department of Environmental Health

### Division of Environmental and Occupational Hygiene  
**Course Goals and Outcomes Form**

**Course number and title:** 20-MECH-653 System Safety II  
**Graduate Credits:** 3 gr. cr  
**Instructor(s) in-charge:** P. A. Stuebbe, PhD, PE  
**Course type (underline all that apply):** Lecture, Laboratory, Field Projects  
**Required or Elective:** Required

<table>
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<th>Course Schedule</th>
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| Lecture:                | 3 hours per week | 1 meetings  
| Discussion:             | _____ hours per week | _____ sessions  
| Field Work:             | _____ hours per week | _____ hours per survey/project  
| Outside Study:          | _____ hours per week |  
| Office Hours:           | __by appt.__  

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<th>Course Assignments:</th>
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| Homework:               | ____ assignments  
| Exams:                  | ___1/1 Mid term and Final  
| Reports:                | __X__ required  
| Project                 | ____X__ required  

**Grading Policy:**  
Based on a field project and a report

**Course Prerequisites:**  
Bachelors level background in engineering and/or biology and/or psychology

**Catalog Description:**  
Application of quantitative deductive methods; including: Boolean logic, fault tree, and sneak circuit analysis; to the rigorous analysis of major systems to identify and rank likely fault states of subsystems and components.

**Textbook and Any Related Course Materials:**  
Class notes are provided by the instructor

**Blackboard:**  
No

**Topics Covered:**  
1. Loss Rate Concept  
2. Introduction to System Safety Analysis  
3. Concepts of Risk Management  
4. Fault Tree Analysis - Qualitative  
5. Fault Trees Analysis - Quantitative  
6. Review of Probability  
7. Introduction to Boolean Algebra/Karnaugh Mapping
Course Goals (and Program Outcomes):

The intent of this course is to present students perusing occupational health and safety studies with a follow on to the introductory course that addresses system complexity and interactions among system features. The primary goals are to impart a knowledge of commonly accepted deductive hazard identification and risk analysis techniques, demonstrate the relevance of these techniques to engineering practice, and provide opportunities to apply the techniques through case studies. The focus of System Safety II is on “system” techniques, which result in hazard models.

NOTE: The ABET Program outcome is shown as a capital letter; the number designates the program specific outcome.

Evaluation Criteria:
Students are evaluated based on a field Project:
Students are required to research systems modeling approaches or techniques that complement or extend those covered in the course.

Relation to Program Educational Objectives:
This is a required course for all Comprehensive Practice majors. The course contributes to the following Program Educational Objectives, as shown:

- _X_ Fundamental Knowledge
  - Hygiene Science _60_ %; Basic Science _20_ %
  - Design Skills _10_ %
  - Professional Skills _5_ %
  - Life-long Learning _5_ %

NOTE: EOH faculty define Hygiene Science as all the Knowledge Elements other than the Basic Sciences; Design skills are those necessary to solve real world problems. Professional skills are those that involve teams, management, leadership, written and oral communication, approach to stakeholders and ethics; life-long learning is demonstration of the need for continuing professional development.

Is there a TA? Yes  No
Is computer use expected? Yes  No

Program outcomes and how they are covered in this course

For each ABET IH Program Outcome (A through L), the EOH Educational Outcomes are shown below. Upon completion of this course, students will have had the opportunity to acquire knowledge (K), skills (S) and attitudes (A) associated with each of the Educational Outcomes, as noted by underlining. Where the educational measurable outcome contributes strongly to the ABET Program Outcome, the K/S/A is shown in upper case; where the contribution is average, the k/s/a is shown in lower case letters. (Note, use the Contribution to Knowledge and Professional Skills estimates above to guide your decision.)

A. Identify agents, factors and stressors generated by and/or associated with defined sources, unit operations and/or processes:

   Identify potential health hazards of workplace processes
and operations

B. Describe qualitative and quantitative aspects of generation of agents, factors and stressors:

- Describe the underlying processes of the generation of hazards in occupational and environmental settings
- Describe qualitative and quantitative aspects of hazards associated with specific occupational or environmental sources

C. Understand physiological and/or toxicological interactions of physical, chemical, biological and ergonomic agents, factors and/or stressors with the human body:

- Understand the relation between exposures and health outcomes
- Compare and contrast the potential for differences in response to hazards due to personal factors among some subjects at risk of exposure and the subsequent need to modify programs and practices

D. Assess qualitative and quantitative aspects of exposure assessment, dose-response, and risk characterization based on applicable pathways and modes of entry:

- Describe how to evaluate potential adverse outcomes of chemical or physical exposures, based on similarity of the exposure to documented hazards
- Describe occupational hygiene aspects of emerging technologies
- Describe the basic principles of conducting sampling and analysis for exposure assessment
- Describe the basic principles of evaluating engineering and non-engineering controls to reduce exposure
- Develop and implement an exposure assessment plan to evaluate potential hazards and existing controls
- Gather, manage and analyze quantitative (e.g., measurements of exposure or system performance) and qualitative (e.g., written programs) data to evaluate potential hazards and existing controls in order to reduce risk

E. Calculate, interpret and apply statistical and epidemiological data:

- Apply epidemiologic and/or statistical concepts to the interpretation of exposure data

F. Recommend and evaluate engineering, administrative and personal protective equipment controls and/or other interventions to reduce or eliminate hazards:

- Identify and recommend appropriate methods to reduce exposure (using engineering controls, personal protective equipment or administrative controls), or deficiencies in written programs and policies
- Design work process/practice interventions
G. Demonstrate an understanding of applicable business and managerial practices:

- Produce accurate oral and written reports, including descriptions of occupational processes and activities, exposure assessment plans and evaluation of occupational and environmental work settings
- Describe approaches to interact with higher-level decision makers in various management structures
- Manage resources effectively
- Display effective leadership

H. Interpret and apply applicable occupational and environmental regulations:

- Understand, interpret and apply occupational and environmental regulations
- Apply guidelines, standards and laws in interpreting qualitative and quantitative data for exposure assessment for risk characterization

I. Understand fundamental aspects of safety and environmental health

- Apply the professional code of ethics to a scenario

J. Attain recognized professional certification

- Explain the importance of ethics in the practice of occupational and environmental hygiene
- Understand the need for and resources available for continuing professional development after graduation
- Describe the requirements to obtain professional certification

K. Conduct a research activity resulting in a report that demonstrates mastery of the subject and high level of professional and public communication skills

- Design a research question, develop a plan and conduct research
- Communicate effectively with a variety of stakeholders (e.g., labor, management, government, peers, safety and health professionals, allied professionals)
- Produce a technical scientific report on research

L. Demonstrate advanced qualitative and quantitative problem-solving Skills

- Function effectively as part of a multidisciplinary team to investigate and propose a solution to an exposure hazard in a workplace

COURSE MATERIAL AND AVAILABILITY

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<th>Students</th>
<th>Instructor(s)</th>
<th>TA</th>
<th>Division</th>
<th>Department</th>
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<td>Course Goals/outcomes</td>
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<td>Lecture notes, assignments</td>
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<td>Samples of homework and correct answers</td>
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<td>Samples of reports, graded</td>
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<td>Samples of exams and correct answers</td>
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<td>Course evaluation from students</td>
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<td>Instructor response/actions to evaluation comments</td>
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**NOTE:** Students provide feedback on individual courses through the end-of-class Department and Division evaluation survey instrument. This instrument provides feedback on the course material, organization and presentation, and perceived contribution of the course to the achievement of Program Outcomes. In addition, feedback is received from the continuing, semi-annual Question-feedback process during which students identify Best Learning Experience, Session/presentation that was an endurance test, What would make life as a student better?, If I could do it over, I would…, Opportunities I would like to have but don’t seem to be available, Opportunities I would like more of, Aspects of the program the faculty should consider eliminating, Worst part of the UC program, Best part of the UC program, Other comments. A Ph.D. and M.S. student participate in Division faculty meetings. Exit surveys are conducted by the University and the Division as part of the requirements for graduation. All students are urged to participate fully in each of these activities in order to improve the educational experience.