Approved by Undergraduate Council 11/22/2011 Sharon Gill

# General Education Course Approval Cover Sheet

**Date of Submission** 04/08/2011

**1. Check which area(s) this course applies to**

| | | | |
|---|---|---|---|
| Inquiry – Arts & Creativity | ☐ | Composition & Communications - II | ☐ |
| Inquiry – Humanities | ☐ | Quantitative Foundations | ☐ |
| Inquiry – Nat/Math/Phys Sci | ☒ | Statistical Inferential Reasoning | ☐ |
| Inquiry – Social Sciences | ☐ | U.S. Citizenship, Community, Diversity | ☐ |
| Composition & Communications - I | ☐ | Global Dynamics | ☐ |

**2. Provide Course and Department Information.**

Department: School of Architecture

Course Prefix and Number: ARC 333 Credit hours: 3.0

Course Title: Environmental Controls II

Expected # of Students per Calendar Yr: 65

Course Required for Majors in your Program (check one)? Yes ☒ No ☐

Prerequisite(s) for Course? ARC 332

This request is for (check one) A New Course ☐ An Existing Course ☒

Departmental Contact Information

Name: Bruce Swetnam Email: bswet0@uky.edu

Office Address: 117 Pence Hall Speedsort 0041 Phone: 502-645-6751/859-257-7374

**3. In addition to this form, the following must be submitted for consideration:**

- A syllabus that conforms to the Senate Syllabi Guidelines, including a mapping of the stated learning outcomes to those presented on the corresponding Course Template.
- A completed Course Review Form. See the Gen Ed website http://www.uky.edu/gened/forms.html for these forms. Proposals prepared prior to September 15th, 2010 are allowed to use a narrative instead of the Course Review Form.
- If applicable, a major course change form for revision of an existing course, or a new course form for a new course.

**4. Signatures**

Department Chair: _____ Date: 4/6/11

Dean: _____ Date: 4/6/11

**All proposals are to be submitted from the College Dean's Office**
**Submission is by way of the General Education website** http://www.uky.edu/gened

**Course Review Form**
**Inquiry in the Natural/Mathematical/Physical Sciences**

| Reviewer Recommendation | |
|---|---|
| Accept ☐ | Revisions Needed ☐ |

**Course:** ARC 333

Using the course syllabus as a reference, identify when and how the following learning outcomes are addressed in the course. Since learning outcomes will likely be addressed multiple ways within the same syllabus, please identify a representative example (or examples) for each outcome.

☒ Course activities that enable students to demonstrate an understanding of methods of inquiry that lead to scientific knowledge and distinguish scientific fact from pseudoscience.

Example(s) from syllabus:
The students are introduced (LEED) Leadership in Energy and Environmental Design standards for building design and construction. Students are instructed in methods for mathematically model a building's thermal load on buildings.

Brief Description:
Information from lectures, text, and information found on charts are used to mathematically model a building's thermal load using a variety of scientific methods. For example, energy transfer though the building envelope by convection may be an analyzed by using the (ACH) Air Change Per Hour Method and/or the Crack Length Method. Discrepancies in the results of the two methods are analyzed and discussed to improve accuracy.

☒ Course activities that enable students to demonstrate an understanding of the fundamental principles in a branch of science.

Example(s) from syllabus:
Students are introduced to Human Physiology, Environment, Thermodynamics, Hydraulics, and Electricity.

Brief Description:
Example: Thermodynamics, course lectures, readings, and homework assignments enable students to understand and quantify the transfer of energy through materials by conduction and radiation.

☒ Course activities that enable students to demonstrate the application of fundamental principles to interpret and make predictions in that branch of science.

Example(s) from syllabus:
Students are required to complete a comprehensive analysis of a building's thermal load, energy use, and operating cost.

Brief Description:
Students use scientific and industry standard methods to anticipate the energy required to heat and cool a building for human comfort conditioning including dry bulb temperature, humidity and mean radiant temperature given a specific site. In addition by using specific fuels and active mechanical systems students calculate energy use and cost.

☒ Course activities that enable students to demonstrate their ability to discuss how at least one scientific discovery changed the way scientists understand the world.

Example(s) from syllabus:
Students are required to design and analyze a building's thermal envelope for conduction, convection, emissivity, vapor migration, and thermal mass.

Brief Description:
Discovery and implementation of new building materials have changed the way wall sections are designed. For example, the use of spray foam insulation, rigid insulation and (SIPS) Structural Insulated Panels have caused us to rethink the location of and need for vapor barriers to prevent migrating water vapor from condensing inside of the building envelope. With new materials the dew point is reached inside of a non-porous material and condensation is not an issue. Therefore the use of separate vapor barriers is minimized.

☒ Course activities that enable students to demonstrate their ability to discuss the interaction of science with society.

Example(s) from syllabus:
Climate Design Strategies for passive thermal control. Social responsibility through environmental stewardship. Resource management through sound economic practices. Sustainability and LEED Certification

Brief Description:
The students in the course are required to maximize passive means of thermal control thus minimizing the use of active systems that often require the use of non-renewable sources of energy. Then students are required to use scientific methods and industry standards to analyze the energy use and cost of active systems for thermal control. Then they propose modifications that will further reduce energy use and calculate what the payback periods would be.

☒ A hands-on student project is required. This project enables students to demonstrate their ability to conduct a scientific project using scientific methods that include design, data collection, analysis, summary of the results, conclusions, alternative approaches, and future studies. Describe the required student product (paper/ laboratory report) based on the hands-on project.
Three major projects are required to demonstrate understanding of the subject matter. The first project is thermal load calculations, energy use, modifications, and economic payback periods. The second project calculates the size and pressure requirements for distribution of potable water and removal of waster and space code requirements. The third project sizes and documents the distribution of concentrated energy to and inside of buildings.

☒ Course activities that demonstrate the integration of information literacy into the course.

Example(s) from syllabus:
The three major projects use both written and graphic means to demonstrate understanding of the subject matter. The mantra here is information, application, and transformation. The students are presented information via lecture, text, and supplemental handouts. The information is applied to a design project that they are produced in Design Studio. The exercise internalizes the information and transforms the way that they approach a design problem from that point forward.

Brief Description:
Design integration with one of their Architectural Design Studio Projects.

Reviewer's Comments

**School of Architecture**
**College of Design**
**University of Kentucky**
**Environmental Controls II Lecture**
**Spring Semester 2010**

| | |
|---|---|
| Course Number | ARC 333 |
| Credit Hours | 3 |
| Course Description | A continuation of ARC 332 with emphasis on mechanically controlled interior environments seen as subsystems of the total building organization |
| Prerequisite | ARC 332 |
| NAAB Criteria | A.4 A.6 A.8 B.3 B.7 B.8 B.10 B.11 B.12 C.6 |
| Class Meetings | Thursdays 1:00 – 3:45 PM / Tuesday Study Sessions TBA |
| Class Location | 209 Pence Hall |
| Course Instruction | Bruce Swetnam<br>Office: 303-A Miller Hall, Hours M, W 12:00 – 1:00<br>Phone:(859)-257-7374<br>Email: bswet0@uky.edu |
| Course Text | Building Control Systems by Bradshaw |
| Supplemental: | Mechanical and Electrical Equipment for Buildings by Stein, Reynolds, McGuinness |
| Course Supplies | Notebook, Calculator, Graphic capabilities (computer or board) |

Course Outcomes

A basic function of architecture is to provide for human environmental comfort. Successful completion of this course will enable the designer of buildings to:

A. Analyze the quality of a mechanical system through efficiency
B. Initiate design with an intuitive understanding of the form and space requirements of environmental control systems
C. Recognize the variety of options available to provide comfort and safety
D. Coordinate the mechanical systems specialists utilized in building design development
E. Design with technology and the environment, not in spite of them

Grading

| | |
|---|---|
| Examination 1 | 20 Points |
| Examination 2 | 20 Points |
| Examination 3 | 20 Points |
| Projects (3) | 30 Points |
| Class participation | 10 Points |

Grading Scale

| | |
|---|---|
| 100-90 | A |
| 89-80 | B |
| 79-70 | C |
| 69-60 | D |
| 59 and below | E |

Reading assignments will be announced in class.

Projects and homework due dates will be announced in class. Projects submitted for evaluation must be individual student work.

Late projects will not be accepted without prior arrangement with the instructor. Any late submission will be subject to a 20 % reduction in grade for every class meeting beyond the due date.

Examination materials will be retained by the instructor. Make-up examinations will be given in emergency circumstances only.

Unannounced quizzes over reading assignments and homework will comprise the 10 point class participation grade.

Class participation / attendance is essential. Each absence beyond the first will result in a 5 point reduction in the final course grade. It is the responsibility of each student to sign the attendance sheet at each class meeting.

Examination Dates

| | | | |
|---|---|---|---|
| Examination | 1 | March | 4 |
| Examination | 2 | April | 8 |
| Examination | 3 | May | 4, 8:00 am |

Project Due Dates

| | | |
|---|---|---|
| Project 1 | February | 25 |
| Project 2 | April | 1 |
| Project 3 | April | 29 |

Course Schedule

| | | |
|---|---|---|
| January | 14 | Class introduction, Systems, Human Comfort |
| | 21 | Climate and Microclimate, Building Envelope |
| | 28 | Building Envelope, Thermodynamics, Mass |
| February | 4 | Load Calculations, Project 1 Assigned |
| | 11 | Climate Design Strategies |
| | 18 | Passive and Active Systems |
| | 25 | Economic Analysis, Project 1 Due |
| March | 4 | Test 1, Lecture and Chapters 1-6 |
| | 11 | Plumbing Supply and Fixture, Project 2 Assigned |
| | 18 | Spring Break |
| | 25 | Plumbing Waste |
| April | 1 | Fire suppression and Life Safety, Project 2 Due |
| | 8 | Test 2, Lecture and Chapters 11 and 12 |
| | 15 | Normal Electric Service, Project 3 Assigned |
| | 22 | On Site Power, Other Concentrated Energy |
| | 29 | Communication and Conveying Systems, Project 3 Due |
| May | 4 | Test 3, Lecture and Chapters 8-10,14 |

Course Objective

The concept of environmental controls, on a basic level, is about making buildings that are user-friendly. In earlier times, we simply expected buildings to provide the most immediate physical needs of thermal comfort, sanitation, and adequate lighting. These expectations have evolved dramatically in the past one hundred years.

A precursor of the changing needs and expectations and resulting architectural form is to be found in the environmentally sensitive design of a house by Catherine Beecher illustrated in The American Woman's Home magazine published in 1869. The design of this house, based on the functions related to thermal comfort, sanitary conditions and flexible use of space anticipates the residential work of Frank Lloyd Wright forty years later.

Beyond meeting the most immediate human needs, we now expect buildings to contain integrated technologies that provide concentrated energies, facilitate communication, provide life safety, and facilitate movement.

Environmental control systems have far-reaching psychological and social implications. The development of elevators, for example, resulted in an increase of urban density while the development of air conditioning changed Southern culture in the United States by moving people from their traditional front porches to the now cooler interiors.

In the study of environmental control systems, we stress not only the engineering of the systems but also their personal, social and economic implications. We recognize that these systems don't occur in isolation. We look for opportunities to integrate these technologies into a comprehensive building design and learn the languages necessary to communicate ideas to building system specialists and constructors.

This Quarter of study in Environmental Technology will consider thermal comfort, sanitation, life safety, concentrated energy and communication. It will involve the analysis of factors that affect the comfort and function of the inhabited space and study the mechanical devices that provide solutions. Projects include schematic designs for the various systems and design calculations.

Christian Norberg-Schulz wrote in 1975: " Whereas spatial organization may be described without referring to a particular technical solution, character cannot possibly be separated from the process of making."