

PURDUE UNIVERSITY

REQUEST FOR ADDITION, EXPIRATION,  
OR REVISION OF AN UNDERGRADUATE COURSE  
(10000-40000 LEVEL)



Office of the Registrar  
FORM 40 REV. 5/11

EPD 13-12  
(201310)

DEPARTMENT Civil Engineering

EFFECTIVE SESSION Fall 2012

INSTRUCTIONS: Please check the items below which describe the purpose of this request.

- |   |   |
|---|---|
| <input checked="" type="checkbox"/> 1. New course with supporting documents | <input type="checkbox"/> 7. Change in course attributes (department head signature only)  |
| <input type="checkbox"/> 2. Add existing course offered at another campus   | <input type="checkbox"/> 8. Change in instructional hours                                 |
| <input type="checkbox"/> 3. Expiration of a course                          | <input type="checkbox"/> 9. Change in course description                                  |
| <input type="checkbox"/> 4. Change in course number                         | <input type="checkbox"/> 10. Change in course requisites                                  |
| <input type="checkbox"/> 5. Change in course title                          | <input type="checkbox"/> 11. Change in semesters offered (department head signature only) |
| <input type="checkbox"/> 6. Change in course credit/type                    | <input type="checkbox"/> 12. Transfer from one department to another                      |

PROPOSED:

Subject Abbreviation CE

Course Number 41400

Long Title Building Mechanical and Electrical System Design

Short Title Bldg Mech & Elect System Dsgn

Abbreviated title will be entered by the Office of the Registrar if omitted. (30 CHARACTERS ONLY)

EXISTING:

Subject Abbreviation \_\_\_\_\_

Course Number \_\_\_\_\_

TERMS OFFERED

Check All That Apply:

Fall  Spring  Summer

CAMPUS(ES) INVOLVED

Calumet  N. Central  
 Cont Ed  Tech Statewide  
 Ft. Wayne  W. Lafayette  
 Indianapolis

CREDIT TYPE

1. Fixed Credit: Cr. Hrs. 3
2. Variable Credit Range:  
Minimum Cr. Hrs. \_\_\_\_\_  
(Check One) To  Or   
Maximum Cr. Hrs. \_\_\_\_\_
3. Equivalent Credit: Yes  No

COURSE ATTRIBUTES: Check All That Apply

1. Pass/Not Pass Only
2. Satisfactory/Unsatisfactory Only
3. Repeatable   
Maximum Repeatable Credit:
4. Credit by Examination
5. Fees:  Coop  Lab  Rate Request  
Include comment to explain fee
6. Registration Approval Type  
Department  Instructor
7. Variable Title
8. Honors
9. Full Time Privilege
10. Off Campus Experience

Schedule Type	Minutes Per Mtg	Meetings Per Week	Weeks Offered	% of Credit Allocated
Presentation	50	3	16	100
Laboratory				
Lab Prep				
Studio				
Distance				
Clinic				
Experiential				
Research				
Ind. Study				
Pract/Observ				

Cross-Listed Courses

RECEIVED

2012 JAN 23 AM 10:02

COURSE DESCRIPTION (INCLUDE REQUISITES/RESTRICTIONS):

Restriction: Junior or higher standing in the College of Engineering.  
Prerequisite: CE 31100 Architectural Engineering or instructor permission

See Attachment for Course Description

\*COURSE LEARNING OUTCOMES:

See Attachment for Course Learning Outcomes

Calumet Department Head _____ Date _____	Calumet School Dean _____ Date _____
Fort Wayne Department Head _____ Date _____	Fort Wayne School Dean _____ Date _____
Indianapolis Department Head _____ Date _____	Indianapolis School Dean _____ Date _____
Central Faculty Senate Chair _____ Date _____	Vice Chancellor for Academic Affairs _____ Date _____
West Lafayette Department Head _____ Date _____	West Lafayette College/School Dean _____ Date _____

*[Signature]* \_\_\_\_\_ Date \_\_\_\_\_  
West Lafayette Registrar

OFFICE OF THE REGISTRAR

LD 1/25/12

FORM 40 Attachment 1 for CE 41400

**CE 41400 BUILDING MECHANICAL AND ELECTRICAL SYSTEM DESIGN**

**Course Description (Include Requisites/Restrictions):**

Restriction: Junior status in the College of Engineering;

Prerequisite: CE 31100 or Instructor permission.

This course covers the design of building mechanical and electrical systems. In the first part of the course students learn principles of designing and integrating heating, ventilation, and air conditioning systems into buildings including air delivery systems, mechanical cooling and heating technologies, duct design and layout, blower and pump selection, and hydronic systems. They also learn to design heating, ventilation, and air conditioning systems within the constraint of achieving satisfactory occupant thermal comfort in buildings. The second part of the course covers design concepts related to building electrical systems; including, single and three-phase power systems, motors, transformers, switching, and relays. The course includes a design project related to mechanical and electrical systems for a commercial building.

**Course Learning Outcomes:**

Upon completion of this course, students will be able to:

- Utilize building thermal load information together with a knowledge of industry standards and numerical methods to design and integrate efficient heating, ventilation, and air conditioning systems into commercial and residential buildings.
- Understand the benefits and drawbacks of conventional and innovative mechanical systems, and identify appropriate opportunities for the selection and integration of both.
- Evaluate the performance and estimate energy consumption of common mechanical systems and components.
- Understand the operating characteristics and appropriately size the components that are integrated into building electrical systems.

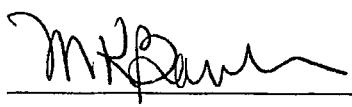
**TO:** The Faculty of the College of Engineering  
**FROM:** The Faculty of the School of Civil Engineering  
**RE:** New Undergraduate Course: CE 41400 Building Mechanical and Electrical System Design

The Faculty of the School of Civil Engineering has approved the following new course. This action is now submitted to the Engineering Faculty with a recommendation for approval.

**CE 41400 Building Mechanical and Electrical System Design**  
Sem. 1 or Sem. 2, Lecture 3, Cr. 3.  
Restriction: Junior status in the College of Engineering; Pre-requisite: CE 31100 Architectural Engineering or permission from the instructor.

**Description:** This course covers the design of building mechanical and electrical systems. In the first part of the course students learn principles of designing and integrating heating, ventilation, and air conditioning systems into buildings including air delivery systems, mechanical cooling and heating technologies, duct design and layout, blower and pump selection, and hydronic systems. They also learn to design heating, ventilation, and air conditioning systems within the constraint of achieving satisfactory occupant thermal comfort in buildings. The second part of the course covers design concepts related to building electrical systems; including, single and three-phase power systems, motors, transformers, switching, and relays. The course includes a design project related to mechanical and electrical systems for a commercial building.

**Reason:** Currently across the United States, buildings account for a large percentage of the total energy that is consumed. Often times as much as half of the energy consumed in a building is attributable to the heating, ventilation, and air conditioning systems that are responsible for maintaining a safe, healthy, and comfortable environment. Additionally, the cost of purchasing and installing these systems in new and existing buildings can represent a significant portion of a project budget. Within the Architectural Engineering emphasis area it is critical that students understand and successfully apply mechanical and electrical system design principles and methods to buildings. This course provides students with a fundamental knowledge of conventional and innovative heating, ventilating, and air conditioning equipment, and building electrical systems. The course was taught as CE 497XX in Spring 2010 and Spring 2011 with enrollments of 25 and 35, respectively.

  
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M.K. Banks  
Bowen Engineering Head and Professor  
Jack and Kay Hockema Professor of Civil Engineering

APPROVED FOR THE FACULTY  
OF THE SCHOOLS OF ENGINEERING  
BY THE ENGINEERING  
CURRICULUM COMMITTEE

ECC Minutes #9  
Date 1-17-2012  
Chairman ECC R. Cipra

## CE 41400 BUILDING MECHANICAL AND ELECTRICAL SYSTEM DESIGN

**Course Instructor:** Travis Horton

**Level:** Undergraduate Level

**Restriction:** Junior status in the College of Engineering.

**Pre-requisite:** CE31100 Architectural Engineering or instructor permission.

**Course Outcomes:** Upon completion of this course students will be able to:

- Utilize building thermal load information together with a knowledge of industry standards and numerical methods to design and integrate efficient heating, ventilation, and air conditioning systems into commercial and residential buildings.
- Understand the benefits and drawbacks of conventional and innovative mechanical systems, and identify appropriate opportunities for the selection and integration of both.
- Evaluate the performance and estimate energy consumption of common mechanical systems and components.
- Understand the operating characteristics and appropriately size the components that are integrated into building electrical systems.

### Course Outline:

- **Introduction and Concept Review.** Define the design scope for building mechanical and electrical systems; Review of fundamental engineering principles, including thermodynamic properties and processes, and fluid dynamics. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) Standard 55. Introduce computer programming and basic numerical methods. [2 weeks]
- **Air Distribution System Design.** Introduction to air delivery system configurations. Constant and variable volume air delivery systems. Duct sizing methods, including equal friction, static regain, equal velocity, and optimization-based techniques. Air system components, including air handling units, grilles, and diffusers. [4 weeks]
- **Building Ventilation Design.** Indoor air quality. Requirements for building ventilation systems and building ventilation standards. ASHRAE Standard 62. Energy recovery devices used in ventilation systems. [1 week]
- **Energy Estimating Techniques for Mechanical Systems.** HVAC energy estimating. Engineering Equation Solver (EES) thermodynamic modeling. ASHRAE Standard 90. [1 week]
- **Heating and Air Conditioning Systems.** Analysis of components and systems, including air conditioners, heat pumps, heat exchangers, boilers, furnaces, and combined heat and power systems. [4 weeks]
- **Building Electrical Systems.** Electrical system fundamentals, including single and three-phase power, voltage drop in conductors, and over-current protection systems. Building electrical system components; motors, transformers, switching, and relays. [3 weeks]

**Total = 15 weeks**

**Course website:** Purdue Blackboard

**Textbook:** R.H. Howell, et. al, Principles of Heating Ventilating and Air Conditioning, American Society of Heating, Refrigerating and Air-Conditioning Engineers, 6<sup>th</sup> Edition, 2005.

**Recommended text:** J.F. Kreider, et. al, Heating and Cooling of Buildings: Design for Efficiency, CRC Press, Taylor & Francis Group, Revised 2<sup>nd</sup> Edition, 2010.

**Grading:** Final course grade will be based on the following breakdown: 90.0% and up = A; 80.0% to 89.9% = B; 70.0% to 79.9% = C; 60.0% to 69.9% = D; 59.9% and below is an F.

Final grades will be based on the following breakdown:

Homework: 15%,  
Projects: 30%  
Quizzes: 25%,  
Exams: 30%

A typical course syllabus is appended on the following pages.

## **CE 49700 BUILDING MECHANICAL AND ELECTRICAL SYSTEM DESIGN**

**Instructor:** Dr. W. Travis Horton  
**Office:** CIVL G219  
**Phone:** 494-6098  
**Time:** MWF 12:30 p.m. - 1:20 p.m.  
**Location:** CIVL 3153  
**Office Hours:** M 2:30 p.m. – 3:30 p.m.  
W 1:30 p.m. – 2:30 p.m.  
F 11:30 a.m. – 12:30 p.m.

**Textbook:** R.H. Howell, et. al, Principles of Heating Ventilating and Air Conditioning, American Society of Heating, Refrigerating and Air-Conditioning Engineers, 6<sup>th</sup> Edition, 2005.

**Recommended text:** J.F. Kreider, et. al, Heating and Cooling of Buildings: Design for Efficiency, CRC Press, Taylor & Francis Group, Revised 2<sup>nd</sup> Edition, 2010.

**Prerequisites:** CE 31100 Architectural Engineering

### **Course Objectives:**

This course covers various aspects related to the design of building mechanical and electrical systems. In the first part of the course students learn principles of designing and integrating heating, ventilation, and air conditioning systems into a building; including, air delivery systems, mechanical cooling and heating technologies, duct design and layout, blower and pump selection, and hydronic systems. They also learn to design heating, ventilation, and air conditioning systems within the constraint of achieving satisfactory occupant thermal comfort in buildings. The second part of the course covers design concepts related to building electrical systems; including, single and three-phase power systems, motors, transformers, switching, and relays. The course includes a design project related to mechanical and electrical systems for a commercial building.

### **Homework and Projects:**

Homework and projects will be assigned regularly. Assignments should be done neatly and submitted with final solutions clearly summarized and marked. Assignments are to be submitted before the beginning of the lecture period on the due date. Assignments turned in late will lose a minimum of 50% of the points. Assignments that are more than a week late will not be accepted unless a specific arrangement has been made with the instructor prior to the due date.

### **Quizzes and Exams:**

Quizzes and exams will be administered during the semester. Quizzes and exams must be taken on the scheduled day and at the scheduled time. Students with conflicts must make arrangements to take a make-up exam or quiz with the instructor at least one week prior to the scheduled quiz or exam.

**Grading:**

Your final course grade will be based on the following breakdown: 90.0% and up = A; 80.0% to 89.9% = B; 70.0% to 79.9% = C; 60.0% to 69.9% = D; 59.9% and below is an F. Final grades will be based on the following breakdown:

Homework:	15%,
Projects:	30%
Quizzes:	25%,
Exams:	30%

**Grade challenge policy:**

Any challenges to a grade received on an assignment, quiz, or exam must be submitted to the instructor in writing within one week of receiving the grade.

**Special Accommodations:**

If you require special accommodations because of a disability, please inform the instructor of your needs by the end of the first week.

**Emergencies:**

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. Any changes will be posted to the course blackboard site.

**Academic Integrity:**

Academic dishonesty will not be tolerated. Please refer to the section, "Definition of Academic Dishonesty," on the following web page: <http://www.purdue.edu/odos/osrr/integrity.htm>. Any incidents of academic dishonesty will, at the very least, result in zero credit for the associated assignment, quiz, or exam. Further penalties, such as immediate failure of the course and/or referral to the Dean of Students, are at the discretion of the instructor.

