**Annual Academic Assessment Survey**

**Construction Management**

**Associate of Applied Science**

**Educational Effectiveness**

**Assessment Plan**

**Adopted by:**

**The Division of Construction, Design and Safety (CDS)**

**Construction Management Program**

**April 1, 2016**

#### Submitted to:

**Institutional Research / SharePoint:**

<https://nextcatalog.uaa.alaska.edu/courseleaf/courseleaf.cgi?page=/programadmin/215/index.html&step=editrecord&id=215&_=1497548891167>

**April 1, 2019**

Contents

[Construction Management Mission Statement 3](#_Toc484094070)

[Introduction 3](#_Toc484094071)

[AAS PROGRAM STUDENT LEARNING OUTCOMES 4](#_Toc484094072)

[STUDENT LEARNING OUTCOME 1 5](#_Toc484094073)

[STUDENT LEARNING OUTCOME 2 7](#_Toc484094074)

[STUDENT LEARNING OUTCOME 3 8](#_Toc484094075)

[STUDENT LEARNING OUTCOME 4 9](#_Toc484094076)

[STUDENT LEARNING OUTCOME 5 10](#_Toc484094077)

[STUDENT LEARNING OUTCOME 6 11](#_Toc484094078)

[STUDENT LEARNING OUTCOME 7 12](#_Toc484094079)

[STUDENT LEARNING OUTCOME 8 13](#_Toc484094080)

[STUDENT LEARNING OUTCOME 9 14](#_Toc484094081)

[STUDENT LEARNING OUTCOME 10 16](#_Toc484094082)

[STUDENT LEARNING OUTCOME 11 17](#_Toc484094083)

[STUDENT LEARNING OUTCOME 12 18](#_Toc484094084)

[STUDENT LEARNING OUTCOME 13 19](#_Toc484094085)

# 

# Construction Management Mission Statement

The mission of the Construction Management program is to prepare future industry employees with the education, skills, and training for entry-level professional positions in construction management.

**Goals**

* Provide an educational program of distinction that prepares individuals for professional careers in the construction industry.
* Provide a challenging learning environment that seeks to maximize the strengths and capabilities of each individual student.
* Strive for consistent improvement and modernization of the academic and technical quality of the degree program.
* Build a strong and mutually beneficial relationship between the program, the alumni, and the local, regional and national construction industry.

# Introduction

This Associate of Applied Science in Construction Management (AASCM) Educational Effectiveness Assessment Plan identifies the thirteen student learning outcomes (SLO) required to be assessed by the American Council for Construction Education (ACCE) and provides a plan for the assessment of each SLO.

All core construction courses in the AASCM program are used to provide assessment data. All data shall be collected, reviewed, and used to identify recommendations for constant improvement in the AASCM program in accordance with the AASCM Assessment Implementation Plan.

# AAS PROGRAM STUDENT LEARNING OUTCOMES

1. Demonstrate effective communication, both orally and in writing.
2. Create construction project cost estimates. (Uses BSCM SLO)
3. Create construction project schedules. (Uses BSCM SLO)
4. Demonstrate the ability to use current technology related to the construction process.
5. Interpret construction documents (contracts, specifications, and drawings) used in managing a construction project.
6. Apply basic principles of construction accounting.
7. Use basic surveying techniques used in building layout.
8. Discuss basic principles of ethics in the construction industry.
9. Identify the fundamentals of contracts, codes, and regulations that govern a construction project.
10. Recognize basic construction methods, materials and equipment.
11. Recognize basic safety hazards on a construction site and standard prevention measures.
12. Recognize the basic principles of structural design.
13. Recognize the basic principles of mechanical, electrical and piping systems.

# 

# STUDENT LEARNING OUTCOME 1

**1. Demonstrate effective communication, both orally and in writing.**

1.1 Source Course – AET A102 – Methods of Building Construction

**Assessment Data 1.1** –

Assignment: Group Case Study Building Analysis

*Methods of Building Construction* introduces basic knowledge of building materials, systems, and assemblies. The class focus is on current, commonly used methods and materials. Research assignments are intended to supplement students’ understanding of the range of methods and materials available within the construction industry. The *Group Case Study Building Analysis* assignment is intended to familiarize students with the methods and materials of building construction through direct observation, research, and analysis. Students are assigned to teams and asked to select an existing structure in Anchorage, Alaska. The team will write a research paper and present their findings to the class using presentation media (preferably Powerpoint).

This assignment is worth 500 points based on the following rubric:

**Grading Rubric**

|  |  |
| --- | --- |
| **CRITERIA** | **POINTS** |
| Final Written Report:  8 to 10 pages, typed, double spaced, Arial font, size 12 / one paper submitted per team | 200 |
| Visual Documentation:  PowerPoint Slide Deck / minimum of 20 to 30 slides with images | 200 |
| In-Class Presentation:  Oral Group Presentation 50 points  Peer Review 50 points | 100 |
| **TOTAL POINTS** | **500** |

STUDENT LEARNING OUTCOME 1 (continued)

1.2 Source Course – CM A201 – Construction Project Management I

**Assessment Data 1.2** –

Assignment: Project 7 / Project Engineers Guest Panel Reflection Papers

*Construction Project Management I* examines construction project management methods and processes. *Project 7* focuses on effective communication, both orally and in written form. Students are asked to prepare at least four (4) questions to ask participants of a Project Engineers Panel. The questions must be submitted to the instructor in advance of the panel discussion. Students are encouraged to actively participate in the panel discussion, as well as take appropriate notes. This assignment provides an opportunity for students to practice active communication skills. Following the panel discussion, students will summarize the information presented during the panel discussion in a reflections paper.

This assignment is worth 25 points based on the following rubric:

**Grading Rubric**

|  |  |
| --- | --- |
| **CRITERIA** | **POINTS** |
| Written Communication –  Meet questions submission deadline 2.5 points  Submit at least four (4) questions 2.5 points  At least one paragraph per panelist in reflections paper 10 points  Use of proper spelling, grammar and punctuation 5 points | 20 |
| Oral Communication – Participation in discussion | 5 |
| **TOTAL POINTS** | **25** |

# STUDENT LEARNING OUTCOME 2

**2. Create construction project cost estimates.**

2.1 Source Course – CM A163 – Building Construction Cost Estimating

**Assessment Data 2.1** –

Assignment: Outhouse Cost Estimate

The *Building Construction Cost Estimating* course focuses on the basics of developing a cost estimate for a structural construction project. The *Outhouse Cost Estimate* assignment provides students with an opportunity to learn and understand the fundamentals of preparing a cost estimate for a basic structure. Students are asked to review the drawing and specifications, and then prepare a Quantity Sheet to estimate the cost of the materials required to complete construction of this building.

This assignment is graded on a Pass/Fail standard; Pass equals 100 points / Fail equals 0 points.

STUDENT LEARNING OUTCOME 2 (continued)

2.2 Source Course – CM A263 – Civil Construction Cost Estimating

**Assessment Data 2.2** –

Assignment: Mallard Lane Cost Estimate

The *Civil Construction Cost Estimating* course focuses on the basics of developing a cost estimate for a civil construction project. The *Mallard Lane Cost Estimate* assignment provides students with an opportunity to learn and understand the fundamentals of preparing a cost estimate for a basic road construction project. Students are asked to review the drawing and specifications, and then use the Average End Area Method to prepare an estimate of the materials required to complete the construction project.

This assignment is worth 60 points.

# 

# STUDENT LEARNING OUTCOME 3

**3. Create construction project schedules.**

3.1 Source Course – CM A202 – Project Planning and Scheduling

**Assessment Data 3.1** –

Assignment: Project 2 / Warehouse CPM Schedule

*Project Planning and Scheduling* introduces students to project management fundamentals. In the *Warehouse CPM Schedule* assignment, the students are asked to create a detailed CPM schedule for a warehouse construction project. The students are given a project scope, and asked to identify all activities, create a work breakdown structure, estimate activity durations, perform a forward pass calculating project duration, perform a backward pass, identify total float, and critical path. The final submission will be a printed CPM network diagram (completed in either Excel or MS Project), as well as written answers to four (4) questions regarding activity duration, critical path, completion dates, and redundant arrows.

This assignment is worth 100 points.

STUDENT LEARNING OUTCOME 3 (continued)

3.2 Source Course – CM A202 – Project Planning and Scheduling

**Assessment Data 3.2** –

Assignment: Project 1 / Clean Your Room Schedule

The *Clean Your Room* assignment is the first project schedule exercise for students in the Project Planning and Scheduling class. Each student must develop a project schedule and materials checklist. Students are encouraged to use the WORKDAY feature in Excel. The project schedule must identify all the necessary tasks required to complete the project. The final deliverable is a CPM schedule with a printed network diagram and list of required supplies.

This assignment is worth 100 points.

# 

# STUDENT LEARNING OUTCOME 4

**4. Demonstrate the ability to use current technology related to the construction process.**

4.1 Source Course – AET A101 Fundamentals of CADD for Building Construction

Assignment: Project 5 / Electrical Plan

*Fundamentals of CADD for Building Construction* introduces students to AutoCAD in the creation and use of construction drawings. *Project 5* asks students to build on their understanding of how to make and read construction documents by using floor plans that they have developed in previous assignments to create an electrical plan of a building. They are required to reference electrical outlets and devices to understand the symbols used in construction documents and how symbols are used to navigate a set of construction documents. Students must understand the configuration of building components and accurately draw and locate them in reference to a floor plan. Students must identify special outlet symbols and understand what building elements are communicated in an electrical plan drawing.

The assignment is worth 100 points.

STUDENT LEARNING OUTCOME 4 (continued)

4.2 Source Course – AET A101 – Fundamentals of CADD for Building Construction

**Assessment Data 4.2** –

Assignment: Revit OAS Column Designation

*Fundamentals of CADD for Building Construction* introduces students primarily to AutoCAD in the creation and use of construction documents. They are taught that the Contract Drawings are only a part of the overall Contract Documents and that the written Specifications and Contract Requirements must be used in conjunction with the drawings. However, other software applications and programs are utilized in the construction industry, and students are encouraged to explore this options. The *Revit OAS Column Designation* assignment provides an opportunity for students to gain some basic experience with Revit. This assignment has three (3) components: creation of an architectural drawing, Mechanical, Electrical and Plumbing drawings (MEP), and a 3D structural rendering.

This assignment is worth 300 points (100 points per component).

STUDENT LEARNING OUTCOME 4 (Continued)

4.3 Source Course – CM A213 – Construction Civil Technology

**Assessment Data 4.3** –

Assignment: Final Project

*Construction Civil Technology* outlines the elements of civil design as it relates to the construction industry. Students become familiar with all the major design tasks in a civil project. They employ Autodesk Civil 3D to go from field information to finished design. In the *Final Project*, students identify data collected in the field, convert it to a known surveying format file, setup a coordinate system and import the information using Civil 3D software. The process includes the creation of drawings with the survey data points of known existing features. Using this information students create and identify an existing surface to be used as a base for the design of a proposed site.

The Final Project is worth 10% of the student’s overall grade.

# STUDENT LEARNING OUTCOME 5

**5. Interpret construction documents (contracts, specifications, and drawings) used in managing a construction project.**

5.1 Source Course – AET A101 – Fundamentals of CADD for Building Construction

**Assessment Data 5.1** -

Assignment: Test 1

*Fundamentals of CADD for Building Construction* introduces students to AutoCAD in the creation and use of construction documents. They are taught that the Contract Drawings are only a part of the overall Contract Documents and that the written Specifications and Contract Requirements must be used in conjunction with the drawings. *Test 1* demonstrates the range of material that students are expected to know in order to effectively interpret construction drawings, cross referencing graphic information with written information.

The test is worth 100 points.

STUDENT LEARNING OUTCOME 5 (continued)

5.2 Source Course – CM A201 – Construction Project Management I

**Assessment Data 5.2** -

Assignment: Exam 1

*Construction Project Management I* introduces students to the management facets of a construction project. *Exam 1* tests the student’s understanding of how to interpret construction documents, such as contracts, specifications, and drawings, and apply this knowledge in the formulation of project management strategies.

The test is worth 200 points.

# STUDENT LEARNING OUTCOME 6

**6. Apply basic principles of construction accounting.**

6.1 Source Course – CM A163 – Building Construction Cost Estimating

**Assessment Data 6.1** –

Assignment: Test 1, Question 11

The *Building Construction Cost Estimating* course focuses on the basics of developing a cost estimate for a structural construction project. *Test 1, Question 11* provides students with an opportunity to become familiar with fundamental principles of accounting as relates to a construction project.

This assignment is worth 100 points.

STUDENT LEARNING OUTCOME 6 (continued)

6.2 Source Course – CM A201 – Construction Project Management I

**Assessment Data 6.2** –

Assignment (Fall 2017 - Carter): Project 7 / Project Engineers Guest Panel Reflection Papers

*Construction Project Management I* examines construction project management methods and processes. For *Project 7*, students were asked to prepare at least four (4) questions to ask participants of a Project Engineers Panel. The panel consisted of industry representatives, and covered all facets of the construction management process, including financial and legal issues. Students were encouraged to actively participate in the panel discussion, as well as take appropriate notes. Following the panel discussion, students summarized the information presented during the panel discussion in a reflections paper.

This assignment is worth 25 points based on the following rubric:

**Grading Rubric**

|  |  |
| --- | --- |
| **CRITERIA** | **POINTS** |
| Written Communication –  Meet questions submission deadline  Submit at least four (4) questions  At least one paragraph per panelist in reflections paper  Use of proper spelling, grammar and punctuation | 20 points  2.5  2.5  10  5 |
| Oral Communication – Participation in discussion | 5 |
| **TOTAL POINTS** | **25** |

# STUDENT LEARNING OUTCOME 7

**7. Use basic surveying techniques used in building layout.**

7.1 Source Course – AET A101 – Fundamentals of CADD for Building Construction

**Assessment Data 7.1** –

Assignment: Project 7 / Topographical Layout

In *Fundamentals of CADD for Building Construction,* students are introduced to AutoCAD in the creation of a topographical layout utilizing surveying data. They are taught that written specifications and surveying data must be used in conjunction with the creation of drawings. This assignment demonstrates the range of material that students are expected to know in order to effectively interpret and develop construction drawings.

This assignment is worth 100 points.

STUDENT LEARNING OUTCOME 7 (continued)

7.2 Source Course – CM A213 – Construction Civil Technology

**Assessment Data 7.2** –

Assignment: Final Project

*Construction Civil Technology* outlines the elements of civil design. Students become familiar with all the major design tasks in a civil project: design, material quantities, costs estimation. Students are introduced to construction surveying.

The Final Project is worth 10% of the student’s overall grade.

# STUDENT LEARNING OUTCOME 8

**8. Discuss basic principles of ethics in the construction industry.**

8.1 Source Course – CM A163 – Building Construction Cost Estimating

**Assessment Data 8.1** –

Assignment: Test 2, Question 14 Essay

The *Building Construction Cost Estimating* course focuses on the basics of developing a cost estimate for a structural construction project. *Test 2, Question 14* provides students with an opportunity to explore alternative decision-making methods that encompass various financial, legal and ethical aspects of a construction management project.

This assignment is worth 100 points.

STUDENT LEARNING OUTCOME 8 (continued)

8.2 Source Course – CM A201 – Construction Project Management I

**Assessment Data 8.2** –

Assignment: Project 7 / Project Engineers Guest Panel Reflection Papers

*Construction Project Management I* examines construction project management methods and processes. For *Project 7*, students were asked to prepare at least four (4) questions to ask participants of a Project Engineers Panel. The panel consisted of industry representatives, and covered all facets of the construction management process, including ethical and legal issues. Students were encouraged to actively participate in the panel discussion, as well as take appropriate notes. Following the panel discussion, students summarized the information presented during the panel discussion in a reflections paper.

This assignment is worth 25 points based on the following rubric:

**Grading Rubric**

|  |  |
| --- | --- |
| **CRITERIA** | **POINTS** |
| Written Communication –  Meet questions submission deadline  Submit at least four (4) questions  At least one paragraph per panelist in reflections paper  Use of proper spelling, grammar and punctuation | 20 Total  2.5  2.5  10  5 |
| Oral Communication – Participation in discussion | 5 |
| **TOTAL POINTS** | **25** |

# STUDENT LEARNING OUTCOME 9

**9. Identify the fundamentals of contracts, codes, and regulations that govern a construction project.**

9.1 Source Course – AET A123 – Codes and Standards

**Assessment Data 9.1** –

Assignment: Test 1

This entire course is based on the Municipality of Anchorage Title 21 (Land Use), the 2012 International Building Code, and associated codes which is regulatory law. The final exam has includes 25 regulatory law questions and problems based on the 2012 IBC. The final exam has a point value of 300 points which is approximately 13 percent of the student’s grade for the course. The scores for the final exam are direct measure of each student’s understanding of fundamentals of contracts, codes, and regulations that govern a construction project.

Test 1 has 32 questions and is worth 100 points.

***Alternative Assessment 9.1*** *There is no final exam. A final project of a code analysis for a proposed structure, as presented in a construction document set, is prepared by the student. The code analysis incorporates elements of the Title 21 and the IBC that include: Zoning districts; Setbacks; Parking; Accessibility for parking, access, and operations; Landscaping requirements; Construction types classification; Height and area limitations and modifications; Occupancy use; Means of egress; Fire resistance ratings for components and assemblies; and Special inspection requirements.*

*The code analysis is prepared by listing: Existing conditions for each category, cite code required conditions with references, and recommendations for compliance where deficiencies in the design are recognized. Students also edit the construction documents to show the ‘worst case scenario’ for path of egress, location of alarms, exit signs, a fire control center, and emergency lighting. The project comes from their own design results in the AET A121 Architectural Drawing class or a student designed building for the theoretical UAA School of Architecture.*

*There is a scoring sheet and the value of the project is 100 out of a total of 2000 points possible for the class.*

STUDENT LEARNING OUTCOME 9 (continued)

9.2 Source Course – CM A201 – Construction Project Management I

**Assessment Data 9.2** –

Assignment: Project 3 / General Conditions of the Contract

*Construction Project Management I* examines construction project management methods and processes. Understanding the contractual and regulatory fundamentals that govern a construction project are essential to a student’s success in the construction industry. *Project 3 – General Conditions of the Contract* covers in detail how a new project team member becomes familiar with the contractual framework of a specific construction project to which they have been assigned.

Students are directed to research the AIA A201 (document provided by instructor), and using the sample reference table, compile a comprehensive list of responsibilities by AIA A201 article in order to understand the fundamentals of contracts, codes, and regulations that govern a construction project.

This assignment is worth 50 points.

# STUDENT LEARNING OUTCOME 10

**10. Recognize basic construction methods, materials and equipment.**

10.1 Source Course – AET A102 – Methods of Building Construction

**Assessment Data 10.1** –

Assignment: Group Case Study Building Analysis

*Methods of Building Construction* introduces basic knowledge of building materials, systems, and assemblies. The class focus is on current, commonly used methods and materials. Research assignments are intended to supplement students’ understanding of the range of methods and materials available within the construction industry. The *Group Case Study Building Analysis* assignment is intended to familiarize students with the methods and materials of building construction through direct observation, research, and analysis. Students are assigned to teams and asked to select an existing structure in Anchorage, Alaska. The team will write a research paper and present their findings to the class using presentation media (preferably Powerpoint).

This assignment is worth 500 points based on the following rubric:

**Grading Rubric**

|  |  |
| --- | --- |
| **CRITERIA** | **POINTS** |
| Final Written Report:  8 to 10 pages, typed, double spaced, Arial font, size 12 / one paper submitted per team | 200 |
| Visual Documentation:  PowerPoint Slide Deck / minimum of 20 to 30 slides with images | 200 |
| In-Class Presentation:  Oral Group Presentation 50 points  Peer Review 50 points | 100 |
| **TOTAL POINTS** | **500** |

STUDENT LEARNING OUTCOME 10 (continued)

10.2 Source Course – CM A163 – Building Construction Cost Estimating

**Assessment Data 10.2** –

Assignment: Outhouse Cost Estimate

The *Building Construction Cost Estimating* course focuses on the basics of developing a cost estimate for a structural construction project. The *Outhouse Cost Estimate* assignment requires students to identify basic construction methods, equipment, and materials for the construction of a basic structure. Students are asked to review the drawing and specifications, and then prepare a Quantity Sheet to identify the materials required to complete construction of this building.

This assignment is graded on a Pass/Fail standard; Pass equals 100 points / Fail equals 0 points.

# STUDENT LEARNING OUTCOME 11

**11. Recognize basic safety hazards on a construction site and standard prevention measures**.

11.1 Source Course – CM A201 – Construction Project Management I

**Assessment Data 11.1** –

Assignment: Quiz 3

*Construction Project Management I* examines construction project management methods and processes. Students are introduced to the potential safety hazards in a construction worksite. The students understanding of the safety hazards on a construction site and standard prevention measures are assessed in *Quiz 3*. This quiz includes 10 essay style questions.

The assignment is worth 25 points.

STUDENT LEARNING OUTCOME 11 (continued)

11.2 Source Course –OSH A405 (effective Spring 2018) – Construction Industry Safety Management

**Assessment Data 11.2** –

Assignment: OSHA 30-hour Construction Safety and Health Training Course

**In Fall of 2017, students were presented with safety plan requirements via lectures, printed materials, videos, and Illness & Injury Prevention Program (IIPP) requirements from the OSHA, Army Corps of Engineers & American National Standards Institute (ANSI). Students were also provided with a copy of an IIPP that was developed for CM A205.**

**Effective as of the Spring 2018 semester, CM A205 was replaced with OSH A405 *Construction Industry Safety Management*. This course, offered through the UAA Community and Technical College’s Occupational Safety and Health program (OSH) and taught by a certified OSH instructor, provides students with a more robust and comprehensive understanding of potential workplace hazards and prevention strategies.**

**Students enrolled in the OSH A405 class are presented with the curriculum of the OSHA 30-Hour Construction Industry Outreach Program. This training program** provides training for workers and employers on the recognition, avoidance, abatement, and prevention of safety and health hazards in workplaces. The program specifically addresses the OSHA Focus Four Hazards **(Falls, Struck-by, Electrocution and Caught-in or Between).**

**Completion of all thirty (30) contact hours of the OSHA 30-Hour Construction Industry Outreach Training program is considered to have met the student learning outcome and is used to assess this student learning outcome for both semesters.**

Students receive a course certification card upon successful completion of this course.

# STUDENT LEARNING OUTCOME 12

**12. Recognize the basic principles of structural design.**

12.1 Source Course – AET A231 – Structural Technology

**Assessment Data 12.1** –

Assignment: Test 2

*Structural Technology* examines structural theory and the physical principles that underlie structural behavior. The course is divided into analysis and design. The projects that demonstrate the basis structural design are the shear and moment diagrams. Design can only proceed when the effects of loading are known.

*Test 2* evaluates students’ ability to recognize the principles of equilibrium and the effects of loading on a beam.

Test 2 is worth 200 points. The problems in CM A231 are graded on the correctness of the solution, however points are deducted for unprofessional presentation.

STUDENT LEARNING OUTCOME 12 (continued)

12.2 Source Course – AET A231 – Structural Technology

**Assessment Data 12.2** –

Assignment: Test 3

*Structural Technology* examines structural theory and the physical principles that underlie structural behavior. The course is divided into analysis and design. The projects that demonstrate the basic principles of structural design are the design of beams in three different materials – steel, wood, and reinforced concrete. This data point is the design of simply supported wide-flange steel beams that are a part of a structural framework. *Test 3* evaluates students’ ability to recognize the principles of structural design of steel beams.

Test 3 is worth 200 points. The problems in CM A231 are graded on the correctness of the solution, however points are deducted for unprofessional presentation.

# STUDENT LEARNING OUTCOME 13

**13. Recognize the basic principles of mechanical, electrical and piping systems.**

13.1 Source Course – AET A142 – Mechanical & Electrical Technology

**Assessment Data 13.1** **– Mechanical Systems**

Assignment: Project 5

*Mechanical and Electrical Technology* introduces students to the basic concepts, processes, and fundamentals of mechanical and electrical systems common to all buildings. *Project 5* focuses on the fluid mechanics associated with water supply systems and the principles used in determining drain, waste, and vent (DWV) requirements. It requires students to calculate water supply pipe requirements based on municipal water supply pressure. Students must reference the Uniform Plumbing Code (UPC) to determine the number of Water Supply Fixture Units associated with supply lines to calculate pipe sizes. Students must also use the UPC to determine the Drainage Fixture Units used to calculate DWV requirements. Calculations are presented in AutoCAD as a Mechanical Plan layout.

Project 5 is worth 80 points.

STUDENT LEARNING OUTCOME 13 (continued)

13.2 Source Course – AET A142 – Mechanical & Electrical Technology

**Assessment Data 13.2** - **Electrical Systems**

Assignment: Final Exam

*Mechanical and Electrical Technology* introduces students to the basic concepts, processes, and fundamentals of mechanical and electrical systems common to all buildings. The *Final Exam* covers material primarily associated with electrical systems. Students must be able to differentiate between series and parallel circuits, AC and DC power, calculate amps, volts, watts, and power within electrical circuits, explain how electrical components (such as GFCI receptacles, single pole, double pole, 3-way & 4 way switches, and transformers) work, explain the types and relative efficiencies of various lamps, demonstrate the use of National Electrical Code tables to determine safe wire sizes, and calculate demand and power usage.

The Final Exam is worth 180 points.