ARCH A220: BUILDING MATERIALS AND SYSTEMS

Item	Value
Curriculum Committee Approval Date	12/07/2022
Top Code	020100 - Architecture and Architectural Technology
Units	4 Total Units
Hours	144 Total Hours (Lecture Hours 36; Lab Hours 108)
Total Outside of Class Hours	0
Course Credit Status	Credit: Degree Applicable (D)
Material Fee	Yes
Basic Skills	Not Basic Skills (N)
Repeatable	No
Grading Policy	Standard Letter (S)

Course Description

This advanced course focuses on the materials, building systems, design, and construction methods used for non-residential construction. The course will include field studies and hands-on projects that explore the principles and properties of various building materials and systems and sustainable considerations. ADVISORY: ARCH A180. Transfer Credit: CSU.

Course Level Student Learning Outcome(s)

1. Identify materials, products and principles of construction used in non-residential buildings through field studies and researched reports.
2. Demonstrate understanding of materials and their properties through design and construction of sample projects and the documentation of the construction process.

Course Objectives

- 1. Identify materials products and principles of construction typically used in commercial and industrial buildings.
- 2. Apply State Building Code standards as appropriate.
- 3. Identify basic principles in site development with respect to soils, grading, drainage, and retaining walls.
- 4. Identify basic structural engineering theories as applied in concrete, steel, masony and wood construction.
- 5. Apply the principles of architectural drafting and/or sketching by detailing the illustration and description of various material components for each building system.
- 6. Interpret the appropriate use of materials and systems of buildings observed on field trips.
- 7. Experiment the strength of materials through hands on field construction and scientific analysis.
- 8. Demonstrate the thermal efficiency of the assembly of differing building components.
- 9. Identify the engineering principles/requirements of heating, ventilating and air conditioning, plumbing and electrical systems in building construction.
- 10. Comprehend the scope of technical data required to meet regulatory controls and to obtain building permits.
- 11. Demonstrate understanding of how to use materials sustainably and methods for conservation of resources.
- 12. Demonstrate knowledge of materials and methods of construction through hands-on projects.
- 13. Document the design and construction process of projects with drawings and images.

Lecture Content

General structural design/engineering principles Basic soil mechanics Topography/topographic maps/mapping conventions. Terrain and methods of slope analysis Grading principles – technical, physical, environmental considerations – design guidelines for grading aesthetics, utilities/infrastructures. Bearing systems – shallow and deep foundations Basic applications of piling Column, wall, and strip footings Retaining walls and waterproofing Concrete History and general properties Sitecast/precast systems Form, mix pour sample concrete Field slump test cylinder sample for future strength test Principles of reinforcement Floor and roof framing systems Pretensioning and posttensioning Wall, column, beam and slab systems Estimating preliminary designs for concrete structures Testing and evaluation of strength requirements Masonry General, solid unit masonry, and concrete masonry Masonry wall types, bearing wall construction Reinforced masonry walls Grout and mortar Veneer installation requirements Steel General, structural engineering principles Commonly used steel shapes – open-web steel joists, joist girders Rivets, bolts, welding, welding symbols – shear and moment connections Simple frame/ rigid frame construction Floor and roof decking – metal decking – composite construction – fireproofing Longer spans in steel –trusses Lightweight steel frames Estimating preliminary designs of steel structures Wood General properties, forest management harvesting Basic engineering concepts and load bearing process Sawn timber elements Manufactured/engineered element Plywood sheets Laminated structural products Assembled truss components Connectors and fasteners Building Envelope Roofing Sloped roof materials and installation Flat roof materials and installation Flashing and intersecting planes Glass and Glazing Window units Window systems/curtain walls Thermal efficiency/solar effects Frame material and installation Exterior Finishes Products Weatherproofing installation Thermal/Insulation requirements Interior Finishes Products and Installation Appropriate application for use Partitions and walls Code influence of fire rated assemblies Doors – Types and Installation Mechanical Requirements Plumbing Supply piping products and principles Waste piping products and principles Heating, ventilating and air conditioning Principles of heating systems Material components requirements Building design requirements Code required efficiency and conservation Electrical Requirements Principles of distribution Power requirements General use Equipment Lighting requirements Lamp fixture types General task lighting Code required efficiency and conservation.

Lab Content

Lab will include field studies, projects, product demonstrations, and small group assignments that apply the knowledge covered in lectures and readings and corresponding to the lecture outline to include: Wood Case Study Research Detail analysis Diagram and model sample construction Preparation of report and presentation Wood Structural Model Bridge, tower, or boomlever project Performance criteria for model Research, design of structure Construction of structure Testing and analysis of structure Report findings Concrete Project Bench, lantern, chair, or similar project Research, design of project Construction for forming Concrete mix

design Pouring curing of concrete, removing forms Analysis and reporting of project Complex Structures Diagrid, monocoque, or composite structure Research, design of project Construction techniques and modeling Digital animation of process, concept Analysis and presentation of project Field Studies Product and manufacturing site visits Simpson, Angelus Block Construction sites - as available Significant architectural sites - as available Report and documentation of field visits

Method(s) of Instruction

- Lecture (02)
- DE Live Online Lecture (02S)
- DE Online Lecture (02X)
- Lab (04)
- DE Live Online Lab (04S)
- DE Online Lab (04X)

Instructional Techniques

1. Instructor lectures, audio-visual demonstrations, field trips, and guest speakers 2. Student-teacher discussions, dialogue, and evaluations 3. Field construction, hands-on experience

Reading Assignments

Reading assignments include technical reference material from the texts, online product technical resources, and other current resources as needed for projects. Students will read approximately 3 hours from the textbook and other assignments and resources.

Writing Assignments

Written assignments include field study reports, project descriptions and annotation, case study reports, and short writings for exams. Students will spend appoximately 1 hour a week analyzing building systems and materials and studying their application in architecture.

Out-of-class Assignments

Examples of out-of-class assignments include model studies (physical and digital), small construction projects, and case study reports. Students will spend 2 hours a week working on assignments including drawings, written response, and other modes of evaluation.

Demonstration of Critical Thinking

Critical thinking is demonstrated in the process of project development, development of construction detailing and building sequencing for projects, written tests, and reports.

Required Writing, Problem Solving, Skills Demonstration

Writing, problem solving, and skills are demonstrated in projects, reports, execution of built models and construction projects, and presentation of projects and experiment findings.

Eligible Disciplines

Architecture: Any bachelors degree and two years of professional experience, or any associate degree and six years of professional experience.

Textbooks Resources

1. Required Francis D. K. Ching. Building Construction Illustrated, Current ed. Wiley, 2019 Rationale: This book is also used for Arch A180, the Construction Document Class. This is an industry standard reference book. 2. Required Allen, Edward, Iano, Joseph. Fundamentals of Building Construction: Materials and Methods, 6th ed. Wiley, 2013 Rationale: This book covers topics of building systems used in the construction of buildings and materials necessary to understand those systems.

Other Resources

1. Computers, printers, and projectors capable of running all the software needed. 2. Fabrication equipment including: Lasers, CNC, woodshop/ power tools, vacuum former, and 3-D printing. 3. Construction tools including: Saws, sanders, planers, and hand tools. 4. Materials including: wood, concrete, hardware, fasteners, adhesives, metal, glass/acrylics, and plastics.