

## AREN Block Diagram – Fall 2020

| Sem.      | CR |                                                                                               |                                                                                                     |                                                                                                     |                                                                                               |                                                                                       |                                                                        |
|-----------|----|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| 8<br>SPR  | 14 | <u>Technical Elective-3cr</u>                                                                 |                                                                                                     | <u>Technical Elective-3cr</u><br>From page 2                                                        | <b>AREN 4319-2cr</b><br>AREN Design 2<br>(AREN 4318, 4080)<br>#                               | <u>Free Elective-3cr</u>                                                              | <u>HSS Elective-3cr</u><br>Upper-division                              |
| 7<br>FALL | 17 | <u>Technical Elective-3cr</u>                                                                 | <b>AREN 4570-3cr</b><br>Electrical Systems<br>for Buildings<br>(AREN 3040)<br>#                     | <u>Technical Elective-3cr</u><br>From page 2                                                        | <b>AREN 4318-3cr</b><br>AREN Design 1<br>(See notes****)<br>#                                 | <b>AREN 4080-2cr</b><br>Arch. Design<br>Studio 2<br>(AREN 3080)<br>#                  | <u>HSS Elective-3cr</u>                                                |
| 6<br>SPR  | 15 |                                                                                               | <b>AREN 3040-3cr</b><br>Electrical Circuits<br>(pre/co-req APPM 2360, PHYS 1120)<br>#               | <b>AREN 4110-3cr</b><br><b>Building Energy Systems Engineering</b><br>(AREN 3010)<br>#              | <b>AREN 4506-3cr</b><br>Pre-Construction<br>Estimating & Scheduling<br>(pre/co-req CVEN 3246) | <b>Structural Design-3cr</b><br>CVEN 4545 or 4555**<br>(CVEN 3525)                    | <b>ARCH 3214-3cr</b><br>History and<br>Theory of Arch. 2<br>#          |
| 5<br>FALL | 15 |                                                                                               | <b>AREN 4550-3cr</b><br>Illumination 2<br>(AREN 3540)<br>#                                          | <b>AREN 3010-3cr</b><br>Energy Efficient<br>Buildings<br>(AREN 2050, 2110, 2120)<br>#               | <b>CVEN 3246-3cr</b><br>Introduction to<br>Construction<br>(36+ credit hours)                 | <b>CVEN 3525-3cr</b><br>Structural Analysis<br>(CVEN 3161)                            | <u>College-Approved Writing Course-3cr***</u>                          |
| 4<br>SPR  | 17 | <b>APPM 2360-4cr</b><br>Introduction to<br>Linear Algebra &<br>Diff. Equations<br>(APPM 1360) | <b>AREN 3540-3cr</b><br>Illumination 1<br>(CSCI 1200, APPM 2350)<br>#                               | <b>AREN 2120-3cr</b><br>Fluid Mech &<br>Heat Transfer<br>(AREN 2110, co-reqs. APPM 2350, 2360)<br># | <b>AREN 3080-3cr</b><br>OR<br><b>AREN 4830</b><br>Arch. Design<br>Studio 1<br>#               | <b>CVEN 3161-3cr</b><br>Mechanics of<br>Materials 1<br>(CVEN 2121, co-req. APPM 2360) | <b>CVEN 2017-1cr</b><br>Excel, Python, R<br>Primer<br>(CSCI 1200)<br># |
| 3<br>FALL | 17 | <b>APPM 2350-4cr</b><br>Calculus 3 for<br>Engineers<br>(APPM 1360)                            | <b>PHYS 1120-4cr</b><br>Gen. Physics 2<br>(PHYS 1110, co-req. APPM 1360)                            | <b>AREN 2110-3cr</b><br>Thermodynamics<br>(PHYS 1110, co-req. APPM 1360)                            | <b>AREN 2050-3cr</b><br>Bldg. Materials<br>& Systems<br>(Soph. standing)<br>#                 | <b>CVEN 2121-3cr</b><br>Analytical<br>Mechanics 1<br>(PHYS 1110, co-req. APPM 2350*)  |                                                                        |
| 2<br>SPR  | 17 | <b>APPM 1360-4cr</b><br>Calculus 2 for<br>Engineers<br>(APPM 1350)                            | <b>PHYS 1110-4cr</b><br>Gen. Physics 1<br>(co-req. APPM 1350)                                       |                                                                                                     | <b>AREN 1027-3cr</b><br>Engineering<br>Drawing                                                | <b>GEEN 1400-3cr</b><br>Engrg. Projects<br>OR<br><b>Basic Engineering Elective</b>    | <u>HSS Elective-3cr***</u>                                             |
| 1<br>FALL | 16 | <b>APPM 1350-4cr</b><br>Calculus 1 for<br>Engineers<br>(APPM 1235 or placement)               | <b>CHEN 1201-4cr</b><br>Gen. Chem. for<br>Engineers 1<br>(1yr HS chem. or<br>CHEM 1021, HS algebra) | <b>Science Lab-1cr †</b><br>CHEM 1114 or<br>PHYS 1140                                               | <b>AREN 1316-1cr</b><br>Introduction to<br>Architectural<br>Engineering<br>#                  | <b>CSCI 1200-3cr</b><br>Intro to<br>Computational<br>Thinking<br>#                    | <u>HSS Elective-3cr***</u>                                             |

Fall 2020/Revised May 2026

# Course is offered only once per year (FALL or SPRING as shown).

() Prerequisite and co-requisite requirements for course listed.

\* Co-requisite APPM 2350; OR co-requisite APPM 1360 and prerequisite GEEN 3830 Engineering Analysis & Problem Solving.

\*\* CVEN 4545 Steel Design offered SPRING only; CVEN 4555 Reinforced Concrete Design offered FALL only.

\*\*\* College-approved writing courses: ENES 1010 (first-year students only); or ENLP 3100, ENES 3100, WRTG 3030, WRTG 3035, or PHYS 3050 (jr. standing). Students who want to take ENES 1010 can switch the HSS elective in Term 1 or 2 with the writing course in Term 5.

\*\*\*\* Prerequisites for AREN 4316: AREN 4110, AREN 4506, AREN 4550, and CVEN 4545 or 4555. Co-requisite: AREN 4570.

† Students can choose either the chemistry lab CHEM 1114 in Term 1 or physics lab PHYS 1140 in Term 3.

## **AREN ELECTIVES AND OPPORTUNITIES FOR SPECIALIZATION**

At least two technical electives must be selected from this list, from any emphasis area(s).  
Some technical electives are offered intermittently, and are not guaranteed to be offered every year.  
Graduate versions of combined courses (e.g. CVEN 5728 instead of CVEN 4728) are also accepted.

### **STRUCTURAL SYSTEMS**

**Strongly recommended:** CVEN 4545 Steel Design\* (CVEN 3525) – spring  
CVEN 4555 Reinforced Concrete Design\* (CVEN 3525) – fall  
CVEN 4525 Computational Structural Analysis 1 (CVEN 3525) - fall

**Recommended:** CVEN 4565 Design of Wood Structures (CVEN 3525) – spring every other year  
CVEN 4728 Foundation Engineering (CVEN 3718) – spring

**Other options:** AREN 4315 Masonry Design (CVEN 3525) – spring every other year  
AREN 5660 Embodied Carbon in Buildings (instructor consent) – spring  
CVEN 4161 Mechanics of Materials II (CVEN 3161) – fall

*\*Can only be taken as a technical elective if not used to fulfill the Structural Design requirement.*

### **MECHANICAL SYSTEMS**

AREN 4010 Energy System Modeling & Control (AREN 4110) – fall, intermittent  
AREN 4040 Building Energy Audits (AREN 3010) – spring, intermittent  
AREN 4890 Sustainable Building Design (AREN 3010) – fall, intermittent  
AREN 4990 Computational Fluid Dynamics (CFD) Analysis (AREN 2120, APPM 2360) – intermittent  
AREN 5080 Computer Simulation of Building Systems (AREN 3010, instructor consent) – spring, intermittent

### **LIGHTING/ELECTRICAL SYSTEMS**

**Strongly recommended:** AREN 4130 Optical Design (AREN 3540) – fall  
AREN 4580 Daylighting (AREN 4550) – spring  
AREN 4620 Adaptive Lighting Systems (AREN 4550) – fall

**Recommended:** AREN 4630 Advanced Lighting Design (AREN 4550) – spring  
AREN 4560 Luminous Radiative Transfer (AREN 3540) – spring

### **CONSTRUCTION ENGINEERING & MANAGEMENT**

**Strongly recommended:** AREN 4606 Construction Project Execution & Control (AREN 4506) – spring  
CVEN 3256 Construction Equipment & Methods (CVEN 3246) – fall and spring

**Other options:** AREN 4315 Masonry Design (CVEN 3525) – spring every other year  
CVEN 3708 Geotechnical Engineering 1 (CVEN 3161) – fall and spring  
CVEN 3718 Geotechnical Engineering 2 (CVEN 3708) – fall and spring  
CVEN 4565 Design of Wood Structures (CVEN 3525) – spring every other year

**Note:** Students are encouraged to consider CVEN 2012 Intro to Geomatics as a basic engineering or free elective.

## **ELECTIVE REQUIREMENTS**

**Basic Engineering Elective** – any 3-credit technical course given in the engineering college with a designator ASEN, AREN, APPM, CHEN, COEN, CVEN, CSCI, ECEN, EMEN, EVEN, GEEN, or MCEN, or other course approved by the CEAE Curriculum Committee. Remedial courses (precalculus, etc.) or courses approved as HSS electives may not be used.

**Free Elective** – Any college-level course, except: cannot be remedial courses needed to fulfill deficiencies (precalculus, introductory chemistry, etc.) and cannot be similar to other courses used toward graduation requirements (algebra-based physics, etc.).

**Humanities and Social Science (HSS) Elective** – See the College requirements and list of approved courses at [www.colorado.edu/engineering/academics/policies/HSS](http://www.colorado.edu/engineering/academics/policies/HSS).

**Technical Elective** – Generally, an upper-division (3000+) science or engineering course with technical content. All upper-division AREN/CVEN courses are technical electives; up to 6 credits outside of AREN/CVEN may be selected from the approved course list posted at <https://www.colorado.edu/ceae/node/111/attachment>. Up to 3 credits of independent study are allowed for technical elective credit.