

**List B Environmental Engineering Technical Electives (upper-division)**- at least two courses from this list (or a second from list A, no double counting). Faculty can petition to add additional courses:

Students are encouraged to select courses that meet their career goals and interests. This may include courses within a similar theme, or cross-cut a breadth of environmental engineering topics. As such, this list is organized under various specialization topics within environmental engineering. *Environmental engineering design courses from List A also fit under these various specialization topics.*

It can be critical that early in the curriculum that students pay careful attention to pre-requisites for these technical electives, as discussed in section 2.1.2. All courses that are numbered 5000 or above are graduate level courses and can only be taken with instructor permission; students should consult carefully with their advisor before selecting a graduate level course. Graduate level courses are good options for double-counting for students admitted to the BS/MS program.

### **Air Quality**

ATOC 3500/CHEM 3151 Air Chemistry and Pollution (3 credits, S; prerequisites: two semesters chemistry)  
ATOC 4720 Introduction to Atmospheric Physics and Dynamics (3 credits, F; prerequisites: APPM 1350, PHYS 1110)

CVEN 4554 Fundamentals of Air Quality Management (3 credits, F prerequisites: APPM 2360, fluid mechanics)

<sup>1</sup>MCEN 3032 Thermodynamics 2 (3 credits, F&S; prerequisites: thermodynamics and fluid mechanics)

MCEN 4141 Indoor Air Pollution (3 credits, I\*; prerequisites: fluid mechanics, heat transfer)

MCEN 4057 Environmental Modeling (3 credits, I\*; prerequisites: chemistry, fluid mechanics, COEN 1300)

MCEN 4032 Sustainable Energy (3 credits, F; prerequisite: thermodynamics, heat)

### **Applied Ecology**

CVEN 3434 Intro to Applied Ecology (3 credits, S; prerequisites: CHEN 1211-1221)

EBIO 4155 Ecosystem Ecology (3 credits, S; prereqs: CVEN 3434 or EBIO 1240, EBIO 2040 or EBIO 3020†)

EBIO 4020 Stream Biology (3 credits, I\*; prereqs: CVEN 3434 or EBIO 1240, EBIO 2040 †)

EBIO 4030 Limnology (3 credits, S; prereqs: CVEN 3434 or EBIO 1240, EBIO 2040 †)

EBIO 4060 Landscape Ecology (3 credits, F; prereq: CVEN 3434 or EBIO 1240)

EBIO/GEOL/ENVS 4160 Introduction to Biogeochemistry (3 credits; S prereq: CHEM 1011 or higher, EBIO 4155 or GEOL 3320)

### **Energy Conversion Fundamentals**

ECEN 3010(S/F) Circuits and Electronics (3 credits, prerequisites: APPM 2360, PHYS 1140)

<sup>1</sup>MCEN 3032 Thermodynamics 2 (3 credits, F&S, prerequisites: MCEN 3012, MCEN 3021 or equivalents)

MCEN 4032 Sustainable Energy (3 credits, F, prerequisite: thermodynamics)

CHEN 4838 Energy Fundamentals (3 credits, S, prerequisite: thermodynamics)

AREN 5020 Building Energy Audits (3 credits, I\*, prereq: AREN 3010 or equivalent, instructor permission required)

AREN 5050 Advanced Solar Design (3 credits, I\*, AREN 2120 or equivalent, instructor permission required)

CVEN 5614 Bioenergy and Bioresources Recovery (3 credits, I\*, desired prerequisite: CVEN 4484, instructor permission required)

### **Engineering for Developing Communities**

<sup>1</sup>CVEN 3424 Water and Wastewater Treatment (3 credits, S; prerequisite: CVEN 3414)  
CVEN 4554 Fundamentals of Air Quality Management (3 credits, F, Prerequisite: APPM 2360 (or MATH 3130 and 4430) and CHEN 3313 (or CHEN 3200 or MCEN 3021)  
GEOG 3682 Geography of International Development (3 credits, F): recommended prerequisite: GEOG 1982, 1992, 2002 or 2412  
EMEN 4200 Technology and Entrepreneurship for the Developing World (3 credits, F or sum; Jrs or Srs only)  
CVEN 4837 Sp Top: Global Engineering (3 credits, S)  
CVEN 4969 Water Air Sanitation Hygiene (3 cr starting in 2017, prereq: CVEN 3414) New starting in **Spring 17**

### **Remediation**

CVEN 4353 Groundwater Engineering (3 credits, F; prerequisite: CVEN 3313 or equivalent fluid mechanics course)  
<sup>1</sup>CVEN 4474 Hazardous and Industrial Waste Management (3 credits, I\*; prerequisite: CVEN 3414)  
EVEN 4100 Environmental Sampling and Analysis (3 credits, F; prerequisites: CVEN 4404/4414, fluid mechanics or instructor consent)  
GEOL 3030 Introduction to Hydrogeology (3 credits, F; prerequisites: GEOL 1010 or GEOL 2100 and MATH 1300, or instructor consent)  
GEOL 4716 Environmental Field Geochemistry (2 credits, F/I\*; prerequisites: GEOL 2700 or 2001, and CHEM 1011/1031, or CHEM 1113/1133, and GEOL 3320, or instructor consent) + will need to make up extra 1 credit.  
MCEN 4057 Environmental Modeling (3 credits, I\*, prerequisites: chemistry, fluid mechanics, CHEN 1310)

### **Water Resources and Treatment**

<sup>1</sup>CVEN 3323 Hydraulic Engineering (3 credits, F; prerequisite: CVEN 3313 or CHEN 3200 or CVEN 3313 or GEEN 3853 or MCEN 3021 or AREN 2120)  
<sup>1</sup>CVEN 3424 Water and Wastewater Treatment (3 credits, S; prerequisite: CVEN 3414)  
<sup>1</sup>CVEN 4323 Water Resource Engineering Design (F, juniors/seniors)  
CVEN 4353 Groundwater Engineering (3 credits, F; recommended prerequisite: CVEN 3313 or CHEN 3200 or CVEN 3313 or GEEN 3853 or MCEN 3021)  
CVEN 4383 Groundwater Modeling (3 credits, S; prerequisite: CVEN 4353)  
CVEN 4594 Water Reuse and Reclamation (3 credits, I\*; Prerequisite: CVEN 3414)  
EVEN 4830 Environmental Engineering Process Modeling (3 credits, F; Prereq's Heat Transfer and Thermo.  
GEOG 4501 Water Resources and Water Management of the Western U.S. (3 credits, S)  
MCEN 4057 Environmental Modeling (3 credits, I\*; prerequisites: chemistry, fluid mechanics, COEN 1300)

### **Chemical Processing** *(these CHEN courses also require CHEN 3200 Fluids & 3320 Thermo, or permission)*

CHEN 4521 Physical Chemistry for Engineers (3 credits, S prereq: APPM 2350 and CHEN 1211; co-req APPM 2360)  
<sup>1</sup>CHEN 3220 Chemical Engineering Separations and Mass Transfer\_(3 credits, S, prereqs: CHEN 3200 and CHEN 3320)  
CHEN 4330 Chemical Engineering Reaction Kinetics (3 credits, S; prerequisites: CHEN 3320 and APPM 2360)

<sup>1</sup> Also on List A

\*I Offered intermittently