New courses are in red.

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/CHM 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)
1MCEN 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; prerequisite: 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; prerequisites: CVEN 3434 or EBIO 1240, EBIO 2040 †)
EBIO 4060 Landscape Ecology (3 credits, F; prerequisite: CVEN 3434 or EBIO 1240)
EBIO/GEOL/ENVS 4160 Introduction to Biogeochemistry (3 credits; S prerequisite: 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)
1MCEN 3032 Thermodynamics 2 (3 credits, F&S, prerequisites: MCEN 3012, MCEN 3021 or equivalents)
MCEN 4032 Sustainable Energy (3 credits, F, prerequisite: thermodynamics and heat)
CHEN 3660 Energy Fundamentals (3 credits, S, prerequisite courses of CHEN 1211 or CHEM 1133 or MCEN 1024 and PHYS 1110 and APPM 1360 or MATH 2300 (all minimum grade C-). Restricted to College of Engineering majors only.)
AREN 5020 Building Energy Audits (3 credits, I*, prerequisite: 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)
CVEN 5544 Solid Waste (3 credits, S). Restricted to EVEN BAM students only no BS only degrees
AREN 3040 Circuits for Architectural Engineers (3 credits, S, Prereqs: APPM 2360, PHYS 1120). Restricted to AREN or CVEN students.
MCEN 4135 Wind Energy and Wind Turbine Design (3 credits, S, prerequisite: MCEN 3021 and ECEN 3010 with a grade of C or better). Restricted to students with 87-180 credits.

**Global Engineering**

1CVEN 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, prerequisite: CVEN 3414) New starting in Spring 17

**Remediation**

CVEN 4353 Groundwater Engineering (3 credits, F; prerequisite: CVEN 3313 or equivalent fluid mechanics course)
1CVEN 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**

1CVEN 3323 Hydraulic Engineering (3 credits, F; prerequisite: CVEN 3313 or CHEN 3200 or CVEN 3313 or GEEN 3853 or MCEN 3021 or AREN 2120)
1CVEN 3424 Water and Wastewater Treatment (3 credits, S; prerequisite: CVEN 3414)
1CVEN 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; Prerequisite'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 prreq: APPM 2350 and CHEN 1211; co-req APPM 2360)

1 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)

1 Also on List A

*I Offered intermittently