Civil Engineering Program Technical Electives

Introduction:
The undergraduate civil engineering concentration requires 10 credits of technical electives, of which at least 3 credits must be in engineering, and at least 3 credits must be in additional science electives. The following list shows the courses that have been approved by the department for each category. Students proposing to take a course for a technical elective that is not on this list need to obtain permission from their adviser and the CEE Department to use the course.

LIST OF APPROVED ADDITIONAL SCIENCE ELECTIVES (Take at least 3 credits)

- GEOL 150, Physical Geology for Scientists and Engineers 4 cr (3-3-0), F
- LIFE 102 Attributes of Living Systems 4 cr (3-3-0), F,S,SS
- or BZ 110 Principles of Animal Biology 3 cr (3-0-0), F,S,SS
  - BZ 111 Principles of Animal Biology Lab 1 cr (0-3-0), F,S,SS  [BZ 100 or concurrent registration]
- or BZ 120 Principles of Plant Biology 4 cr (3-3-0), F,S
- GR 210 Physical Geography 3 cr (3-0-0), S
- ATS 350 Intro to Weather and Climate 2 cr (2-0-0), F,S
- ATS 351 Intro to Weather and Climate Lab 1 cr (0-3-0), F,S  [ATS 350 or concurrent registration]

LIST OF APPROVED ENGINEERING TECHNICAL ELECTIVES (Take at least 3 credits)

- CIVE 413, Environmental River Mechanics 3 cr (3-0-0), S  [CIVE 300 or WR 416]
- CIVE 423, Groundwater Engineering 3 cr (3-0-0), S  [CIVE 300 or CBE 331 or WR 416]
- CIVE 425 (CE 425), Soil and Water Engineering 3 cr (2-3-0), S  [CIVE 300]
- CIVE/ENVE 437, Wastewater Treatment Fac. Design 3 cr (3-0-0), S  [CIVE 300, CIVE/ENVE 438]
- CIVE/CBE 439, Environmental Engr Chemical Concepts 3 cr (2-3-0), F  [CHEM 113, MATH 340]
- CIVE 440, Nonpoint Source Pollution 3 cr (3-0-0), F  [CIVE 300]
- CIVE 455, Applications in Geotechnical Engr 3 cr (3-0-0), F  [CIVE 355]
- CIVE 502, Fluid Mechanics 3 cr (3-0-0), F  [CIVE 300]
- CIVE 504, Wind Engineering 3 cr (2-3-0), F  [CIVE 300]
- CIVE 506, Wind Effects on Structures 3 cr (3-0-0), S  [CIVE 504]
- CIVE 510, Operation of Hydraulic Systems 3 cr (3-0-0), F even yrs  [CIVE 401]
- CIVE 512, Irrigation Design and Management 3 cr (3-0-0), F  [CIVE/ENVE 322 or CIVE 425]
- CIVE 514, Hydraulic Structures/Systems 3 cr (3-0-0), F  [CIVE 401]
- CIVE 516, Water Control and Measurement 3 cr (3-0-0), S  [none]
- CIVE 520, Physical Hydrology 3 cr (3-0-0), F  [CIVE/ENVE 322]
- CIVE 521, Hydrometry 3 cr (2-3-0), F  [CIVE/ENVE 322]
- CIVE/WR 524, Modeling Watershed Hydrology 4 cr (3-0-1), S  [CIVE/ENVE 322 or WR 416, ST 304 or STAT 315]
- CIVE 525, Water Engr: International Development 3 cr (3-0-0), F  [CIVE 401 or CIVE 425 or CIVE/ENRV 438 ]
- CIVE 531, Groundwater Hydrology 3 cr (3-0-0), F  [CIVE 300 or CBE 331 or MECH 342]
- CIVE 536, Wastewater Treatment 1 cr (1-0-0), S  [CIVE 540/CBE 540]
- CIVE 537, Residuals Management 3 cr (3-0-0), S  [CIVE 300]
- CIVE 538, Aquous Chemistry 3 cr (3-0-0), S  [CHEM 113, MATH 340]
- CIVE 539, Water and Wastewater Analysis 3 cr (2-3-0), F odd yrs  [CHEM 113, MATH 340]
- CIVE/CBE 540, Fund of Environ. Biotechnology 2 cr (2-0-0), F  [none]
- CIVE 541, Environmental Unit Ops-Treatment Design 4 cr (3-3-0), S  [CIVE/CBE 439]
- CIVE 542, Water Quality Modeling 3 cr (3-0-0), F  [Two semester of chemistry; one course in hydrology or water quality]
CIVE 544, Water Resources Planning and Management 3 cr (3-0-0), F [CIVE/ENVE 322]
CIVE 546, Water Resource Systems Analysis 3 cr (3-0-0), F [CIVE/ENVE 322; ENGR/MATH 510]
CIVE/STAT 547, Statistics for Environmental Monitoring – 3 cr (3-0-0), S [statistics]
CIVE 549, Drainage and Wetlands Engineering 3 cr (3-0-0), S [CIVE 425]
CIVE 550, Foundation Engineering 3 cr (3-0-0), F [CIVE 355]
CIVE 553, Earth and Earth-Retaining Structures 3 cr (3-0-0), S odd yrs [CIVE 355]
CIVE 556, Seepage and Earth Dams 3 cr (3-0-0), S [CIVE 355]
CIVE 558, Containment Systems for Waste Disposal 3 cr (3-0-0), F [CIVE 355]
CIVE 560, Advanced Mechanics of Materials 3 cr (3-0-0), F [CIVE 360]
CIVE 562, Fundamentals of Vibrations 3 cr (3-0-0), S [CIVE 360]
CIVE 565, Finite Element Method 3 cr (3-0-0), S [MATH 340]
CIVE 566, Intermediate Structural Analysis 3 cr (3-0-0), F [CIVE 367]
CIVE 567, Advanced Concrete Design 3 cr (3-0-0), S [CIVE 467]
CIVE 569, Intermediate Design of Wood Structures 3 cr (3-0-0), F [CIVE 367, CON 432]
CIVE 571, Pipe System Engineering & Hydraulics 3 cr (3-0-0), S [CIVE 300]
CIVE 572, Analysis of Urban Water Systems 3 cr (2-2-0), F even yrs [CIVE 300, 401]
CIVE 573, Urban Stormwater Management 3 cr (2-2-0), F odd yrs [CIVE/ENVE 322, CIVE 401]
CIVE 576, Engineering Applications of GIS and GPS 3 cr (2-2-0), F [none]
CIVE 577, GIS in Civil and Environmental Engineering 3 cr (2-2-0), S [CIVE 300, CIVE/ 322]
CIVE 578, Infrastructure Engineering and Management 3 cr (3-0-0), S [10 or more cr. of Engrg, Econ, public administration or planning courses]

Other engineering courses most often considered for use as CIVE Technical Electives are, but may require approval from the respective departments:

ECE 201, Circuit Theory 3 cr (2-2-0), F [MATH 161, PH 142]
ENGR 510, Linear Programming and Network Flows 3 cr (3-0-0), F,S,SS [MATH 261 or 315]
MECH 307, Mechatronics and Measurement Systems 4 cr (3-3-0), F,S [CIVE 261, ECE 204, MATH 340]
MECH 331, Introduction to Engineering Materials 4 cr (3-2-0), F,S [CHEM 111, PH 142]
MECH 411, Manufacturing Engineering 3 cr (3-0-0), S [MECH 331, CIVE 360]
MECH 431, Metals and Alloys 3 cr (3-0-0), F [MECH 331]

LIST OF APPROVED TECHNICAL ELECTIVES (Take at least 3 credits. Technical electives also include courses from the above two lists of additional science and engineering electives.)

1. Additional Mathematics, Chemistry and Physics courses
CHEM 114, General Chemistry Laboratory II 1 cr (0-3-0), F,S,SS [CHEM 112, CHEM 113]
CHEM 245, Fundamentals of Organic Chemistry 4 cr (4-0-0), F,S,SS [CHEM 113]
CHEM 246, Fundamentals of Organic Chemistry Laboratory 1 cr (0-3-0), F, S [CHEM 112 or 114, CHEM 245]
CHEM 245 and CHEM 246 are required for the BS Env Engr and the Env Engr minor
CHEM 261, Fundamentals of Inorganic Chemistry 3 cr (3-0-0), S [CHEM 113]
CHEM 345, Organic Chemistry I 4 cr (3-3-0), F,S [CHEM 113, CHEM 114]
CHEM 346, Organic Chemistry II 4 cr (3-3-0), F,S [CHEM 345]
CHEM 471, Physical Chemistry for Biological Sciences 4 cr (4-0-0), F [CHEM 113, MATH 161, or MATH 255, PH122 or PHCC142]

MATH 331, Introduction to Mathematical Modeling 3 cr (3-0-0), F [MATH 161]
MATH 332, Partial Differential Equations 3 cr (3-0-0), S [MATH 340 or 345]
MATH 366, Introduction to Abstract Algebra 3 cr (3-0-0), F,S,SS [MATH 161]
MATH 369, Linear Algebra 3 cr (3-0-0), F,S,SS [MATH 161, MATH 229]
MATH 419, Introduction to Complex Variables 3 cr (3-0-0), F,S [MATH 261]
MATH 450, Introduction to Numerical Analysis I  
3 cr (3-0-0), F  
[MATH 261, programming or MATH 151]

MATH 451, Introduction to Numerical Analysis II  
3 cr (3-0-0), S  
[MATH 340, programming or MATH 151]

MATH 476, Topics in Mathematics  
3 cr (3-0-0), F,S,SS  
[Instructor’s consent]

MATH 510/ENGR 510, Linear Prog & Network Flows  
3 cr (3-0-0), F  
[MATH 261 or MATH 315]

MATH 531, Discrete Models of Physical Systems  
3 cr (3-0-0), F  
[MATH 340 or 345]

MATH 532, Mathematical Modeling of Large Data Sets  
3 cr (3-0-0), S  
[MATH 369 or 530]

PH 245, Introduction to Electronics  
3 cr (2-3-0), F  
[PH 142, MATH 161]

PH 314, Introduction to Modern Physics  
4 cr (4-0-0), S  
[PH 142, MATH 261]

PH 315, Modern Physics Laboratory  
2 cr (0-4-0), S  
[PH 314]

PH 341, Mechanics  
4 cr (4-0-0), F  
[PH 141, MATH 340]

PH 571, Mathematical Methods for Physics I  
3 cr (3-0-0), F  
[MATH 340]

PH 572, Mathematical Methods for Physics II  
3 cr (3-0-0), S  
[PH 571]

STAT 420, Probability and Mathematical Statistics I  
3 cr (3-0-0), F  
[MATH 261 or MATH 255]

STAT 520, Introduction to Probability Theory  
4 cr (4-0-0), F  
[MATH 340]

2. Additional Natural Science Courses

AA 301, Astrophysics I  
5 cr (4-2-0), F odd yr  
[MATH 124, MATH 126, PH 110 or 121 or 141]

AA 302, Astrophysics II  
5 cr (4-2-0), F  
[MATH 124, MATH 126, PH 110 or 121 or 141]

AA 303, Astrophysics III  
5 cr (4-2-0), S  
[MATH 124, MATH 126, PH 110 or 121 or 141]

ATS 350, Introduction to Weather and Climate  
2 cr (2-0-0), F, S  
[none]

ATS 351, Introduction to Weather and Climate Laboratory  
1 cr (0-3-0), F, S  
[ATS 350]

BC 351, Principles of Biochemistry  
4 cr (4-0-0), F,S,SS  
[BZ 110 or 120 or LIFE 102, CHEM 245 or CHEM 346]

BC 352, Principles of Biochemistry Laboratory  
1 cr (0-3-0), F, S  
[BC 351 or BC 401]

BIO 320, Ecology  
3 cr (3-0-0), F,S  
[BZ 101 or BZ 110 or BZ 120 or LIFE 102; MATH 155 or MATH 160]

ERHS 220, Environmental Health  
3 cr (3-0-0), F,S  
[BZ 101 or 104 or 110, BZ 120 or LIFE 102]

ERHS 446, Environmental Toxicology  
3 cr (3-0-0), F  
[CHEM 245 or CHEM 346]

GEOL 150, Physical Geology for Scientists and Engineers  
4 cr (3-3-0), F  
[none]

GEOL 442, Applied Geophysics  
4 cr (3-2-0) F  
[MATH 161; PH 142; GEOL 372]

GR 210, Physical Geography  
3 cr (3-0-0), S  
[none]

GR 342, Geography of Water Resources  
3 cr (3-0-0), F  
[none]

GR 345, Geography of Hazards  
3 cr (3-0-0), S  
[GR 210]

WR 304, Principles of Watershed Management  
3 cr (3-0-0), F,S  
[none]

MIP 300, General Microbiology  
3 cr (3-0-0), F,S,SS  
[LIFE 102, BZ 110 or BZ 120 CHEM 245 or CHEM 345]

MIP 301, Fundamental Microbiology Laboratory Techniques  
1 cr (0-3-0), F  
[MIP 300]

MIP 342, Immunology  
4 cr (3-0-1), S, SS  
[MIP 300, CHEM 245 or 340 341 or 345]

MIP 432, Aquatic Microbiology  
4 cr (3-3-0), S even yr.  
[MIP 300]
3. Upper Division Business Courses
FIN 305, Fundamentals of Finance 3 cr (3-0-0) F, S [ACT 205 or 210, ECON 204]
MKT 305, Fundamentals of Marketing 3 cr (3-0-0), F, S [AREC 202 or ECON 101 or ECON 202]

Credit not allowed for both MKT 300 and MKT 305
MGT 305, Fundamental of Management 3 cr (3-0-0), F, S, SS [none]

4. Computer programming and software courses
CS 150, Interactive Programming with Java 4 cr (3-0-1), F, S [Placement into MATH 117 or MATH 130]
GRAD 510, Fund of High Performance Computing 3 cr (2-2-0), F

5. Additional Technical Classes in Other Than Engineering
Three credits of technical electives are allowed from among junior and senior year AS (Aerospace Studies) or MS (Military Science) courses for students completing a minor in either AS or MS.

LI 301, Research in the Information Age 1 cr (1-0-0), S, F, SS [none]
NR 322, Introduction to Geographic Information Systems 4 cr (2-4-0), F, S [none]
NR 323, Remote Sensing of Natural Resources 3 cr (2-2-0), F [none]
NR 440, Land Use Planning 3 cr (2-2-0), F [none]
SOCR 240, Introductory Soil Science 4 cr (3-2-0), F, S, SS [CHEM 107 or 111]