

# APPROVED TECHNICAL ELECTIVES FOR COMPUTER ENGINEERS

Twenty-one (21) semester credit hours of Technical Electives are required. **Courses not on these lists may be counted as Technical Electives only if they are approved by the Curriculum Committee.** A written request must be submitted and approved **before** the course is taken. For 500-level technical elective options, see your academic adviser. A 500-level course is open to “qualified undergraduate students” (students in the upper half of their class). **NO Graduate or Undergraduate Seminars** are allowed for Technical Elective credit. Graduate Special Topics courses require ECpE Curriculum Committee review.

- At least nine (9) credits must be from the list of CprE electives
- Six (6) credits must be taken from the list of Computational Thinking electives
- Six (6) credits can be taken from the Non-CprE/EE Technical Elective List

## IMPORTANT NOTATIONS (Please Read):

1. \$ Course is cross-listed (same course). Can only apply one towards graduation EE, CprE, SE, or ComS
2. ✓ Will need to check "Schedule of Classes" at <http://classes.iastate.edu/> for class availability
3. \* Only one course either MatE 273 or MatE 392 may be applied as a technical elective
4. \* Only Math 207 or Math 317 can apply towards graduation requirements, not both courses
5. EE 351 and EE 388 may be used to fulfill International Perspective requirements - You must choose if you want the course applied to either a general education or technical elective requirement, but not both
6. ENGR/EE/CprE 467, EE 442 & EE 448 **cannot** be used to fulfill any elective requirements

## COMPUTER ENGINEERING ELECTIVES (9 cr.)

COURSES	DESCRIPTION	CR	PREREQUISITES (Check latest catalog for complete lists)
\$CprE/SE 329	Software Project Management	3	ComS 309
\$CprE/EE 330	Integrated Electronics	4	EE 201, Cr/E EE 230, CprE 281
CprE/Cybe 331	Application of Cryptographic Concepts to Cyber Security	3	CprE/Cybe 231
\$CprE/SE 339	Software Architecture & Design	3	SE 319
CprE 388	Embedded Systems II: Mobile Platforms	4	CprE 288
\$ComS/SE/CprE 412	Formal Methods in Software Engineering	3	Com S 311, Stat 330
CprE 414	Introduction to Software Systemes for Big Data Analytics	4	ComS 363; CprE 315 or 308; Com S 311 or 352
\$CprE/SE 416	Software Evolution and Maintenance	3	ComS 309
\$CprE/EE 418	High Speed Sys. Engr. Meas. & Test.	4	EE 230, EE 311
\$CprE/SE 419	Software Tools for Large Scale Data Analysis	4	CprE 308 or ComS 352, ComS 309
\$CprE/SE 421	Software Analysis and Verification for Safety and Security	3	ComS 309; CprE 310 or ComS 230
\$CprE/ComS/Math 424	Introduction to High Performance Computing	3	Math 265; Math 207 or Math 317
\$CprE/ComS 425	High Performance Computing for S & E Apps	3	ComS 311, Engl 250, SpCm 212
\$CprE/ComS 426	Intro to Parallel Algorithms and Program.	4	CprE 308 or ComS 321, CprE 315 or ComS 311
CprE 430/530	Network Protocols and Security	3	CprE 381 or equivalent
CprE 431	Basics of Information Systems Security	3	Cr/E CprE 308 or ComS 352
\$CprE/EE 435	Analog VLSI Circuit Design	4	EE 330
CprE/Cybe 437x	Introduction to Wireless Security	3	CprE 331 or CprE 430
CprE/Cybe 440x	Operating System Security	3	CprE 308 or ComS 352
\$CprE/ComS 444	Introduction to Bioinformatics	4	Math 165 or Stat 401 or equivalent
CprE 450	Distributed Systems & Middleware	3	CprE 308 or ComS 352
\$CprE/ComS 454	Distributed & Network Operating Systems	3	ComS 311, ComS 352
CprE 458	Real-Time Systems	3	CprE 308 or ComS 352
\$CprE/EE 465	Digital VLSI Design	4	EE 330
\$CprE/EE 466	Multidisciplinary Engineering Design	3	Senior within 2 semester of graduation, instructor permission
CprE 480	Graphics Processing and Architecture	4	CprE 381 or ComS 321
CprE 482x	Hardware Design for Machine Learning	4	CprE 381 or Com S 321
CprE 483	Hardware Software Integration	4	CprE 381
CprE 488	Embedded Systems Design	4	CprE 381 or ComS 321
CprE 489	Computer Networking & Data Comm	4	CprE 381 or EE 324
CprE 490	Independent Study	1-2	Only 2 credits of 490 may be used as tech elective, Senior Classification in CprE

**COMPUTATIONAL THINKING ELECTIVES (6 cr.)**

<b>COURSES</b>	<b>DESCRIPTION</b>	<b>CR</b>	<b>PREREQUISITES (Check latest catalog for complete lists)</b>
ComS 331	Theory of Computing	3	Min of C- in ComS 228, Math 166, & CprE 310 or ComS 230; Engl 250
ComS 342	Principles of Programming Languages	3	Min of C- in ComS 228 & Math 165; Com S 230 or CprE 310
\$ComS 350	Number Theory	3	Math 201 or ComS 230
\$ComS/SE/CprE 412	Formal Methods in Software Engineering	3	ComS 311; Stat 330
ComS 415	Software System Safety	3	Com S 309 or Com S 11
ComS 418	Intro to Computational Geometry	3	ComS 311 or permission from instructor
ComS 421	Logic for Math & Computer Science	3	Math 301 or 207 or 317 or ComS 230
\$ComS/CprE 426	Introduction to Parallel Algorithms and Programming	4	CprE 308 or ComS 321, CprE 315 or ComS 311
ComS 435	Algorithms for Large Data Sets: Theory and Practice	3	Com S 311 or equivalent
ComS 440	Principles & Practices of Compiling	3	ComS 331, ComS 342, Engl 250, SpCm 212
ComS 441	Programming Languages	3	ComS 342 or 440
ComS 455	Simulation: Algorithms & Implementation	3	ComS 311, ComS 230, Stat 330, Engl 150, Sp Cm 212
ComS 472	Principles of Artificial Intelligence	3	Com S 311, Stat 330 or 305, Engl 250, Sp Cm 212
ComS 474	Introduction to Machine Learning	3	Com S 311, Stat 330 or 305, Math 165, Engl 250, Sp Cm 212
\$ComS/Math 481	Numerical Mthds for Differential Equations	3	Math 265, Math 266 or 267
EE 224	Signals and Systems I	4	EE 201, Math 267, Phys 222
EE 324	Signals and Systems II	4	EE 224
IE 312	Optimization	3	Credit or Enrollment in Math 267
MATH 301	Abstract Algebra I	3	Math 166, Math 317 or 407, C- in Math 201
MATH 302	Abstract Algebra II	3	Math 301
MATH 304	Combinatorics	3	Math 166; Math 201 or experience with proofs
MATH 314	Graph Theory	3	Math 166; Math 201 or experience with proofs
MATH 317	Theory of Linear Algebra	4	Credit or Enrollment in Math 201
MATH 331	Topology	3	Math 201; Math 301, 317, 414 or 435
MATH 342	Introduction to the Theory of Probability and Statistics II	4	Stat 201 or equivalent; Stat 341; Math 207 or 317
MATH 350	Number Theory	3	Math 201 or Com S 230
MATH 365	Complex Variables with Applications	3	Math 265
MATH 373	Introduction to Scientific Computing	3	Math 265
MATH 385	Introduction to Partial Differential Equations	3	Math 265 and Math 266 or 267
MATH 407	Applied Linear Algebra	3	Math 317 or Math 207 and experience with proofs
MATH 414	Analysis I	3	Min of C- in Math 201
MATH 415	Analysis II	3	Math 414; Math 265; Math 317 or 407
MATH 421	Logic for Mathematics and Computer Science	3	Math 301 or 207 or 317 or ComS 230
MATH 424	Introduction to High Performance Computing	3	Math 265; Math 207 or 317; or permission of the instructor
MATH 435	Geometry I	3	Math 201; Math 207 or 317
MATH 436	Geometry II	3	Math 201; Math 207 or 317
MATH 474	Mathematics of Finance	3	Check catalog for prereqs

**TECHNICAL ELECTIVES (6 cr.)**

CprE students may select up to six credits of Non-EE/CprE Electives from 300- and 400-level courses in the following areas: Computer Science, Mathematics, Physics, and other Engineering departments (e.g. ConE 380, or Aer E 494X). The courses listed below are approved exceptions to these guidelines.

<b>COURSES</b>	<b>DESCRIPTION</b>	<b>CR</b>	<b>PREREQUISITES (Check latest catalog for complete lists)</b>
AerE 494	M2I	1...3	
ArtIS 408	Principles of 3D Animation	3	ARTIS 308 (see adviser for form)
ArtIS 409	Computer/Video Game Design & Dvmt	3	Permission of Instructor, ComS 227, ComS 228, ComS 229, Artis 230, Artis 208
Astro 342	Introducation to Solar System Astronomy	3	Phys 222
Astro 344L	Astronomy Laboratory	3	Phys 222
Astro 346	Introduction to Astrophysics	3	Phys 222
Astro 405	Astrophysical Cosmology	3	Astro 346
BME 220	Introduction to Biomedical Engineering	3	See catalog for prereqs
Biol 211	Principles of Biology I	3	HS Bio
Biol 211L	Principles of Biology I Lab	1	Credit or enrollment in Biol 211
Biol 212	Principles of Biology II	3	HS Biol; HS Chem or Cr/E in Chem 163 or 177
Biol 212L	Principles of Biology II Lab	1	Credit or enrollment in Biol 212
CE 274	Statics of Engineering	3	Cr/E Math 166, Cr/E Phys 221
Chem 331	Organic Chemistry I	3	Chem 178 or Chem 201
Chem 331L	Organic Chemistry I Lab	1	Chem 177L; credit or enrollment in Chem 331
Chem 332	Organic Chemistry II	3	Chem 331
Chem 332L	Organic Chemistry II Lab	1	Chem 331L; credit or enrollment in chem 332
Com S 252	Linux Operating System Essentials	3	CprE or SE 185 or Com S 127 or 207 or 227
ConE 241	Construction Materials & Methods	3	ConE 222
MatE 215	Introduction to Materials Science and Engineering I	3	Math 165 and Chem 177 or 167
*MatE 273	Principles of Materials Science & Engr	3	Chem 167 or 177, Math 165, Soph class
* Math 207	Matrices and Linear Algebra	3	2 semesters of calculus
ME 231	Engineering Thermodynamics I	3	Math 166, Chem 167, Phys 221
Mteor 342	Atmospheric Physics II	3	Mteor 341
Mteor 435	Radar Applications in Meteorology	3	Mteor 341
NS 320	Naval Ship Systems I - Engineering	3	NROTC students only – Phys 221, Sophomore
NS 330	Naval Ship Systems II - Weapons	3	NROTC students only – Phys 221, Sophomore
Stat 231	Probability & Statistical Inference for Engr	4	Cr/E in Math 265
Stat 322	Probabilistic Methods for Elec. Engineers	3	EE 224

