

**TECHNICAL ELECTIVES
FOR
COMPUTER ENGINEERING UNDERGRADUATES**
Graduating 2010

The courses listed below are approved for CpE in-major and non-major technical elective credit. **Actual course offerings will be based on sufficient resources, including faculty availability and student demand.** Refer to the University's on-line timetable of classes for specific course availability information.

In-Major Technical Electives

All courses are grouped according to their inter-relatedness, but students are free to choose from multiple groups. If you are not sure of an academic focus, then you are encouraged to take courses from several groupings, giving you a broader background.

Course prerequisites are shown in []. Co-requisites are shown in (). DTE indicates Design Technical Elective.

COMPUTERS (from ECE Department)

- 4504 (3) Computer Organization [CS 3204]
- 4514 (4) Digital Design II [3504] DTE
- 4520 (3) Digital and Mixed-Signal System Testing and Testable Design [2574, 3504]
- 4524 (4) Artificial Intelligence and Engineering Applications [2574] (STAT 4714) DTE
- 4530 (3) Hardware/Software Codesign [3504, 3534] DTE
- 4540 (3) VLSI Circuit Design [2204, 3504] DTE
- 4550 (3) Real-Time Systems [4534 or CS 3204] DTE
- 4560 (3) Computer and Network Security Fundamentals [4564]
- 4564 (3) Network Application Design [2504, 2574] DTE
- 4570 (3) Wireless Networks and Mobile Systems [4564 or CS 4254] DTE
- 4574 (3) Large-Scale Software Development for Engineering Systems [3574] DTE
- 4984 (3) Computer Organization [2500, 3534] (to be developed)
- 4984 (3) ID-ECE Interdisciplinary Design Project [4514 or 4534] DTE

COMPUTERS (from CS Department)

NOTE: The Computer Science Department may restrict some of its courses to CS majors during registration periods. Contact that department and follow any specific procedure they may have on registering for their courses. CS requires a C or better in all in-major prerequisite courses.

- CS 2606 (3) Data Structures and Object Oriented Development II [CS 2605]
- CS 3204 (3) Operating Systems [2504 or CS 2504, CS 2604 or CS 2606]
- CS 3304 (3) Comparative Languages [CS 2604 or CS 2606]
- CS 3414 (3) (Math 3414) Numerical Methods [CS 1044 or 1705, Math 2214, 2224]
- CS 3824 (3) Introduction to Computational Biology & Bioinformatics [CS 2204, CS 2606]
- CS 4104 (3) Data and Algorithm Analysis [CS 2604 or CS 2606, Math 3134 or Math 3034]
- CS 4114 (3) Formal Languages [Math 3134 or Math 3034]
- CS 4124 (3) Theory of Computation [Math 3134 or Math 3034]
- CS 4204 (3) Computer Graphics [CS 2604 or CS 2606]
- CS 4214 (3) Simulation and Modeling [CS 1706, STAT 4714]
- CS 4224 (3) Performance Evaluation of Computer Systems [CS 3204, STAT 4714]
- CS 4234 (3) Parallel Computation [CS 3204]
- CS 4244 (3) Internet Programming [CS 3204]
- CS 4254 (3) Network Arch Programming [CS 3204]
- CS 4304 (3) Compiler Design [CS 3204]
- CS 4414 (3) Issues in Scientific Computing [MATH 2214, MATH 3214]
- CS 4604 (3) Introduction to Database Management Systems [CS 2604 or CS 2606]
- CS 4624 (3) Multimedia/Hypertext [CS 2604 or CS 2606]

COMMUNICATIONS

- 3614 (3) Introduction to Communication Systems [2704] (STAT 3614)
- 4605 (3) Radio Engineering [3106, 3204, 3614] (4675)
- 4606 (3) Radio Engineering [4605]
- 4614 (3) Telecommunication Networks [2504, 2704, STAT 4714]
- 4624 (3) Digital Signal Processing and Filter Design [3704]
- 4634 (3) Analog and Digital Communications [3614, STAT 4714]
- 4644 (3) Satellite Communications [3614]
- 4654 (3) DSP Implementation of Communication Systems [4624, 4634]
- 4664 (1) Analog and Digital Communications Lab [3614] (4634)
- 4674 (1) Scattering Parameters Lab [4605, 4675]
- 4675 (1) Radio Engineering Lab [3106, 3204] (4605)
- 4676 (1) Radio Engineering Lab [4675] (4606)
- 4684 (1) Digital Signal Processing Lab [4624]

ELECTROMAGNETICS

- 3105 (3) Electromagnetic Fields [2004, MATH 2224, PHYSICS 2306]
- 3106 (3) Electromagnetic Fields[3105]
- 4104 (4) Microwave and RF Engineering [3106, 3204]
- 4114 (3) Antennas [3106]
- 4124 (3) Radio Wave Propagation [3106]
- 4134 (3) Fiber Optics and Applications [3106]
- 4144 (3) Optical Information Processing [3106]
- 4164 (4) Global Positioning Systems (GPS) Theory and Design [3106]
- 4184 (1) Fiber Optics Laboratory [4134]
- 4984 (3) Perils of Space: An Introduction to Space Weather [3106]

CIRCUITS/ELECTRONICS

- 3004 (3) AC Circuit Analysis [2704]
- 3074 (1) AC Circuit Analysis Lab [2074] (3004)
- 3204 (3) Analog Electronics [2204, 2704] (3274)
- 3274 (1) Electronics Lab [2274] (3204)
- 4205 (3) Electronic Circuit Design [3204]
- 4206 (3) Electronic Circuit Design [4205]
- 4214 (3) Semiconductor Device Fundamentals [2204 or MSE 3204 or PHYS 3455]
- 4220 (3) Analog Integrated Circuit Design [3204]
- 4224 (3) Power Electronics [3204]
- 4234 (3) Semiconductor Processing [2204 or 3054]
- 4240 (3) Intermediate Semiconductor Wafer Processing laboratory [4234 or MSE 4234]
- 4284 (1) Power Electronics Lab [4224]
- 4984 (3) Advanced Semiconductor Processing Lab (4234)

POWER SYSTEMS

- 3304 (3) Introduction to Power Systems [3004]
- 3354 (1) Power Laboratory (3304)
- 4304 (3) Design in Power Engineering
- 4324 (3) Electronic Control of Machines [4405, 4224]
- 4334 (3) Power System Analysis and Control [3304]
- 4344 (3) Electric Power Quality for the Digital Economy [3304]
- 4354 (3) Power System Protection [4334]
- 4364 (3) Alternate Energy Systems [STAT 4714]
- 4374 (1) Power System Protection Lab [4334] (4354)

SYSTEMS/CONTROLS

3704 (3) Continuous and Discrete System Theory [2704]
4405 (3) Control Systems [3704]
4406 (3) Control Systems [4405]
4415 (1) Control Systems Lab (4405)
4416 (1) Control Systems Lab [4415]
4704 (3) Principles of Robotics Systems [3704]
4734 (3) Mechatronics [2504, 2704]

INDEPENDENT WORK and SPECIAL STUDIES

The courses listed below can *generally* be used for technical elective credit or design technical elective credit, based on the particular content of each course as it is taught in a given semester. Please discuss technical elective credit options for these courses with your advisor prior to registering for the courses.

4974 (ARR) Independent Study
4984 (ARR) Special Study
4994 (ARR) Undergraduate Research

Notes:

4974, and 4994: Students must complete an Undergraduate Research, Independent Study Authorization Form, prior to Registration. Forms are available in the ECE Advising office in 340 Whittemore or online at www.ece.vt.edu/ugrad/policies.html.

For purposes of satisfying the major technical elective requirements, the sum of the number of hours taken from ECE 4974, 4994 cannot exceed 6, without prior approval.

Non-Major Technical Electives

ECE students may take up to 3 credit hours of non-major technical electives. Students are reminded that they DO NOT have to take a non-major technical elective. *All* technical electives can come from the in-major list.

- 1) Any 3000 or 4000 level course, *except those listed in Items 2 and 3 below*, in Engineering, Biology, Chemistry, Mathematics, Physics, and Statistics **NOT REQUIRED FOR GRADUATION, THAT DOES NOT DUPLICATE** any course in the program of study, and for which you have the appropriate prerequisite, may be used as a non-major technical elective.
- 2) Non-major 4904, 4964, 4974, 4984, 4994 courses and study abroad courses must be approved for non-major technical elective credit in advance. See your advisor for guidance.
- 3) REMINDER: ESM 4404 – Fundamentals of Professional Engineering – **CANNOT** be used as a non-major technical elective and **DOES NOT COUNT TOWARDS GRADUATION**.