Computer Engineering: 
Incoming MS Student Orientation 
Requirements & Course Overview

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MS Requirements: Overview *(see bulletin for details)*

- **Total:** at least 30 points (at or above 4000-level)
- **“Core” requirement:** at least 15 points from listed core
- **Distribution requirement:** at least 6 points each: CS, EE
  - “CSEE”, “EECS”: count for either CS or EE
- **6000-level requirement:** at least 15 points (CS, EE, joint included)
- **Research credits (optional):** at most 9 points (towards requirements)
- **Non-tech electives (optional):** at most 3 points (towards requirements)
- **Min GPA:** at least 2.7
- **Time period:** at most 5 years
Core Comp Eng Course List - 42

- COMS W4113 Fund. Large-Scale Dist. Sys.
- COMS W4115 Prog. Lang. & Translators
- COMS W4118 Operating Systems, I
- CSEE W4119 Computer Networks
- COMS W4130 Parallel Programming
- CSEE W4140 Computer Networking Lab
- COMS W4180 Network Security
- EECS E4321 Digital VLSI Circuits
- EECS E4340 Computer Hardware Design
- ELEN E4350 VLSI Design lab
- ELEN E4702 Digital Communications
- ELEN E4750 GPU for Sig. Proc. & Comm.
- ELEN E4810 Digital Signal Processing
- CSEE W4823 Adv. Logic Design
- CSEE W4824 Computer Architecture
- ELEN E4830 Digital Image Processing
- CSEE W4840 Embedded Systems
- ELEN E4896 Music Signal Processing
- COMS W6118 Operating Systems, II
- CSEE W6180 Modeling & Perf. Evaluation
- COMS W6181 Adv. Internet Services
- EECS E6321 Adv. Digital Elec. Circuits
- ELEN E6350 VLSI Design Lab
- ELEN E6488 Optical Interconnects
- ELEN E6761 Computer Comm. Net., I
- ELEN E6762 Computer Comm. Net., II
- EECS E6765 Internet of Things
- ELEN E6770 Topic: Next Gen. Networks
- CSEE E6824 Parallel Computer Architecture
- CSEE E6831 Sequential Logic Circuits
- CSEE E6832 Topics in Logic Design
- CSEE E6847 Distributed Embedded Systems
- ELEN E6850 Visual Information Systems
- ELEN E6860 Advanced Digital Sig. Proc.
- CSEE E6861 CAD of Digital Systems
- CSEE E6868 System-on-chip Platforms
- ELEN E6950 Wireless & Mobile Net., I
- ELEN E6951 Wireless & Mobile Net., II
- COMS E6998 (Adv. Dist. Sys.)
- COMS E6998 (Resilient Hardware Sys.)
- COMS E6998 (Formal Verif. HW/SW)
Overview of 4000-/6000-Level Comp Eng Courses

- Selective survey of some key computer engineering courses
- Focus: COMS (i.e. CS), CSEE, EECS courses
  - EE comp eng courses: covered in EE presentations
- ... incomplete list!: MS degree allows other courses too
Digital/VLSI Design

CSEE W4823 Advanced Logic Design [Fall]

Instructor: Prof. Steve Nowick

Description:

- 2nd-level course in digital system design

- **Topics include:**
  - designing/optimizing large complex subsystems = RTL design
  - VHDL (industrial hardware description language)
  - advanced arithmetic circuits (Kogge-Stone prefix adders, array multipliers)
  - low-power design: bus encoding, “precomputation”, gated clocking
  - controller design (Mealy/Moore)
  - fault-tolerance, error correction/detection, soft errors, Hamming & CRC codes
  - design projects: custom floating point units, Huffman conversion
Digital/VLSI Design (cont.)

EECS E4321 Digital VLSI Circuits [Fall]

Instructor: Prof. Ken Shepard

Description:

- Design and analysis of high speed VLSI logic, arithmetic and memory circuits.

[see EE course presentation]
Digital/VLSI Design (cont.)

EECS 6321 Advanced Digital Electronic Circuits [Spring]

Instructor: Prof. Mingoo Seok

Description:

- Advanced techniques: VLSI logic, arithmetic and memory circuits.

[see EE course presentation]
Computer Architecture/Parallel Systems

CSEE W4824 Computer Architecture [Spring]

Instructor: Prof. Luca Carloni

Description:

- Advanced topics in modern computer architecture, illustrated by recent case studies.
- Topics include:
  - quantitative analysis
  - pipelining, out-of-order execution, speculation
  - superscalar, VLIW and vector processors
  - parallel processors and thread-level parallelism
  - memory hierarchy design
  - synchronization and cache coherence protocols
  - interconnection networks
Computer Architecture/Parallel Systems (cont.)

CSEE E6824 Parallel Computer Architecture

Instructor: Prof. Simha Sethumadhavan

Description:

• Fundamentals of parallel computer systems
• **Topics include:**
  • recent parallel architectures (industrial/research)
  • shared memory and distributed memory systems
  • synchronization and coherence models
  • recent case studies
Computer Architecture/Parallel Systems (cont.)

COMS W4130 Parallel Programming [Fall]

Instructor: Prof. Kim

Description:

• Programming parallel processors, concurrency foundations.

• Topics include:
  • basics of parallel programming
  • principles of concurrency: data parallelism, deadlock, determinacy
  • pgmg. assignments: incl. game playing, high-performance cptg., machine learning
  • modern parallel programming languages
Embedded Systems

CSEE W4840 Embedded Systems [Spring]

Instructor: Prof. Stephen Edwards

Description:

• Embedded system design and implementation combining hardware and software.

• **Topics include:**
  
  • hardware/software interfacing
  • bus protocols and device drivers
  • custom peripherals
  • microprocessor-based system design
  • team project target: a substantial embedded system
    • hardware/software design employing FPGA’s
    • e.g. digital tone control, speech synthesizer, internet radio, interfacing and peripherals
SOC Platforms

CSEE E6868 System-on-Chip Platforms [Fall]

Instructor: Prof. Luca Carloni

Description:

• Design & programming of system-on-chip platforms.

• **Topics include:**
  
  • overview of technology & trends
  • methodologies & CAD tools
  • software simulation
  • system-C language
  • hardware-software partitioning
  • communication, power, applications
Special Offerings:

COMS E6998-10 Formal Verification of Hardware/Software Systems [Fall 15]
Instructor: Drs. Theobald (D.E. Shaw Research)/Ivancic (NEC Research)

COMS E6998-11 Advanced Distributed Systems [Fall 15]
Networking and Communications

CSEE W4119 Computer Networks [Fall, Spring]

Instructor: G. Zussman and others

Description:
- Introduction to modern computer networks.
- **Topics include:**
  - Technical foundations of the Internet
  - Applications, protocols
  - Local area networks (LANs)
  - Algorithms for routing and congestion control
  - Security
  - Basics of performance evaluation
Networking and Communications (cont.)

CSEE W4140 Networking Laboratory [Fall, Spring]

Description:
- Hands-on networking lab course.
- **Topics include:**
  - technologies and protocols of the Internet
  - CISCO routers
  - wide area networks
  - networking protocol foundations:
    - IP, ARP, ICMP, UDP, TCP, DNS, RIP, FTP, TELNET, SMTP
  - Substantial projects: putting “principles into practice”
Networking and Communications (cont.)

COMS W4180 Network Security *(sometimes)*

Description:
- Introduction to network security concepts and mechanisms.

CSEE E6180  Modeling and Performance Analysis *(sometimes)*

Description:
- Introduction to queuing analysis and simulation techniques.

COMS E6181  Advanced Internet Services *(sometimes)*

Description:
- In-depth survey of protocols and algorithms to transport multimedia info across the Internet.