

ECE 587 – Hardware/Software Co-Design Spring 2026

Instructor: Professor Jia Wang (jwang34@illinoistech.edu)

Prerequisite:

- **CS 201** Introductory data structures, algorithms, and object-oriented programming.
- **ECE 441** Microprocessors, memories, I/O interfaces, and interrupt systems.
- Though not required, you are recommended to take at least one course in VLSI design, software development, and computer architecture concurrently or before taking this course.

Class Time and Location: Mon./Wed. 11:25 AM – 12:40 PM, Perlstein Hall 131

Office Hour and Location: Mon. 1:00 PM – 2:00 PM, Siegel Hall 317

Class Home Page: <https://wngjia.github.io/ece587-web/>

Textbook:

- (Recommended) “Embedded System Design: Modeling, Synthesis and Verification”
D. D. Gajski, S. Abdi, A. Gerstlauer, G. Schirner, Springer, 2009. ISBN-13: 978-1-4419-0503-1 (eBook available from <http://library.iit.edu/>)
- Additional online material and research papers

Computer and Network Requirements:

- A recent Windows computer with at least 4 CPU cores, 16GB memory, and 512GB SSD for multicore programming and hardware simulation.
 - Or a x64 Ubuntu server with 4 CPU cores, 8GB memory, and 100GB storage.
 - We are not able to support ARM-based computers like Apple MacBooks and Raspberry Pi’s, as well as computers that are more than 5 years old.
- Access to Google Colab for CUDA programming.
- Internet access to common services and repositories like GitHub.

Course Objective: To give students a clear understanding of state-of-the-art hardware/software co-design methodology for computing systems.

Topics Covered: Hardware/software co-design of computing systems; Models of computation; Verification; Multicore and CUDA programming; High-level synthesis; Hardware and software architectures for neural networks; Trends in hardware acceleration and interconnection networks.

Grading: Homeworks: 15% / Projects: 90%. A: $\geq 90\%$ / B: $\geq 80\%$ / C: $\geq 60\%$.

Homework and Project Policy: Late homeworks and projects will not be graded. Deadlines will NOT be extended, except for extraordinary reasons. Homeworks will be graded based on general approach and completion. Discussions on homeworks/projects are encouraged, but copying will call for disciplinary action.

Lecture Schedule (tentative):

No.	Date	Topic/Chapters	HW Out/Project Due
1, 2	1/12, 1/14	Introduction/1, 2	
3, 4	1/19, 1/21, 1/23	Neural Networks and GEMM	
5, 6	1/26, 1/28	State-Based Models/3.1	
7, 8	2/2, 2/4	Process-Based Models/3.1	Homework 1
9,10	2/9, 2/11	Multicore Programming I	GEMM 1: The Baseline
11,12	2/16, 2/18	Multicore Programming II	
13,14	2/23, 2/25	System Modeling/3.2–3.7	Homework 2
15,16	3/2, 3/4	Verification/7	GEMM 2: CPU Optimizations
17,18	3/10, 3/12	CUDA Programming I	
	3/16–3/20	Spring Break	
19,20	3/23, 3/25	CUDA Programming II	Literature Survey (progress)
21,22	3/30, 4/1	Systolic Array, Chipyard	
23,24	4/6, 4/8	Hardware Synthesis I/6	GEMM 3: CUDA
25,26	4/13, 4/15	Hardware Synthesis II/6	Homework 3
27,28	4/20, 4/22	Hardware Acceleration	
29,30	4/27, 4/29	Interconnection Networks	GEMM 4: Hardware Accelerator
	5/4–5/8	No Final Exam	Literature Survey (final)

ADA Statement: Reasonable accommodations will be made for students with documented disabilities. In order to receive accommodations, students must obtain a letter of accommodation from the Center for Disability Resources and make an appointment to speak with me as soon as possible. The Center for Disability Resources is located in the Life Sciences Building, room 218, 312-567-5744 or disabilities@iit.edu.

Sexual Harassment and Discrimination Information: Illinois Tech prohibits all sexual harassment, sexual misconduct, and gender discrimination by any member of our community. This includes harassment among students, staff, or faculty. Sexual harassment of a student by a faculty member or sexual harassment of an employee by a supervisor is particularly

serious. Such conduct may easily create an intimidating, hostile, or offensive environment. Illinois Tech encourages anyone experiencing sexual harassment or sexual misconduct to speak with the Office of Title IX Compliance for information on support options and the resolution process. You can report sexual harassment electronically at iit.edu/incidentreport, which may be completed anonymously. You may additionally report by contacting the Title IX Coordinator, Virginia Foster at foster@iit.edu or the Deputy Title IX Coordinator at eespeland@iit.edu. For confidential support, you may reach Illinois Tech's Confidential Advisor at (773) 907-1062. You can also contact a licensed practitioner in Illinois Tech's Student Health and Wellness Center at student.health@iit.edu or (312)567-7550 For a comprehensive list of resources regarding counseling services, medical assistance, legal assistance and visa and immigration services, you can visit the Office of Title IX Compliance website at <https://www.iit.edu/title-ix/resources>.

University Resources for Students' Rights, Responsibilities, and Related Policies:

- The Center for Disability Resources (CDR) Rights and Responsibilities
<https://www.iit.edu/cdr/faqs/rights-and-responsibilities>
- The Family Educational Rights and Privacy Act (FERPA)
<https://www.iit.edu/registrar/students-and-alumni/ferpa>
- Code of Conducts (from Student Handbook)
<https://www.iit.edu/student-affairs/student-handbook/fine-print/code-conduct>
- Policies Procedures and Regulations (from Student Handbook)
<https://www.iit.edu/student-affairs/student-handbook/fine-print/policies-regulations-and-procedures>