Embedded and Cyber-Physical Systems (ECPS)

Courses

ECPS 202. Cyber-Physical Systems Design. 4 Units.
Requirements and specification, models of computation, tools, design, merging cyber and physical, data-driven modeling for edge artificial intelligence systems, cyber-physical examples. Design process, specification, requirements, modeling, components, selection, interfaces, system structure, different levels, verification, testing.

Restriction: Graduate students only.

ECPS 203. Embedded Systems Modeling and Design. 4 Units.
Embedded systems definition, system-level specification, models and languages. Concepts, requirements, examples. Embedded system models at different levels of abstraction. Test benches, design under test, IP components. Discrete event simulation, semantics, and algorithms.

Restriction: Graduate students only.

ECPS 204. Embedded System Software. 4 Units.
Embedded system software requirements, concepts, and examples for applications in the cyber-physical domain. Embedded operating systems, real-time system software (RTOS), I/O software. Multithreading. System software for power and energy management, and middleware.

Restriction: Graduate students only.

ECPS 205. Sensors, Actuators, and Sensor Networks. 4 Units.
Fundamental principles and applications of sensors, actuators. Smart sensors and microsensor/microactuator array devices. Introduction to signal processing and sensor/actuator networks, deployment and architecture, wireless communication, multiple access control layer, data gathering, routing and querying, collaborating signal processing.

Restriction: Graduate students only.

ECPS 206. Real-Time and Distributed Systems. 4 Units.
Time dependent systems, clock synchronization, real-time communication protocols, specification of requirements, task scheduling. Validation of timelines, real-time configuration management. Middleware architecture for distributed real-time and secure services.

Restriction: Graduate students only.

ECPS 207. Security and Privacy in Cyber-Physical Systems. 4 Units.
Embedded and cyber-physical systems security: attacks and countermeasures, authentication, identification, confidentiality, data integrity, authorization, access control, security protocols. Privacy awareness and mitigation. Side-channel attacks and defenses. Applications of public key and symmetric cryptography, digital certificates, credentials.

Restriction: Graduate students only.

ECPS 208. Control Systems for Cyber-Physical Systems. 4 Units.
Dynamic models, from first principles or via identification. Concepts in control (stability, controllability, observability). Control design (continuous times) and digital implementation. Introduction to optimization and direct discrete time control. Multi-agent systems, their control and implementation related concepts.

Restriction: Graduate students only.

ECPS 209. Cyber-Physical Systems Case Studies . 4 Units.
Covers CPS case studies in applications such as (but not limited to): automotive and transportation, manufacturing, power distribution grid, medical and healthcare, robotics, civil infrastructure, avionics.

Restriction: Graduate students only.

ECPS 210. Cyber-Physical Systems Project. 4 Units.
Students are required to complete a project that deals with a specific emphasis of Cyber-Physical Systems, such as (but not limited to): automotive, transportation, manufacturing, power grid, medical healthcare, robotics, civil infrastructure, avionics.

Prerequisite: ECPS 202 or ECPS 203 or ECPS 216. ECPS 202 with a grade of B- or better. ECPS 203 with a grade of B- or better. ECPS 216 with a grade of B- or better

Repeatability: May be taken for credit 3 times.

Restriction: Graduate students only.

ECPS 211. Machine Learning and Data Mining. 4 Units.
Introduction to principles of machine learning and data-mining. Learning algorithms for classifications, regression, and clustering. Emphasis is on discriminative classification methods such as decision trees, rules, nearest neighbor, linear models, and naive Bayes.

Restriction: Graduate students only.

ECPS 212. Entrepreneurship for Scientists and Engineers. 4 Units.
Real-world introduction to the theory and practice of entrepreneurship. Explores organizational, strategic, and financial challenges; start-up strategies; business-idea evaluation; and business-plan writing. Presentations by prestigious entrepreneurs and industry leaders.

Restriction: Graduate students only.

ECPS 216. Internet of Things Systems and Software. 4 Units.
Internet of Things (IoT) concept, sensors and actuators, serial protocols, network and communication protocols and programming, IoT platforms, real-time performance, middleware architecture for IoT, edge and cloud support for IoT applications.

Restriction: Graduate students only.

ECPS 234. Preparation for Capstone Design. 0-1 Units.
Provides students in the Master of Embedded and Cyber Physical Systems program with information, practical skills, and preparation for their capstone project. Students form capstone teams and participate in initial project matching with faculty and industry mentors.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

Restriction: Graduate students only.

ECPS 291. Internship. 1 Unit.
Students go through practical training under an industry mentor in a technical field corresponding to their area of interest.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

Restriction: Graduate students only.

ECPS 295. Special Topics in CPS. 1-4 Units.
Studies in selected areas of CPS. Topics addressed vary each quarter.

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only.

ECPS 299. Individual Research. 1-12 Units.
Individual research or investigation under the direction of an individual faculty member.

Repeatability: May be repeated for credit unlimited times.

Restriction: Graduate students only.