

Embedded and Cyber-Physical Systems (ECPS)

Courses

ECPS 202. Cyber-Physical Systems Design. 4 Units.

Requirements and specification, MoCs, tools, design, merging cyber and physical, manufacturing, examples (robots, energy house, self-driving car, pacemaker, etc.). 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, specification, and languages. Concepts, requirements, examples. Embedded system models at different abstraction levels. Test benches, design under test, Intellectual Property components. Discrete event simulation, semantics, algorithms. Design, analysis techniques for decentralized computer architectures, communication, and hardware-software systems.

Restriction: Graduate students only.

ECPS 204. Embedded System Software. 4 Units.

Embedded system software concepts, requirements, examples, for engineering applications such as multimedia and automotive. Software methodology. Specification, design constraints. Embedded operating systems. Input/output, interrupt handling. Code generation, compilation, instruction set simulation. Distributed object model, distributed environment, platform-independent software agents, components.

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.

ES and CPS security: attacks and countermeasures, authentication, identification, confidentiality, data integrity, authorization, access control, malware attacks and counter-measures, security protocols. Privacy issues e.g., vehicular devices and smart metering. Applications of public key and symmetric cryptography, e.g., digital certificates, credentials.

Restriction: Graduate students only.

ECPS 208. Control Systems for Cyber-Physical Systems. 4 Units.

State space representation (continuous and discrete), principles of optimization, model predictive control, robustness to actuation or communications limitations, control of networked systems, multi-agent co-operation and control.

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. 8 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 and ECPS 204 and ECPS 209

Repeatability: May be taken for credit 3 times.

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 299. Individual Research. 1-16 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.