ROBOTICS AND CONTROL SYSTEMS (EGRS)

EGRS 105 Robotics Applications & Trends 1 Credit Hour (1,0)
This course will present articles, news releases, videos, and information from select media outlets on the latest applications and developments in the field of robotics. Also, trends in the use of robotics in the job market will be discussed using data from resources such as the Bureau of Labor Statistics and the International Federation of Robotics.

EGRS 215 Introduction to Robotics 2 Credit Hours (1,2)
An introduction and orientation to the field of robotics. Challenges in robotics manufacturing, design and structure of robotic systems, classification of robots, robot geometry, power sources, robotic control systems are covered in this course. The lab part of the course will provide an overview of robotics applications in industry through videos and hands-on experiences. Applied laboratory topics will cover basic programming concepts, structures, and applications using industrial robots.
Prerequisite(s): MATH102 or equivalent

EGRS 235 Industry 4.0 4 Credit Hours (3,2)
An introduction to Industry 4.0 concepts and supporting technology. Students will learn the philosophy of Industry 4.0, the application of Industrial Internet of Things (IIoT), and the integration of workcell sensors for digital data collection for the purpose of analytics and predictive actions.
Prerequisite(s): MATH131 or higher, EGEE125, (EGET270 or EGEE210), (EGNR140 or CSCI105 or EGNR265 or some programming background)

EGRS 305 Robot Safe/Collabtive Robotics 3 Credit Hours (2,2)
A systematic overview of safety guidelines for robots and collaborative robotics technology. Topics include risk assessment for robotics applications, robot diagnosis and maintenance needs, Robotics Industries Association (RIA) robotics safety standards, applications of collaborative robots (cobots), end-of-arm tooling for cobots, industry 4.0, and basics of data analytics, machine learning, and AI.
Pre or Corequisite(s): EGRS381 or EGRS385 or at least one course with lab in industrial robotics at the sophomore level or above, or permission of the instructor

EGRS 325 Industrial Control Systems 3 Credit Hours (2,3)
An introduction to the equipment and techniques commonly used in industrial control & automation systems. Topics include technical and safety standards, electrical diagrams, control panel design and wiring, pneumatic systems, and motor drives.
Prerequisite(s): EGET270 or EGEE210

EGRS 365 Programmable Logic Controllers 3 Credit Hours (2,3)
An introduction to programmable logic controllers (PLC) with an emphasis on programming of the controller and operator interface. Standard PLC devices (bits, timers, counters etc.) and controller functions dealing with math, compare, moves, program flow, analog input, and high-speed counters will be covered in the course. Written and oral business communications are an integral part of the course.
Pre or Corequisite(s): EGNR265 or EGEE125 or CSCI121 and sophomore status

EGRS 366 Programmable Logic Controllers 3 Credit Hours (2,2)
An introduction to the use of programmable logic controllers (PLC). Basic components of the PLC along with the interface to hydraulic/pneumatic systems and sensors will be discussed. Some higher-level functions such as zone control, master control and sequencers will also be covered. This course will only be offered at the regional sites. It is not a communication-intensive course.
Prerequisite(s): Electrical fundamentals course

EGRS 372 Mobile Robotics 4 Credit Hours (3,3)
An introduction to mobile robotics. Students will learn to integrate sensor data in order to control mobile robots to perform useful tasks in both known and unknown environments. Applications could include drones, autonomous vehicles, underwater robots, and warehouse robots. Students will also learn about current trends and areas of research within the field of mobile and service robotics.
Prerequisite(s): MATH151 or MATH112, EGNR265 or CSCI121 (minimum grade of C or higher), and EGRS215

EGRS 375 Cyber-Physical Sys & Security 3 Credit Hours (3,0)
An introduction to cyber-physical systems. Students will learn digital storage of sensory data, cloud (edge) computing, threat analysis and data protection at the hardware level, security designs applicable for industrial environments, and the application of various intelligent algorithms for data analytics.
Prerequisite(s): MATH207 or MATH308, EGNR265 or CSCI201, CSCI265
Pre or Corequisite(s): EGRS235

EGRS 380 Robotics Technology 2 Credit Hours (2,0)
This course will cover topics relative to robotics and robotics systems. Two- and three-dimensional kinematics, end effectors, active and passive collision systems, sensors, feedback devices, robotic safety, and principles of operation of applicable hardware will be studied.
Prerequisite(s): MATH111 and MATH131 with grade of C or better, and PHYS221

EGRS 381 Robotics Technology Lab 1 Credit Hour (0,3)
Laboratory exercises will provide hands-on examples in the use of industrial robots. Focus will be on learning a structured robotics programming language. Applications and projects will simulate industrial situations as well as emphasize system integration.
Prerequisite(s): EGNR265 or CSCI121

EGRS 382 Intro to Robotics Programming 1 Credit Hour (0,3)
The laboratory work will provide an introduction to the use and application of an industrial robot. Programming concepts and structures in the V+ programming language as used in Adept and Staubi robots will be studied. Industry-like applications and system integration projects will be assigned.
Prerequisite(s): EGRS380

EGRS 385 Robotics Engineering 3 Credit Hours (3,0)
An introduction to the field of robotics engineering. Topics include classification of robotic manipulators, accuracy and repeatability, wrists and end-effectors, actuators and sensors, homogeneous transformations, Denavit-Hartenberg convention, forward kinematics, inverse kinematics, trajectory planning and an introduction to velocity kinematics.
Prerequisite(s): EGNR140 and MATH251
Pre or Corequisite(s): EGRS381

EGRS 430 Sys Integration/Machine Vision 4 Credit Hours (3,3)
A study of the theory and application of sensors and machine vision in modern manufacturing systems. Topics will include position sensors, encoders, interface electronics, force and torque sensors, LAN, PLC, electrical noise, machine vision, lighting techniques, control software, feature extraction techniques and robot guidance.
Prerequisite(s): MATH152 or EGNR245, EGNR140, EGRS381 or EGRS385, and EGNR265 or CSCI121

EGRS 435 Automated Manufacturing System 2 Credit Hours (2,0)
A study and analysis of the components of an automated manufacturing system. Topics include mathematical modeling of manufacturing systems, analysis of flow lines, automated assembly systems, materials requirement planning (MRP), Automated Guided Vehicle Systems (AGVS), and production economics.
Prerequisite(s): EGRS385
Pre or Corequisite(s): EGRS481

EGRS 460 Control Systems 4 Credit Hours (3,3)
An introduction to the analysis and design of linear feedback control systems. The course will include a study of system modeling, block diagrams, system response, stability, steady state error, bode plots and root locus. Laboratory exercises will develop a student's ability to design feedback systems and quantify system performance.
Prerequisite(s): MATH310, EGEM220 and EGEE210
Pre or Corequisite(s): EGNR340

EGRS 461 Design of Control Systems 4 Credit Hours (3,3)
This course builds upon the fundamental control system theory covered in EGRS460 and introduces various control system design techniques. General topics include Bode and root locus design techniques, controllability and observability, optimal control, state space design. Several classical design techniques such as phase-lead, phase-lag, deadbeat, pole placement and PID design are covered.
Prerequisite(s): EGRS460

EGRS 480 Manufacturing Automation 3 Credit Hours (3,0)
Study of the mathematical modeling of production concepts, analysis of automated flow lines, automated assembly systems, production economics, automated guided vehicles and materials requirement planning.
Prerequisite(s): EGRS380, EGRS381 or EGRS382, and MATH112 or MATH151 with a grade of C or better

EGRS 481 Manufacturing Automation Lab 1 Credit Hour (0,3)
The first part of the laboratory work will focus on programming industrial robots different from the robots used in EGRS381. Industry-like applications and system integration projects will be assigned. The second part of the lab work will include the application of industry standard manufacturing discrete-event simulation software package to study and analyze manufacturing systems.
Prerequisite(s): EGNR265 or CSCI121 either with a grade of C or better

EGRS 482 Automation and Simulation Lab 1 Credit Hour (0,3)
Laboratory work in automation will focus on programming Fanuc robots using the Karel programming language. Industry-like applications and system integration projects will be assigned. Lab work in simulation will include the introduction to a discrete-event manufacturing simulation software package. Several manufacturing systems will be modeled, verified, validated and optimized using the simulation software package.
Prerequisite(s): EGRS480