Industrial Engineering Department
ISEN455 – Senior Elective Course
Principles of Programmable Automation

CATALOG DESCRIPTION

Comprehensive treatment of the principles of computer numerical control, direct numerical control, computer-aided part programming and industrial robots; emphasis on the operations and applications of CNC, DNC machine tools and industrial robots; laboratory experience in using part-programmable software and robotic programming languages to develop programmable automation systems.

PREREQUISITES

ISEN 316; ISEN 416 or registration therein. CAD experience (e.g., AutoCAD), knowledge of a high level programming language (e.g., C, Pascal, BASIC), Linear Algebra.

COURSE OBJECTIVES

(1) Learn about 2D and 3D transformations. (2) Introduce students to robotics. (3) Learn about logic, automation and part programming. (4) Hands-on exposure to machine control. (5) Introduce students to computer integrated manufacturing.

TEXTBOOK AND ADDITIONAL COURSE MATERIAL


Reference Texts:


TOPICAL OUTLINE

Topics to be covered in the lectures:

(1) Introduction (Chapter 1).
(2) Building Blocks for Automation (Chapter 2).
(3) Numerical Control (Chapter 5, Notes).
(4) NC Programming (Notes, Lab).
(5) Industrial Robotics (Chapters 6, 7).
(6) Industrial Logic Control Systems (Chapters 11, 12).
(7) Programmable Logic Controllers (Chapter 13).

Laboratory Components: Robot Joint manipulation, Part Programming using MasterCAM, machining using ProLight machining center, logic design using Allen Bradley SLC500.
CLASS AND LAB SCHEDULE

Lectures: Two days a week, 50 minutes per day.
Lab: One section (up to 20 students); 150 minutes a week.

PROFESSIONAL COMPONENT

This course provides fundamental concepts, theory and procedures for the study of 2D/3D transformations, robotics, automation, and manufacturing systems control. Quantitative models are developed to understand concepts from robotics and automation, and their applications to control and automate discrete manufacturing processes. The knowledge learned in this course will be integrated with knowledge from selected related courses to develop a laboratory design project. Knowledge acquired in ISEN 316, 424, CPSC 206, and MATH 304, along with the student's creativity and ability to apply this material will be of fundamental importance to succeed in this course.

PROGRAM OUTCOMES

A. An ability to apply knowledge of mathematics, science, and engineering.
   Specific topics of ISEN 455 in which knowledge of mathematics, science and engineering is applied are: (1) 2D/3D Transformations. (2) Forward and Inverse Kinematics. (3) Logic design. (4) Cycle time calculations of automated systems.

C. An ability to design a system, component, or process to meet desired needs.
   The steps of the scientific method can be reformulated as follows when we consider specifically the engineering design process: (1) define the problem; (2) analyze the problem; (3) generate alternative designs; (4) evaluate the alternatives; (5) select the preferred design; and (6) implement the design.

E. An ability to identify, formulate, and solve engineering problems.
   ISEN 455 emphasizes on the importance of the following functions of manufacturing systems: (1) numerical control, (2) automation, (3) computer integrated manufacturing, and (4) programmable logic. Specific formulations studied in this course are: (a) different types of robot configurations, (b) logic control systems, (c) throughput analysis of automated manufacturing systems.

K. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
   The following techniques, skills and tools are studied and used: AutoCAD, MasterCAM, MATLAB, Robot arm manipulation, PLC programming.

PREPARED BY: Amarnath Banerjee. DATE: 10-19-04