University of Idaho

Industrial Technology (IndT) 453

Computer Integrated and Robotics Manufacturing Technology

3 Credit Hours 16 Weeks
Spring Semester 2025 Year
Prerequisite(s): IndT 353 or Instructor Permission

Instructor Information

Instructor: Dr. Alex Vakanski
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E-mail is the preferred medium of communication for any changes to the class schedule. All e-mail notifications will be sent to the student's University of Idaho account only. Course information can be found on Canvas in the Courses section.

Course Description (Catalog)

The course provides an overview of computer-integrated manufacturing technology with a focus on robotic automation. Covered topics include: computer-aided design, computer-aided manufacturing, automated production lines and assembly systems, cellular and flexible manufacturing. The integration of hardware and software components for manufacturing automation is studied, with an emphasis on sensors, actuators, controllers, computer numerical control, and kinematic modeling of industrial robots.

Course Scope

In-depth examination of automated production systems and computer-integrated manufacturing, manufacturing support systems, hardware and software components for manufacturing automation and control, robot modeling and industrial applications, material handling, automated production lines, and automated assembly systems.

Course Objectives

The objective is that upon the completion of the course the students should demonstrate the ability to:

1. Understand the technical and engineering aspects of automated production systems.
2. Describe the main characteristics of typical sensors and actuators employed in computer integrated manufacturing.
3. Outline the integration of hardware and software components for automation and process control.
4. Employ computer-aided manufacturing for machine tool paths definition and for generating computer numerical control code.
5. Identify applications of industrial robots for manufacturing automation, and identify common robot configurations and end of arm tooling.
6. Describe kinematic analysis of industrial robotic arms.
7. Categorize the major forms and systems for automated production and automated assembly lines.

Learning Outcomes and Competencies

The learning outcomes and competencies of the IndT 453 course relate to the ability of students to:

1. Apply theories and principles from mathematics, physical science, and computer applications and information technology to solve practical technology problems (1a).
2. Demonstrate proficiency in the use of manufacturing equipment to solve practical technology and engineering problems (1c).
3. Apply the principles of cognitive systems and human performance to perform task analyses and evaluate human-computer/machine interfaces (1d).
4. Demonstrate ability to adapt emerging technologies (4c).

Note: The numbers in parentheses refer to Learning Outcomes and Competencies for the Industrial Technology program at the University of Idaho, as defined by the Advisory Board. The full list of learning outcomes and competencies is available at the following link.

Project Information

The course does not require a project.

Course Materials

Textbook: Mikell P. Groover
"***Automation, Production Systems, and Computer-Integrated Manufacturing***"
4th edition, 816 pages, Prentice-Hall, 2014
ISBN-10: 0-13-3499618
ISBN-13: 978-0133499612

There is a more recent 5th edition of the textbook published in 2018, and also there is an older 3rd edition of the textbook published in 2008, which can both be used for the course.

Optional Reference Materials

1. Larry T. Ross, Stephen W. Fardo, James W. Masterson, Robert L. Tower, "*Robotics: Theory and Industrial Applications*," 2nd edition, Goodheart-Willcox Company, 2011, ISBN: 978-1-60525-321-3.

2. L. Sciavicco, B. Siciliano, "*Modeling and Control of Robot Manipulators*," 2nd edition, Springer-Verlag, 2005, ISBN: 1852332212.

Evaluation Procedures

The course is delivered in a hybrid format. There will be 3 live class meetings and 4 live labs, and the rest of the lectures will be posted for self-study. All course materials, including lecture notes, assignments, exams, and supplementary materials, will be posted on Canvas on a regular basis. Canvas is the main medium for communication between the students and the instructor in the course.

Examination: There is one midterm examination and one final examination. The dates of each examination are indicated in the Course Outline below. Failure to submit the exams on the due dates, without prior approval, will result in marks deduction. Prior approval for extension could be granted only under acceptable circumstances.

Homework: There are six homework assignments. The dates for submitting the homework assignments are indicated in the Course Outline below. The section Late Assignments below provides additional information regarding the submission policy.

Labs: There are four practical labs in the course. Attendance is mandatory. The labs can be completed either on weekends, evenings, or on weekdays. The students and the instructor will communicate to arrange the lab meetings.

Grading/Evaluation Procedure:

Homework assignments	50 marks
Labs attendance	10 marks
Midterm Exam	20 marks
Final Exam	20 marks
Total	100 marks

Final Grades:	Above 90	A
	80 – 89	B
	70 – 79	C
	60 – 69	D
	Below 60	F

Example of Assessment of Learning Outcomes: Students' ability to apply theories and principles from mathematics, physical science, and computer applications and information technology to solve practical technology problems will be assessed through the homework assignments. For example, in Assignment 3 the students will calculate the torque and rotational speed for a DC servomotor, given the motor parameters.

Course Outline

Date	Topics	Course Objectives	Learning Outcomes	Readings	Assignments
Jan. 14	**Introduction to Production Systems and Manufacturing**	1	1	Chapters 1, 2	
Jan. 21	**Automation and Control Systems (class meeting)**	1, 3	1, 4	Chapters 4, 5, 9	
Jan. 28	**Computer-Aided Design, Computer Integrated Manufacturing**	3	1, 2, 4	Chapters 23, 24	**HW 1**
Feb. 4	**Sensors for Automation and Process Control**	1, 2	1	Chapter 6	
Feb. 11	**Actuators for Automation and Process Control (class meeting)**	1, 2	1	Chapter 6	**HW 2**
Feb. 18	**Computer Numerical Control**	4	1, 2, 4	Chapter 7	**HW 3**
Feb. 25	**Introduction to Robotics**	1, 3, 5	1, 2, 3, 4	Chapter 8	
Mar. 4	**Midterm Exam**				**Midterm**
Mar. 18	**Industrial Robotics**	1, 6	1, 2	Chapter 8	
Mar. 25	**Kinematic Modeling of Industrial Robots (class meeting)**	1, 6	1, 2	Materials Provided	
Apr. 1	**Manufacturing Cells and Assembly Lines**	1, 7	1, 2	Chapters 14, 15	**HW 4**
Apr. 8	**Automated Production Lines**	1, 3, 7	1, 3	Chapter 16	**HW 5**
Apr. 15	**Automated Assembly Systems**	1, 3, 7	1, 3	Chapter 17	
Apr. 22	**Cellular and Flexible Manufacturing**	1, 3, 7	2, 3, 4	Chapters 18, 19	**HW 6**
Apr. 29	**Laboratory Practices**	1	2, 3, 4		
May 6	**Final Exam**				**Final**

Policies

WRITING EXPECTATIONS

All written submissions should be submitted in a font and page set-up that is readable and neat. It is recommended that students try to adhere to a consistent format, which is described below.

- Typewritten in double-spaced format with a readable style and font and submitted inside the electronic classroom (unless classroom access is not possible and other arrangements have been approved by the professor).
- Arial 11 or 12-point font or Times New Roman styles.

- Page margins Top, Bottom, Left Side and Right Side = 1 inch, with reasonable accommodation being made for special situations and online submission variances.

CITATION AND REFERENCE STYLE

Assignments completed in a narrative essay or composition format must follow APA or MLA style guidelines.

LATE ASSIGNMENTS

For each day of late submission of the homework assignments, 10% of the assignment marks will be deducted, unless the student contacts the instructor ahead of time about an extenuating situation.

DISABILITY ACCOMODATIONS

This institution complies with the Americans with Disabilities Act, Section 504 of the Rehabilitation Act, and the World Wide Web Consortium's (W3C) Universal Access Guidelines. Reasonable accommodations are available for students who have a documented disability. Please notify your instructor(s) during the first week of class regarding accommodation(s) needed for the course. All accommodations must be approved through the ISU Counseling Testing and Career Services Office in Idaho Falls. For assistance, please call 282-7750 or stop by their office in the Student Union Building Room 223.

CELL PHONE/TEXTING POLICY

Does not apply to hybrid and web-based courses.

NETIQUETTE

Online universities promote the advancement of knowledge through positive and constructive debate –both inside and outside the classroom. Discussions on the internet, however, can occasionally degenerate into needless insults and "flaming." Such activity and the loss of good manners are not acceptable in a university setting, where basic academic rules of good behavior and proper "netiquette" must persist. Remember that you are in a place for the fun and excitement of learning, which does not include descent to personal attacks, or student attempts to stifle the discussion of others.

- Technology limitations: while you should feel free to explore the full-range of creative composition in your formal papers, keep e-mail layouts simple. The Educator classroom may not fully support MIME or HTML encoded messages, which means that boldface, italics, underlining, and a variety of color-coding or other visual effects will not translate in your e-mail messages.
- Humor note: despite the best of intentions, jokes and (especially) satire can easily get lost or taken seriously. If you feel the need for humor, you may wish to add "emoticons," such as ;-), :), or J, to help alert your readers.

ACADEMIC INTEGRITY

The University of Idaho expects that students will engage in academic activity with high standards of honesty and integrity. These values are central to the educational process and are also cornerstone values for citizenship and professional conduct after you leave the University.

The University of Idaho has specific academic honesty expectations described in the Student Code of Conduct. These are minimum standards that are generally applied across the University.

For more information see;

http://www.uidaho.edu/DOS/academicintegrity

NONDISCRIMINATION POLICY

The University of Idaho has a policy of nondiscrimination on the basis of race, color, religion, national origin, sex, age, disability or status as a Vietnam era veteran. This policy applies to all programs, services, and facilities, and includes, but is not limited to, applications, admissions, access to programs and services, and employment. Such discrimination is prohibited by titles VI and VII of the Civil Rights Act of 1964, title IX of the Education Amendments of 1972, sections 503 and 504 of the Rehabilitation Act of 1973, the Vietnam Era Veterans' Readjustment Assistance Act of 1974, the Age Discrimination Act of 1975, the Age Discrimination in Employment Act Amendments of 1978, the Americans With Disabilities Act of 1990, the Civil Rights Act of 1991, the Rehabilitation Act Reauthorization of 1992 and other state and federal laws and regulations. Sexual harassment violates state and federal law and policies of the Board of Regents, and is expressly prohibited, as stated in Faculty Staff Handbook (FSH) 3220. The University of Idaho also prohibits discrimination on the basis of sexual orientation, as stated in FSH 3215. The entire FSH can be accessed online at http://www.webs.uidaho.edu/fsh. Questions or concerns about the content and application of these laws, regulations or University policy may be directed to the Human Rights Compliance Officer (208-885-4213); Complaints about discrimination or harassment should be brought to the attention of the Human Rights Compliance Office (208-885-4212). Retaliation for bringing forward a complaint is prohibited by FSH 3810.

LIBRARY RESOURCES

As a UI student, you not only have access to valuable print and electronic resources from the university's library, but you also have the access to personalized assistance from the librarians. If you have assignments or research questions and aren't sure how to make the most of library resources from off-campus, feel free to contact the College of Education liaison librarian with questions. Help may be obtained via phone; 208-885-2503. As always, you may also call the main reference desk anytime Monday to Thursday from 9 am to 9 pm, Friday from 9 am to 5 pm, and Sunday from 1 pm to 9 pm, 208-885-6584, or visit http://www.lib.uidaho.edu for email or IM assistance.

DISCLAIMER STATEMENT

Course content may vary from the outline to meet the needs of this particular group.