Class time and location:

SMFG 386-01	(3236) - MWFr10:00AM – 10:50AM	Online
SMFG 386-02	(3237) - Th 5:00PM - 7:50PM	Online

Instructor: H. Sinan Bank, **hsbank@mail.csuchico.edu**, 530-898-4619

Office: Zoom
Office Hrs.: MW 12:00 pm – 2:00 pm

Prerequisites: PHYS 202, SMFG 360

Course Usage of Blackboard Learn:
The course syllabus and other material will be posted on Blackboard Learn**. You are responsible for regularly checking the on-line resources, which is accessed through the Chico State Portal**. We will also use a course webpage to show off some of the details for the class publicly.

Course Description:
Concepts, principles, and relationships of automated assembly equipment, computer-aided drafting design, computer-aided manufacturing (CAM), robotics, numerical control (NC), programmable logic controllers, autonomous ground vehicles (AGVs), flexible manufacturing systems (FMS), and computer-integrated manufacturing (CIM).

Student Learning Outcomes
Upon satisfactory completion of the course, the students will be able to:
1. Explain various reasons for employing automation in a manufacturing environment and describe various applications.
2. Describe the basic function of a sensor and an actuator in an automated application.
3. Select an appropriate sensor and/or actuator for a given automated application.
4. Describe the fundamentals of NC technology.
5. Use a Programmable Logic Controller (PLC) and embedded microcontroller, to perform specified control functions.
6. Describe the basic anatomy and attributes of a robotic systems (e.g., arm, mobile, etc.).
7. Identify and distinguish the different components and interfaces in a Flexible Manufacturing Systems
8. Troubleshoot a system and take appropriate action(s) to resolve the issue(s)
9. Design an automated system to meet defined operational specifications.
10. Research and summarize a unique technology and/ or application in the field of automation or robotics.

Units of Study
Section 1 – Introduction to Production Systems Design and Architecture
- Model-based Systems Design and Engineering [Notes and presentation]
- Introduction to Production Systems and Basic Principles of Automation [Groover Chapter 1]
- Manufacturing Operations [Groover Chapter 2]

Section 2 –Automation and Control Systems
- Introduction to Automation [Groover Chapter 4]
- Industrial Control Systems [Groover Chapter 5]
- Hardware Components; Sensors, Actuators, Analog Digital Conversion (ADC), Digital Analog Conversion (DAC) [Groover Chapter 6, Hanssen Chapter 2-3]

Section 3 – Automation and Process Control
- Discrete Control and Programmable Logic Controllers [Groover Chapter 9 and Hanssen Chapter 5-8]
- Microcontrollers [Notes and presentation]

Section 4 – Robotics and Automated Manufacturing Systems
- Robotics [Groover Chapter 8]
- NC Technology [Groover Chapter 7]

Section 5- Planning and Perception in Manufacturing Automation with Examples [Time Permits]
- Computer Vision [Groover Chapter 22]
- Single-Station Manufacturing Cells – 5 Axis CNC Machine Example [Groover Chapter 14]
- Planning, Scheduling, and Task Allocation on Factory Operations [Groover Chapter 15]

Textbook
Groover, Mikell P. Automation, production systems, and computer-integrated manufacturing. Pearson Education, 2019. (eBook is acceptable)
Other suggested books/ references for students self-learning efforts and the instructor would incorporate some questions from there. Please see more information at the corresponding Blackboard's Section
Hanssen, Dag H. Programmable logic controllers: a practical approach to IEC 61131-3 using CoDeSys. John Wiley & Sons, 2015. (eBook is acceptable)
Scherz, Paul, and Simon Monk. Practical electronics for inventors. McGraw-Hill Education, 2013. (eBook is acceptable)
Mechatronics with Experiments, Sabri Cetinkunt, 2015 (eBook is acceptable)

Required Software Packages
The details of the software package for the lab is provided below.
- Windows 10 PC – Virtual Machines would be problematic on macOS and the instructor will NOT assist to solve your IT issues.
- Python 3.6 with Visual Studio Code
- Mathworks MATLAB Suite with additional required toolboxes (e.g. System Composer) as pointed in the Black Board.
- CoppeliaSim for physics-based simulation of labs and some of the examples
- CoDeSys 3.5 IEC-61131-3 based PLC programming.
- SimulIDE for microcontroller simulation
- Rhino with Grasshopper (free trial suffices) – Parametric Design
- **Please register Omron learning: https://omronlearning.com/#/login**

The instructor is NOT responsible the installation of the <u>software</u>. There are appropriate details provided on Blackboard. However, the instructor <u>will NOT assist</u> any installation of any software and any delays of the assignments will be subject to the penalties.

Hardware

We will have in class labs for you to realize the theoretical knowledge into something tangible. In manufacturing system design, using simple systems to test the theoretical application is a generic approach.

Assignments and Grading Policies

Labs	15%
Exams*	15%
HWs	15%
Group Project	15%
Final Exam	30%
Participation**	10%

*There will be online exams. Each successive exam may include prior course material.

** Participation credit is based on your intellectual contribution to the class. Your attendance to the class **is NOT affecting the participation credit.**

All of the exams will be online (most probably from Friday evening until Sunday midnight), and the students will have 48 hours+ to upload their solutions to provided Google Form. Late uploads of the exams will **NOT** be accepted.

Please be aware that you **MUST** use your student email address (student_email_id@mail.csuchico.edu) and make sure that you logged out from other Gmail addresses while using the resources from Google Drive.

You will also receive an email regarding a shared folder SPRING_2021_SMFG_386_student_email_id where I will share with you any documents (e.g., exam or HW results).

Note:
1. These subject to change with a fair notification.
2. Late homework will be accepted with additional penalties.

Topics/ Tentative Schedule (Please note that the topics are subject to change with a fair notification.)

Topic	Wk	Hours	Sections	Lab	Suggested Resources	HW DUE
1- Model-based Systems Design and Engineering	1	2 hrs	Presentation and Notes	L1	Videos, Videos	N/A
2- Introduction to Production Systems and Basic Principles of Automation	2	2 hrs	Chapter 1			HW1, Omron Factory Automat.
3- Manufacturing Operations	3	2 hrs	Chapter 2	L2	Video	Omron Robotics
DUE: Team and Project Proposal						
4- Introduction to Automation	4	2 hrs	Chapter 4	L3	Article 1	HW2
Exam 1						
5- Industrial Control Systems	5	2 hrs	Chapter 5	L4		HW3
6- Hardware	6-7	4 hrs	Groover Chapter 6, Hanssen Chapter 2-3			
7- Discrete Controllers and PLCs	8-9	4 hrs	Chapter 9	L5		HW4
7- Microcontrollers	10	2 hrs	Presentation and Notes			
DUE: Final Project Proposal						
8- Robotics	11-12	4 hrs	Chapter 8 and other presentation and notes	L6		HW5
9- NC Technology	13	2hrs	Chapter 7			
Exam 2						
10- Computer Vision	15	2 hrs	Chapter 22 and other resources	L7		Omron Vision
11- Examples Single Station and Multi-station Manufacturing Cells	16	2hrs	Chapter 14-15, and other resources			
DUE: Final Project Delivery						
Final	17					N/A

The details of the Evaluation for the Group Projects:

A team must consist of three students and you will fill requested Google Spreadsheets (e.g., the description of the project and problem, team members, project milestone, etc.) that provided during the semester.

The project consists of the presentation and a concise documentation similar to provided templates. The other criteria for the projects are as follows:
- Theoretical rigor (20%)
- Complexity of application (15%)
- Documentation and presentation (25%) - the presentations are limited to 5 mins
- Results and final implementation (40%)
- The vote from other groups/ group members (*optional) (10-20%) - if the students give free points the instructor has the veto and change power for fairness. Your project is 20% of the total grade of the class. The groups can ask more questions during the office hours.

Following the provided procedure will assist you to gain easier credits. From each percentage, the appropriateness of the content will result in the corresponding grade. For example, a documentation with a lot of typos and unstructured text will be graded poorly from the corresponding percentage 5 out of 25.

Irrespective the percentages above, incomplete projects will be evaluated by 60% of the total -in other words, starting from 60.

Dropping and Adding:
You are responsible for understanding the policies and procedures about add/drops, academic renewal, etc., found in the CSU Chico University Catalog. You should be aware of the new deadlines and penalties for adding and dropping classes.

Classroom Protocol:
Needlessly to highlight, during class, please do not engage in any activities that are not related to the class, i.e. personal web surfing, online shopping, e-mail, Facebook, LinkedIn, Snap Chat, Kik, etc.

University Policies and Campus Resources
Academic Integrity
Students are expected to be familiar with the University's Academic Integrity Policy. Your own commitment to learning, as evidenced by your enrollment at California State University, Chico, and the University's Academic Integrity Policy requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the Office of Student Judicial Affairs (Office of Student Conduct, Rights & Responsibilities). The policy on academic integrity and other resources related to student conduct can be found on the Student Judicial Affairs (Office of Student Conduct, Rights & Responsibilities) web site.

Student Services
Student services are designed to assist students in the development of their full academic potential and to motivate them to become self- directed learners. Students can find support for services such as skills assessment, individual or group tutorials, subject advising, learning assistance, summer academic preparation and basic skills development. Student services information can be found on the current students' page of the CSU Chico web site.

Americans with Disabilities Act
If you need course adaptations or accommodations because of a disability or chronic illness, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible or see me during office hours. Please also contact Accessibility Resource Center (ARC) as they are the designated department responsible for approving and coordinating reasonable accommodations and services for students with disabilities. ARC will help you understand your rights and responsibilities under the Americans with Disabilities Act and provide you further assistance with requesting and arranging accommodations.

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Accessibility Resource Center
530-898-5959, Student Services Center 170, arcdept@csuchico.edu

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Student Learning Center
The mission of the Student Learning Center (SLC) is to provide services that will assist CSU, Chico students to become independent learners. The SLC prepares and supports students in their college course work by offering a variety of programs and resources to meet student needs. The SLC facilitates the academic transition and retention of students from high schools and community colleges by providing study strategy information, content subject tutoring, and supplemental instruction. The University Writing Center has been combined with the Student Learning Center. You can also visit the Student Learning Center web site.