

## GE 298 – Manufacturing Automation

Spring 2017 (Jan 16 – May 12)

	Time	Location	TA
Lecture	T-R – TBD	TBD	TBD
Lab	TBD	Senior Design Lab, 3 floor, Transportation Building	TBD

### Course Info:

Instructor : Pramod Chembrammal (pramodch@illinois.edu)  
Office : 1201 CSL Studio (1 floor, North Campus Parking Building)  
Office Hours : TBD

### Course Description:

This course is intended to provide an introduction to methods in automation of manufacturing processes. Topics include an overview of manufacturing processes, computer numerical control, controllers, sensors and actuators, unmanned ground vehicles (UGVs), introduction to robotics, task planning and scheduling, design for manufacturing and assembly. The course will also have weekly labs and visits to Mechanical Engineering machine shop.

**Prerequisite:** ECE 110 – Introduction to Electrical and Computer Engg.

### Course Material:

Course slides, Course notes and prescribed textbooks

### Textbooks:

1. Systems Approach to Computer Integrated Design and Manufacturing, Nanua Singh, John Wiley & Sons
2. Fundamentals of Robotics and Control, Robert J. Schilling, Prentice Hall

### Course Outcomes:

- Understand manufacturing processes
- Understand and implement basic methods in robotics
- Learn how to use automation controllers, sensors and UGVs
- Use methods of design for manufacturing and assembly

**Teaching Assistants and Office Hours:** TBD

### Communication:

- Compass 2G is the main channel for communication. Course material, announcements, home-work assignments, practice exams, solutions, and grades will be posted there. You are responsible to check it regularly.
- You are welcome to drop me emails to discuss your personal concerns and questions. Please start with [GE 298] when drafting your Email Subjects to get timely response.

**Grading:**

Mid-terms (2) :	20%
Final Exam :	20%
Home works :	30%
Labs :	30%

**Class Policies:**

**Homework** You are encouraged to discuss homework problems with your fellow students. But your final answers should be based on your own understanding. Copying others' work is NOT acceptable and violates the honor code. The homework should be handed in before the end of the class on the due date. NO late submission is acceptable without an institute-approved absence.

**Exams** You are allowed to bring a SINGLE-sided 8.5 by 11 sheet of paper for Mid-Term-2 and Final exam. Any supplemental tables or resources that are needed will be provided. NO devices with communication capabilities are allowed during any exams. If you want to use a calculator, make sure to bring one that does not have communication capability (e.g. you will not be allowed to use the calculator on your cell phone, laptop, iPad, etc). Students should arrive no later than 10 minutes after the exam starting time. There will be no make-up exams for any reason! If you have an official UIUC accepted reason for missing an in-class exam, you must produce appropriate documentation justifying your absence no later than one week from the date of the exam.

**Lab** The lab reports will be due at the start of following lab.

**Re-grade Policy** If you believe that there has been an error in the grading of your exam, homework, or lab report, you have one week from the day to submit it for a re-grade. (Note: one week is counted from the day the exam/homework/lab report is distributed; you do not get an extension if you choose to pick it up late.) When you resubmit the assignment, it must be accompanied by a written explanation of the suspected grading mistake stapled to the original assignment. Do not write on the original assignment. The assignment will not be re-graded if the procedures outlined here are not followed.

**In Class Cell Phone and Laptop Policy** Please dedicate all of your energy to THIS class and be respectful of your classmates and our learning community. DO NOT use laptops or cell phones in my class for anything other than for this subject.

**Course Outline and Tentative Schedule:**

WEEK	DATE	TOPIC	ADDITIONAL READINGS	LAB SESSIONS		
1	17-Jan	<b>Introduction to manufacturing Process</b>	SME videos (TBD)	<b>Mech. Engg. Work shop visits</b>		
	19-Jan	<b>Casting</b>				
2	24-Jan	<b>Machining</b> - Conventional methods - 1. Turning, Milling, Drilling				
	26-Jan	2. CNC machining				
3	31-Jan	<b>Machining</b> - Unconventional machining - 1. EDM, EBM				
	2-Feb	2. Nano and Additive manufacturing				
4	7/9 Feb	<b>Cutting tool mechanics</b> - Tool materials, geometry, cutting parameters and cutting fluid				
5	14-Feb	<b>Joining processes</b> - Welding and rivetting				
	16-Feb	<b>Finishing processes</b> - Deburring, Polishing, surface coating methods				
6	21/23 Feb	<b>Quality Inspection</b> - Methods to inspect dimenions, geometries, surface finish, strength and quality of joints				
7	28-Feb	<b>Assembly</b> - Types and methods of assembly, Inventory mgmt and material transportation				<b>CNC lab</b>
	2-Mar	<b>Process control</b> - Process plans, flow charts, shop layouts and tool use control				
8	7-Mar	<b>Mid Term 1</b>				
	9-Mar	<b>Introduction to automation</b> - Need for automation; Elements and building blocks of automation				
9	14-Mar	<b>Programmable logic controllers</b> - Types and applications; ladder diagram		<b>PLC Lab 1</b>		
	16-Mar	Programming PLCs using ladder diagram				
10	28-Mar	<b>Fundamentals of Industrial robotics</b> - Types of robots; types of joints		<b>PLC Lab 2</b>		
	30-Mar	DH Parameters				
11	4-Apr	Trajectory Planning		<b>Robotics Lab - fundamentals</b>		
	6-Apr	<b>Mid-term 2</b>				
12	11-Apr	<b>Material transportation and handling</b> - Automatic guided vehicles, conveyors etc		<b>Robotics Lab - Task scheduling</b>		
	13-Apr	<b>Task scheduling</b> - Theory				
13	18-Apr	Applications of UGVs, pick and place robots				
	20-Apr	<b>Design for automation</b> - Design for manufacturing, Design for Assembly (1)				

14	25-Apr	Design for Assembly (2), design for material handling		<b>Automation/ FMS lab</b>
	27-Apr	<b>Computer aided Manufacturing - 1.</b> CAD/CAM - Feature detection and extraction		
15	2-May	<b>Revision</b>		
16	5-12 May	<b>Final exam</b>		