Walla Walla University School of Engineering

ENGR480 Manufacturing Systems Engineering

Spring 2011

Facts:

- Instructor: Ralph Stirling
- Office: CSP262, 527-2071, ralph.stirling@wallawalla.edu
- Class: 10:00 10:50AM MWF CSP163, Lab 2-5PM T KRH105
- Webpage: http://engr.wallawalla.edu/engr480
- Text: Machinery's Handbook, Industrial Press

Important Background:

- Basic circuit analysis if you have forgotten all your Circuits, you may have trouble in this class review will be in order.
- Instrumentation if you were completely baffled by sensors and signal conditioning, you may have trouble in this class.
- Machine Design and Advanced CAD you will need to design a lot of fixtures and parts for the lab project.
- Materials & Processes if you slept through M&P, you missed important information about machining, which you will need to put into practise in this class.

What you will learn in this course:

- What manufacturing is all about.
- How to automate the handling and creation of parts.
- How to make nifty mechanical widgets that actually do things.
- How to use pneumatics.
- How to do manual and CNC machining.
- How to wire electrical controls.
- How to program a PLC to make your machine "think".

What your grade will be based on:

1. Project - The majority of credit in the class will be based on a large, quarter-long, team lab project. This project will involve the design, fabrication, assembly, programming, wiring, testing, and documenting of an automated production machine. Each team will consist of four students, chosen by me. Each team will be given a grade on their project quality and on their documentation quality, and an individual weighting factor will be applied based on the value of the contribution of each team member.

- 2. Memos and Reports Most of your work will be documented in memo and report format. Grading will be on content, writing quality, and persuasiveness.
- 3. Quizzes, homework, and tests I will use some more traditional forms of evaluation from time to time as needed.
- 4. Reading you will receive 2% extra credit for reading an article each week from a trade magazine or journal, such as Manufacturing Engineering, Design News, Machine Design, Industrial Automation, Modern Machine Shop, or ASME or SME publications. Either print or online editions are acceptable. The CNC Forum on <u>http://www.practicalmachinist.com</u> is also very useful. Just send me an email each week telling me what article you read.
- 5. Attendance Marginal grades may be decided by attendance record. Attendance means full engagement in classroom activities, not just physical presence. Surfing the web, texting on your phone, reading email, or playing solitare does not constitute attendance.
- 6. Shop safety Your grade may be penalized if you cause an accident in the shop or lab that results in injury to anyone or damage to equipment, through negligence, ignorance, or carelessness.
- 7. Grade thresholds will be approximately: A: 95%, A-: 90%, B+: 85%, B: 80%, B-: 75%, C+: 70%, C: 65%, C-: 60%, D:55%

Useful Supplemental References:

- Automation Direct DL06 PLC manual
- Designing Technical Reports by J.C.Mathes and Dwight W. Stevenson
- Pneumatic Systems Principles and Maintenance by S.J.Majumdar
- Metal Cutting Principles by Milton Shaw
- A Study of the Toyota Production System by Shigeo Shingo
- Industrial Automation and Process Control by Jon Stenerson
- Computer Numerical Control: Operation and Programming by Jon Stenerson
- Getting Started Manual FeatureCAM

Special Considerations:

If you have a learning disability or otherwise need special consideration, please contact the appropriate campus office and have them discuss your needs with me. Since you are all seniors, I assume you will know this process by now if you have such a problem.

Notes on Laboratory and Shop Usage:

- CLEAN UP after yourself as soon as you have finished an operation. Put aluminum chips in the barrel marked ALUMINUM, and steel chips in the barrel marked STEEL. Mixed scrap goes in the trash. There are brooms and brushes in both lab and shop, and a shop vacuum available. There may also be a webcam in the shop for me to monitor the condition of the room before and after use.
- **PUT TOOLS AWAY.** Learn where tools are kept and return them when you are done using them each day. Keep materials you are working on under your lab station, but don't hoard.
- **USE SAFETY EQUIPMENT.** Eye shields and ear protectors are provided to help protect you when using machinery. Please use them! Don't wear long sleeves or long hair when working on machines. Clamp work down, remove chuck keys, and use proper feeds and speeds.
- ONLY USE MACHINES YOU ARE FAMILIAR WITH. No power tool is to be used until you have been checked out on it first by Erik Biesenthal (lab assistant), Wes Brown, or myself. The shop courses taught by the Department of Technology are highly recommended as preparation. You may also have parts fabricated by Technical Support Services.
- **KEEP E-STOPS PRESSED** except when machine or robot is actually in use. This is especially important with Ethernet controlled devices.

Approximate Schedule

Week	Date	Time	Торіс	Reading
1	Mar 28	10:00	Machining - basic CNC	Machinery's Handbook - Numerical Control Programming
	Mar 29	2:00	Lab - CNC Turning	
	Mar 30	10:00	Machining - CNC boring and threading	Machinery's Handbook - Numerical Control Programming
	Apr 1	10:00	Machining - CNC turning cycles	Machinery's Handbook - Numerical Control Programming
2	Apr 4	10:00	Machining - CNC boring/threading exercise	
	Apr 5	2:00	Lab - Flashlight machining	
	Apr 6	10:00	Part Feeding	
	Apr 8	10:00	Generating Motion - pneumatics	
3	Apr 11	10:00	Generating Motion - stepper motors	
	Apr 12	2:00	Lab - Nelson Irrigation Tour	
	Apr 13	10:00	Sensors	
	Apr 15	10:00	CNC Milling - Pro/E	
4	Apr 18	10:00	Relay Logic	Machinery's Handbook - Numerical Control
	Apr 19	2:00	Lab - Assembly Machine Design	
	Apr 20	10:00	Relay Logic	
	Apr 22	10:00	PLC - wiring and I/O	
5	Apr 25	10:00	PLC - state machines	
	Apr 26	2:00	Lab - Machine Fab & Assembly	
	Apr 27	10:00	PLC - state machines	
	Apr 29	10:00	PLC - program editing	
6	May 2	10:00	PLC - programming	
	May 3	2:00	Lab - Machine Assembly	
	May 4	10:00	Stepper motor control - EMC2	
	May 6	10:00	Stepper motor control - EMC2	
7	May 9	10:00	Motoman robot controller	
	May 10	2:00	Lab - Machine Wiring	

	May 11	10:00	Motoman robot controller
	May 13	10:00	PLC/motion controller coordination
8	May 16	10:00	PLC/motion controller coordination
	May 17	2:00	Lab - Machine Wiring & Programming
	May 18	10:00	Flexible manufacturing - stock feeding
	May 20	10:00	Flexible manufacturing - parts unloading
9	May 23	10:00	Toyota Production System
	May 24	2:00	Lab - Machine Programming
	May 25	10:00	Writing memos and reports
	May 27	10:00	Philosophy of Automation
10	May 30		Memorial Day
	May 31	2:00	Lab - Final testing
	June 1	10:00	Philosophy of Automation
	June 3	10:00	Lab Cleanup (attendance taken)
11	June 6 (Monday)	10:00	Final project demos/Final Quiz