ENGG*3070 Integrated Manufacturing Systems
Fall 2013

School of Engineering

(Revision 0: September 5, 2013)

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1 Instructional Support

1.1 Instructor

Instructor: Fantahun M. Defersha, PhD. EIT.
Office: THRN 2403, ext. 56512
Email: fdefersh@uoguelph.ca
Office hours: TBA on Courselink or by appointment

1.2 Lab Technician

Technician: Barry Verspagen
Office: THRN 1175, ext. 58821
Email: baverspa@uoguelph.ca

1.3 Teaching Assistants

Saber Bayat Movahed sbayatmo@uoguelph.ca TBA on Courselink

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2 Learning Resources

2.1 Course Website

Course material, news, announcements, and grades will be regularly posted to the ENGG*3070 Courselink site. You are responsible for checking the site regularly.

2.2 Required Resources

1. Author: Mikell P Groover; Title: Automation, Production Systems, and Computer-Integrated Manufacturing; Publisher: PEARSON-Prentice Hall; Year of Publication: 2008; Edition: 3rd; ISBN: 0-13-239321-2

2.3 Recommended Resources

1. Author: Ronald G. Askin and Charles R. Standridge; Title: : Modeling and Analysis of Manufacturing Systems; Publisher: Wiley; Year of Publication:1993; Edition 1st; ISBN 0-471-51418-7:
2. Author: Edward A. Silver, Daid F. Pyke, and Rein Peteson; Title: Inventory Management and Production Planning and Scheduling; Publisher: Wiley; Year of Publication: 1998; Edition: 1st; ISBN: 0-471-11947-4
3. Author: Kelton, W., Randall, S., and Nancy S.; Title: Simulation with Arena; Publisher: McGraw-Hill; Year of Publication: 2009; ISBN: 978-0073376288

2.4 Additional Resources

Lecture Information: All the lecture notes are posted on CourseLink. The lecture is the primary source of information for the course and certain topics will be more elaborated than presented in the text book. Discussion and Examples that may not be available from the text book will also be presented during the lecture time to help you further understand the subject matter of the various topics. As such it is highly recommended that you attend the lectures.

Miscellaneous Information: Other information related to recent research in Manufacturing Systems will be posted on the web page.

2.5 Communication & Email Policy:

Please use lectures and lab help sessions as your main opportunity to ask questions about the course. Major announcements will be posted to the course website. It is your responsibility to check the course website regularly. As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its student.

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3 ASSESSMENT

3.1 Dates and Distribution

Quizzes: 10%

September 27, in class
October 18, in class
November 22, in class

Labs: 10 %

The first few laboratory sections are intended to provide the students a demonstration how the different components of the manufacturing systems are integrated and programmed. Application of discrete event simulation and optimization techniques in the analysis manufacturing systems will be extensively covered in the Lab. See section 5.3 below for schedules

Assignment: 10%.

This includes problem solving and reading assignments. For the reading assignments, reports have to be prepared using word processing software (MS-Word, Latex) and both paper and electronic copies are to be submitted. (Assignment problems will be announced on Courselink)

Assignment Due Dates

- Assignment 1, Sept. 23 (in class)
- Assignment 2, Oct. 7 (in class)
- Assignment 3, Oct. 21 (in class)
- Assignment 4, Nov. 4 (in class)
- Assignment 5, Nov. 18 (in class)

Midterm: 30 %

Saturday October 26, 9:30-12:00, Room TBA on Courselink

Final Exam: 40%

Thurs Dec 12, 02:30-04:30, Room TBA on Webadvisor

3.2 Course Grading Policies

Missed Assessments: If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Accommodation of Religious Obligations: If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml

Passing grade: Students must obtain a grade of 50% or higher on the exam portion of the course (quizzes, mid-term and final) in order for the assignment and laboratory portion of the course to count towards the final grade.

Missed quiz and midterm tests: If you miss a test due to grounds for granting academic consideration or religious accommodation, the weight of the missed test will be added to the final exam. There will be no makeup quiz or midterm tests.

Lab Work: You must attend and complete all laboratories. If you miss a laboratory due to grounds for granting academic consideration or religious accommodation, arrangements must be made with the teaching assistant to complete a makeup lab.

Late Lab Reports: Late submissions of lab reports will not be accepted.

4 AIMS, OBJECTIVES & GRADUATE ATTRIBUTES

4.1 Calendar Description

Common production machines and manufacturing systems are dealt with, particularly automated systems, robotics, computer control and integration techniques, materials handling, inspection processes and process control. The course addresses societal and environmental issues related to manufacturing..

Prerequisite(s): ENGG*2120

4.2 Course Aims

The course is aimed at introducing students with production automation and the role of the computer in modern manufacturing systems and providing understanding to the various topics in the operations of modern manufacturing systems. These include: automation and control technologies, material handling and identification technologies, single stations manufacturing cells, manual assembly lines, automated production lines, cellular manufacturing and group technology, flexible manufacturing systems, process planning and concurrent engineering, production planning and control systems, just-in-time and lean production, six-sigma, value stream mapping and process improvement.

4.3 Learning Objectives

At the successful completion of this course, the student will have demonstrated the ability to:

1. Identify the basic components of integrated manufacturing systems
2. Understand the fundamental of automation and control technologies in manufacturing
3. Develop Ladder Logic Programming,
4. Know the techniques how different components (machine tools, material handling, robots, inspection, storage) of a manufacturing system can be integrated
5. Understand the role of material handling systems(e.g. conveyors, automated guided vehicles), material storage and retrieval systems, automatic identification and data capture in integrated manufacturing systems
6. Understand the design criteria of single station manufacturer cells, assembly lines, cellular manufacturing, flexible manufacturing systems
7. Investigate performance issues in assembly and
8. Apply optimization techniques in the design and analysis of assembly and transfer lines, cellular manufacturing, automated guided vehicle and facility layout
9. Understand the fundamental of manufacturing support systems such as process planning, production planning and control, just-in-time and lean production.
10. Master the basic techniques of production and inventory control.

11. Develop simulation models for manufacturing systems

4.4 Graduate Attributes

Successfully completing this course will contribute to the following CEAB Graduate Attributes:

Graduate Attribute	Learning Objectives	Assessment
1. Knowledge Base for Engineering	8, 10	Assignment , Quizzes, Exams
2. Problem Analysis	3, 6, 7, 8, 10	Assignment , Quizzes, Exams
3. Investigation	6, 7, 11	Assignment , Quizzes, Exams
4. Design	6, 8	Assignment , Quizzes, Exams
5. Use of Engineering Tools	2, 8,11	Lab, Assignment
6. Communication		Assignment
7. Individual and Teamwork		
8. Professionalism		
9. Impact of Engineering on Society and the Environment		
10. Ethics and Equity		
11. Environment, Society, Business, & Project Management		
12. Life-Long Learning		

4.5 Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on Courselink/D2L but these are not intended to be stand-alone course notes. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and project.

4.6 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and tutorials. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate. The best leaning experience will be achieved if you ***attend lecture and lab regularly***. Scientific studies have proven that a student success rate is strongly related to his/her class attendance. Those who attend classes, tutorials and labs have higher success rates than those who do not.

4.7 Relationships with other Courses & Labs

Previous Courses:

ENGG*212- Manufacturing systems process engineering materials to produce different goods. Thus, the fundamental knowledge of engineering materials is necessary to study manufacturing systems.

Follow-on Courses:

ENGG*4030: Knowledge about the various core and supporting elements of integrated manufacturing systems is essential for manufacturing systems design.

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5 TEACHING AND LEARNING ACTIVITIES

5.1 Timetable

Lectures:			
Monday		12:30 AM– 01:20 PM	JTP, Room 214
Wednesday		12:30 AM– 01:20 PM	JTP, Room 214
Friday		12:30 AM– 01:20 PM	JTP, Room 214
Lab:			
Monday	Sec 01	01:30 PM – 3:20 PM	THRN 1009, THRN 1313
Wednesday	Sec 02	11:30 AM – 1:20 PM	THRN 1009, THRN 1313
Friday	Sec 03	01:30 PM – 3:20 PM	THRN 1009, THRN 1313

5.2 Lecture Schedule

Lecture	Lecture Topics	References	Learning Objectives
1, 2	**Introduction** • Automation in Production Systems • Manual Labor in Production Systems • Types Manufacturing Operations and Production Facilities • Basic Elements of Automation • Level of Automation • Components of Manufacturing Systems • Classification Scheme for Manufacturing Systems	Chapters 1, 2, 3, 4, 13	1
3, 4	**Discrete Control Using Programmable Logic Controller** • Discrete Process Control • Ladder Logic Diagrams • Programmable Logic Controller	Chapter 9	2, 3

5	**Single Station Manufacturing Cells** • Single Station Manned Cells • Single Station Automated Cells • Application of Single Station Cells	Chapter 14	1
6, 7	**Introduction to Optimization** • Fundamentals of linear programming • Modelling techniques • Introduction to LINGO	Other resources, lecture note	1, 5
8-12	**Manual and Automated Production and Assembly Lines** • Fundamental of Manual Assembly Lines • Analysis of Single Model Assembly Lines • Line Balancing Algorithms • Mixed Model Assembly Lines • Fundamentals of Automated Production and Assembly Lines • Applications of Automated Production and Assembly Lines • Analysis of Transfer Lines and Assembly Systems		2, 3, 4
13, 14, 15	**Cellular Manufacturing System** • Part families • Part Classification and Coding • Production Flow Analysis • Cellular Manufacturing • Application of Group Technology • Quantitative Analysis in Group Technology	Chapter 18, Other resources, lecture note	2, 3, 4
16, 17, 18	**Flexible Manufacturing Systems** • FMS Components • FMS Applications and Benefits • FMS Planning and Implementation Issues • Quantitative Analysis of Flexible Manufacturing Systems	Chapter 19, Other resources, lecture note	2, 3, 4
19, 20	**Introduction to Discrete Event Systems Simulation** • Fundamentals of Simulation • Time Advance Event Scheduling Algorithm • Basic Simulation Modeling	Other resources, lecture note	1, 5
21-24	**Material Handling and Storage Systems** • Introduction to Material Handling • Material Transport Equipment • Analysis of Material Transport Systems • Storage systems Performance and Locations Strategies • Conventional Storage and Methods and Equipment • Automated Storage Systems	Chapter 10, 11 and other resources	2, 3

	• Engineering Analysis of Storage Systems		
25-36	**Manufacturing Support Systems** • Process Planning and inventory control • Just-in-time and Lean Production • Order Release • Flow Shop Sequencing • Job Shop Sequencing • Six-sigma and value stream-mapping	Chapter 24, 25, 26 and other relevant resources, lecture notes	2, 3

5.3 Lab Schedule

Topic	**Date**
Complete overview of Integrated Manufacturing Systems	Week 3
Ladder Logic Programming of Material Feeder (Group 1A, 2A, 3A)	Week 4
Ladder Logic Programming of Material Feeder (Group 1B, 2B, 3B)	Week 5
Feeder, Robot, Gantry Integration	Week 6
Simulation (Basic Processes)	Week 7
Simulation (Advanced Processes)	Week 8
Simulations (Transporter-I)	Week 9
Simulations (Transporter -II)	Week 10
Optimization (Assembly Line and Cellular Manufacturing)	Week 11
Optimization (AGV and Flexible Manufacturing)	Week 12
Laboratory attendance and activities will be graded at the end each lab section.	

5.4 Other Important Dates

Thursday, 5 September 2013: First class
Monday, 14 October 2013: Thanks giving holiday
Thursday, 31 October 2013: drop date – 40th class
Thursday, 28 November 2013: last class (Monday Schedule in effect)

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6 LAB SAFETY

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

7 ACADEMIC MISCONDUCT

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member.

7.1 Resources

The Academic Misconduct Policy is detailed in the Undergraduate Calendar:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

A tutorial on Academic Misconduct produced by the Learning Commons can be found at:
http://www.academicintegrity.uoguelph.ca/

Please also review the section on Academic Misconduct in your Engineering Program Guide.

The School of Engineering has adopted a Code of Ethics that can be found at:
http://www.uoguelph.ca/engineering/undergrad-counselling-ethics

8 ACCESSIBILITY:

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability for a short-term disability should contact the Centre for Students with Disabilities as soon as possible