

# IEM5303/4323-Manufacturing Systems Design:

High Volume Manufacturing Systems

Schedule: 2-3:30 TR@ Cordell 128

## INSTRUCTOR

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<http://www.usc.edu/dept/ise/nmcl>

## GOALS AND OBJECTIVES OF THE COURSE

This course provides a graduate level treatment of advanced computer integrated manufacturing systems for high-volume production. The specific objectives are to provide team project-driven learning experiences to

- expose the sequence of engineering activities during a product life-cycle
- provide an in-depth understanding of modeling and sensing technologies for real-time quality and asset management in high-volume manufacturing operations
- elicit student interests to pursue advanced research in manufacturing and manufacturing systems

## TEXT AND OTHER READING/INSTRUCTIONAL MATERIALS

Required: Article collection to be made available during the first week of the class.

Supplementary readings from: Groover, Mikell P., Automation, Production Systems, and Computer Integrated Manufacturing 2<sup>nd</sup> Edition, Prentice Hall, ISBN 0-13-088978-4, Upper Saddle River, New Jersey, ©2001.

Other Materials or links to them on the world wide web will be provided as the semester proceeds.

## TENTATIVE SYLLABUS

Week	Lecture	Demo/Project	Reading
1	Introduction to Modern Manufacturing Systems Engineering: High-Volume Production Processes and Machines, course policies, projects, Matlab	Machine tool construction and operation	Matlab tutorial Matlab links, Chp 1
2	High Volume Manufacturing Systems: Life-Cycle Engineering: Design, Costs and Efficiency	Matlab Demo	Article set 1 (CIRP def., Finger and Dixon), Chp. 2, 13, 24
3	CAD/CAM Technology for High-Volume Manufacturing: Control Hierarchy and Elements	Process Planning and Numerical Control	Article set 2 (Tlusty, Altintas NC example), Chp. 3,4,6
4	Introduction to Computer-Aided On-Line Quality Control: Rationale, Architecture and Examples	Modeling with Matlab	Article set 3 (Liang, Hardt, Ulsoy and Koren), Chp. 20-23
5	Sensor-based Modeling	Process Dynamics Simulation	Article set 4 (Hanna and Tobias, Balachandran)
6	Computer Modeling and Analysis (Machine Tool Dynamics and Chatter Example)	Process Dynamics Simulation	LabView tutorial, Chp.5
7	Sensing and DAQ fundamentals	Midterm 1	Article set 5 (PRE95)
8	Fourier Analysis and Signal Sampling	Fourier Analysis Demo	Handout 1
9	Periodogram Analysis	Periodogram Demo	
10	Classical Time-Series Methods, ARMA modeling	ARMA Demo	Handout2
11	Midterm 2	M-ARMA Demo	
12	Nonlinear Signal Analysis	Midterm 2	Article set 6 (Abarbanel)
13	Thanksgiving week	Nonlinear Analysis Lab	
14	Anomaly Detection and Quality Monitoring	Integration with Manufacturing Cells, Lines, Shop-floor and Enterprise	Article set 7 (JMSE00, JMP03)
15	Project Presentations		
16	Final Exam		Comprehensive

\* He conducts research on Sensor-based Modeling--a new approach based on augmenting statistical and intelligent systems foundations of traditional monitoring systems with nonlinear dynamic systems theory--for improving quality and integrity of manufacturing machines and processes, and other real-world complex systems. His recent research pursuits are available at <http://www.usc.edu/dept/ise/nmcl>.

## CATALOG DESCRIPTION

Principles and procedures related to the design, implementation, documentation, and control of manufacturing systems focusing on higher volume, lower product variety production systems. Introduction to product life cycle concepts and the application of computer-aided design and computer-aided manufacturing tools to systems characterized by dedicated production equipment and the need for absolute minimization of unit costs. Consideration of product and production system design, analysis, and operation for fixed automation. Study of operational philosophies and applicable systems concepts, especially those relating to line design, analysis, efficiency, and unit production cost reduction.

## COURSE EXECUTION AND GRADING POLICIES

The class will meet twice a week: one meeting will focus on lectures—where concepts will be presented, and the other will focus on practice—where computer-based assignments demonstrations to implement and exercise the concepts will be provided. The computer assignments will be based in Matlab environment, as it is best suited for various CIM applications including process modeling, data analysis and control. Weekly assignments will extend the in-class experiences and will, in addition, provide new conceptual perspectives.

The course will also feature a project that will consolidate the learning achieved during the course. The nature of the project may involve either an implementation of computer-aided modeling and sensing of a relevant manufacturing process or an infrastructure, or an *extensive* literature survey of a relevant technology. All project plans must be submitted for approval by October 1, and plans must be finalized and approved by October 31. Overall project grade will be derived from combining the performances in participation (10%), presentation (10%) and the report (80%). The report will be graded based on how well the objectives and the plan are executed.

The overall grade will assigned by consolidating the grades of the individual components as follows:

Assignments	30%
Midterms	30%
Final Project	30%
Participation	10%

Students are free to choose between a project and an exam option.

*Project option* students will take at most 2 midterms (the highest midterm grade will be considered) and the project;

*Exam option* students will take 2 midterms (averaged to 30%) and a comprehensive final exam (which will count towards 30% of the total grade). The midterm exams need not be conducted in-class. Should a student choose to not take the finals, the average mid-term grade will be used against the final exam grade.

*All students will need to submit a literature survey assignment.* In order to ensure consistency in grading computer assignments and projects, the performance will be consistently graded on a scale of 1-5 with the following equivalent translations:

5-Very Good: complete work devoid of any mistakes (Grade A)

4-Good: mistakes if any are minor and the work demonstrates the efforts of the student to learn (Grade A-/B+)

3-Average, mistakes are significant but the work demonstrates some effort to learn (Grade B/B-),

2-Fair, serious problems with efforts (Grade C)

1-Poor, highly incomplete and sloppy work (Grade F).

The final grade will be derived on a relative basis using a “curve.” Natural clusters separate the grade categories.

## POLICIES REGARDING ACADEMIC INTEGRITY

Definition and Guidelines on academic dishonesty and misconduct provided as part of Section 6.12 of the University Academic Regulations, as published in the Oklahoma State University Catalog, as well as Industrial Engineering & Management Policy on Work Product Prepared by Students as a Submission for a Grade will be strictly followed.

All work submitted is to be your/your team’s independent work. Both the receipt and the provider of dishonest aid will be considered as guilty. All work copied, paraphrased or modeled from any source other than YOU must be properly cited - failure to do so constitutes plagiarism. No students are to work together or share information on any assignment, in whole or in part, without explicit permission from the course instructor.