San Jose State University
Charles W. Davidson College of Engineering
Department of Aviation and Technology

Tech 149 Computer Integrated Manufacturing (CIM) Systems

Course Syllabus

Semester and Year:	Spring, 2012
Course Section:	1 & 11
Class days & Times:	R: 1500-1650; T: 1500-1745
Class Locations:	ENG 101, 103; IS 119 & 122
Instructor:	Dr. Samuel C. Obi
Office Room:	IS 105
Office Hours:	W: 12 noon – 2:30 PM; R: 11:00 AM -1:30 PM
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Catalog Description
Integration of all aspects of a manufacturing enterprise using computer-integrated manufacturing (CIM) technologies. Design, development and implementation of manufacturing systems using project management techniques and team work.

Prerequisites: Tech 145, Tech 147, ME 106. (2 hrs lecture, 3 hrs lab. units.)

Course Description
This course emphasizes the integration of manufacturing enterprise using computer-integrated manufacturing (CIM) technologies. It employs CAD/CAM interface and other CIM sub-systems, database management, facility layout, product documentation, process planning, production planning and control, Group technology, teamwork, and manufacturing operations and management to bring about a students-designed CIM-oriented enterprise. Tech 149 is divided into five instructional units each with its associated objectives. Each unit has associated laboratory activities designed to augment those objectives.

Required Textbook and Other Materials

- Rehg, James A. & Kraebber, Henry W. (2005). Computer-Integrated Manufacturing. (3rd Ed.) Prentice-Hall: Englewood Cliffs, N.J. (**Required for course**)
- Student Edition of 2011-2012 SolidWorks CAD software, available at any of the following sites (**Required for course**):

  a) http://www.novedge.com/products/2928

  b) Spartan Bookstore's website: http://www.creationengine.com/html/ss_spartan.html
- Kalpakjian, S. & Schmid, S. R. (2010). Manufacturing Engineering and Technology. (6^{th}. Edition) Upper Saddle River, NJ: Pearson Prentice Hall. (**Highly recommended for your certification exam**)
- Biekert, Russell. CIM Technology: Fundamentals and Applications, the Goodheart-Willcox Company, Inc. (Latest edition) (Recommended)
- Learning Mastercam (latest Version) for Mill Projects Series (not required but recommended)
- Other readings and handouts as assigned.
- A minimum of 4g flash drive
- Laptop/notebook computer with ample memory and speed (highly recommended)
- Scientific hand calculator with trig and square root functions
- Safety goggles
- Digital calipers
- Email address and Internet access

Course Objectives

After taking this course, the student should be able to:

1. Demonstrate knowledge of classical and state-of-the-art production systems, control systems, management technology, cost systems, and evaluation techniques.
2. Describe computer-integrated manufacturing (CIM) and its impact on productivity, product cost, and quality.
3. Describe computer technologies including computers, database and data collection, networks, machine control, etcetera, as they apply to factory management and factory floor operations.
4. Describe the integration of manufacturing activities into a complete system
5. Demonstrate sensitivity to human-factors related issues as they affect decision making in the factory environment.

Outline of Course Content and Unit objectives

Unit 1: Introduction to CIM Technology

Objectives:

a) Describe the nature of computer integrated manufacturing enterprise
b) Define computer integrated manufacturing (CIM)
c) List the basic components of CIM
d) Describe the goals and objectives of CIM
e) Apply various manufacturing practices and the various issues related to the application of CIM

Reading List for Unit 1:

1. Rehg & Kraebber: Chapters 1 & 2
2. Handouts for Unit 1
3. Video: Computer-Integrated Manufacturing, Part 1: Developing a Strategy (XB-1021A)

Unit 2: Components of Computer Integrated Manufacturing

Objectives:

a) Describe the design, nature and relationships of CIM sub-systems
b) Develop an advanced understanding of CIM sub-systems
c) Describe activities performed in each CIM sub-system
d) Determine the nature of enabling technologies behind each CIM sub-system
e) Relate the concept of CIM to a manufacturing enterprise's model

Reading List for Unit 2

1. Rehg & Kraebber: Chapters 3 & 10
2. Handouts for Unit 2
3. Videos: Computer-Integrated Manufacturing, Part 2: Evaluating Manufacturing Technology (XB-1022A); Computer-Integrated Manufacturing (XU-1074A)

Unit 3: Computer Integrated Manufacturing Technology: (CAD & CAM)

Objectives:

a) Apply CIM concepts in the creation of an appropriate database
b) Develop product from CAD-CAM interface as CIM sub-systems
c) Describe the concept of computer numerical control programming as part of CIM
d) Describe the role of inventory control system in CIM environment
e) Generate and edit part programs using latest CAM software
f) Develop the concept of group technology as an aspect of CIM

Reading List for Unit 3
1. Rehg & Kraebber: Chapter 4 & 5
2. Handouts for Unit 3

Unit 4: Manufacturing Planning, Control and Scheduling in CIM Environment

Objectives:
a) Develop a general understanding of manufacturing planning and control in a CIM environment
b) Explore different forecasting techniques used in modern manufacturing
c) Employ scheduling strategies employed in a CIM enterprise
d) Describe inventory management techniques as applied to CIM
e) Describe quantitative methods, software applications, and financial management employed in a CIM environment

Reading List for Unit 4
1. Rehg & Kraebber: Chapters 6, 7, 8 & 9
2. Handouts for Unit 4

Unit 5: Automated Manufacturing

Objectives:
a) Apply industrial controls, programmable logic controllers, and industrial robots in a CIM environment
b) Describe the theory of operation, programming, and the practical application of PLCs and robots
c) Describe fundamentals of data communications and local area networks as they relate to the various levels of communications between shop floor computers, PLCs, robots, CNC machine tools and automatic identification equipment
d) Integrate commonly used industrial control devices, including CAD/CAM, computer-assisted numerical control programming, computer-assisted quality control, and automatic identification

Reading List for Unit 5
1. Rehg & Kraebber: Chapters 11, 12 & 13
2. Handouts for Unit 5
3. Manufacturing Insight: Material Handling (TU0954A) (video)

Course Requirements

Reading Assignments
All textbook reading assignments must be completed according to the activity schedule, and students must be prepared for discussion of weekly reading topics in class. In addition, students will undertake outside readings of articles and texts from current literature relevant to topics being discussed and studied in class.

Class Assignments (50)
There will be five class assignments designed to help students understand the various aspects of Computer-Integrated-Manufacturing. These assignments will be issued in class at various times in the semester during and after class discussions.

Reading Critiques (45 points)
There are three (3) out-of-class reading assignments. The readings are to be from a magazine or professional journal no more than three years old. The subjects to be read and reported on must be concerned with some aspect of computer-integrated manufacturing. Be prepared to discuss your paper in class on the day it is due. The assignments must be prepared with a word processor in the "Outside Reading Assignment" format which will be provided.

Laboratory Exercises: Refresher Project (50 points)
Students will complete one individual project involving selected short laboratory exercises that include the use of computer and machine technology in basic CAD/CAM, CNC programming, material handling, machining, machine control, and other topics selected by the instructor.

A written report, including graphics and printouts will be required describing the experiences and activities of the exercise in relation to a CIM environment. A detailed description of the project will be provided at the scheduled date during the semester.

Team Project (100 points)
You will, in a small group, develop a product proposal involving a product and manufacturing technologies required to produce it. Each team will design a different and approved product, which consists of six or more parts (eight or more parts for a four-member team). At least two of the parts must share some design/processing commonalities (attributes) to facilitate the incorporation of group technology (GT) concept. Teams should identify a product that requires a flexible manufacturing system (FMS) made up of at least the following sub-systems: machines/machining centers, MHS, measurement/inspection, loading/unloading station, part washing station, and labor. The project is expected to include some aspect of product design, documentation, web design and management, scheduling, process planning, CNC programming, tool design, facility layout, simulation, written and oral presentations.

Students will obtain written approval for their topics and the proposal must be completed for presentation on the due date (see course semester schedule).

A title and outline (schedule) for the class project is due no later than the second week of team's formation. The completed project documentation is due on date scheduled (see class semester activity schedule). A detailed description of the project will be

provided at the scheduled date during the semester. A comprehensive **oral presentation** of the project with appropriate visual aids will be required. The purpose is to give you experience in analyzing, organizing, writing, and presenting information on current manufacturing methods.

Term Paper (40 points)
Separate from the term project, which is product-centered, a term paper is required from each student. Students may propose any manufacturing-related topic with an approved written outline. A tentative term paper outline and title are due as scheduled (see class semester activity schedule provided). The topic should be on a detailed description of any of the many CIM sub-systems discussed in class, but should be based on outside materials other than the course textbooks. Your paper must conform to the APA format. A more detailed format for this paper will be provided. The completed paper is also due on the scheduled date. The term paper report shall be from 5 to 8 pages, not including appendices and illustrations, and shall conform to specified class format.

Course Examinations (150 points)
There will be one midterm and one final examination, covering reading assignments, lectures, classroom discussions, field trips, and laboratory exercises. The midterm and final will be announced at least one week in advance, and will occur close to the dates scheduled for the course.

Pop Quizzes (30 points)

Three pop quizzes will take place occasionally during the semester.

Certified Manufacturing Specialist (CMS) and/or Certified Manufacturing Technologist (CMfgT) Examinations
This course requires each student to take one of two professional exams. The selected exam serves several functions:

1) As soon-to-graduate seniors in manufacturing program, it gives students an opportunity to earn this certification for their future career growth, because earning the certification demonstrates your competence in the fundamentals of manufacturing,

2) As a result, it helps to improve your resumes by informing potential employers that you are well prepared for a manufacturing career,

3) It helps manufacturing students to assess and prepare themselves professionally for their future career goals because it helps them to know what are expected of them in the field, and

4) It helps the department to do program assessment of manufacturing program, which is necessary for program accreditation and other university requirements.

A) Association of Technology, management and Applied Engineering (ATMAE) Certification Exam
The Certified Manufacturing Specialist (CMS) program is geared toward programs with a strong manufacturing emphasis and the exam was developed with help from ATMAE members working in such programs. The exam is an open book, 180-question, multiple choice examination with questions on 16 content areas of manufacturing, including:

joining, casting, forming, machining, nontraditional machining, materials, quality, CIM, production planning, wood technology, metrology, supervision/management, technical drafting and electronics. The ATMAE certification program recognizes individual certified members who have met certain professional standards to become certified and to maintain their certification. A study guide with sample practice questions can be found at: http://atmae.org/certif/CMSStudyGuide.pdf.

B) Society of Manufacturing Engineers' (SME) Certification Examination.
The Certified Manufacturing Technologist (CMfgT) exam takes three hours and consists of 130 multiple choice questions covering subjects including math, applied science, design, materials, manufacturing processes, manufacturing management, manufacturing economics, quality control, computer applications, and automation. The department will pay for the exam, but all students will take it in the class during a scheduled time and date to be announced. But it is in the student's interest to individually prepare for the exam on their own. All of the SME exams are meant to be taken as "open book" exams. Students are allowed to bring reference books and text books into the exam along with a non-programmable calculator. Resource material is available at SME's web site at: http://www.sme.org/cgi-bin/certhtml.pl?/cert/cmfgtp.htm&&SME&

Exam and Assignment Notes:

1. **At least one week's notice will be given of changes in forthcoming exams.**
2. **No make-up of examinations shall be given, except if an emergency arises. Such situations must be documented immediately.**
3. **All assignments are due as scheduled and must be typewritten or they will not be accepted.**
4. **NO PAPERS WILL BE ACCEPTED LATE UNLESS PROPER AND APPROVED WRITTEN PERMISSION HAS BEEN OBTAINED BEFORE THE DUE DATE.**
5. **Assignments are due at the BEGINNING of the class period on the designated due date.**

Class Participation
Class participation is critical for the success of the class as a whole and for your learning. You are expected to arrive at class meetings on time and stay for the entire period. If you need to do work elsewhere, you must inform your instructor of the details before leaving the class. If you miss periods at which your group is working it will affect your participation grade significantly.

Grading	# Assigned		Points Each		Totals
Outside reading critiques	3	x	12	=	36
Outside reading presentations	3	x	3	=	9
Class assignments	5	x	10	=	50
Refresher lab exercises (as project 1)	1	x	50	=	50
Quizzes	3	x	10	=	30
Team project & documentation	1	x	90	=	90
Team project presentation	1	x	10	=	10
Term paper	1	x	30	=	30
Term paper presentation	1	x	10	=	10
Midterm exam	1	x	50	=	50
Final exam	1	x	100	=	100
Total					**465**

Grades will be computed from the ratio of total points achieved to total points possible:

97+% = A+, 93-96 = A, 90-92 = A-; 87+% = B+, 83-86 = B, 80-82 = B-; etcetera.

Course Delivery

The course provides for about five hours per week of class time. One to two hours will be used for lectures, exams, discussions, and presentations. Two to three hours will be provided for laboratory exercises (after the second week), and field trips (when possible) will take place at either time.

Note on Academic Dishonesty

Cheating of any kind is not acceptable, and will be reported to the campus student affairs office.
It will result in loss of credit for the assignment, which cannot be made up, and it MAY result in an "F" in the class or even expulsion from the University.

University Policy Information

a) Academic integrity statement (from Office of Student Conduct and Ethical Development): "Your own commitment to learning, as evidenced by your enrollment at San José State University, 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 Conduct and Ethical Development. The policy on academic integrity can be found at (http://ss.sjsu.edu/student_conduct).

b) Campus policy in compliance with the Americans with Disabilities Act: "If you need course adaptations or accommodations because of a disability, or if you need 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. Presidential Directive 97-03 requires that students with disabilities requesting accommodations must register with DRC to establish a record of their disability."

Computers and Other Laboratories

Most of the lab work for this class will take place in the advanced manufacturing systems lab, E101 and its adjoining lab, E 103. Industrial Studies rooms 119 and 122 may also be used but have no computers.

- Request permission to work in the lab ahead of time, and announce yourself to the instructor each time you arrive.
- Clean up your work area and return the system or machine to the condition and state (on/off, covered, etcetera) it was in when you arrived.

If you are found working in a lab without instructor permission you will lose lab privileges altogether.

- No copying of software will be tolerated IN ANY LAB, and
- Storage devices which have program files on them may not be used.
- You are not permitted to load ANY programs on ANY computer without express permission from the lab director.
- Lab time is to be used only for class projects, not for papers or work for other classes
- Students who abuse their laboratory privileges will lose those privileges.
- Read the handout provided on specific safety rules on using CNC and conventional machine tools

Recommended Readings

Groover, M. P. (Latest edition). ***Automation, Production Systems, and C.I.M***. Prentice-Hall: Englewood Cliffs, N.J.

Foston, Smith, & Au (Latest edition). ***Fundamentals of CIM***. Prentice-Hall.

Schey, John A. (Latest edition). **Introduction to Manufacturing Processes**. 3rd. Ed., New York: McGraw Hill.

TECH 149 SCHEDULE OF COURSE SEMESTER ACTIVITIES

WEEK OF:	TOPICS TO BE DISCUSSED	ASSIGNMENTS	LAB DUTIES
JAN 26	ORIENTATION	BUY MATERIALS	
FEB. 2	UNIT 1: INTRODUCTION TO CIM	REHG & KRAEBBER, 1&2	ALL
FEB. 9	UNIT 1: INTRODUCTION TO CIM	**REFRESHER PROJECT BEGINS**	ALL
FEB. 16	UNIT 2: COMPONENTS OF COMPUTER-INTEGRATED MANUFACTURING	REHG & KRAEBBER, 3&10/ **1ST OUTSIDE READING**	ALL
FEB. 23	UNIT 2: COMPONENTS OF COMPUTER-INTEGRATED MANUFACTURING	REHG & KRAEBBER, 3&10	ALL
MAR. 1	UNIT 3: COMPUTER-INTEGRATED MANUFACTURING TECHNOLOGY: CAD/CAM	REHG & KRAEBBER, 4&5	ALL
MAR. 8	UNIT 3: COMPUTER-INTEGRATED MANUFACTURING TECHNOLOGY: CAD/CAM	**REFRESHER PROJECT DUE**	ALL
MAR. 15	**MID-TERM EXAM**	**TEAM PROJECT BEGINS/ 2ND OUTSIDE READING**	
MAR. 22	UNIT 4: MANUFACTURING PLANNING, CONTROL & SCHEDULING IN CIM ENVIRONMENT	REHG & KRAEBBER, 6,7,8&9; **TERM PAPER BEGINS**	ALL
MAR. 29	**SPRING BREAK**	**SPRING BREAK**	**SPRING BREAK**
APR. 5	UNIT 4: MANUFACTURING PLANNING, CONTROL & SCHEDULING IN CIM ENVIRONMENT	REHG & KRAEBBER, 6,7,8&9	ALL

APR. 12	UNIT 5: AUTOMATED MANUFACTURING	REHG & KRAEBBER, 11,12&13	ALL
APR. 19	UNIT 5: AUTOMATED MANUFACTURING	GROUP PROJECT/ **3RD OUTSIDE READING**	
APR. 26	REVIEW/ADJUSTMENT, ETC.	GROUP PROJECT	ALL
MAY 3	**RESEARCH PRESENTATIONS**	**TERM PAPER PRESENTATIONS**	ALL
MAY 10/15	**LAST DAY OF CLASS**	**GROUP PRESENTATIONS/PROJECT DUE**	**ALL**
MAY 17	**FINAL EXAMINATION**	**THURSDAY, MAY 17, FROM 2:45 - 5:00 PM.**	

THIS SCHEDULE IS SUBJECT TO CHANGES DUE TO CIRCUMSTANCES DURING THE SEMESTER

MARCH 26 – 30 IS SPRING BREAK (CAMPUS CLOSED)