I. Catalog Description and Credit Hours of Course: Provides students an opportunity to study the integration of robots, CNC, CAD/CAM, databases, and automated systems into the manufacturing environment. 3 credit hours.

II. Prerequisites: MN354; MN356 or consent of instructor.

III. Objectives of Course: Upon completing this course the student should be able to

A. Define computer integrated manufacturing (CIM).

B. Use manufacturer's reference manuals to determine the system's normal operating characteristics.

C. Set-up, program, and troubleshoot a system comprised of a minimum of two transfer lines, one robot and at least one CNC machine tool.

D. Program a host computer to control several "lower-level" computers that in turn control portions of an automated system.

E. Develop material handling specifications for a flexible manufacturing cell.

F. Program and set-up a machine vision system.

G. Describe the economic and social factors when implementing a computer integrated manufacturing system.

H. Specify safety considerations for personnel, work area, operations, and machines following OSHA guidelines.

IV. Expectations of Students:

A. Regular attendance and participation.

B. Keep a complete set of notes from the lectures and demonstrations.

C. Complete all laboratory and homework assignments.

D. Take all scheduled quizzes and examinations.

E. Graduate students will complete extra work of an advanced nature.

V. Course Content or Outline (Week Number):
A. CIM: An Overview (1)
   1. What is CIM?
   2. The Goal of CIM
   3. What is Manufacturing?
   4. Characteristics of a System

B. Productivity and Work (2)
   1. Definitions
   2. Measurement and Control
   3. Process Evaluation
   4. Project Planning
   5. Plant-Manufacturing-Industrial Engineering
   6. Human Factors

C. CIM Units: Computers (3)
   1. Programmable Controllers
   2. Micro/Mini/Maxi Computers
   3. Distributed Systems
   4. Interfaces
   5. Networks
   6. Software and Peripherals
   7. Data Bases and Files

D. CIM Units: Input/Output (4)
   1. Electronic, Electromechanical, and Mechanical Devices
   2. Motors and Pumps
   3. AC/DC Drives
   4. Stepping Motors
   5. Encoders
   6. A/D and D/A Converters
   7. Sensors -- Visual, Tactile, Sonic, and Physical
   8. Voice Data Entry
   9. Bar Coders and Readers

E. CIM Units: Computer-Aided Functions (5-7)
   1. Robots
   2. Material Handling
   3. Computer-Aided Manufacturing (CAM)
   5. Computer-Aided Design (CAD)
   6. Machine Vision
   7. Computer-Aided Engineering (CAE)
   8. Human Factors in CAE/CAD/CAM
   9. Inventory Control and Scheduling

F. Requirements Planning Approach (MRP and MRP II) (8)
   1. How does MRP work?
   2. The use of the MRP system
   3. Manufacturing Resource Planning (MRP II)
4. Production Database
5. The Status of MRP/MRP II as a Paradigm for CIM

G. Systems Design (9-10)
1. Cell Structure
2. Group Technology
3. Flexible Manufacturing
4. Hybrid Systems
5. Automated Warehouses
6. Plant Layout and Sizing
7. Kanban Method

H. Design of the Data Base (11)
1. GIGO and Sufficiency
2. Integrating Software
3. Artificial Intelligence
4. Expert Systems
5. Access and Security
6. Protocol

I. Integrating the Technology (12)
1. Standards
2. Operating Systems and Languages
3. Interfaces
4. Hardware and Security

J. Process Planning (13)
1. What is Process Planning?
2. The Process Planner
3. Group Technology

K. CIM Management (14)
1. Evaluating and Selecting Systems
2. Personnel Concerns
3. Future Developments in CIM

L. The Role of Executive Leadership (15)
1. Commitment
2. Overdesign
3. Looking at CIM as a Cure-all
4. Controlling the Right Things

M. Considerations for Successful Implementation (16)
1. Defining Objectives
2. Organizing for CIM Development
3. Identifying CIM Needs
4. CIM Project Management and Control
5. Implementation Control and Feedback
6. Benchmarking CIM Success

VII. **Basis for Student Evaluation:**

A. **Written Exams**
   1. Midterm Exam – 25%
   2. Final Exam – 25%

B. **Laboratory Activity Reports** – 20%

C. **Final Project** – 30%

D. **Letter grades will be based on the following criteria:**
   1. A = 90-100%
   2. B = 80-89%
   3. C = 70-79%
   4. D = 60-69%
   5. F = Below 60%

All lab reports and the Final Project have to be typed and/or word processed and doubled space. For the Final Project students will be given a list of manufacturing topics to analyze, troubleshoot, and evaluate in an automated manufacturing systems environment. Grades will be based on the content, neatness, and overall presentation.