ME 445
Integrated Manufacturing Systems

www.me.metu.edu.tr/courses/me445

Course Staff

COURSE INSTRUCTOR
Prof. Dr. M. A. Sahir ARIKAN

COURSE ASSISTANTS
Sinem Gözde DEFTERLİ (Office: B-175)
   gozde.defterli@metu.edu.tr

Fulya EROL (Office: B-175)
   fulya.erol@metu.edu.tr
Objectives-I

- Teach basic elements of flexible automation,
- Teach/practice CNC machines and programming, and robotics,
- Introduce the concepts of modern technologies used in today's manufacturing enterprises, like, group technology (GT), integrative manufacturing planning and control, etc.,
- Give a broad view of Computer Integrated Manufacturing (CIM) and its basic features.

Objectives-II

- During the CIM Laboratory practice hours, perform process planning and programming, manufacture some parts personally by using CNC machine tools, thus:
  - Experience the CIM environment and some related activities,
  - Learn and practice process planning, CNC machining, PLC programming by writing programs for handling and manufacturing of parts.
**Grading**

- Two Midterm Examinations  
  (MT I 20% - MT II 20%)
  - Multiple-choice, problem solving
  - Closed book and notes.
- Final Examination (40%)  
  - Multiple-choice, problem solving
  - Closed book and notes.
- CIM Laboratory (20%)
- If attendance is over 70%  
  ➔ Bonus up to 5% maximum
  (70% gets 0, 100% gets 5% bonus) TOTAL 105%  

**Examinations**

**REGULAR EXAMINATIONS**
Examination dates, hours, and places will be announced by the Mechanical Engineering Department.

**MAKE-UP EXAMINATIONS**
Make-up examinations may be given to those with valid excuses (i.e. medical report, ...) approved by the Mechanical Engineering Department.

If you are eligible to take any of the make-up examinations, you must contact the course instructor or the course assistant.

Make-up examinations may not be of multiple-choice type.

All make-up examinations will be given after the final.
Examinations

EXAMINATION RULES
• During the examinations you are only allowed to use pencil and eraser; when allowed calculators.
• Your mobile phones should be in your handbag, backpack, etc. or in your pocket.
• During the examinations, you will be given a question booklet and an answer sheet.
• Return both of them to the assistants before you leave the classroom.
• If you do not return both of them, your examination will not be evaluated (will be invalid) and a disciplinary investigation will be started according to the Disciplinary Regulations of Middle East Technical University.

CIM Laboratory Work
• CIM Laboratory (20 %)
  • Sensors
  • Process Planning and Programming for Turning and Milling
  • Statistical Process Control
  • PLC Ladder Diagram Programming

Quality characteristic
Order of sampling

Course Policy
ME 445 Integrated Manufacturing Systems
ME 445 Integrated Manufacturing Systems

Course Policy

• Duration: about 7-8 weeks;

• Needs to allocate extra hour(s) per week; (excluding lunch break: 12:30 - 13:30)

• A student is only allowed to miss only one week of the CIM Laboratory work, without a valid excuse (10 points will be deducted from overall CIM Laboratory grade),

• If missed weeks are more than one, letter grade from the course will be NA.

• Course assistants will evaluate the CIM Laboratory work.

CIM Laboratory Work

• CIM Laboratory hours will be arranged until the end of the 2nd or 3rd week by considering the course schedules of the students.

• For the arrangement, individual course schedules will be collected during lecture hours in the 2nd or 3rd week.

• CIM Laboratory practice will start in the 3rd or 4th week of the semester.
ATTENDANCE

Article 8

Students must attend classes, practices and examinations.

Students' attendance is followed by the Instructor concerned.

EXAMINATIONS AND ASSESSMENT

Article 9

The student is given a grade by the course instructor by taking into account the midterm examinations, final examinations, the semesters work and attendance.

If your class attendance is less than 70.00 %, regardless of your other grades, NA will be given as your COURSE GRADE at the end of the semester.
Attendance

• Class attendance will be taken starting from the first lecture.

• Even if you are planning to add the course afterwards, attend the classes starting from the first lecture.

• For some reason, if you are planning to register to the course afterwards by directly applying to the Mechanical Engineering Department, again attend the classes starting from the first lecture.

Otherwise you will not be accepted.

NA

• Middle East Technical University

ACADEMIC RULES AND REGULATIONS CONCERNING UNDERGRADUATE PERIOD OF STUDY, EXAMINATIONS AND ASSESSMENT

Article 10

NA - Nonattendance is the grade given to students who have failed to regularly attend courses or have not fulfilled the requirements of course practices.

NA is processed like FF in computing grades.
Text Book

Automation, Production Systems, and Computer-Integrated Manufacturing
Third Edition

Mikell P. Groover

ISBN-10: 0132393212
PEARSON - Prentice Hall, 2008

Reference Books

Reference Books

Course Policy

ME 445 Integrated Manufacturing Systems

Course METU Catalogue Description

1. Introduction to new concepts in manufacturing engineering,
2. Group technology,
3. Process planning,
4. Integrative manufacturing planning and control,
5. Numerical control in manufacturing,
6. Measurement, analysis and actuation,
7. Computer Integrated Manufacturing (CIM) systems.
### Chapters from the Textbook

#### PART I OVERVIEW OF MANUFACTURING

**Chapter 2** MANUFACTURING OPERATIONS

- 2.1 Manufacturing Industries and Products
- 2.2 Manufacturing Operations
- 2.3 Production Facilities
- 2.4 Product/Production Relationship
- 2.5 Lean Production

**PART II AUTOMATION AND CONTROL TECHNOLOGIES**

**Chapter 4** INTRODUCTION TO AUTOMATION

**Chapter 6** HARDWARE COMPONENTS FOR AUTOMATION AND PROCESS CONTROL

- 6.1 Sensors
- 6.2 Actuators
- 6.3 Analog-to-Digital Converters
- 6.4 Digital-to-Analog Converters
- 6.5 Input/Output Devices for Discrete Data
### Chapters from the Textbook

#### PART II AUTOMATION AND CONTROL TECHNOLOGIES

**Chapter 7**  
NUMERICAL CONTROL
(“Appendix B 7: Part Programming with APT” is not included.)

**Chapter 8**  
INDUSTRIAL ROBOTICS

**Chapter 9**  
DISCRETE CONTROL USING PROGRAMMABLE LOGIC CONTROLLERS AND PERSONAL COMPUTERS

---

**MT I**

---

#### PART IV MANUFACTURING SYSTEMS

**Chapter 18**  
CELLULAR MANUFACTURING

**Chapter 19**  
FLEXIBLE MANUFACTURING SYSTEMS

---

**PART V QUALITY CONTROL IN MANUFACTURING SYSTEMS**

**Chapter 20**  
QUALITY PROGRAMS FOR MANUFACTURING

20.1 Quality in Design and Manufacturing
20.2 Traditional and Modern Quality Control
20.3 Process Variability and Process Capability
20.4 Statistical Process Control
Chapters from the Textbook

PART VI MANUFACTURING SUPPORT SYSTEMS

Chapter 23 PRODUCT DESIGN AND CAD/CAM IN THE PRODUCTION SYSTEM

Chapter 24 PROCESS PLANNING AND CONCURRENT ENGINEERING

Chapter 25 PRODUCTION PLANNING AND CONTROL SYSTEMS

Chapter 26 JUST IN TIME AND LEAN PRODUCTION

What to Do?

1. Attend classes, follow lectures!
   Attendance will be taken regularly.
2. Take notes when necessary
3. Read the textbook
4. Refer reference books
5. Study regularly
6. Attend CIM Laboratory work