A) COURSE

Course Id:	Course
5704	**Computer Integrated Manufacturing**

Class Hours per Week	Lab hours per week	Complementary practices	Credits	Total hour course
3	2	3	8	48

B) GENERAL COURSE INFORMATION:

	EE (IEA)	ME (IM)	MME (IMA)	EME (IME)	MTE (IMT)
Level:	X				
Course Type (Required/Elective)	Elective				
Prerequisite Course:	Robotics A (5719)				
CACEI Classification:	IA				

C) COURSE OBJECTIVE

At the end of the course, the student will be capable of:
To apply concepts and techniques of manufacturing and control in the process of design, selection, implementation, evaluation and operation of a Computer Integrated Manufacturing System, justifying the result as a way to improve processes and increase the competitiveness of the manufacturing industry

D) TOPICS (CONTENTS AND METHODOLOGY)

1. Introduction to manufacturing		Hours
Specific Objective:	**Identify the activities and basic components of a manufacturing system, defining the requirements to planning and control of it.**	
	1.1 Basic definitions of manufacturing systems **1.2 Manufacturing environments** **1.3 Classification of Automated Manufacturing Systems** **1.4 Basic elements of an automated system** **1.5 Systems of a CIM environment** **1.6. Control of a manufacturing system**	
Readings and other resources		
Teaching Methodologies	Presentation of topics by the teacher. Illustration of manufacturing environments with example cases.	
Learning Activities		

2. Industrial robotics		Hours
Specific Objective:	**Identify types and basic components of industrial robots. Make an appropriate selection process based on the needs of a specific application. Additionally they should exercise programming languages for robots and know how to evaluate the advantages and disadvantages of each languages. Finally efficient programs must be designed for movement of a robotic manipulator.**	
2.1.- Main concepts of Industrial Robotics **2.2.- Features and components of an industrial robot.** **2.3.- Classification of industrial robots.** **2.4.- Use and selection methodology for industrial robots** **2.5.- Technique and economic justification for the use of industrial robots.** **2.6 . Robots programming languages.** **2.7 - Precision and repeatability in Industrial robotics**		
Readings and other resources	its recomended to read articles about new robotics applications in manufacturing industry	
Teaching Methodologies	Exposition by the teacher Using audiovisual tools showing the different configurations of robots and applications Solving exercises about robot programation	
Learning Activities	Homework with robot programming exercises. practices with cartesian and spherical robots	

3. Numerical control		Hours
Specific Objective:	**Identify different numerical control equipment used in industry as well as different programming languages thereof. The student will be able to calculate the requirements in the manufacture and to implement the travel and miscellaneous functions necessary to generate one piece.**	
3.1 Principles of NC Technology **3.2 Role of Numerical Control in Computer Integrated** **3.2.1 Manufacturing Systems.** **3.3 Numerical Control fundamentals.** **3.4 NC Programming**		
Readings and other resources		
Teaching Methodologies	Exposition by the teacher Using CAD and CAM tools for designing and programming parts Solving exercises robot programming	
Learning Activities	Homework with CNC programming exercises. Turning and milling practices in integrated environments CNC (communication band conveyor-robot-CNC for loading and unloading.	

4. Group technology and cellular Manufacturing		Hours
Specific Objective:	**The student will be able to define and understand the advantages and disadvantages of Technology Groups, as well as economic benefits in the areas of design, manufacturing and administration. In addition, the student will apply the methods of classification and codification of families of parts.**	
4.1 Introduction. **4.2 Part Families.** **4.3 Parts Classification and Coding.** **4.4 Production Flow Analysis** **4.5 Cellular Manufacturing** **4.6 Quantitative Analysis in Cellular Manufacturing**		

Readings and other resources	Lectures of methods of classification and coding parts
Teaching Methodologies	Exposition by the teacher Presentation of cases to show benefits of cellphone manufacturing Solving exercises about group technology and cellphone manufacturing
Learning Activities	Homeworks about manufacturing cell formation

5. Manufacturing planning and control	Hours
Specific Objective:	**The student will be able to apply analytical methods to optimize the resources of manpower, equipment and space in a manufacturing system.**

5.1 Manufacturing environment
5.2 Procedures for the planning of manufacturing systems.
5.3 Batch sizing
5.4 Multiproduct scheduling
5.5. Flow-shop scheduling
5.6. Job-shop scheduling

Readings and other resources	Reading articles about techniques for planning production lines
Teaching Methodologies	Exposition by the teacher Presentation of cases to show advantages and disadvantages of scheduling techniques of production lines, and that each case should be used. Solving exercises on scheduling techniques
Learning Activities	Exercises tasks scheduling techniques Development practices on planning and control of production lines

6. Quality control for manufacturing Systems	Hours
Specific Objective:	**Students will learn the most used techniques in manufacturing industry to check the quality of products manufactured in a production line. He also understand the principles of inspection and techniques used for automated inspection. Finally, students will use the information learned in this topic to evaluate between alternatives which suits the integration of Integrated Manufacturing System.**

6.1 Quality in Design and Manufacturing
6.2 Inspection Fundamentals
6.3 Sampling vs. 100% Inspection
6.4 Automated Inspection
6.5 Inspection technologies

Readings and other resources	
Teaching Methodologies	Exposition by the teacher Case presentations and audiovisual resources applications to display vision techniques for quality control
Learning Activities	Development of practices using vision systems

7. Flexible manufacturing systems	Hours
Specific Objective:	**Understand and identify the major components of a Flexible Manufacturing System, and know and apply techniques to plan and implement such systems.**

7.1 What is a Flexible Manufacturing System?
7.2 FMS Components
7.3 FMS Planning and Implementation Issues

Readings and other resources	

Teaching Methodologies	Exposition by the teacher
	Solving exercises on analysis of efficiency of production lines
Learning Activities	Exercises tasks with efficiency analysis of production lines

8. Programmable Logic Controllers	Hours
Specific Objective:	**Know the different types of programmable logic controllers and understand their use. Create ladder diagrams for the control system and program a logic controller to achieve a sequence of operations.**
8.1 Introduction to Programmable Logic Controllers **8.2 Logic control elements** **8.3 Logic controllers architecture** **8.4 PLC Programming**	
Readings and other resources	
Teaching Methodologies	Exposition by the teacher Resolution PLC programming exercises for workstations and production lines Using simulation software to understand PLC's logic.
Learning Activities	Tasks with PLC programming exercises

E) TEACHING AND LEARNING METHODOLOGIES

Presentation of course topics by the teacher including real case examples. Tasks and bibliographic research regarding the main topics and readings support will be assigned to the students.

This course considers 45 instruction hours plus three hours for the application of tests.

F) EVALUATION CRITERIA:

Evaluation:	Schedule	Suggested Form of Evaluation and weighing	Topics
1st Term	Session 16	Exam 85%, Homework 15%,	Units 1 and 2
2nd Term	Session 32	Exam 85%, Homework 15%,	Units 2 and 3
3rd Term	Session 48	Exam 85%, Homework 15%,	Units 3 and 4
Final evaluation		100% (Average of the partial evaluations)	
Other activity:			
Exam, Extraordinary	According to schedule	100% Exam	100% of topics
Exam, Title sufficiency	According to schedule	100% Exam	100% of topics
Exam, regularization	According to schedule	100% Exam	100% of topics

G) BIBLIOGRAPHY AND ELECTRONIC RESOURCES

Main Books
a)   AUTOMATION, PRODUCTION SYSTEMS, AND COMPUTER-AIDED MANUFACTURING, (3rd Edition)

Groover, M. P.

Prentice-Hall, 2008

Complementary Books
a)   COMPUTER-INTEGRATED DESIGN AND MANUFACTURING
Bedworth, David D.; Mark R.; Philip H.
McGraw-Hill 1991

b)   COMPUTER CONTROL OF MANUFACTURING SYSTEMS
Koran, Yorarn
McGraw-Hill, 1983

c)   FLEXIBLE MANUFACTURING SYSTEM HANDBOOK
Automation and Management Systems Division
Noyes Publications. Park Ridqe, N.Y. 1994

d)   PRINCIPLES OF OPERATION MANAGEMENT (8th Edition)
Heizer, J.; Render, B.
Prentice-Hall 2010

Internet Links