



A) COURSE

Course Id:	Course
5719	Robotics A

Class Hours per Week	Lab hours per week	Complementary practices	Credits	Total hour course
4	2	4	10	64

B) GENERAL COURSE INFORMATION:

	EE (IEA)	ME (IM)	MME (IMA)	EME (IME)	MTE (IMT)
Level:	X				VII
Course Type (Required/Elective)	Elective				Required
Prerequisite Course:	Control Engineering II				225 Credits Approved
CACEI Classification:	IA				IA

C) COURSE OBJECTIVE

At the end of the course, the student will be capable of:
APPLY THE CONCEPTS OF KINEMATICS, DYNAMICS AND CONTROL OF ROBOT MANIPULATORS. IT WILL BE ABLE TO COMPUTE AND PROGRAMMING TRAJECTORIES TO OPERATE AN INDUSTRIAL ROBOT.



D) TOPICS (CONTENTS AND METHODOLOGY)

UNIT 1: INTRODUCTION		4 Hrs
Specific Objective:	THE STUDENT WILL LEARN THE HISTORY OF ROBOTICS AND AN OVERVIEW OF THE CONSTRUCTION, MODELING AND CONTROL OF THE COMMON ROBOTS..	
1.1 HISTORY OF ROBOTICS 1.2 DYNAMICS AND CONTROL OF ROBOT MANIPULATORS. 1.3 COMPONENTS AND STRUCTURE OF ROBOT MANIPULATORS		
Readings and other resources	Robótica. John J. Craig. Pearson Education, 3a Ed. 2006. ISBN: 970-26-0772-8 Fundamentos de Robótica. Antonio Barrientos, Luis Felipe Peñín, Carlos Balaguer y Rafael Aracil. Mc Graw Hill	
Teaching Methodologies	The subject will be taught in the traditional manner, with the teacher's explanation. Coupled with homework.	
Learning Activities	Lectures, Homework, Exercises.	

UNIT 2: KINEMATICS MODELING		12 Hrs
Specific Objective:	UNDERSTANDING THE CALCULATIONS FOR DETERMINING THE POSITION AND ORIENTATION OF THE END EFFECTOR OF THE ROBOT ACCORDING TO THE STRUCTURE OF THE ROBOT.	
2.1 GEOMETRIC DESCRIPTION AND TRANSFORMATIONS 2.2 DIRECT KINEMATIC MODEL OF ROBOT MANIPULATORS 2.3 INVERSE KINEMATIC MODEL OF ROBOT MANIPULATORS		
Readings and other resources	Modeling and Control of Robot Manipulators. Lorenzo Sciavicco, Bruno Siciliano. McGraw Hill, 1996. ISBN: 0-07-057217-8 Robótica. John J. Craig. Pearson Education, 3a Ed. 2006. ISBN: 970-26-0772-8 Fundamentos de Robótica. Antonio Barrientos, Luis Felipe Peñín, Carlos Balaguer y Rafael Aracil. Mc Graw Hill	
Teaching Methodologies	The subject will be taught in the traditional manner, with the teacher's explanation. Coupled with homework and researches.	
Learning Activities	Lectures, Homework, Exercises.	

UNIT 3: MANIPULATOR JACOBIAN: VELOCITY AND FORCE		12 Hrs
Specific Objective:	THE STUDENT MUST UNDERSTAND THE RELATIONSHIP BETWEEN THE VELOCITIES AT JOINTS AND LINEAR AND ANGULAR VELOCITIES OF THE END EFFECTOR ELEMENT. ALSO UNDERSTAND THE RELATIONSHIP BETWEEN THESE FORCES AND THE TORQUES ON THE MANIPULATOR.	
3.1 JACOBIAN 3.2 KINEMATIC SINGULARITIES 3.3 DIFFERENTIAL KINEMATICS INVERSION 3.4 STATIC FORCE IN THE MANIPULATOR		
Readings and other resources	Modeling and Control of Robot Manipulators. Lorenzo Sciavicco, Bruno Siciliano. McGraw Hill, 1996. ISBN: 0-07-057217-8 Robótica. John J. Craig. Pearson Education, 3a Ed. 2006. ISBN: 970-26-0772-8 Fundamentos de Robótica. A	
Teaching Methodologies	TOPICS EXPOSITION, ANALYSIS OF PRINCIPLES AND EXAMPLES, DISCUSSION OF RESULTS OF NUMERICAL EXERCISES AND ASSIGNMENTS, MIDTERMS, HOMEWORK AND LABS. DEVELOPMENT OF SIMULATIONS IN SPECIALIZED SOFTWARE FOR ELECTRICAL AND ELECTRONIC CIRCUITS.	
Learning Activities	Lectures, Homework, Exercises.	



UNIT 4: TRAJECTORY GENERATION		12 Hrs
Specific Objective:	THAT THE STUDENT APPLIES THE METHODS FOR COMPUTING THE TRAJECTORY THAT DESCRIBES THE DESIRED MOVEMENT OF THE MANIPULATOR IN THE CARTESIAN-SPACE AND JOINT-SPACE.	
4.1 GENERAL CONSIDERATIONS IN PATH DESCRIPTION AND GENERATION 4.2 JOINT-SPACE SCHEMES 4.3 CARTESIAN-SPACE SCHEMES 4.4 GEOMETRIC PROBLEMS WITH CARTESIAN PATHS		
Readings and other resources	Modeling and Control of Robot Manipulators. Lorenzo Sciavicco, Bruno Siciliano. McGraw Hill, 1996. ISBN: 0-07-057217-8 Robótica. John J. Craig. Pearson Education, 3a Ed. 2006. ISBN: 970-26-0772-8 Fundamentos de Robótica. A	
Teaching Methodologies	The subject will be taught in the traditional manner, with the teacher's explanation.	
Learning Activities	Lectures, Homework, Exercises.	

UNIT 5: MOTION CONTROL		12 Hrs
Specific Objective:	THAT THE STUDENT BE ABLE TO DESIGN BASIC CONTROL MOVEMENTS OF A ROBOT MANIPULATOR.	
5.1 THE CONTROL PROBLEM 5.1 JOINT SPACE CONTROL 5.2 OPERATIONAL SPACE CONTROL (CARTESIAN)		
Readings and other resources	Modeling and Control of Robot Manipulators. Lorenzo Sciavicco, Bruno Siciliano. McGraw Hill, 1996. ISBN: 0-07-057217-8 Robótica. John J. Craig. Pearson Education, 3a Ed. 2006. ISBN: 970-26-0772-8 Fundamentos de Robótica. A	
Teaching Methodologies	The subject will be taught in the traditional manner, with the teacher's explanation. Coupled with homework and researches.	
Learning Activities	Lectures, Homework, Exercises.	

UNIT 6: TRAJECTORY CONTROL PROJECT IN INDUSTRIAL ROBOTS		12 Hrs
Specific Objective:	STUDENTS MUST APPLY THE THEORETICAL KNOWLEDGE ACQUIRED DURING THE COURSE, IN A SPECIFIC PROJECT: A REAL APPLICATION.	
6.1 PROJECT DEVELOPMENT.		
Readings and other resources	Modeling and Control of Robot Manipulators. Lorenzo Sciavicco, Bruno Siciliano. McGraw Hill, 1996. ISBN: 0-07-057217-8 Robótica. John J. Craig. Pearson Education, 3a Ed. 2006. ISBN: 970-26-0772-8 Fundamentos de Robótica. A	
Teaching Methodologies	The subject will be taught in the traditional manner, with the teacher's explanation. Coupled with homework and researches.	
Learning Activities	Lectures, Homework, Exercises.	

E) TEACHING AND LEARNING METHODOLOGIES

- a) Topics Explanations.
- of) Reading scientific papers.
- c) Research by students.
- d) Learning oriented projects.
- e) Use of simulators.



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 16	Exam 85%, Homework 15%,	Units 3, and 4
3rd Term	Session 16	Exam 85%, Homework 15%,	Units 4 and 5
4th Term	Session 16	Exam 85%, Homework 15%	Unit 6
Final evaluation		100% (Average of the partial evaluations)	
Other activity:			
Extraordinary Exam	According to schedule	100% Exam	100% of topics
Title Exam	According to schedule	100% Exam	100% of topics
Regularization Exam	According to schedule	100% Exam	100% of topics

G) BIBLIOGRAPHY AND ELECTRONIC RESOURCES

Main Books

1. Modeling and Control of Robot Manipulators. Lorenzo Sciavicco, Bruno Siciliano. McGraw Hill, 1996. ISBN: 0-07-057217-8
2. Robótica. John J. Craig. Pearson Education, 3a Ed. 2006. ISBN: 970-26-0772-8
3. Fundamentos de Robótica. Antonio Barrientos, Luis Felipe Peñín, Carlos Balaguer y Rafael Aracil. Mc Graw Hill.