



University of Puerto Rico  
Mayagüez Campus  
College of Engineering  
Department of Mechanical Engineering  
Bachelor of Science in Mechanical Engineering



## Course Syllabus

<b>1. General Information:</b> Alpha-numeric codification: INME 4850 Course Title: Introduction to Robotics Number of credits: 3 Contact Period: Two hours of lecture and three hours of laboratory per week
<b>2. Course Description:</b> English: Analysis and design of mechanical manipulators by means of kinematic and dynamic models. Use of the direct or inverse kinematics analysis techniques to calculate the position of the robot tool, the required joint variables, and to perform workspace analysis and trajectory and motion planning. Spanish: Análisis y diseño de manipuladores mecánicos mediante modelos cinemáticos y dinámicos. Uso de técnicas de análisis cinemático directo e inverso para calcular la posición de la herramienta del robot, las variables requeridas en las uniones para realizar análisis del espacio de trabajo y planificación de trayectoria y movimiento.
<b>3. Pre/Co-requisites and other requirements:</b> Prerequisites: INME 4011
<b>4. Course Objectives:</b> After completing this course, the student should be able to: <ul style="list-style-type: none"><li>● Identify the robot's classification based on its joint design.</li><li>● Calculate the robot reachable space.</li><li>● Analyze robot models to calculate the end-effector coordinates by performing the forward kinematics approach.</li><li>● Calculate the joint variables required so that end-effector reaches its goal destination by performing the inverse kinematic approach.</li><li>● Calculate the robot singularities.</li><li>● Estimate forces and velocities acting or resulting on the robot while it follows the programmed path.</li><li>● Design a simple robot.</li></ul>
<b>5. Instructional Strategies:</b> <input checked="" type="checkbox"/> conference <input type="checkbox"/> discussion <input type="checkbox"/> computation <input type="checkbox"/> laboratory <input type="checkbox"/> seminar with formal presentation <input type="checkbox"/> seminar without formal presentation <input type="checkbox"/> workshop <input type="checkbox"/> art workshop <input type="checkbox"/> practice <input type="checkbox"/> trip <input type="checkbox"/> thesis <input type="checkbox"/> special problems <input type="checkbox"/> tutoring <input type="checkbox"/> research <input type="checkbox"/> other, please specify:
<b>6. Minimum or Required Resources Available:</b> Computer Aided Design Laboratory, access to robot for demonstration and homework.

<b>7. Course time frame and thematic outline</b>		
<b>General Topics</b>	<b>Contact Hours</b>	
Introduction	2	
Spatial transformations	7	
Forward Kinematics	5	
Inverse Kinematics	7	
Velocity analysis	3	
Dynamics	6	
Trajectory planning	6	
Mechanical design of robots	6	
Exams	3	
<b>Total hours: (equivalent to contact period)</b>	<b>45</b>	
<b>8. Grading System</b>		
<input checked="" type="checkbox"/> Quantifiable (letters) <input type="checkbox"/> Not Quantifiable		
<b>9. Evaluation Strategies</b>		
	<b>Quantity</b>	<b>Percent</b>
<input checked="" type="checkbox"/> Exams	<b>2-3</b>	<b>50-75</b>
<input checked="" type="checkbox"/> Final Exam *	<b>1</b>	<b>0-25</b>
<input checked="" type="checkbox"/> Short Quizzes	<b>0-3</b>	<b>0-10</b>
<input checked="" type="checkbox"/> Oral Reports	<b>0-4</b>	<b>0-25</b>
<input type="checkbox"/> Monographies		
<input type="checkbox"/> Portfolio		
<input checked="" type="checkbox"/> Projects	<b>0-1</b>	<b>0-50</b>
<input type="checkbox"/> Journals		
<input checked="" type="checkbox"/> Other, specify: Homework	<b>0-5</b>	<b>0-25</b>
<b>TOTAL:</b>		<b>100%</b>
*In design courses		
<b>10. Bibliography:</b>		
<b>Textbook:</b>		
Craig, J. J. (2017). <i>Introduction to robotics: Mechanics and control</i> . NY NY: Pearson.		
<b>11. Law 51: The Comprehensive Educational Services Act for People with Disabilities:</b>		
States that after identifying with the instructor and the institution, the student with disabilities will receive reasonable accommodation in their courses and evaluations. For more information, contact the Department of Counseling and Psychological services at the Office of the Dean of Students (Office DE 21) or call 787-265-3864 or 787-832-4040 x 3772, 2040 and 3864.		
<b>12. Academic Integrity</b>		
The University of Puerto Rico promotes the highest standards of academic and scientific integrity. Article 6.2 of the UPR Students General Bylaws (Board of Trustees Certification 13, 2009-2010) states that academic dishonesty includes, but is not limited to: fraudulent actions; obtaining grades or academic degrees by false or fraudulent simulations; copying the whole or part of the academic work of another person; plagiarizing totally or partially the work of another person; copying all or part of another person answers to the questions of an oral or written exam by taking or getting someone else to take the exam on his/her behalf; as well as enabling and facilitating another person to perform the aforementioned behavior. Any of these behaviors will be subject to disciplinary action in accordance with the disciplinary procedure laid down in the UPR Students General Bylaws.—		

**13. Certification 06-43 of the Academic Senate**

"The academic guidelines for offering online courses," defines: Traditional face-to-face courses are those that have less than 25% of the course's regular contact hours via the Internet. Therefore, a three-credit course will be considered "face to face" if, of the 45 hours of regular contact, 11 or less are taught via the Internet. According to certification 06-43 of the Academic Senate, a course may include up to 25% of its total contact hours via the Internet. The objective of this is so that all professors have this alternative in the case of any unscheduled eventuality.

**14. Sexual Harassment: Certification 130-2014-2015 states:**

Sexual harassment in the workplace and in the study environment is an illegal and discriminatory act and is against the best interests of the University of Puerto Rico. All persons who understand they have been subject to acts of sexual harassment at the University of Puerto Rico may file a complaint and request that the institution investigate, where necessary, and assume the corresponding action by the university authorities. If the complainant is a student, he or she must refer his or her complaint to the Office of the Student Ombudsperson or that of the Dean of Students.

*Revised: February, 2019*