



**University of Tehran**  
**School of Electrical and Computer Engineering**

<b>Course:</b>	<b>8101187 – Introduction to Robotics</b>											
<b>Course type:</b>	EE*						CE*				Credit:  3	
		Com	E	P	B	Con	D	SW	HW	IT		MI
	Required	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>
Elective	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Level:</b>	Undergraduate <input type="checkbox"/> Graduate <input checked="" type="checkbox"/>											
<b>Co-requisite(s):</b>	Linear Control Systems (8101224)											
<b>Prerequisite(s):</b>	None											
<b>Prerequisite by topic:</b>	Linear Algebra (8101174)											
<b>Textbook(s):</b>	<p>[1] Craig, John J., <i>Introduction to robotics: mechanics and control</i>, Pearson Prentice Hall, 2005.</p> <p>[2] Spong, Mark W., Seth Hutchinson, and Mathukumalli Vidyasagar, <i>Robot modeling and control</i>, New York: Wiley, 2006.</p> <p>[3] Sciavicco, Lorenzo, and Bruno Siciliano, <i>Modelling and control of robot manipulators</i>, Springer Science &amp; Business Media, 2012.</p>											
<b>Coordinator:</b>	Dr. Nili Ahmadabadi, Professor, School of ECE, Dr. Moradi, Associate Professor, School of ECE, Dr. Sharbafi, Assistant Professor, School of ECE.											
<b>Goals:</b>	To introduce the basics of robotics, such as transformations, forward kinematics, inverse kinematics, dynamics, and trajectory planning of robots, as well as basics of robot control especially high degree of freedom manipulators and mobile robots.											
<b>Outcome:</b>	<p>Upon successful completion of the course, students will be able to</p> <ol style="list-style-type: none"> <li>1. Model and analyze robotic systems in terms of <ol style="list-style-type: none"> <li>1.1. forward kinematics,</li> <li>1.2. inverse kinematics,</li> <li>1.3. dynamics;</li> </ol> </li> <li>2. develop trajectory planning methods;</li> <li>3. develop and use calibration tools;</li> <li>4. develop and use robot simulators in commercial software;</li> <li>5. develop robot control methods and simulate them;</li> <li>6. design robot mechanism and sensor system for different tasks;</li> <li>7. construct and use laboratory robots by assembling basic components.</li> </ol>											
<b>Topics:</b>	<ol style="list-style-type: none"> <li>1. What is robotics;</li> <li>2. The basics of robots;</li> </ol>											

	<ol style="list-style-type: none"> <li>3. Sensors and actuators;</li> <li>4. Rigid motion and homogeneous transformations;</li> <li>5. Forward kinematics;</li> <li>6. Inverse kinematics;</li> <li>7. Differential kinematics;</li> <li>8. Kinematic Singularity;</li> <li>9. Kinematic calibration;</li> <li>10. Dynamics;</li> <li>11. Trajectory planning;</li> <li>12. Robot Control; including independent joint, inverse dynamics, force, impedance and hybrid control methods.</li> </ol>								
<b>Computer usage:</b>	Implementing the projects using Matlab Software or other robotic simulator softwares; e.g. Webots.								
<b>Assignments:</b>	5 to 6 homeworks and 5 laboratory sessions covering the basic topics.								
<b>Projects:</b>	Elective laboratory projects								
<b>Grading:</b>	<table style="width: 100%; border: none;"> <tr> <td style="width: 60%;">Assignments:</td> <td style="text-align: right;">45%</td> </tr> <tr> <td>Projects:</td> <td style="text-align: right;">0%</td> </tr> <tr> <td>Midterm exams:</td> <td style="text-align: right;">25%</td> </tr> <tr> <td>Final exam:</td> <td style="text-align: right;">30%</td> </tr> </table>	Assignments:	45%	Projects:	0%	Midterm exams:	25%	Final exam:	30%
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<b>Further readings:</b>	Some state of the art papers.								
<b>Prepared by:</b>	Dr. Majid Nili Ahmadabadi.								
<b>Date:</b>	September, 19, 2017.								

*EE: Electrical Engineering		CE: Computer Engineering	
Com	Communications	SW	Software
E	Electronics	HW	Hardware
P	Power	IT	Information Technology
B	Bioelectronics	AI	Machine Intelligence and Robotics
Con	Control		
D	Digital System		