

# ROBOT DESIGN AND APPLICATIONS

<b>1</b>	Course Title:	ROBOT DESIGN AND APPLICATIONS	
<b>2</b>	Course Code:	BMB4019	
<b>3</b>	Type of Course:	Optional	
<b>4</b>	Level of Course:	First Cycle	
<b>5</b>	Year of Study:	4	
<b>6</b>	Semester:	7	
<b>7</b>	ECTS Credits Allocated:	5.00	
<b>8</b>	Theoretical (hour/week):	3.00	
<b>9</b>	Practice (hour/week):	0.00	
<b>10</b>	Laboratory (hour/week):	0	
<b>11</b>	Prerequisites:	None	
<b>12</b>	Language:	Turkish	
<b>13</b>	Mode of Delivery:	Face to face	
<b>14</b>	Course Coordinator:	Dr. Öğr. Üyesi CEYDA NUR ÖZTÜRK	
<b>15</b>	Course Lecturers:		
<b>16</b>	Contact information of the Course Coordinator:	ceydanur@uludag.edu.tr	
<b>17</b>	Website:		
<b>18</b>	Objective of the Course:	To teach kinematic calculations, trajectory planning, and various control methods for designing robots of manipulator or rover type. To have theoretical information and functions of different sensors and actuators comprehended with applications to be developed on available robotic systems.	
<b>19</b>	Contribution of the Course to Professional Development:		
<b>20</b>	Learning Outcomes:		
		<b>1</b>	Being able to perform forward or inverse position calculations for different robot configurations
		<b>2</b>	Being able to perform forward or inverse velocity calculations through differential analysis
		<b>3</b>	Knowing techniques that are used for trajectory planning and motion, velocity, or force control
		<b>4</b>	Having knowledge about types and functions of sensors and actuators
		<b>5</b>	Being able to program robotic systems using proper interfaces
		<b>6</b>	Being able to develop controller software for a robotic system to run in real-time
		<b>7</b>	
		<b>8</b>	
		<b>9</b>	
		<b>10</b>	
<b>21</b>	Course Content:		
		<b>Course Content:</b>	
Week	Theoretical	Practice	
<b>1</b>	Robotic systems and application areas, common robot configurations		

2	Fundamentals of mathematical robot modeling, homogeneous coordinates and representation of transformations with matrices	
3	Forward and inverse kinematics for common robot configurations	
4	Programming different robots with interfaces of robot operating system	
5	Denavit-Hartenberg representation of forward and inverse kinematics	
6	Differential motion analysis, forward and inverse Jacobian calculations	
7	Dynamic analysis and forces	
8	Path and trajectory planning, trajectory planning with high-order polynomials and via points	
9	Motion, velocity, and force control, proportional, integral, and derivative controllers	
10	Vision-based control methods	
11	Fuzzy logic-based control methods	
12	Sensors: position, velocity, acceleration, pressure, light and proximity sensors, range scanners and camera systems	
13	Actuators: hydraulic and pneumatic devices, electric motors	

Activites	Number	Duration (hour)	Total Work Load (hour)
Theoretical	Systems, Applications, Prentice Hall, New Jersey, 2000.		42.00
Materials:	2. Siegwart R., Nourbakhsh I. R. and Scaramuzza D. Press (2nd Edition).		28.00
Practicals/Labs	0	0.00	0.00
Self study and preperation	2	14.00	28.00
Homeworks	4	8.00	32.00
<b>TERM LEARNING ACTIVITIES</b>	<b>NUMBER</b>	<b>WEIGHT</b>	
Projects	1	20.00	20.00
Field Studies	0	0.00	0.00
Midterm exams	0	10.00	10.00
Others	0	0.00	0.00
Final Exams	1	14.00	14.00
Total Work Load			146.00
Total work load of 30 hr			4.87
Contribution of Term (Year) Learning Activities to ECTS Credit of the Course			5.00
Contribution of Final Exam to Success Grade		60.00	
Total		100.00	
Measurement and Evaluation Techniques Used in the Course			

**24 ECTS / WORK LOAD TABLE**

25	CONTRIBUTION OF LEARNING OUTCOMES TO PROGRAMME QUALIFICATIONS															
	PQ1	PQ2	PQ3	PQ4	PQ5	PQ6	PQ7	PQ8	PQ9	PQ10	PQ11	PQ12	PQ13	PQ14	PQ15	PQ16
ÖK1	5	5	3	3	1	2	2	1	0	1	0	0	0	0	0	0

<b>ÖK2</b>	5	5	3	3	1	2	2	1	0	1	0	0	0	0	0	0
<b>ÖK3</b>	5	5	3	3	1	2	2	1	0	1	0	0	0	0	0	0
<b>ÖK4</b>	4	2	1	3	1	2	1	1	2	0	0	0	0	0	0	0
<b>ÖK5</b>	3	1	4	5	3	5	3	3	4	3	1	0	0	0	0	0
<b>ÖK6</b>	5	3	5	5	4	5	3	3	3	3	1	1	0	0	0	0

**LO: Learning Objectives    PQ: Program Qualifications**

<b>Contribution Level:</b>	<b>1 very low</b>	<b>2 low</b>	<b>3 Medium</b>	<b>4 High</b>	<b>5 Very High</b>
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