

SYLLABUS

1. Course name: ROBOTICS IN PRACTICE

2. Course code: PROB311446

3. Credits: 1 (0/1/2)

Duration: 7 weeks (45h main course and 90h self-study)

4. Instructors:

1 - PhD. Nguyen Van Thai

2 – M.Eng. Truong Tran Minh Nguyet

3 – M.Eng. Tran Manh Son

5. Course conditions

Prerequisites: Microcontroller

Corequisites: Robotics

6. Course description

The course provides the students with basic knowledge in design a robot manipulator, basic skill in using the software Solidworks in mechanical design manipulators, skill in programming to control the robot manipulator with the forward and inverse kinematics.

7. Course Goals

Goals	Goal Description <i>(The course provides the students with:)</i>	ELOs
G1	Knowledge in programming to control DC motor, control RC servo motor..	1.1
G2	Knowledge in programming using KIT Arduino and STM.	1.2
G3	Knowledge in mechanical design a robot manipulator using the software Solidworks.	2.2
G4	Knowledge in programming to control the robot manipulator with the forward and inverse kinematics.	3.1

Course Learning Outcomes (CLOs)

CLOs		Description (Students are able to:)	Outcome
G1	G1.1	Understand a DC motor's, RC servo motor's working	1.1
	G1.2	Program to control a DC motor, RC servo motor	1.1
G2	G2.1	Program with KIT Arduino	1.2
	G2.2	Program with KIT STM	1.2
G3	G3.1	Use the software Solidworks in basic mechanical design	2.2
	G3.2	Design a robot manipulator 4DoF using Solidworks	2.2
G4	G4.1	Program to control the robot manipulator with the forward kinematic	3.1
	G4.2	Program to control the robot manipulator with the inverse kinematic	3.1

8. Study materials

❖ Textbooks

- John J. Craig, Introduction to Robotics: Mechanics and Control, 2005.
- K. S. Fu, R. C. Gonzalez and C. S. G. Lee, Robotics: Control, Sensing, Vision, and Intelligence, 1987.
- Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani and Giuseppe Oriolo, Robotics: Modelling, Planning and Control, 2009.

❖ References

- Ph.D Nguyen Van Thai's online lectures on YouTube:
 1. Forward Manipulator Kinematic:
<https://www.youtube.com/watch?v=gkYF6Rv8W5U&t=1120s>
 2. Forward Manipulator Kinematic - Ex #1:
https://www.youtube.com/watch?v=Rvod_NM4Vso&t=1664s
 3. Forward Manipulator Kinematic - Ex #2:
<https://www.youtube.com/watch?v=nfbMzdTUu58&t=5s>
 4. Forward Manipulator Kinematic - Ex #3:
<https://www.youtube.com/watch?v=plDIYqRmO7E&t=72s>
 5. Forward Manipulator Kinematic - Ex #4:
https://www.youtube.com/watch?v=R_U_2K6ii-8&t=3s
 6. Inverse Manipulator Kinematic using algebraic solution:
<https://www.youtube.com/watch?v=0vnku9z3sNY&t=39s>
 7. Inverse Manipulator Kinematic using geometric solution:
<https://www.youtube.com/watch?v=p1wIJut1bTs&t=3s>
 8. Solidworks and Simulation the Forward & Inverse Kinematic in Matlab:
<https://www.youtube.com/watch?v=EAF2KQPeXBU>
 9. Installation Solidworks 2017 SP2:
<https://www.youtube.com/watch?v=5nGzo9tEcmY&t=14s>

10. Design of 4DOF Robot - Part 1:
<https://www.youtube.com/watch?v=GjKL6kXGrCg&t=83s>
 11. Design of 4DOF Robot - Part 2:
<https://www.youtube.com/watch?v=XzH1FxpplDQ>
 12. Design of 4DOF Robot - Part 3:
<https://www.youtube.com/watch?v=JEEig73Vvng>
 13. Design of 4DOF Robot - Part 4:
<https://www.youtube.com/watch?v=aG082xjy9jU>
 14. Design of 4DOF Robot - Part 5:
<https://www.youtube.com/watch?v=OBVIEwGKm9E>
 15. Design of 4DOF Robot - Part 6:
<https://www.youtube.com/watch?v=QU-QPF8we8>
 16. Design of 4DOF Robot - Part 7:
<https://www.youtube.com/watch?v=PeztD5rY2I0>
 17. Design of 4DOF Robot - Part 8:
<https://www.youtube.com/watch?v=TNpmzm0NstM>
 18. Design of 4DOF Robot - Part 9:
<https://www.youtube.com/watch?v=hCUYo6q9rbY>
 19. Design of 4DOF Robot - Part 10:
<https://www.youtube.com/watch?v=jXLSFlczhoM>
- Presentation by Prof. Oussama Khatib from Stanford University, consists of 16 lectures:
<http://www.youtube.com/watch?v=0yD3uBshJB0&list=PL65CC0384A1798ADF&index=1>

9. Student Assessments

- Grading points: 10
- The following is the plan for student assessment:

Test	Content	Week	Evaluation	Standards	Ratio (%)
Exam# 1	Program to control a DC motor, a RC servo motor	Week 2	- Team working - Evaluation	G1.1, G1.2	10
Exam #2	Present design of the robot manipulator 4DoF	Week 4	- Team working - Presentation - Evaluation	G2.1, G2.2	30
Exam #3	Program to control the robot manipulator with the forward kinematic	Week 6	- Team working - Presentation - Evaluation	G3.1	20
Exam #4	Program to control the robot manipulator with the inverse kinematic	Week 7	- Team working - Presentation - Evaluation	G3.2	20
Exam #5	Video to describe team's project	Week 8	- Evaluation	G4.1, G4.2	10

10. Course details

Week	Content	Standards
1	<i>Lesson 1</i> Control a DC motor and a RC servo motor	
	A. Contents and Lecturing methods at class: (5)	G1.1, G1.2,

	<p>Contents:</p> <p>1.1 Working of a DC motor 1.2 Program to control a DC motor using KIT Arduino and STM 1.3 Working of a RC servo motor 1.4 Program to control a RC servo motor using KIT Arduino and STM</p> <p>Lecturing methods:</p> <ul style="list-style-type: none"> - Lecturing - Group discuss - Slide-show 	
	<p>B. Contents for self-study at home: (5)</p> <ul style="list-style-type: none"> - Watch videos about DC motor and RC servo motor on YouTube. - Watch on YouTube about programming to control a DC motor, a RC servo motor. 	
2	<p><i>Lesson 2</i> Mechanical design a robot manipulator 4DoF using Solidworks</p>	
	<p>A. Contents and Lecturing methods at class: (5)</p> <p>Contents:</p> <p>2.1 Presentation and Evaluation: Program to control a DC motor 2.2 Design a robot manipulator 4DoF using the software Solidworks</p>	<p>G2.1, G3.1, G3.2</p>
	<p>B. Contents for self-study at home: (5)</p> <ul style="list-style-type: none"> - Ph.D Nguyen Van Thai's online lectures on YouTube: <ol style="list-style-type: none"> 1. Design of 4DOF Robot - Part 1: https://www.youtube.com/watch?v=GjKL6kXGrCg&t=83s 2. Design of 4DOF Robot - Part 2: https://www.youtube.com/watch?v=XzH1FxpplDQ 3. Design of 4DOF Robot - Part 3: https://www.youtube.com/watch?v=JEEig73Vvng 4. Design of 4DOF Robot - Part 4: https://www.youtube.com/watch?v=aG082xjy9jU 5. Design of 4DOF Robot - Part 5: https://www.youtube.com/watch?v=OBVIEWGKm9E 	
3	<p><i>Lesson 2 (Cont.)</i> Mechanical design a robot manipulator 4DoF using Solidworks</p>	
	<p>A. Contents and Lecturing methods at class: (5)</p> <p>Contents:</p> <p>2.3 Presentation and Evaluation: Program to control a RC servo motor 2.4 Design a robot manipulator 4DoF using the software Solidworks</p>	<p>G2.2 G3.1, G3.2</p>
	<p>B. Contents for self-study at home: (5)</p> <ul style="list-style-type: none"> - Ph.D Nguyen Van Thai's online lectures on YouTube: <ol style="list-style-type: none"> 1. Design of 4DOF Robot - Part 6: https://www.youtube.com/watch?v=QU-QPF8we8 	

	<ol style="list-style-type: none"> 2. Design of 4DOF Robot - Part 7: https://www.youtube.com/watch?v=PeztD5rY2I0 3. Design of 4DOF Robot - Part 8: https://www.youtube.com/watch?v=TNpmzm0NstM 4. Design of 4DOF Robot - Part 9: https://www.youtube.com/watch?v=hCUYo6q9rbY 5. Design of 4DOF Robot - Part 10: https://www.youtube.com/watch?v=jXLSFlczhoM 	
4	<p>Lesson 2 (Cont.) Mechanical design a robot manipulator 4DoF using Solidworks</p>	
	<p>A. Contents and Lecturing methods at class: (5) Contents: 2.5 Presentation and Evaluation: Design a robot manipulator 4DoF using the software Solidworks</p>	G3.1, G3.2,
	<p>B. Contents for self-study at home: (5) - Ph.D Nguyen Van Thai's online lectures on YouTube:</p> <ol style="list-style-type: none"> 1. Forward Manipulator Kinematic: https://www.youtube.com/watch?v=gkYF6Rv8W5U&t=1120s 2. Forward Manipulator Kinematic - Ex #1: https://www.youtube.com/watch?v=Rvod_NM4Vso&t=1664s 3. Forward Manipulator Kinematic - Ex #2: https://www.youtube.com/watch?v=nfbMzdTUu58&t=5s 	
5	<p>Lesson 3 Using KIT Arduino and STM for programming to control the robot manipulator with the forward kinematic</p>	
	<p>A. Contents and Lecturing methods at class: (5) Contents: 3.1 Introduction KIT Arduino 3.2 Introduction KIT STM 3.3 Programming to control the robot manipulator with the forward kinematic Lecturing methods: - Lecturing - Group discuss - Slide-show</p>	G4.1, G4.2
	<p>B. Contents for self-study at home: (5) - Ph.D Nguyen Van Thai's online lectures on YouTube:</p> <ol style="list-style-type: none"> 1. Forward Manipulator Kinematic - Ex #3: https://www.youtube.com/watch?v=plDIYqRmO7E&t=72s 2. Forward Manipulator Kinematic - Ex #4: https://www.youtube.com/watch?v=R_U_2K6ii-8&t=3s 	
6	<p>Lesson 3 (Cont.) Using KIT Arduino and STM for programming to control the robot</p>	

	manipulator with the forward kinematic	
	A. Contents and Lecturing methods at class: (5) Contents: 3.4 Presentation and Evaluation: Programming to control the robot manipulator with the forward kinematic	G2.1, G2.2 G4.1, G4.2
	B. Contents for self-study at home: (5) - Ph.D Nguyen Van Thai's online lectures on YouTube: 1. Inverse Manipulator Kinematic using algebraic solution: https://www.youtube.com/watch?v=0vnku9z3sNY&t=39s 2. Inverse Manipulator Kinematic using geometric solution: https://www.youtube.com/watch?v=p1wIJut1bTs&t=3s 3. Solidworks and Simulation the Forward & Inverse Kinematic in Matlab: https://www.youtube.com/watch?v=EAF2KQPeXBU	
	Lesson 4 Using KIT Arduino and STM for programming to control the robot manipulator with the inverse kinematic	
7	A. Contents and Lecturing methods at class: (5) Contents: 4.1 Programming to control the robot manipulator with the inverse kinematic 4.2 Presentation and Evaluation: Programming to control the robot manipulator with the inverse kinematic Lecturing methods: - Lecturing - Group discuss - Slide-show	G2.1, G2.2 G3.1, G3.2,
	B. Contents for self-study at home: (5)	

11. Learning ethics

- Home assignments and projects must be done by the students themselves. Plagiarism found in the assessments student will get zero score.

12. First approved date:

13. Approval level:

Dean

Department

Instructor

**Assoc. Prof. PhD.
Nguyen Minh Tam**

**Assoc. Prof. PhD. Truong
Dinh Nhon**

PhD. Nguyen Van Thai

14. Syllabus updated process

1st time: Updated content dated	Instructors
2st time: Updated content dated	Head of department