

Course Description:

This course aims at introducing and laying down the fundamental of modeling, design, planning and synthesis of mechanical robot systems such as serial manipulators, parallel manipulators, humanoid and mobile robots. The materials elaborated during this course tempt to provide an insight into relevant issues into kinematics, statics and dynamics of robotic mechanical systems. Control of robotic mechanical systems is not directly treated and it is covered upon a practical project. The course is established in such a way that includes readings, 6 homework and one project. There will be six quizzes, and a final examination. These examinations will be open book unless otherwise stated. Lectures will be based mainly, but not exclusively, on material in the textbook given below. Students are asked to show they abilities in applying theoretical concepts into practical problems for which three practical projects are envisaged for this end. To provide the essential materials for practical projects several workshops are considered which are given by the TA listed below.

The Class Homepage:

Instructor: Mehdi Tale Masouleh , Office A217, Phone: 6111-8574

Teaching Assistant: Monday 14:00 – 15:30

1. Payam Ghasemi
2. Morteza Daneshmand (Kinematic Sensitivity Analysis)
3. Behzad Mehrafrouz (Chapter 7–Dynamic Analysis of Serial Manipulators-MEX)
4. Mojtaba Yazdani (SolidWorks)
5. Iman Yahyapour (Dynamic Analysis of Parallel Manipulators)

Office Hours: 9:00-10:00 Wednesday and by appointment.

Textbook:

1. Fundamentals of Robotic Mechanical Systems (Theory, Methods and Algorithms), Jorge Angeles
2. Parallel Robots, Jean-Pierre Merlet
3. Type Synthesis of Parallel Mechanisms, Xaniwen Kong and Clément Gosselin

Prerequisites:

- L^AT_EX(Words typeset are not accepted)
- Matlab

- Maple
- A CAD software (Preferably SolidWorks)
- Last but not least: Patience

Course Outline:

<u>Fundamentals of Robotic Mechanical Systems – 9 weeks</u>	
Chapter 2	approx 2 weeks
Chapter 3	approx 2 weeks
Quiz I	
Chapter 4	approx 2 weeks
Chapter 5	approx 1 weeks
Quiz II	
Chapter 7 ADAMS	approx 2 weeks
First Exam	4 hours
<u>Parallel Robots – 10 weeks</u>	
Chapter 2 & Introduction into Screw Theory	approx 2 weeks
Quiz III	
Chapter 3	approx 1 weeks
Chapter 4	approx 2 weeks
Quiz IV	
Chapter 5	approx 2 weeks
Chapter 6	approx 2 weeks
Quiz V	
Chapter 7	approx 1 weeks
Final Exam	4 hours
<u>Humanoid Robots – 2 weeks</u>	
Introduction to Humanoid Robots and Kinematics Analysis	approx 1 week
Case study: You Will Learn to Program NAO H25	approx 1 week

Projects: Works done by students are of two sorts:

1. **Six Homeworks:** Homeworks are essentially based on theoretical concepts and are designated to get familiar students with basic issue of robotic mechanical systems.
2. **One Practical Project:** One practical project is considered in this course in order to have some insight of theoretical concept into practical concepts. This projects is:
 - Kinematic ans static analysis of NAO H25;

Report: Homeworks should be done individually, unless otherwise is stated, and plagiarism is not tolerated. In the case of plagiarism, the note of the corresponding work would be marked as zero. All the reports should be typeset in L^AT_EX upon following the class proposed by IEEE in. The report should follows the the instruction given by IEEE and includes:

- Abstract
- Introduction
- Main body (each section should corresponds to a problem)
- Conclusion
- Reference

Academic Honesty: As a University of Tehran student, you have agreed to abide by the University’s academic honesty policy. A Lack of knowledge of the academic honesty policy is not a reasonable explanation for a violation. Questions related to course assignments and the academic honesty policy should be directed to the instructor.

Extra Help: Do not hesitate to come to my office or contact me during office hours or by appointment to discuss a homework problem or any aspect of the course. Moreover, TA considered for each part are also at your total disposal for helping you in your homework, projects and exams.

Important Dates and Grades: Quizzes (2% each) and Exam (10%) are scheduled based on the calender provided in the course outline and have flexible date.

<u>Homeworks (8 % each):</u>	
First Homework	1392/12/02
Second Homework	1392/12/23
Third Homework	1393/01/20
Fourth Homework	1393/02/10
Fifth Homework	1393/02/31
Sixth Homework	1393/03/21
<u>Project (30%):</u>	
Final Project	1393/04/01