



# Robotics

CSE421

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<https://mnourgwad.github.io/CSE4316>

Lecture 1: **Robotic Fundamentals**

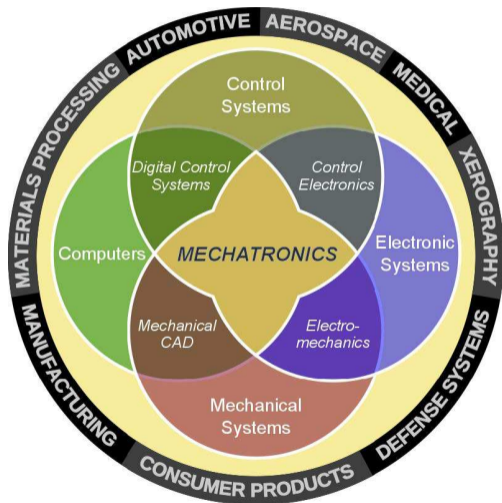
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# The Course

CSE4316: Robots



<https://en.wikipedia.org/wiki/Mechatronics>

# The Course

## CSE4316: Robots

This course enables you to:

- state basic **definitions** related to the field of robotics.
- acquire the knowledge on advanced algebraic **tools** for the description of **robot motion**.
- develop the ability to **analyze and design** the motion for articulated systems. build skills to use software tools for analysis and design of **robotic systems**.

# The Course

## CSE4316: Robots

- Course Facts: 5thY, 2nd T, Selective, 1 Lec/W, 1 Tut/W.
- Assessment Methods

Method	Time	Weight
Assignments, Quizzes	weekly	5%
Group Assignment	week 5	5%
Midterm	week 6	15%
Project (Project Report + Demo)	week 10	5%
Final	week 12	70%

## Recommended Textbooks

- Mark W. Spong, Seth Hutchinson, M. Vidyasagar (2005). **Robot Modeling and Control** (1st Edition). Wiley, ISBN: 978-0471649908.
- B. Siciliano and O. Khatib (2008). **Springer Handbook of Robotics**. Berlin Heidelberg: Springer-Verlag. ISBN: 978-3540239574.

Relevant Websites <http://roboticscourseware.org>

# Lecture: 1

## Robotic Fundamentals

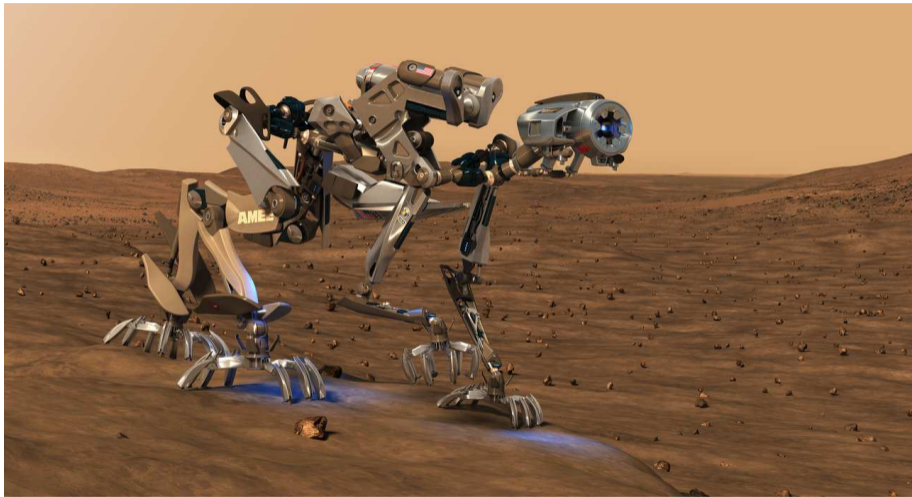
- History of Robotics.
- Basic Definitions (Robot, Robotics, ...).
- Classification of Robots. Basic Robot components.

**What is your favorite robot and robot movie?**

**Why?**

# My Favorite Robot

AMEE: Autonomous Mapping, Exploration, and Evasion



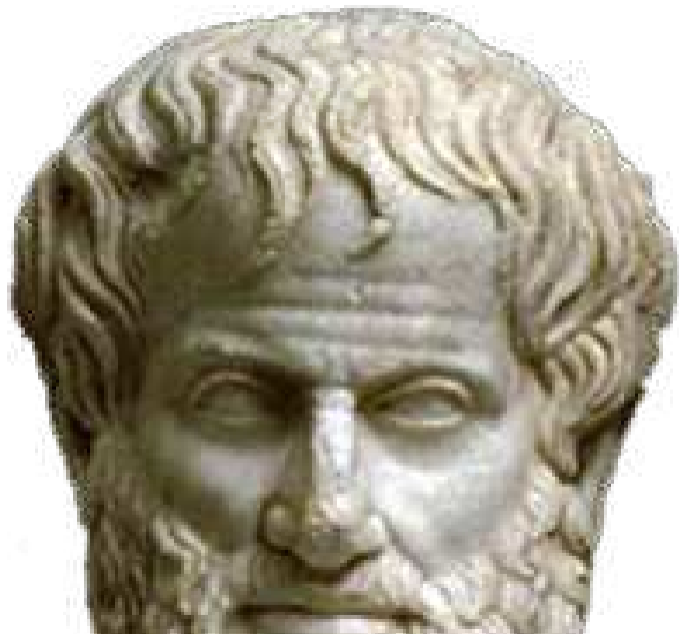
Movie, *Red Planet*, Warner Bros., 2000, <https://www.youtube.com/watch?v=oJGJEepIOt0>

**Aristotle**, Greek philosopher, 384–322 BC

If every tool, when ordered, or even of its own accord, could do the work that befits it, then there would be no need either of apprentices for the master or slaves for the lords.







# Robotic Timeline

- 1923 Karel Čapek coins the term robot in his play Rossum's Universal Robots (R.U.R.).
- The word Robot comes from the Czech word robota, which means “servitude” or “forced labor”.
- 1942 Isaac Asimov writes Runaround where he first sets down the three laws of robotics.
- Asimov, among others glorified the term robotics, particularly in I.Robot.

# Robotic Timeline

- 1136–1206 Al-Jazari created many automates
- one was a boat with four automatic musicians that floated on a lake to entertain guests at royal parties.
- 1954 Cyril W Kenward devised a manipulator that moved on an x-y-z axis system.
- 1957, Kenward patent it. The robot was called: Positioning/Manipulating Apparatus

# Robotic Timeline

- 1952 George C. Devol invented a robotic device (called: Programmed Article Transfer) for parts handling.
- 1961 Unimate, the first industrial robot, was created by Unimation.

# Robotic Timeline 1990's to present

- Robots are designed for a variety of uses: i.e. Exploring harsh environments, play games, medical advancements, toys, military uses, etc.

# Robotic Timeline Robots in Industry

- So what IS a Robot?



- There is no widely accepted definition of what a robot is.

# Definitions

- Robot
- Robotics Industry Association (RIA)
- A re-programmable, multifunctional manipulator designed to move material, parts, tools or specialized devices through variable programmed motion for a variety of tasks
- Robotics
- the science dealing with design, construction and operation of robots.
- Most roboticists state that a robot is
- a man made version of animal life with a reprogrammable brain that controls a body.
- machines that mimic human or animal behaviors. possess certain anthropomorphic<sup>1</sup> characteristics
- mechanical arm
- sensors to respond to input
- Intelligence to make decisions
- 1 anthropomorphic: described or thought of as being like human beings in appearance, behavior, etc. – Merriam-Webster Dictionary

- Mobile Robot
- A type of robot with its own engine or power able to move without constraints on its path.
- Rover
- A robotic vehicle equipped with different sensors. and designed for exploring an environment.
- The Lunar Roving Vehicle (LRV)

- Industrial Robot
- A manipulator designed to perform various programmed tasks during manufacturing. They are automated by a program that controls its duties which tend to be dangerous or difficult for humans.
- The most apparent anthropomorphic feature is the robot mechanical arm, or manipulator
- Robots are typically used as substitutes for humans
- to perform a variety of tasks (loading/unloading, spot welding, and spray painting)

# Robot Anatomy

- A robot consists of
  - Mechanical manipulator
    - A set of joints and links to position and orient the end of the manipulator relative to its base
  - Controller
- Operates the joints in a coordinated fashion to execute a program

# Manipulator Joints and Links

- A robot joint is similar to a human body joint
- It provides relative movement between two parts of the body
- It constrains the motions of the connected links. Typical industrial robots have five or six joints
- Coordinated movement of joints enables robot to move, position, and orient objects
- A joint can be classified as: One, Two, or Three degrees of freedom (DOF).



# Thanks for your attention.

## Questions?

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