# Course Form for PKU Summer School International 2024

| | |
|---|---|
| **Course Title** | Title in English: Introduction to Affective Intelligent Robotics |
| | Title in Chinese: 情感智能机器人引论 |
| **Teacher** | 王韬 Tao WANG |
| **First day of classes** | July 1, 2024 |
| **Last day of classes** | July 26, 2024 |
| **Course Credit** | 2 credits |

**Course Description**

**Objective：**

1. Let students understand the historical development and key technologies of affective intelligent robots;
2. Enable students to master the core concepts of hardware and software of affective intelligent robot system;
3. Let students have an understanding on the important research fields of affective intelligent robots, enable them to conduct more in-depth research in the future.

**Pre-requisites /Target audience**

Undergraduate and graduate students with unlimited majors

**Proceeding of the Course**

The course is a four-week, 32 hours program scheduled for July 2 to July 26 2024, with classes each Tuesday (16:10 – 18:00), Wednesday (15:10 – 18:00) and Friday from (15:10 – 18:00). Sessions will combine class teaching and discussion.

**Assignments (essay or other forms)**

One Essay submitted by the end of the course

**Evaluation Details**

- Participation：50%
- Essay：50%

**Text Books and Reading Materials**

Handbook of Robotics 2nd Ed.
Bruno Siciliano, Oussama Khatib (Eds.)
Springer
2016
978-3-319-32550-7

**Academic Integrity (If necessary)**

| |
|---|
| **CLASS SCHEDULE**<br>(Subject to adjustment) |

| Session 1：***The historical development of robots*** | Date: July 2, 2024 |
|---|---|

**【Description of the Session】(purpose, requirements, class and presentations scheduling, etc.)**

- What is a robot?
- The historical development of robots.

**【Questions】**

Why “robots” instead of “machines”?

**【Readings, Websites or Video Clips】**

None

**【Assignments for this session (if any)】**

None

| Session 2：***Modern robots*** | Date: July 3, 2024 |
|---|---|

**【Description of the Session】(purpose, requirements, class and presentations scheduling, etc.)**

- Kinds of robots
- The characteristics of various kinds of robots

**【Questions】**

Imagine a practical scenario, what would a robot look like? What useful abilities does it have?

**【Readings, Websites or Video Clips】**

None

**【Assignments for this session (if any)】**

None

| Session 3：***Basic concept of robotics*** | Date: July 5, 2024 |
|---|---|

**【Description of the Session】(purpose, requirements, class and presentations scheduling, etc.)**

- Hardware structure of robots
- Simplified model of intelligent robots

- Preliminary kinematics and dynamics

**【Questions】**

1. What components should a robot have?
2. Why can robots complete tasks such as movement and operation?

**【Readings, Websites or Video Clips】**

None

**【Assignments for this session (if any)】**

None

| Session 4：***Overview of robot sensing*** | Date: July 9, 2024 |
|---|---|

**【Description of the Session】(purpose, requirements, class and presentations scheduling, etc.)**

- General perception process
- Sensors commonly used for robots

**【Questions】**

1. What steps does a robot need to perceive the environment?
2. What sensors do robots need?

**【Readings, Websites or Video Clips】**

None

**【Assignments for this session (if any)】**

None

| Session 5：***Common sensing methods (part 1)*** | Date: July 10, 2024 |
|---|---|

**【Description of the Session】(purpose, requirements, class and presentations scheduling, etc.)**

- Visual sensing
- Distance sensing
- Inertial sensing

**【Questions】**

1. What are the principles of these sensing methods?
2. How to implement these sensing methods?

**【Readings, Websites or Video Clips】**
None

**【Assignments for this session (if any)】**
None

| Session 6：***Common sensing methods (part 2)*** | Date: July 12, 2024 |
|---|---|

**【Description of the Session】(purpose, requirements, class and presentations scheduling, etc.)**

- Auditory sensing
- Force/tactile sensing

**【Questions】**

1. What are the principles of these sensing methods?
2. How to implement these sensing methods?

**【Readings, Websites or Video Clips】**
None

**【Assignments for this session (if any)】**
None

| Session 7：***Software architecture of intelligent robots*** | Date: July 16, 2024 |
|---|---|

**【Description of the Session】(purpose, requirements, class and presentations scheduling, etc.)**

- Layered robot control architecture
- Robot Operating System (ROS)

**【Questions】**

1. What are the advantages of layered robot control structure?
2. What benefits does ROS bring to robot design/manufacturing?

**【Readings, Websites or Video Clips】**
None

**【Assignments for this session (if any)】**
None

| Session 8：***Mobile robots*** | Date: July 17, 2024 |
|---|---|

**【Description of the Session】(purpose, requirements, class and presentations scheduling, etc.)**

- Fundamentals of mobile robots
- Simultaneous Localization and Mapping (SLAM)

**【Questions】**

1. What is the relationship between mobility planning and obstacle avoidance? What's the difference?
2. What are the commonly used map representations? Which scenarios are they suitable for?

**【Readings, Websites or Video Clips】**

None

**【Assignments for this session (if any)】**

None

| Session 9：***Intelligent manipulation*** | Date: July 19, 2024 |
|---|---|

**【Description of the Session】(purpose, requirements, class and presentations scheduling, etc.)**

- Grasping and manipulation tasks
- Singularity
- Compliant motion
- Visual servoing

**【Questions】**

1. What constraints should be considered during manipulation planning?
2. When is compliant motion required? When is visual servoing required?

**【Readings, Websites or Video Clips】**

None

**【Assignments for this session (if any)】**

None

| Session 10：***Affective intelligent robots*** | Date: July 23, 2024 |
|---|---|

**【Description of the Session】(purpose, requirements, class and presentations scheduling, etc.)**

- Overview of affective intelligent robots
- Being with affective intelligent robots

**【Questions】**

When do robots need affection?

**【Readings, Websites or Video Clips】**
None

**【Assignments for this session (if any)】**
None

| Session 11：***Methods for emotion recognition*** | Date: July 24, 2024 |
|---|---|

**【Description of the Session】(purpose, requirements, class and presentations scheduling, etc.)**

- Basics of emotion recognition
- Multimodal emotion recognition

**【Questions】**
How can robots quickly recognize human emotions?

**【Readings, Websites or Video Clips】**
None

**【Assignments for this session (if any)】**
None

| Session 12：***Roboethics*** | Date: July 26, 2024 |
|---|---|

**【Description of the Session】(purpose, requirements, class and presentations scheduling, etc.)**

- Roboethics
- Coexistence of humans and affective intelligent robots

**【Questions】**
Are there any ethical issues for robots that you have seen? Why?

**【Readings, Websites or Video Clips】**
None

**【Assignments for this session (if any)】**
None