

2TOP 2018

# Capstone Design Project Course (CDPC)

*Theme: Development of Innovative 3D Printers*

1-31 August 2018 @ Taiwan Tech

## **Basic Information**

- Taiwan Tech course code: [ME3214](#) (Mechanical System Design and Practice/機械系統設計與實務)
- Credits: 4 (72 hours)
- Offered level: 3rd- and 4th-year undergraduates
- Course coordinator: [Chin-Hsing Kuo](#) (Associate Prof., ME Dept., Taiwan Tech)
- Class dates: 1-31 August 2018 (30 days)
- Capacity: 30 students (15 from Tokyo Tech + 15 from Taiwan Tech)
- Info inquiry: [Prof. Chin-Hsing Kuo \(chkuo717@me.ntust.edu.tw\)](mailto:chkuo717@me.ntust.edu.tw)

## **Course Description**

Engineering design is a creative and implementation process that encompasses systems, components, and processes related to, for example, material, chemical, mechanical, and mechatronic systems. This Capstone Design Project Course (CDPC) aims to provide the opportunity for engineering students to summarize, evaluate, and integrate their learnt knowledge and skills about engineering design through the implementation of a hands-on design project.

The development of 3D printers may be a representative example of engineering design in modern technology. The design and manufacturing process of a 3D printer involves the knowledge encompassing material science, chemical engineering, mechanical design, mechatronics, and robotics, etc. In CDPC, the students will be asked to design their owned 3D printers and to implement their designs by using commercial 3D printers, i.e., *3D printing a 3D printer*. The students will learn a series of specific knowledge and technical skills about 3D printing and printing machines. They will then be motivated to transform what they learnt to build up their owned 3D printers. The overall 72 course hours of the CDPC will comprise of a series of multidisciplinary lectures, integrated courses, industrial visits, and project teamwork time, followed by a final contest of the design project as a summary of the students' learning performance.

The CDPC will accept 30 students including 15 undergraduate students from Taiwan Tech and 15 undergraduate students from Tokyo Tech. These students will be blended and divided into several groups for performing the design project by teamwork.

## **Course Objectives**

The principal objective of this intensive four-credit capstone design course is to engage the students with the design and manufacturing of innovative 3D printers. The course instructors are formed by cross-disciplinary teams from Tokyo Tech and Taiwan Tech as well industrial experts, delivering essential knowledge and techniques related to 3D printer development, e.g., principles, materials, and processes of 3D printing, mechanical system design, mechatronics, and robotics. Students will apply analytic tools and modeling, simulation techniques, and hands-on implementation to learn the design process of 3D printers. The specific skills and knowledge that students will get involved include:

### *Knowledge*

- 3D printing technology—Fundamentals and applications
- 3D printing and additive manufacturing materials
- 3D scanning and reverse engineering
- Innovative design thinking
- Mechanical system design
- Mechanical part standards and selection
- Mechatronics & robotics

### *Skills*

- Intercultural skill
- Communication skill
- Specialist skill
- Practical and problem-solving skill

## **Instructors**

### *Taiwan Tech*

- **Chin-Hsing Kuo** (Assoc. Professor/**Mechanism design, team instruction & contest/9 hours**)
- **Yih-Lin Cheng** (Assoc. Professor/**3D printing principles and hands-on 3D printing/15 hours**)
- **Chi-Ying Lin** (Assoc. Professor/**Mechatronics/12 hours**)
- **Ming-Hua Ho** (Professor/**Photopolymer of 3D printing/3 hours**)
- **Shu-Kai Yeh** (Assoc. Prof./**Polymer processing of 3D printing/3 hours**)

### *Tokyo Tech*

- **Yukio Takeda** (Professor/**Mechanical system design/3 hours**)
- **Hiraku Sakamoto** (Assoc. Professor/**Design thinking & team building/3 hours**)
- **Hitoshi Kimura** (Assist. Professor/**Robotics & team instruction/6 hours**)
- **Hiroki Nakanishi** (Assoc. Professor/**Team instruction & contest/6 hours**)

### *Industry*

- **Ken Wang** (Assist. Manager, MISUMI Group Inc./**Mech. part standards & selection/3 hours**)
- **Chien-Zhi Chen** (Cal-Comp Electronics and Communications Co./**Practice mentor/12 hours**)

## Course Agenda of CDPC 2018 (subject to change)

1-31 August 2018						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
		<b>1 August 2018</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
		2TOP & GSEP Opening Ceremony	Project description & Mechanism design (3 hrs) <i>C.-H. Kuo</i>	Design Thinking & team building (3 hrs) <i>H. Sakamoto</i>		
<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>
Mechanical system design (3 hrs) <i>Y. Takeda</i>	Mechatronics (3 hrs) <i>C.-Y. Lin</i>	Mechatronics (3 hrs) <i>C.-Y. Lin</i>	Principle of 3D printing (3 hrs) <i>Y.-L. Cheng</i>	Introduction to robotics (3 hrs) <i>H. Kimura</i>		
<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>
Mechanical part standards & selection (3 hrs) <i>Ken Wang</i>	Photopolymer of 3D printing (3 hrs) <i>M.-H. Ho</i>	Polymer processing of 3D printing (3 hrs) <i>S.-K. Yeh</i>	3D scanning & reverse engineering (3 hrs) <i>Y.-L. Cheng</i>	Design presentation (CAD design) (3 hrs) <i>C.-H. Kuo</i>		
<b>20</b>	<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>25</b>	<b>26</b>
Hands-on 3D printing (3 hrs) <i>Y.-L. Cheng</i>	Integrated course (5 hrs)	Project teamwork (3 hrs) <i>C.-H. Kuo</i>	Industry visit & special courses (5 hrs)	Industry visit & special courses (5 hrs)		
<b>27</b>	<b>28</b>	<b>29</b>	<b>30</b>	<b>31</b>		
Project teamwork (12 hrs) <i>Y.-L. Cheng, C.-Y. Lin, H. Kimura &amp; H. Nakanishi (3 hrs/each)</i> <i>Chien-Zhi Chen (12 hrs)</i>				Project Contest Closing Ceremony (3 hrs) <i>Y.-L. Cheng, C.-Y. Lin, H. Nakanishi</i>		

Notes: The daily class time for regular lectures is from **9:10 am** to **12:00 pm**, i.e., 3 hours.