課程綱要表

<table>
<tr><td colspan="3">課程名稱：（中文）微致動器與智能材料
（英文）Microactuators and Smart Materials</td><td colspan="2">開課學程
課程代碼</td><td>NEMS581000</td></tr>
<tr><td colspan="6">授課教師：馮國華</td></tr>
<tr><td>學分數</td><td>3</td><td>必/選修</td><td>選修</td><td>開課年級</td><td>一</td></tr>
<tr><td colspan="6">先修課程：</td></tr>
<tr><td colspan="6">課程概述與目標：介紹智能材料運作之微致動器原理、製程、分析及應用</td></tr>
<tr><td>教科書 [1]</td><td colspan="5">Course handout</td></tr>
<tr><td colspan="2" rowspan="2">課程綱要</td><td rowspan="2">對應之學生核心能力</td><td colspan="2" rowspan="2">核心能力達成指標</td></tr>
<tr></tr>
<tr><td>單元主題</td><td colspan="2">內容綱要</td><td colspan="2" rowspan="6">1.具備優質的外語能力
2.具備扎實的奈微米工程基礎知識與技術
3.培養具備異質領域整合、溝通與協調能力之領導人才
4.具備能夠獨立思考、研發設計與實務執行之能力
5.培養自我學習、持續創新及具有冒險勇氣的領導人才</td></tr>
<tr><td>Introduction of smart materials</td><td colspan="2">1. General description of smart material-based transducers, including the following materials: Shape memory alloys and dielectric elastomers, Piezoresistive and piezoelectric material, Electrostrictive and magnetostrictive material, etc.</td></tr>
<tr><td>Fundamentals of Piezoelectric Materials</td><td colspan="2">1. Manufacturing and processing technology of piezoelectric materials
2. Characterization of Piezoelectric Ceramics</td></tr>
<tr><td>Piezoelectric thin-film transducers</td><td colspan="2">1. Design of piezoelectric thin-film devices, fabrication
2. Fabrication and evaluation of the piezoelectric thin film</td></tr>
<tr><td>Piezoelectric Energy Harvesting Systems</td><td colspan="2">1. Important parameters for evaluating energy output of the piezoelectric device
2. Case studies of piezoelectric energy harvesting systems</td></tr>
<tr><td>Selected topics for microactuator applications</td><td colspan="2">1. Piezoelectric Device applications
2. Signal processing for acquiring sensing and actuating signals
3. Shape memory alloy actuators
4. Ionic polymer metal composites actuators</td></tr>
</table>

教學要點概述[2]：

一、課程說明(Course Description)

The main goal of this course is to introduce engineering students to some basic understanding of the characterization and control of micro-sized actuators or actuators working at the micro-scale made of smart materials.

Various knowledge and emerging techniques of actuators will be conveyed in this course, such as actuators' properties, manufacturing, and the theory behind them. Topics will include commonly used smart materials for fabricating microactuators or actuators working on a micro-scale. The smart materials cover piezoelectric material, shape memory alloy, dielectric elastomer and ionic polymer, magnetorheological fluid, and magnetorheological elastomer. Moreover, the concept of modeling and modeling techniques of microactuators will be discussed. Both physical and chemical characterizations of the smart material fabricated devices will be described in detail in actuating aspect.

二、參考書籍(References)

1. Rakotondrabe, Micky, et al. "Smart materials-based actuators at the micro/nano-scale." Characterization, Control, and Applications. Springer (2013).
2. Vijay Varadan, K. J. Vinoy, S. Gopalakrishnan, "Smart Material Systems and MEMS. Design and Development Methodologies", John Wiley and Sons Ltd (2006).
3. Seung-Bok Choi, Jaewhan Kim, "Smart Materials Actuators: Recent Advances in Characterization & Applications", Nova Science Publishers Inc, (2015).
4. C.W. de Silva, "Sensors and Actuators, CRC Press (2007).
5. Inamuddin, Rajender Boddula, Abdullah M. Asiri, "Actuators: Fundamentals, Principles, Materials and Applications", Wiley-Scrivener (2020).

三、教學方式(Teaching Method)

Lectures and research reports.

四、教學進度(Syllabus)

- Week 1-3. Introduction to smart materials
- Week 4-6. Fundamentals of Piezoelectric Materials
- Week 7-9. Piezoelectric thin-film transducers
- Week 10. Midterm
- Week 11-12. Piezoelectric Energy Harvesting Systems
- Week 13-15. Selected topics for microactuator applications
- Week 16. Final project presentation (I)
- Week 17. Final project presentation (II)

五、成績考核(Evaluation)
Homework and Midterm 60%, Final report 40% (Oral 20%/Written 20%)
Attendance will also be considered.

六、AI 使用規則 (Indicate which of the following options you use to manage student use of the AI)
本課程無涉及 AI 使用 Not applicable

註：1. 教科書請註明書名、作者、出版社、出版年等資訊。
2. 教學要點概述請填寫教材編選、教學方法、評量方法、教學資源、教學相關配合事項等。
3. 研究所所有開設之課程皆須填寫此表格或提供原有格式之課程綱要表，並呈現於實地訪評現場。