

# 國立中興大學 通識課程 教學大綱

## Syllabus of NCHU General Education Course

<b>課程名稱</b> course name	奈米科技到機器人				
	Nanotechnology to Robotics				
<b>開課系所班級</b> dept. & grade	通識教育中心 General Education Center	<b>學分</b> credits	2	<b>規劃教師</b> teacher	科教中心 吳孟真
<b>課程屬性</b> course type	必修 compulsory	<b>授課語言</b> language	中文或英文 Chinese/English	<b>開課學期</b> semester	上或下 fall or spring
<b>課程分類</b> course classification	109 學年度前入學新生適用		自然領域－工程科技學群		
	110 學年度起入學新生適用		統合領域－專業實作		
<b>課程簡述</b> course description	奈米科技到機器人的課程旨在為大學本科生介紹奈米技術和機器人技術的基本概念。課程將使用 Mathematica 來解問題集。透過小組專案、考試和課程講座，我們的目標是擴大對機器人技術的視野，並找到與基礎科學和工程的協同作用。以上基礎將應用在太陽能、電池與自動化的新技術。				
	This Nanotechnology to Robotics course seeks to introduce fundamental introductory concepts in nanotechnology and robotics for the college undergraduate. The course requires Mathematica for solving problem sets and exam problems. Through a group project, exam, and course lecture, the goal is to expand our view of robotics and find synergies with fundamental science and engineering. These basics are to be applied to technologies such as solar and fuel cells, batteries, and self-driving vehicles.				
<b>教學目標</b> course objectives	對於科學和非科學本科的學生來說，本課程介紹機器人技術、奈米技術和量子力學的基本概念。我們涵蓋向量、矩陣和波動方程，然後應用這些想法來理解太陽能/燃料電池、電池和自動駕駛汽車。				
	For the science and non-science major alike, this course introduces fundamental concepts in robotics and nanotechnology. We extend understanding of Newton's laws and introduce quantum mechanics. We cover vectors, matrices, pendulums and the wave equation, then apply these ideas to understand solar/fuel cells, batteries and self-driving vehicles.				
<b>先修課程</b> prerequisites	無 None (high school science courses)				
<b>六項核心能力配比 (加總為 100%)</b> The 6 core learning outcomes add up to 100%					
人文素養	科學素養	溝通能力	創新能力	國際視野	社會關懷
15%	15%	10%	20%	20%	20%
Humanities Literacy	Scientific Literacy	Communication Skills	Innovative Ability	International Perspective	Social Concerns

教學方法 teaching methods	學習評量方式 evaluation
Lecture, Presentation, Guided Session	Lecture, Attendance, Problem Set, Exam
<b>授課內容 (單元名稱與內容、習作/考試進度)</b> <b>course contents and homework/tests schedule</b>	
<ol style="list-style-type: none"> <li>1. Fundamental Concepts 基礎概念 – “There’s plenty of room at the bottom” (Feynman) and “I, Robot” (Asimov, laws of robotics)</li> <li>2. Introduction to Robotics 什麼是機器人學 – what are “assistants” and “agents”, what are the vision and auditory mechanisms for robots // Problem Set 1 Due</li> <li>3. Introduction to Nanotechnology 什麼是納米科技 – Microscopy, STM, AFM</li> <li>4. Optics and Introduction to Quantum Mechanics 光與量子力學 – Waves and particles duality and mechanics // Problem Set 2 Due</li> <li>5. Atoms and Molecules 原分子 – hydrogen atom introduction, Lotus effect, hydrophobic-hydrophilic surfaces</li> <li>6. Atoms and Molecules 原分子 – Fourier transform infrared spectroscopy, what are good materials for robotics: metals, plastics, polymers // Problem Set 3 Due</li> <li>7. Atoms and Molecules/ Stern-Gerlach Experiment and Spin 原分子與電子自旋 (斯特恩-革拉赫實驗) – Does spin of the electron matter for robots?</li> <li>8. Exam</li> <li>9. Exam work through, Atoms and Molecules – X-rays and photoelectrons X 光與光電效應 // Problem Set 4 Due</li> <li>10. Applied Concepts 應用 : Solar Cells, Thermoelectrics, Self-driving Trains, Cars, Drones 太陽能, 熱電, 自動車</li> <li>11. Applied Concepts 應用: Battery Systems, Fuel Cells 電池 // Problem Set 5 Due</li> <li>12. Concepts in Magnetism, Solids, and Optoelectronic Devices 電磁, 半導體</li> <li>13. Medical Physics 醫學物理的自動化 : Mechanics and Power Laws, Systems of Many Particles and Thermodynamic Concepts, Atoms and Lights, Sound and Ultrasound, Radiometry and Photometry, Medical Uses of X-rays, Photons (select topics depending on time) // Problem Set 6 Due</li> <li>14. Student Presentations</li> <li>15. Student Presentations / Electronic Sound // Problem Set 7 Due</li> <li>16. How does Robotics Help Us in these Fundamental Science Areas – what “assistants” and “agents” do we need to build to improve on AI, robotics and new unexplored areas.</li> <li>17-18. Exam or flexible scheduling</li> </ol>	
<b>教科書與參考書目 (書名、作者、書局/代理商…)</b> <b>textbooks &amp; other references (title, author, publisher…)</b>	
<ol style="list-style-type: none"> <li>1. Modern physics textbooks Arthur Beiser, Kok Wai Cheah. Concepts of Modern Physics. Intl. editions 2019, McGraw-Hill;</li> <li>2. Introduction to Robotics: Mechanics and Control, John J. Craig, Addison-Wesley Publishing Company, 3rd Edition, 2003</li> <li>3. Charles P Poole Jr. and Frank J. Owens. “Introduction to Nanotechnology, Wiley 2003.</li> <li>4. Isaac Asimov. “I, Robot” 2008.</li> </ol>	

5. Recommended Textbook: Jasprit Singh. Modern Physics for Engineers. John Wiley & Sons 1999

Required software: Mathematica for problem solving and graphing.

課程教材（教師個人網址請列在本校內之網址）

**teaching aids & teacher's website**

[phillip-wu.com/science](http://phillip-wu.com/science)

課程輔導時間

**office hours**

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