國立台灣科技大學 114學年 第2學期 課程大綱

Spring 2026 NTUST Course Outline

授課教師：Hairus

Instructor:Hairus Abdullah

課程名稱：奈米材料於能量轉換與儲存之應用

Course Title：Nanomaterials for Energy Conversion and Storage

2026/5/6

課程代號： TX5018701 Course Code 學分數： 3 Credits	必選修：選修/半學年 Required/Electve:Elective/Half Yr. 先修課程： Prerequisites
節次教室： Time/Location	M6(IB-409-2) M7(IB-409-2) M8(IB-409-2)
專業核心能力： Core Professional Competencies	■1.具備基礎科學與材料工程專業知識之整合、創新能力。 ■2.具備收集文獻、建構研究規劃、設計實驗流程與整合分析之能力。 ■3.具備執行專題研究、應用研究成果，以及口頭發表與報告撰寫之能力。 ■4.具備創新思考，並可獨立解決複雜性問題之能力。 □5.具備良好團隊分工合作之能力。 ■6.具備語文能力及良好之國際觀，尊重多元價值觀點。 □7.具備管理、規劃與領導之能力。 □8.體認及實踐工程倫理與社會永續發展之觀念，具備終身自我學習與成長之能力。
課程網址： Course Website	
課程宗旨： Course Objectives	1. Introduction to nanomaterials related with energy conversion and storage. 2. Important knowledge for encouraging students to work on sustainable and renewable energy related fields. 3. To present nanotechnology as the solution for energy and environmental issues. 4. To introduce promising technologies for energy conversion and storage. 5. To enhance the students' interest in working on the research of sustainable and renewable energy. 6. The basic idea to creatively modify the existing nanotechnology for efficiently harvesting natural resources.
課程大綱： Outline of Lectures	

1.水分解之光電化學原理
2.太陽光催化半導體用於之氫轉化
3.可見光驅動的光觸媒材料
4.金屬氮化物奈米結構：新興的人工光合作用之催化劑
5.光電化學水分解的半導體其界面工程
6.太陽能水分解裝置的光陽極和光陰極材料
7.能源技術中的電催化製程
8.軟X射線光譜學於光催化反應的應用
9.用於評估能量轉換裝置的光電化學工具
10.充電電池的基本原理與其電極材料的電化學電位
11.五氧化二釩作為鋰離子電池之正極材料
12.錫基化合物作為鋰離子電池之負極材料
13.鋰離子以外：鈉和鎂離子電池的電極材料
14.儲能裝置中具離子和電子傳輸的奈米材料與結構 1. The principle of photoelectrochemical water splitting
2. Semiconducting photocatalysis for solar hydrogen conversion
3. Visible-light driven photocatalysis
4. Metal nitride nanostructures: emerging catalysts for artificial photosynthesis
5. Surface engineering for semiconductor for photoelectrochemical water splitting
6. Photoanodic and photocathodic materials applied for free-running solar water splitting devices
7. Electrocatalytic processes in energy technologies
8. Soft X-ray spectroscopy on photocatalysis
9. Photoelectrochemical tools for the assessment of energy conversion devices
10. Fundamentals of rechargeable batteries and electrochemical potentials of electrode materials
11. Revitalized interest in vanadium pentoxide as cathode material for alkali ion batteries
12. Tin-based compounds as anode materials for lithium ion storage
13. Beyond Li ion batteries: electrode materials for sodium and magnesium-ion batteries
14. Nanomaterials and nanostructures for regulating ions and electron transport in advanced energy storage devices

授課方式： Method of Instruction	講授 Lecture：50% 分組討論 Group discussion：0% 案例研討 Case study：50% 操做練習 Practical exercises：0% 講授 Lecture：%
教科書： Textbooks	Related Published Papers in high reputation Journals
參考書目： References	Related Published Papers in high reputation Journals
修課須知： Notice	There is no TA in this course
評量方式： Grading	Attendance = 10% Assignment (Student notes) = 20% Mid-term (Presentation) = 25% Final-term (Presentation) = 35% Asking questions during presentation = 10% Total = 100%
備註說明： Notes	No requirement