

# 材料工程系大學部中英文課程內容摘要

## Department of Materials Engineering

### 一、必修科目 Required Courses

456001 材料科學導論(1) 3 必 李英杰、上

本課程主要針對各種材料(金屬、陶瓷、高分子、複合材料)之基本原理,性質及應用,做概要性的介紹。內容包括材料之晶體結構與晶體缺陷,固體材料之原子擴散,相圖與相變化,材料製程及應用,材料之物理性質(光性質、電性質、磁性質及熱性質),材料之機械性質(強度、延展性、硬度、韌性、疲勞、潛變),材料之強化機構與方法。

456001 Fundamental Experiments  
Science and Engineering (1) 3 R Ying-Chieh Lee、F

This course is directed against various kinds of materials mainly (The metal, ceramic, polymer, composite) Basic principle, Nature and application, do the outline introduction. The content includes the crystal structure of the material and crystal defect, the atom diffusion of the solid material, phase picture and phase change, the process and application of material, physical property of material (light nature, electric nature, magnetic quality and hot nature), mechanical nature of the material (The intensity, ductility, hardness, toughness, fatigue, creep), Strength mechanism and method of the material.

456002 材料科學導論(2) 3 必 洪廷甫、下

本課程主要針對各種材料(金屬、陶瓷、高分子、複合材料)之基本原理,性質及應用,做概要性的介紹。內容包括材料之晶體結構與晶體缺陷,固體材料之原子擴散,相圖與相變化,材料製程及應用,材料之物理性質(光性質、電性質、磁性質及熱性質),材料之機械性質(強度、延展性、硬度、韌性、疲勞、潛變),材料之強化機構與方法。

456002 Fundamental Experiments  
Science and Engineering (2) 3 R Ting-Fu Hong、S

This course is directed against various kinds of materials mainly (The metal, ceramic, polymer, composite) Basic principle, Nature and application, do the outline introduction. The content includes the crystal structure of the material and crystal defect, the atom diffusion of the solid material, phase picture and phase change, the process and application of material, physical property of material (light nature, electric nature, magnetic quality and hot nature), mechanical nature of the material (The intensity, ductility, hardness, toughness, fatigue, creep), Strength mechanism and method of the material.

456003 材料實驗(1) 1 必 曾光宏、上

在使材料本科同學，對於各種相關的材料實驗及技巧有基本的認識。

456003 Fundamental Experiments in materials (1) 1 R Kuang-Hung Tseng、F

Classmates of material undergraduate course that making, have basic understanding to various kinds of relevant material experiments and skills.

456004 材料熱力學(1) 3 必 曹龍泉、上

將熱力學定律應用於計算凝結相之化學位能與其平衡，逸壓和活性因素，溶液熱力學，多元金屬溶液，相圖和相變化，運用電腦模擬相反應和相圖，及研擬冶金數學模式。

456004 Thermodynamics of Materials (1) 3 R Lung-Chuan Tsao、F

It applies the theory of thermodynamics to calculate chemical potential energy and its equilibrium of condensed phase, released pressure and activated factors, solution thermodynamics, complex metal solution, phase diagram and phase change, computer-aided phase reaction and phase diagram simulation, and planning a mathematics model of metallurgy.

456005 工程數學 3 必 李佳言、上

本課程主要目標在介紹與實際問題相關之數學領域，以模擬解題及詮釋等方式，將數學方法應用在工程問題上。課程內容有常微分方程，線性代數，向量微積分，Fourier 分析及偏微分方程式等章節，訓練同學在理論，計算及實驗間建立正確的認知及意義。內容將繼續介紹複數分析及數值方法等章節，尤其對計算機的概念及演算法乃給予較多的強調，對實際問題亦有簡化討論。另外，在應用解決問題構想，練習例題及理論間，更有相輔相成的效果。至於線性規化，圖形 組合機率理論及數學機率等內容亦有概略介紹，務使同學有正確的認知。

456005 Engineering Mathematics 3 R Chia-Yen Lee、F

The course's main target is to introduce math region which is relating to practical questions with simulate solution and interpretation, it applies the math method to engineering questions. The course content includes ordinary differential equation, linear algebra, vector calculus, Fourier analysis and partial differential equation partial differential equation, with the aim to train students in establishing an exact perception to the meaning of theory, calculation and experimentation. it also introduces complex number analysis and numeric method, especially put more emphasis at the computer concept and algorithm, a simplified discussion to the practical problem as well. Besides, it has a mutual supporting effect in solving question concepts, practising model question and theory. As to the linear programming, graphs and combinatorial optimization, probability theory and

mathematical probability, this course also has a brief introduction, its target is to let all the students

456006 金屬材料 3 必 曾光宏、上

材料之特性取決於材料內部組織，所以課程內容也注重內部組織與材料特性之間的關係，內部組織的變化對材料特性之影響，由理論為基礎之探討至實際之應用上。對本課程有關的基本概念，則詳加說明，初學材料者能得到材料上所必備之基本知識，若基本概念已有充分了解，則利用這些知識即可參考材料規格或手冊就可得到欲知之條件，進而以此概念作基礎，亦可研習更高深之學問，本課程內容著重於介紹材料之結構，基本原理有：1. 金屬之基本理論，金屬及合金之構造，材料之組織，塑性加工變形之理論，材料之物理化學，機械性質及其實驗。2. 鋼和鐵之製造，組織及其熱處理，變態理論。3. 構造用鋼，合金鋼，工具鋼，特殊鋼之特性、用途及其熱處理方法。4. 鋼之表面硬化理論及其熱處理方法。5. 鑄鐵之冶煉，種類及其熱處理方法。6. 非鐵金屬材料，銅，鋁，鈦，鎂，錫，鋅，鉛，鎳等合金種類之特性及其處理方法。

456006 Metallic Materials 3 R Kuang-Hung Tseng、F

The characteristics of material depend on the inside tissue, therefore, the content also put more emphasis on the relationship between the inside tissue and material characteristics, how the change of inside tissue influences it in full details from the discussion of the theory basis to practical application. It has a detail description to the basic idea of this course, the novice may get requisite fundamental knowledge. Once they fully perceive these basic ideas, they may refer to material specification or manual to get the conditions they request, or they may use these foundation to further explore advanced knowledge.

456007 材料實驗(2) 1 必 李英杰、下

在使材料本科同學，對於各種相關的材料實驗及技巧有基本的認識。

456007 Fundamental Experiments in materials (2) 1 R Ying-Chieh Lee、S

Classmates of material undergraduate course that making, have basic understanding to various kinds of relevant material experiments and skills.

456008 物理冶金(1) 3 必 洪廷甫、下

材料科學為工程教育的重要科技，材料的性質與特性，為現代工程設計中佔有相當重要的地位，金屬材料的各種性質，都基於其內部構造的變化，其內部原子聚集成規則的結晶構造，亦或聚集成非結晶構造，其所形成的各種物理特性，由最基本的結晶構造開始了解。電子顯微鏡，破壞力學，超導性，電傳導，超塑性，動態回復，動態時效應變。差排理論、結晶核的形成與成長，合金相理論，晶界自由度，鑄造物的成核與均質化，硬化現象，固體擴散現象，破壞現象及理論，潛變的形成與原因等，充分了解金屬材料特性上的理論基礎

與變化軌跡。

456008 Physics Metallurgy(1) 3 R Ting-Fu Hong、S

Properties and characteristics of materials play important role in modern engineering design. Each property of materials is based on its transformation at inner structure, its atoms inside converge either a regulated crystal structure or a noncrystal structure, their physical property should be understood from the most fundamental crystalline structure, such as electronic microscope, destructive dynamics, super-conductivity, electronic conductivity, super-plasticity, dynamic recovery, dynamic aging strain, dislocation theory, the formation and growth of crystalline nucleus, alloy phase theory, crystal boundary free degree, nucleus and homogenization of casting product, hardening phenomenon, solid diffusion phenomenon, destructive phenomenon and theory, creep formation and its reason, all of these make student fully understand the theory basis and change record of the metallic material characteristics.

456009 陶瓷材料 3 必 洪廷甫、下

本課程以訓練學生對陶瓷材料性質認識，並進而介紹陶瓷材料基本製程。課程重點在陶瓷粉體製備成形方法，燒結及燒結理論，除加強學生認識傳統陶瓷外，並對結構陶瓷與電子陶瓷之應用，作有系統的介紹。

456009 Ceramic Materials 3 R Ying-Chieh Lee、S

This course aims at training the knowledge of ceramics materials and to introduce the basic manufacturing process of ceramics materials. The focus of this course is the formation method of ceramics powder, sintering and sintering theory. Except for strengthening the perception of traditional ceramics, it also has a systematic introduction to the application of structural ceramics and electronic ceramics.

456010 高分子材料 3 必 盧威華、下

本課程包含高分子結構及其物理性質、高分子定性與分析、高分子流變學、高分子複合材料。

456010 Introduction of Material Topics 3 R Wei-Hua Lu、S

The contents include : Polymeric Structure and its Properties、Characterization and Analysis of Polymers、Rheology of Polymers、Polymeric Composite Materials.

456011 材料實務專題 1 必 指導教授、下

所有學生在研究課題內容之前，必須先學習相關的材料文件，通過實驗路線，實驗測量操作和結果分析，從課程寫作的科學論文，學生將能夠在整體方面進行單獨的培訓 思考和解決問題能力。

456011 Practice of material topics 1 R Advisor、S

All the students must study related material documents before they research the subject-matter content, through scheming experimental route, experimental measurement operation and results analyses, scientific papers writing from the courses, students will be able to exercises in overall aspects to be trained up individually thinking and solving problem abilities.

456012 物理冶金(2) 3 必 洪廷甫、上

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456012 Physics Metallurgy(2) 3 R Ting-Fu Hong、F

Properties and characteristics of materials play important role in modern engineering design. Each property of materials is based on its transformation at inner structure, its atoms inside converge either a regulated crystal structure or a noncrystal structure, their physical property should be understood from the most fundamental crystalline structure, such as electronic microscope, destructive dynamics, superconductivity, electronic conductivity, super-plasticity, dynamic recovery, dynamic aging strain, dislocation theory, the formation and growth of crystalline nucleus, alloy phase theory, crystal boundary free degree, nucleus and homogenization of casting product, hardening phenomenon, solid diffusion phenomenon, destructive phenomenon and theory, creep formation and its reason, all of these make student fully understand the theory basis and change record of the metallic material characteristics.

456013 材料分析方法與實習(1) 3 必 合授、上

本課程包含：OM 微觀分析、熱分析：TG, DSC, DTA, TMA..、光譜分析：原子、紅外線、紫外線..、表面分析法。

456013 Materials Analysis (1) 3 R Joint teaching、F

The contents include : OM Microanalysis、Thermal analysis: TG, DSC, DTA, TMA...、Spectral analysis: Atomic, infrared, ultraviolet、Methods of Surface analysis: (XPS, AES, SIMS).

456014 材料分析方法與實習(2) 3 必 合授、下

本課程包含：XRD 分析、EDS 成分分析、TEM 分析

456014 Materials Analysis (2) 3 R Joint teaching、S

The contents include : XRD analysis、3. Composite analysis: EDS、TEM analysis

456015 工廠管理 3 必 李英杰、下

本課程規劃在讓學生了解工廠的作業流程、產品管理、組織管理、資材管理等。工廠管理即是其中一項重要的基礎管理工作。工廠乃是產品的製造場所，所謂工廠管理即將勞動力、土地、資本、原材料等各種有效資源導入製造場所，憑藉計劃、組織、人事、指導、控制等活動，使工廠能夠有計劃、按步驟地如期達成生產目標。使學生能充份了解產業實際管理面與應用面。授課內容包括工廠組織、工廠佈置、物料搬運、產品研發、資材管理與品質管理。授課內容包括工廠管理導論、工廠組織、工廠佈置、物料搬運、產品研發資材管理、品質管理。

456015 Factory Management 3 R Ying-Chieh Lee、S

The aim of this course unit is to acquaint the students with the know-how of factory management. The course also introduces to the students the organization management, factory layout, finished-good moving, products development and quality management. With the background, a course section on quality management topic is presented. It is hoped that it will be very useful to students who have to learn about the essential area of this management know-how. The content includes fundamentals of factory management, organization management, quality management and product management. The contents include Factory management introduction、Factory organization、Factory layout、Finished-good moving、Product development、Raw material management、Quality management.

456016 電子顯微鏡學 3 必 林鉉凱、下

本課程讓學生了解掃描式電子顯微鏡及成分分析之原理及其應用，並安排示範操作，讓學生充分了解各項設備的功能，進而有深刻認識。授課內容為顯微鏡之結構及其原理、X 射線之原理及應用。

456016 Scanning Electron Microscopy 3 R Hsuan-Kai Lin、S

The aim of this course is to acquaint the students with the principles of scanning electron microscopy (SEM) and energy dispersive X-ray spectrometer (EDS). The course also arranges the practical sessions to the students in order to fully understand the functions in our system. This course includes the principle and structure of SEM, and qualitative X-ray analysis in our equipment.

452017 校外實習(暑期) 3 必 合授、下

本課程規劃讓學生於國內外產學機構進行實務實習，可有效提升對材料科學與工程實務之認識。本課程期使學生掌握最新之材料科技與產品應用發展趨勢，強化學生實作能力，協助學生提早體驗職場，瞭解產業運作，結合理論與實務，培養正確工作態度，以及提升就業競爭性。

452017 Internship (Summer) 3 R Joint teaching、S

This course allows students to conduct practical training in the industry or academic institutions at home and abroad, which can effectively enhance their understanding of practical techniques in the material science and engineering fields. This course aims to enable students to: master the cutting edge material technology and related product application development trends, strengthen their practical ability, experience the operation of industry for the combination of theory knowledge and practical techniques, develop their positive work attitude, as well as to enhance their competitive employability.

## 二、選修科目 Elective Courses

452018 電腦繪圖 3 選 曹龍泉、上

本科目之目標，在培養學生認識基本圖學觀念、電腦繪圖的內涵及各種繪圖技巧，建立電腦繪圖概念，作為資訊時代繪圖能力之準備。主要內容包括：(1)簡介電腦繪圖軟體、電腦環境各項設定。(2)認識各項格式設定及操作應用。(3)認識各項繪圖指令、編輯指令設定、修改指令設定及操作應用。(4)認識各項標註指令及操作應用。(5)圖學應用。除口授教學外，每章節教學完畢後，應即時指定作業讓學生練習，教師親自示範以加深學生學習印象，並訓練學生達到快速及準確之電腦繪圖標準，以奠定良好基礎

452018 Computer Drafting 3 S Lung-Chuan Tsao、F

The objectives of this course are to cultivate students understanding of the basic concepts of graphics, connotation of computer graphics and various drawing skills, and to establish the concept of computer graphics as a preparation for the ability to draw graphics in the information age. The main contents include: 1.Introduction Computer graphics software, computer environment settings. 2.Understand the formatting and operation of the application. 3.Understand various drawing instructions, edit instruction settings, modify instruction settings and operation applications. 4.Understand the various labeling instructions and operational applications. 5.Graph application. In addition to oral teaching, after each chapter is completed, students should be given immediate assignments for practical exercises. Teachers should demonstrate in-person to deepen students learning impressions and to train students to achieve fast and accurate computer graphics standards in order to lay a solid foundation.

452019 普通物理學(2) 3 選 林鉉凱、下

本課程為一基礎課程，主要延續普通物理學(1)之教學內容，持續就光學/電學/磁學等物理科學知識以及相關的基本原理進行介紹。希望透過這門課程，能夠讓學生清楚明白到未來將接觸到的相關知識；同時，也讓學生能夠對於將鑽研的方向有辨識以及選擇的能力。

452019 General Physics(2) 3 S Hsuan-Kai Lin、S

This course is a basic course which mainly extends the teaching contents of general physics (1) and continuously introduces the physical science knowledge such as optical / electrical / magnetic and related basic principles. It is hoped that through this course, students will be able to clearly understand the relevant knowledge that they will come into contact with in the future. At the same time, students will also be able to identify and select the directions they will study.

452020 普通物理學實驗(2) 1 選 林鉉凱、下

本課程之目的為使學生藉由物理實驗過程來印證古典力學、流體力學、熱力學之理論及定律，同時培養學生實作能力。課程內容包括：(1)基本量測，(2)自由落體，(3)單擺，(4)摩擦係數，(5)力的分解，(6)碰撞，(7)表面張力，(8)固體比熱，(9)液體比熱，(10)線膨脹。

452020 General Physics Lab (2) 1 S Hsuan-Kai Lin、S

The purpose of this course is to enable students to confirm the theories and laws of classical mechanics, fluid mechanics and thermodynamics through the process of physical experiment while cultivating the practical ability of students. The course contents include: (1) basic measurement, (2) free fall, (3) pendulum, (4) coefficient of friction, (5) force decomposition, (6) collision, ) Specific heat of solid, (9) Specific heat of liquid, (10) Line expansion.

452021 普通化學(2) 3 選 下

本課程的目的在使學生對量子理論有相當的認識並對化學鍵結有較深入的了解，加強水溶液的反應性質及化學平衡觀念，並熟悉相關的理論與計量方法，以奠定修習及研究相關科目的穩固基礎，其內容如下：1.量子理論、2.元素的週期表關係、3.化學鍵結（基本概念及分子的立體結構）、4.液體及固體的分子間作用力、5.溶液的物理特性、6.化學平衡、7.酸和鹼、6.酸鹼平衡。

452021 General Chemistry (2) 3 S S

This course focuses on quantum theory, chemical bonding, the chemical reaction of aqueous and chemical equilibrium principles, and mathematical methods of chemistry. The outlines are offered as below: 1.Quantum theory, 2.Periodic relationships among the elements 3.Chemical bonding( basic concepts and molecular geometry ), 4.Intermolecular forces and liquids and solids, 5.Physical properties of solutions, 6.Chemical equilibrium, 7.Acids and bases, 8.Acid-base equilibrium.



452022 普通化學實驗(2) 1 選 下

本課程主要瞭解內容包括各項實驗操作技術介紹以及針對實驗原理及反應機制進行探討.授課者會提出問題來測試學生相關知識及應用程度.學生在課程結束會具有操作儀器、學習觀察及正確整合實驗結果之能力。

452022 General Chemistry Lab (2) 1 S S

This course emphasis on laboratory techniques essential for the related topics. The laboratory provides not only the principle but also the reaction mechanisms involved in the experiments. The questions at the end of the experiment will be selected by the instructor to test the student's knowledge of the experimental theory and the applications. With the training, the students can develop the ability to handle the equipment, make observations and correctly interpret the results.

452023 專利檢索與分析 3 選 上

本課程將近年來所發表部份文稿並將之整理，其中包括專利制度之研究，化學品、醫藥品、植物新品種及生物技術之專利保護，立法例及重要案例分析，以及專利技術與產業技術革新之關係。

452023 Patent Survey and Analysis 3 S F

Course this publish some manuscript combine arrangement it, including research of patent system in recent years, patent protection of the chemicals, medical product, new variety plant and biotechnology, legislative example and important case analysis, and the relation between patented technology and industry's technological innovation.

452024 科技英文實務 2 選 上

本課程主要教授科技英文之閱讀技巧，進行科技英文文章之閱讀練習，協助學生能在科學或工程領域中閱讀、瞭解、並擷取重要科技資訊，以及在句型、寫作風格與表達方式。

452024 Proficiency in Technology English 2 S F

This course aims at teaching the reading ability on technical English papers and assisting students to study, understand and access the important technical information in science or engineering fields. The focus is put on the application of students' knowledge of this genre, frequently employed sentence patterns, vocabulary items and expressions.

452025 近代物理 3 選 盧威華、上

二十世紀初開始的物理學基礎理論體系的重大變革—近代物理學的誕生是自然科學的一個革命性飛躍.以相對論，量子理論為先導，形成高能物理學，

核物理學，低溫物理學，凝聚態物理學，鐳射物理學等學科，促成了核裂變，核融合，半導體，晶體管，鐳射器等重大科技成果的出現，形成諸多影響人類社會生產力的高新產業，它改變了物理學乃至自然科學的面貌，掀開了人類自然觀和科學觀的新的一頁。在近代材料科學上，人們認識到是物質巨視性質的任何突破都是以對其微視架構及規律的認識的突破為前提。因而，從事材料科學理論和應用專業的學生必須具有高能，微視領域的基礎理論知識，才能在後繼課程的學習中有所斬獲，在今後的工作中有所創造。

452025 Concepts of Modern Physics 3 S Wei-Hua Lu、F

Great change of the basic theoretical system of physics begun at the beginning of the 20th century - The birth of modern physics is a revolutionary leap of the natural science. With Theory of Relativity, the quantum theory is the guide, form high-energy physics, nuclear physics, low temperature physics, condense attitude physics, such disciplines as laser physics,etc., have facilitated nuclear fission, nuclear fusion, the appearances of such great scientific and technical results as the semiconductor, the transistor, the laser instrument,etc., orming the high-new industry of the productivity of human society of a great deal of influence, it has changed the appearances of physics and even natural science, have raised mankind's natural view and a new chapter of the scientific view. On modern material science, people realize any break-through that is the macroscopical nature of material is to regard break-through of the understanding of its micro structure and law as the prerequisite. Therefore, are engaged in the material scientific theory and use specialized students to have high energy, the basic theory knowledge of the micro field, could reap to some extent in the study of course of carrying on, create to some extent in future work.

452026 有機化學 3 選 上

本課程乃著重於重要之碳化合（包括烷、烯、炔、醇、醚，有機鹵化物，芳香族化合物，醛，酮，酯與胺）之官能基反應，各類有機物之合成方法，相互間之關係以及其實際之應用。

452026 Organic Chemistry 3 S F

A systematic study of the important classes of carbon compounds (alkane, alcohol, ether, organic halides, aromatic compounds, aldehyde, ketone, carboxylic acid, ester and amine) reactions of their functional groups, methods of synthesis, relations and uses. Proteins are presented.

452027 材料力學 3 選 洪廷甫、上

本課程規劃在讓學生認識材料力學的相關理論及其在工程上的常見應用，並著重在符合力平衡、變形相容性及材料行為之需求重要性探討。授課內容為工程力學中之基本靜力學觀念、應力與應變、材料機械性質、材料受軸向載重、扭轉、彎曲之應力應變分析、應力應變轉換。

452027 Mechanics of Materials 3 S Ting-Fu Hong、F

The aim of this course is to provide a clear presentation to acquaint the student

with the theory concept and applications of Mechanics of Materials. The course will emphasize the importance of satisfying equilibrium, compatibility of deformation and material behaviour requirements. After the successful completion of this course unit the student will understand: Basic concepts of Statics in Engineering Mechanics、Stress and strain、Mechanical properties of materials、Stress and strain analysis on materials under axial load, torsion and bending、Stress and Strain Transformation.

452028 材料化學 3 選 下

此課程主要對各種材料之介紹，已說明其特性，機械強度，腐蝕情形為主，並且說明各種材料之製造程序。

452028 Material chemistry 3 S S

This course has already stated its characteristic to the introduction to various kinds of materials mainly, mechanical intensity, corrode the situation as the main fact, and explain the manufacture procedures of various kinds of materials.

452029 固態物理導論 3 選 下

介紹晶體的各種完美結構，缺陷結構的形成與各種物理特性的相互關係，電子的波動與粒子之性質，電子於自由電子能量井，固態中行為與能帶觀念之介紹，固態材料的鬆散行為，固態的介電性質。

452029 Solid State Physics 3 S S

An introduction to Solid-State Physics in materials science

452030 非破壞檢測方法與實習 3 選 曾光宏、下

本課程目標將介紹非破壞檢測之方法、理論及程序步驟，並於課程中介紹目前非破壞檢測技術之應用現況，以及材料破損分析實務，可使學生獲得相關之知識與實務，使成為日後職場之重要技能。本課程授課內容包括：液滲檢測技術、超音波檢測技術、射線檢測技術、渦電流檢測技術、磁粉檢測技術及破損分析等。

452030 3 S Kuang-Hung Tseng、S

The objectives of this course are to introduce to the students the methodology, theory, and procedures of non-destructive test. The course also introduces to the students the application practices in non-destructive testing field. With the background, a course topic on the failure analysis is presented. Students are expected to gain the related practical knowledge and will become their critical skill in the future. Main topics of this course include: liquid penetrant inspection, ultrasonics inspection, radiography inspection, eddy-current inspection, magnetic particle inspection, and failure analysis.

452031 材料熱力學(2) 3 選 曹龍泉、下

將熱力學定律應用於計算凝結相之化學位能與其平衡，逸壓和活性因素，溶液熱力學，多元金屬溶液，相圖和相變化，運用電腦模擬相反應和相圖，及研擬冶金數學模式。

452031 Thermodynamics of Materials(2) 3 S Lung-Chuan Tsao、S

It applies the theory of thermodynamics to calculate chemical potential energy and its equilibrium of condensed phase, released pressure and activated factors, solution thermodynamics, complex metal solution, phase diagram and phase change, computer-aided phase reaction and phase diagram simulation, and planning a mathematics model of metallurgy.

452032 電工學 3 選 下

學生在校實習時或校外實際工作時，經常與機械及電有關機具接觸，故學生應對電路、電動機、變壓器等有所認識，方可減少工作傷害，確保安全。

452032 Electrical Engineering 3 S S

Student while practising in the school or when being outside school real work, related to machinery and electricity machines often keep in touch, so students should know to circuit, motor, voltage transformer, etc. to some extent, can reduce the working injury, guarantee the security.

452033 電化學 3 選 下

電化學是一門涉及電子與化學反應相互關係的科學，而電子的各種性質與行為，在近百年來，才逐漸明瞭。使得電化學雖比其他科學古老，但發展卻較為延遲。然而在環保意識高漲的今日，電化學已成為一門「新興」且倍受期待的科學。

452033 Electrochemistry 3 S S

Electrochemistry is a science of involving electrons and chemical reaction interreaction, and various kinds of nature and behavior of the electron, in the last hundred years, clear gradually. Make electrochemistry although older than other science, development is comparatively postponed. But today surging in environmental consciousness, electrochemistry has already become a 'new developing' and science expected extremely.

452034 機械冶金 3 選 上

本課程說明金屬材料在外力作用下的各種基本現象和金屬內部組織結構的關係，闡明其物理本質。並且探討金屬製件在外力作用下損傷的原因及強化措施。

452034 Machine metallurgy 3 S F

This course states the relation of institutional framework within various kinds of basic phenomena and metal under external force function of metal material, expound its physics essence. Measure that and probe into the metal and makes a reason to damage under external force function and melts toughly.

452035 金屬腐蝕與防蝕 3 選 曾光宏、上

本課程將介紹金屬腐蝕之基本原理，並於課程中介紹目前產業最先進之防蝕技術與工程實務，以及表面工程，使學生能深入了解產業應用此製程技術之核心。其授課內容包括金屬腐蝕原理、電化學機構、腐蝕電動勢及電極電位、極化及腐蝕速率、鈍化、應力腐蝕、大氣腐蝕、散亂電流腐蝕、氧化反應、陰極防蝕、塗層及抑制劑、材料選擇與設計。

452035 Corrosion & Protection of Metals 3 S Kuang-Hung Tseng、F

The aim of this course unit is to acquaint the students with the basic principles of metal corrosion. The course also introduces to the students the advanced technology and engineering practices of corrosion control industry field. With the background, a course section on advanced surface engineering topic is presented. It is hoped that it will be very useful to students who have to learn about the essential area of this processing technology. The content includes Principles of Metal Corrosion、Mechanisms of Electrochemical、EMF of Corrosion and Electrode Potential、Polarization and Corrosion Rate、Passivity、Stress Corrosion、Atmospheric Corrosion、Stray Current Corrosion、Oxidation Reactions、Cathodic Protection、Coatings and Inhibitors、Material Selection and Design.

452036 半導體製程導論 3 選 李佳言、上

本半導體製程導論為教導學生對半導體製程的基本原理認識，以及深入瞭解半導體材料與設備、半導體製作與半導體產業之運作，運用業界所普遍使用的半導體材料與設備介紹，使學生瞭解材料工程師在半導體業界可扮演的角色與任務。授課內容包括積體電路生產簡介、半導體基礎、晶圓製造、加熱製程、微影製程、電漿原理、離子佈植、蝕刻、化學氣相沈積及金屬化製程。

452036 Introduction to Semiconductor 3 S Chia-Yen Lee、F

The Introduction to Semiconductor Process To educate students on the basic principles of semiconductor manufacturing process, as well as in-depth understanding of the operation of semiconductor materials and equipment, semiconductor manufacturing and semiconductor industry, the use of semiconductor materials and equipment commonly used in the industry are introduced to enable students to understand material engineers in semiconductors Industry can play a role and mission. Lectures include integrated circuit production profiles, semiconductor foundations, wafer fabrication, thermal processing, lithography, plasma, ion implantation, etching, chemical vapor deposition and metallization processes.

452037 電子材料 3 選 上

本課程是介紹電子元件，以半導體積體電路為主的製作，數百種的材料，包括有機和無機、化學材料、金屬材料、半導體材料。型式有氣體、液體、固體或電漿。以及和材料相關的設備、製程、廠務及檢驗分析等等。

452037 Electronics Materials 3 S F

This course is to introduce the electronic element, the making relying mainly on semiconductor integrated circuit, several hundred kinds of materials, including organic with inorganic, chemical material, metal material, semiconductor material.

There are gas, liquid, solid or electric thick liquid in the model. And equipment that correlated with material, make Cheng, factory's affair and examining analysing etc.

452038 生醫材料 3 選 洪廷甫、上

本課程規劃在讓學生認識生物醫學材料的發展概念和應用，著重在於材料在組織替代與植入物上扮演的角色，與其機械與生物性質在應用上的重要性。

452038 Introduction to Biomaterials 3 S Ting-Fu Hong、F

The aim of this course unit is to acquaint the student with the concept and applications of synthetic materials as prostheses for natural tissue replacement, and the mechanical behaviour of components of human body.

452039 計算材料學與實務 3 選 上

電腦模擬在科學技術領域日益重要，已成為材料研究領域的重要新興科學，也是材料組成、結構、性能及材料成型過程能預測量化的主要方法。介紹計算材料科學的基本原理與內容，以及運用電腦進行計算模擬之技術，並以實例說明電腦模擬在材料科學的應用。

452039 Computational Materials 3 S F  
Science and Practice

Computer simulation is an important research field of Material science and engineering. The material composition, microstructure, property and also one of quantitative research methods of Materials processing. To introduce the basic principle and content of computational materials science, as well as several common simulation techniques. Some applications of the techniques on materials science will be also exercised.

452040 工程統計 3 選 上

從經濟、材料、工程和控制工程等廣泛的領域進行統計分析，其複雜的數據集是非常重要的。成為這些材料與其他領域，能是使用這些數據集來開發模型來預測或預測未來的行為。在未來 AI 電腦能使用此統計分析的使用。

452040 Engineering statistics 3 S F

The need for the development and understanding of large, complex data sets in a wide range of different fields, including economics, material, engineering, and control engineering is very important.

In all these fields, the common thread is using these data sets for the development of models to forecast or predict future behavior. Furthermore, the availability of AI computers has meant that many of the techniques can now be used and tested even on one's own computer.

452041 軟性電子製程技術 3 選 林鉉凱、上

本課程主要介紹軟性電子製程技術，就軟性電子的特點說明市場與應用趨勢，其授課內容包括薄膜沉積、微影蝕刻、雷射原理、電極圖案化、捲對捲傳輸與先進封裝等製程技術與設備，並舉出軟性電子應用(例如:軟性顯示器、軟性太陽能電池與軟性感測器等)。讓學生了解未來投入相關產業該具備的技術。

452041 Flexible Electronics Process 3 S Hsuan-Kai Lin、F

This course is designed to introduce flexible electronics process and describes the market and application trend. The content includes the thin film, lithography, etch, principle of laser, electrode patterning, Roll to Roll process, advance packing and applications (including flexible display, flexible solar cell and flexible sensor applications). The course will offer the basic knowledge relative to flexible electronics field.

452042 材料機械性質 3 選 盧威華、下

材料機械性質是一門探討金屬在承受應力下所表現的行為及反應的專業知識領域。本門課分為三大部分：第一部分，機械基礎，討論數學架構及應力應變關係；第二部分，冶金基礎，從結構觀點討論塑性變形及破壞；第三部分，機械性質測試，以工程觀點對材料在機械性質測試後之破壞進行探討。

452042 Mechanical Behaviors of materials 3 S Wei-Hua Lu、S

Mechanical metallurgy is the area of knowledge which deals with the behavior and response of metals to applied forces. This course will be divided into three parts. Part One, Mechanical Fundamentals, presents the mathematical framework and stress-strain relationships for many of the chapters will follow. Parts Two, Metallurgical Fundamentals, deals with the structural aspects of plastic deformation and fracture. Part Three, Application to Materials Testing, deals with the engineering aspects of the common testing techniques of mechanical failure of metals. Mechanical metallurgy is the area of knowledge which deals with the behavior and response of metals to applied forces. This course will be divided into three parts. Part One, Mechanical Fundamentals, presents the mathematical framework and stress-strain relationships for many of the chapters will follow. Parts Two, Metallurgical Fundamentals, deals with the structural aspects of plastic deformation and fracture.

Part Three, Application to Materials Testing, deals with the engineering aspects of the common testing techniques of mechanical failure of metals.

452043 奈米材料 3 選 下

介紹各種奈米結構材料：奈米碳管、奈米線、量子點、量子線和奈米複合材料的基本特性以及製備與應用技術，期能對奈米材料的物性、製造與應用有整體的認識。

452043 Nanometer-Scale Materials 3 S S

This course will deal with the chemical and physical properties of nanomaterials. It will cover the preparation, structure, properties and applications of quantum dots and lines, carbon nanotubes, and nanocomposites.

452044 表面工程 3 選 下

材料表面處理是各種製造工業不可或缺的過程，不論是傳統的工業或現代的高科技產業，表面處理都一直扮演著極重要的角色。本課程主要是對表面處理技術在理論基礎，方法與應用等方面的講述，以期培養學生的興趣與專業的知識。課程內容包括表面處理技術的基本理論，前處理技術，各種表面處理的方法與相關知識，以及各種表面處理技術的應用等項目。

452044 Surface Engineering 3 S S

Surface coating and chemical surface treatment are the main subjects to be taught in this course. The phase composition of the each coating methods is introduced initially. Association of these process with chemical pre-treatment of the material surface is reviewed next. Both experimental procedures and techniques base on concepts of electrode reactions and impedances are discussed during the entire presentation of this course.

452045 生物科技概論 3 選 下

生物科技的學術研究除了解決糧食生產的問題之外，對於醫藥保健、環境復育，甚至國防安全均有其廣泛的重要性。生物科技的學術研究除了解決糧食生產的問題之外，對於醫藥保健、環境復育，甚至國防安全均有其廣泛的重要性。

452045 Introduction of. Biotechnolog 3 S S

Academic research of biotechnology besides solving the problem of grain-production, reply and breed medicines and health protection, environment, even the national defence has its extensive importance safely.



452046 半導體製程實作 1 選 合授、下

本半導體製程導論為教導學生對半導體製程的基本原理認識，以及深入瞭解半導體材料與設備、半導體製作與半導體產業之運作，運用業界所普遍使用的半導體材料與設備介紹，使學生瞭解材料工程師在半導體業界可扮演的角色與任務。授課內容包括積體電路生產簡介、半導體基礎、晶圓製造、加熱製程、微影製程、電漿原理、離子佈植、蝕刻、化學氣相沈積及金屬化製程。

452046 Introduction to Semiconductor Manufacturing 1 S Joint teaching、S

The Introduction to Semiconductor Process To educate students on the basic principles of semiconductor manufacturing process, as well as in-depth understanding of the operation of semiconductor materials and equipment, semiconductor manufacturing and semiconductor industry, the use of semiconductor materials and equipment commonly used in the industry are introduced to enable students to understand material engineers in semiconductors Industry can play a role and mission. Lectures include integrated circuit production profiles, semiconductor foundations, wafer fabrication, thermal processing, lithography, plasma, ion implantation, etching, chemical vapor deposition and metallization processes.

452047 貴重儀器實習 1 選 下

本課程讓學生了解材料相變特性、顯微組織、成分分析與圖案化之原理及其應用，並安排示範操作及實作訓練課程，讓學生充分了解各項設備的功能，進而有深刻認識並用於其研究工作。授課內容為熱分析，顯微鏡、X射線與雷射系統之原理與機台操作。

452047 Introduction to Semiconductor Manufacturing 1 S S

The aim of this course is to acquaint the students with the principles of phase transformation, microstructure, element and patterning. The course also arranges the practical sessions to the students in order to fully understand the functions in our system. The students can make use of the system on their research in the future. This course includes the principle and structure of DSC, SEM, qualitative X-ray analysis, laser and practical operating in our equipment.

452048 金屬熱處理 3 選 下

本課程將介紹金屬材料熱處理之基本原理，並於課程中介紹目前產業最先進之熱處理技術與工程實務，以及品質工程，使學生能深入了解產業應用此製程技術之核心。其授課內容包括金屬熱處理原理、硬度與硬化能、熱處理爐及其相關設備、熱處理製程控制、碳鋼熱處理、合金鋼熱處理、不銹鋼熱處理、工具鋼熱處理、鑄鐵熱處理、熱處理品質與製程保證。

452048 Heat Treatment of Metals 3 S S

The aim of this course unit is to acquaint the students with the basic principles of heat treatment of metals. The course also introduces to the students the advanced technology and engineering practices of heat treatment industry field. With the background, a course section on quality engineering topic is presented. It is hoped that it will be very useful to students who have to learn about the essential area of this processing technology. The content includes Fundamentals of the Heat Treatment of Metals、Hardness and Hardenability、Furnaces and Related Equipment for Heat Treatment、Heat Treatment Processes Control、Heat Treatment of Carbon Steels、Heat Treatment of Alloy Steels、Heat Treatment of Stainless Steels、Heat Treatment of Tool Steels、Heat Treatment of Cast Irons、Assuring Quality in Products and Processes of Heat Treatment.

452049 可程式控制實務 3 選 下

本課程要旨為介紹近來工業界最常用之可程式控制器，其優點為精確、功能大、價格低、抗高溫及擴充性大。課程內容包括：控制器軟硬體介紹、撰寫程式、周邊設備架設、系統安裝及維修及故障排除。

452049 PLC Practice 3 S S

The purpose of this course is to introduce the most-used Programmable Logic Controller (PLC) in industries. The advantages of PLC are precision, easy-use, low-cost, anti high-temp and easy-expand. The course includes as follow : the hardware and software of PLC, the PLC programming, the peripherals setup, and systems installation, maintaining equipments and eliminating malfunction .

452050 材料儀器分析 3 選 下

課程內容有以下述項:分析化學基本概念、定量分析工具以及分析設備與方法、樣品前處理技術、實驗誤差以及統計學、實驗數據品保品管系統介紹、傳統定量分析技術。希望學生修習此課程後對於分析基本技巧以及數據之判讀與處理有基本的能力。

452050 Material Instrumental Analysis 3 S S

T Provide students with a theoretical background of analytical chemistry、Introduce the fundamentals of classical analytical chemistry、Encourage students to develop problem-solving skills.

452051 能源工程 3 選 上

本課程著重於推動熱力、流力、熱傳、電機、能源等相關科目之傳授。學生於修習基礎課程及核心課程後，將對能源工程具有基本之概念。

452051 Energy Engineering 3 S F

This course focuses on promoting heating power, flowing such the teaching of

relevant subjects as strength, heat spreading, electrical machinery, energy, etc. And after the key course for student's basic course in cultivation, will have basic concepts to the energy project.

452052 光電元件物理 3 選 楊茹媛、上

自從 1947 年的雙極性電晶體發明後，半導體元件即快速成長。本課程就元件物理和工作原理，做詳盡的敘述，每一單元多少會用到 MATLAB 軟體程式，做為學生電腦輔助學習用，本課程含半導體概論、載子模型-量子化觀念、載子擴散、漂移與再結、基本元件製程、PN 接面二極體、光電元件、MS 接觸與蕭特基二極體、接面型場效電晶體 JFET、金氧半型場效電晶體 MOSFET、量子力學概論

452052 Physics of optic-electrical devices 3 S Ru-Yuan Yang、F

Since the bipolar junction transistor (BJT) was developed in 1947, Semiconductor devices were grown rapidly. This course contains physics of devices and the theory of operation, it will be described detail. Each topic from this course used MATLAB software to be computer-assisted learning for students. The course is intended for undergraduate seniors or graduate students. The course contains ten chapters, covering: Semiconductor introduction、Carrier Modeling-The Quantization Concept、Carrier Action: Drift, Diffusion and Recombination、Basics of Device Fabrication、PN Junction Diodes、Optoelectronic Diodes、MS Contacts and Schottky Diodes、Field Effect Devices - JFET、MOSFET、Elements of Quantum Mechanics.

452053 表面處理科技特論 3 選 上

本課程規劃在讓學生認識表面處理科技的發展和應用，著重在於熱處理、鋼鐵表面處理、防蝕與陽極處理及其他特殊機能表面處理技術理論與實務上的重要性。

452053 Advanced Surface Treatment Technology 3 S F

The aim of this course unit is to acquaint the student with the concept and applications of advanced surface treatment technology. The course will focus on teaching the theoretical and practical knowledge of heat treatments, steel surface treatment technologies, corrosion resistance treatments, anodic treatments and other special functional surface treatment technologies.

452054 薄膜技術 3 選 上

讓學生在修習此一課程後，能對薄膜工程有基礎的認識，以利就業與研究工作的進行。

452054 Thin Film Technology 3 S F

Let this course in cultivation of students be back, Yes understanding that the project of the membrane has the foundation, with the going on of the favourable employment and research work.

452055 微機電系統導論 3 選 上

為教導學生對微感測器設計與製程的基本原理認識，以及深入瞭解感測器材料與相關製程設備、感測器製作與感測器產業之運作，運用業界所普遍使用的感測器材料與設備介紹，使學生瞭解材料工程師在感測器研發與製作可扮演的角色與任務。授課內容包括微機電系統簡介、微感測器簡介、環境感測器、車輛感測器。

452055 Introduction to Microelectromechanical Systems 3 S F

To educate students on the basic principles of micro-sensor design and process knowledge, as well as in-depth understanding of sensor materials and related process equipment, sensor manufacturing and sensor industry operations, the use of the industry's most commonly used sensor materials And equipment introduction to enable students to understand the roles and tasks material engineers can play in sensor development and production. Lectures include introduction of micro-electromechanical systems, micro-sensor profile, environmental sensors, vehicle sensors.

452056 人工智慧與材料選用 3 選 上

本課程主要係介紹各國材料之規範，以及其使用時應注意的事項，尤其是 CNS 規格與美國規格。另外，介紹人工智慧與大數據分析進行材料選用。課程內容主要包括：CNS 手冊讀法與使用法、CNS 材料特性、ASTM 手冊讀法即使用法、ASTM 材料特性、AI&材料選用要領、以及實例分析。

452056 A.I & Materials Selection 3 S F

The main topics offered in this course include: an introduction of material ASTM handbooks, the characteristic of CNS system. In addition, the introduction of artificial intelligence (AI) and big data analysis for material selection and some case studies.

452057 校外實習(學期) 6 選 上

為促進產學間技術與人才之交流，提升產學合作研發能量，增加學生校外實習機會，並為企業培育未來人才，特開設本課程。修習本課程之學生將在授課教師與指導教授協助之下進入業界以實習工程師進行至多六個月的實習。以其學生在畢業以前能深入了解業界生態，培養就業技能，並增進其職場競爭力。

452057 Internship(Semester) 6 S F

In order to promote the exchange of technology and talents between production and academia, to enhance the cooperation in research and development of production and learning, to increase students' internship opportunities and to cultivate talents for the future, this course is specially set up. Students who take this course will be assisted by the instructor and the instructor Enter the industry for internships with internship engineers for up to 6 months. Before their graduation, students can gain an in-depth understanding of the industry ecology, develop employment skills and enhance the competitiveness of their workplaces.

452058 進階材料實務專題 1 選 上

由已完成所有實務專題必修課程之學生選定進階材料實務專題方向，在原專題指導教授指導下，由前三個學期建立的實務專題基礎與成果上進行更進階的實驗與研究，最後依據實驗研究結果完成進階實務專題報告。

452058 Advanced Project Research 1 S F

Based on the knowledgement of the three previous semesters of Project Researches, undergraduate students should propose their advanced research project, complete experiments and write a report under advisors' supervision.

452059 品質工程 3 選 上

教導學生了解，近世紀以來由於經濟性與多樣化成為產品發展主要考慮因素，使得「品質」要求已從觀念性或直覺性的描述而演變成為具體量化的品質特性指標，因而在品質技術發展上產生了許多實用的技術和方法以迎合產品發展各階段實際的需要，經過多年的技術研發及經驗累積，我們能提供由產品研發、商品化、試量產、量產、售後維護等完整的品質技術服務。採用工業界普遍的在應用「田口方法」，「田口方法」的理論簡短易懂的，化繁為簡，避開艱澀難懂的統計學觀念，使此方法能讓一般大專程度的工程師也能接受、了解、而加以應用。

452059 Quality Engineering 3 S F

The objective of this course is to introduce the Taguchi Methods as a tool to handle the quality engineering of product. The Taguchi method is known as the simple and fast toll for industries applications. The S/N ratio derived from cost functions is the most power analysis criteria for quality. The optimun paremeter design is the main idea of this course. ANOM and ANOVA are introduced in detail. A final project is presented in the end of the course.

452060 校外實習(學期) 9 選 下

為促進產學間技術與人才之交流，提升產學合作研發能量，增加學生校外

實習機會，並為企業培育未來人才，特開設本課程。修習本課程之學生將在授課教師與指導教授協助之下進入業界以實習工程師進行至多六個月的實習。以其學生在畢業以前能深入了解業界生態，培養就業技能，並增進其職場競爭力。

452060 Internship(Semester) 9 S S

In order to promote the exchange of technology and talents between production and academia, to enhance the cooperation in research and development of production and learning, to increase students' internship opportunities and to cultivate talents for the future, this course is specially set up. Students who take this course will be assisted by the instructor and the instructor. Enter the industry for internships with internship engineers for up to 6 months. Before their graduation, students can gain an in-depth understanding of the industry ecology, develop employment skills and enhance the competitiveness of their workplaces.

452061 生物光源技術 3 選 下

本課程旨在加強學生對生物技術之了解、其範圍涵蓋遺傳工程技術、細胞融合技術和蛋白質工程技術等三大領域的理論和臨床上應用等方面的學習，培養生物技術相關人才為目的。

452061 Bio-light Technology 3 S S

The curriculum will emphasize three major areas, including genetic engineering, hybridoma techniques and protein engineering. The purpose is to train students understanding the concept of biotechnology and their applications.

452062 複合材料力學 3 選 下

讓學生在修習此一課程後，能對複合材料(主要是以纖維複合材料為主)有深入的了解，以利研究工作的進行。

452062 Mechanics of composite materials 3 S S

Let student after cultivation course this, can be to the composite(mainly take fibre composite as the core) There is deep understanding, with the going on of favourable research work.

452063 新興科技產業分析 3 選 下

本課程教學在於培養學生之新興科技產業發展架構的理論基礎及說明五種新興科技發展；其授課內容包括新興科技產業、國家近期重點科技發展、新興科技與經濟關係、產業分析工具、新興科技產業分析(一~五)--智慧化居住、前瞻材料、綠色能源、半導體、生物科技、智慧型機器人及個案研討。

452063 Emerging Technology Industry Analysis 3 S S

This course will develop the student's capabilities to analyze particular emerging technologies for technology monitoring, forecasting, and assessment, and exploration of five emerging technologies. The content includes fundamentals of the emerging technology、national mid-term and long-term science and technology development plan、economy relationship and emerging technology relationship、industrial analysis tools、emerging technology industry analysis (1 ~ 5) — intelligent home、smart materials、green energy、semiconductor、biotechnology、intelligent robotics and case Studies.

452064 電子構裝技術 3 選 下

本課程主要是說明如今半導體封裝中的大概製程，並且敘述整段製程的詳細內容與現代產業的新興技術。

452064 Electronics Packaging 3 S S

This course is mainly nowadays explained probably making to Cheng in semiconductor encapsulation, narrate whole sections of new developing technology of detailed content and modern industry to make Cheng.

452065 材料接合技術 3 選 下

本課程將介紹銲接冶金之核心理論，並於課程中介紹目前產業最先進之銲接製程，以及破損分析，使學生能深入了解材料銲接之關鍵技術。

452065 Materials Joining Technology 3 S S

The aim of this course unit is to acquaint the students with the core principles of welding metallurgy. The course also introduces to the students the advanced welding processes. With the background, a course section on fracture analysis topic is presented. It is hoped that it will be very useful to students who have to learn about the features and the key technologies in materials welding.

452066 農業高分子材料 3 選 下

介紹農業高分子材料之構造、機能性、製造方法及其應用。

452066 Agriculture Polymer Materials 3 S S

This course introduces the current topics in the agriculture polymer, including microstructure, mechanical properties, chemical properties, physicochemical properties, biochemistry properties, manufacturing method and application.

452067 生物感測器設計與實作 1 選 下

本課程主要是提供生物感測元件的設計與實作。課程中並將進行生物感測元件實作。

452067 Biosensor Design and Practice 1 S S

The aim of this course is to introduce the design and practice of biosensor. Students will make the biosensor component.

452068 物聯網感測器 3 選 李佳言、下

本課程為教導學生對微感測器設計與製程的基本原理認識，以及深入瞭解感測器材料與相關製程設備、感測器製作與感測器產業之運作，運用業界所普遍使用的感測器材料與設備介紹，使學生瞭解設備工程師在感測器研發與製作可扮演的角色與任務。授課內容包括微機電系統簡介、微感測器簡介、環境感測器、載具感測器。

452068 Micro Sensors of IoT 3 S Chia-Yen Lee 、S

The aim of “Micro-sensors” is to acquaint the students with the basic principles of micro-sensor design and manufacturing. The course also introduces the students to the sensor materials and manufacturing equipment, the sensor fabrication and the sensor business. Utilizing the knowledge of commercial sensor materials and equipment, the students can understand their roles in the sensor fields. The contents include Introduction to MEMS, Introduction to Micro-sensors, Environmental Sensors and Vehicle Sensors.

452069 相變化 3 選 林鉉凱、下

本課程以材料熱力學為基礎，討論材料相變化之基本原理與機構，內容將包含各種相圖、擴散理論、界面，固化、擴散型相變化和非擴散型相變化。

452069 Transfan 3 S Hsuan-Kai Lin、S

The main purposes of this course are to introduce the phase transformations in solid material. The course includes phase diagrams, diffusion, crystal interface, solidification, diffusional transformations and diffusionless transformations.

452070 材料製造方法 3 選 曹龍泉、下

本課程將使學生了解不同材料製造的技術，並深入了解相關材料產業應用製造技術之核心。將針對金屬材料、陶瓷材料、電子材料、高分子材料、奈米材料及複合材料等六大類製造方法與應用。

452070 Material manufacturing method 3 S Lung-Chuan Tsao、S

This course will enable students to understand the manufacturing technology of different materials, and gain an in-depth understanding of the core of applied manufacturing technology in the relevant material industry. It will focus on six types of manufacturing methods and applications: metal materials, ceramic materials, electronic materials, polymer materials, nano materials and composite materials.



# 材料工程系碩士班中英文課程內容摘要

## Department of Materials Engineering

### 一、必修科目 Required Courses

456001 專題討論 4 必 輪授、上 & 下

本課程安排一系列專題演講，訓練學生熟習學術研討會的情況，此為四學期課程，邀請校內教師與校外學者專家演講，或請研究生發表研究成果，後二學期，每一學生必須針對其有關碩士論文主題做口頭報告。

456001 Seminar 4 R All Teachers、F & S

A sequence of lectures are arranged in the course to train the students to be familiar with the situation of a academic symposium or a conference. Basically, it is a four semesters course. Some lectures are given by the teachers in the school or by the experts invited from outside the school in the course. The lecture may also be given by the graduate students who have certain solid conclusions drawn their research. In the last two semesters, each student is required to present on the topic involving his master thesis.

456002 碩士論文 6 必 指導教授

每位碩士班研究生選定論文題目，再指導教授指導下進行實驗、研究、依據實驗研究結果完成論文。

456002 Thesis 6 R adviser

Graduate students propose their research project, complete experiments and write a thesis under advisor supervision.

### 二、選修科目 Elective Courses

456003 材料工程特論與實作 3 選 輪授、上

本課程將介紹材料科學與工程理論，並於課程中探討以材料結構與性質間之關係為基礎，進一步設計材料結構以獲得預期性質。學生熟悉材料各種特性、結構-性質間之關係，以及材料製程技術，將可以此知識為基礎，自信做出明智的材料選擇。本課程授課內容包括有原子結構與原子鍵結、晶體結構、固體缺陷、材料機械性質、金屬材料結構與性質、陶瓷材料結構與性質及高分子材料結構與性質等。

456003 Essential Topics and Experiments on Materials Engineering 3 S All Teachers、F

The aim of this course is to acquaint the students with the principles of materials science and engineering. The course also introduces to the students the basic relationship of the structure-property, designing the structure of a material to produce a predetermined set of properties. The student will be familiar with the various characteristics and structure-property relationships, as well as processing techniques of materials, the student will be more proficient and confident to make judicious choices based on these criteria after this course. The content includes atomic structure, interatomic bonding, crystal structure, imperfections in solid, mechanical properties and structures of metal, ceramic and properties materials.

456004 物理冶金 3 選 林鉉凱、上

本課程主要以物理、化學、熱力學、動力學等為基礎，針對結晶組織之固體材料，(包括金屬、陶瓷、複合材料等)，討論其基本冶金特性，如:化學成份、微觀組織、結晶組織缺陷，材料受力之變形行為，擴散理論，相及相圖，相變態，疲勞、潛變，金屬之強化機構，製程中相變態之熱力與動力學理論、及機械強度性能等，金屬的腐蝕及防蝕原理、鋼鐵之熱處理原理及應用，以及材料結構與成份之分法，如：X 光繞射原理，Laue 照相法，粉末照相法，繞射儀法，電子顯微鏡分析技術，作一綜合而有系統之探討。包括：金屬結構與結晶體、塑性變形、金屬磨耗、合金鋼、相圖、凝固。

456004 Physical Metallurgy 3 S Hsuan-Kai Lin、F

Introduction to the following topics: quantitative metallography; compositional and structural analysis; structure of metals; mechanical properties; grain boundary and vacancies; solid solution and phase diagram; diffusion; plastic deformation and annealing; heat treatment of metals and its application, focusing on steel and its alloys; strengthening mechanism. The contents include Metal Structure and Crystallization、Plastic Deformation、Wear of Metal、Tool Steels、Phase Diagrams、Solidification.

456005 材料熱力學 3 選 李英杰、上

將熱力學定律應用於計算凝結相之化學位能與其平衡，逸壓和活性因素，溶液熱力學，多元金屬溶液，相圖和相變化，運用電腦模擬相反應和相圖，及研擬冶金數學模式。

456005 Thermodynamics of Materials 3 S Ying-Chieh Lee、F

It applies the theory of thermodynamics to calculate chemical potential energy and its equilibrium of condensed phase, released pressure and activated factors, solution thermodynamics, complex metal solution, phase diagram and phase change, computer-aided phase reaction and phase diagram simulation, and planning a mathematics model of metallurgy.

456006 材料力學 3 選 洪廷甫、上

本課程規劃在讓學生認識材料力學的相關理論及其在工程上的常見應用，並著重在符合力平衡、變形相容性及材料行為之需求重要性探討。授課內容為工程力學中之基本靜力學觀念、應力與應變、材料機械性質、材料受軸向載重、扭轉、彎曲之應力應變分析、應力應變轉換。

456006 Mechanics of Materials 3 S Ting-Fu Hong、F

The aim of this course is to provide a clear presentation to acquaint the student with the theory concept and applications of Mechanics of Materials. The course will emphasize the importance of satisfying equilibrium, compatibility of deformation and material behaviour requirements. After the successful completion of this course unit the student will understand: Basic concepts of Statics in Engineering Mechanics、Stress and strain、Mechanical properties of materials、Stress and strain analysis on materials under axial load, torsion and bending、Stress and Strain Transformation.

456007 材料機械性質 3 選 盧威華、上

材料機械性質是一門探討金屬在承受應力下所表現的行為及反應的專業知識領域。本門課分為三大部分：第一部分，機械基礎，討論數學架構及應力應變關係；第二部分，冶金基礎，從結構觀點討論塑性變形及破壞；第三部分，機械性質測試，以工程觀點對材料在機械性質測試後之破壞進行探討。

456007 Mechanical Behaviors of Materials 3 S Wei-Hua Lu、F

Mechanical metallurgy is the area of knowledge which deals with the behavior and response of metals to applied forces. This course will be divided into three parts. Part One, Mechanical Fundamentals, presents the mathematical framework and stress-strain relationships for many of the chapters will follow. Parts Two, Metallurgical Fundamentals, deals with the structural aspects of plastic deformation and fracture. Part Three, Application to Materials Testing, deals with the engineering aspects of the common testing techniques of mechanical failure of metals.

456008 材料分析 3 選 曹龍泉、上

X-ray 微觀分析、掃描式電子顯微鏡、穿透式電子顯微鏡、表面分析法。

456008 Materials Analysis 3 S Lung-Chuan Tsao、F

X-ray Microanalysis、Scanning Electron Microscopy、Transmission Electron Microscopy、Methods of Surface analysis.

456009 電子顯微鏡原理與實作 3 選 林鉉凱、上

本課程讓學生了解掃描式電子顯微鏡及成分分析之原理及其應用，並安排示範操作及實作訓練課程，讓學生充分了解各項設備的功能，進而有深刻認識並用於其研究工作。授課內容為顯微鏡之結構及其原理、X射線之原理及應用與機台操作。

456009 Practical Electron Microscopy 3 S Hsuan-Kai Lin、F

The aim of this course is to acquaint the students with the principles of scanning electron microscopy (SEM) and energy dispersive X-ray spectrometer (EDS). The course also arranges the practical sessions to the students in order to fully understand the functions in our system. The students can make use of the system on their research in the future. This course includes the principle and structure of SEM, qualitative X-ray analysis and practical operating in our equipment.

456010 微感測器 3 選 李佳言、上

微感測器為教導學生對微感測器設計與製程的基本原理認識，以及深入瞭解感測器材料與相關製程設備、感測器製作與感測器產業之運作，運用業界所普遍使用的感測器材料與設備介紹，使學生瞭解材料工程師在感測器研發與製作可扮演的角色與任務。授課內容包括微機電系統簡介、微感測器簡介、環境感測器、車輛感測器。

456010 Micro-sensors 3 S Chia-Yen Lee、F

The aim of "Micro-sensors" is to acquaint the students with the basic principles of micro-sensor design and manufacturing. The course also introduces the students to the sensor materials and manufacturing equipments, the sensor fabrication and the sensor business. Utilizing the knowledgement of commercial sensor materials and equipments, the students can understand their roles in the sensor fields. The contents include Introduction to MEMS, Introduction to Micro-sensors, Environmental Sensors and Vehicle Sensors.

456011 生醫材料特論 3 選 洪廷甫、上

介紹材料在生物醫學應用上的基本要求、評估材料是否適合用於生醫替代及植入物、介紹各種體內或體外之生物相容性實驗方法、講解基本生物材料力學、組織工程及

仿生材料。

456011 Advanced Biomaterials 3 S Ting-Fu Hong、F

Describe the requirements for synthetic implant materials in biomedical applications、Assess various materials in relation to their suitability for implant materials、Describe the function and degradation of synthetic replacement materials in vitro and in vivo、Discuss the concept of bioactivity by biocompatibility testing、Understand generation of forces within the body and the behaviour of the structures in resisting these forces. Illustrate fundamental tissue engineering and biomimetic materials.

456012 金屬材料特論 3 選 曾光宏、上

本課程主要是介紹合金微結構與機械性質之關係，及各合金在不同的製造方法及熱處理下之結構。課程包括(1)鐵-碳合金，(2)碳鋼，(3)合金鋼，(4)鋁合金，(5)銅及銅合金，(6)不鏽鋼。

456012 Essential Topics on Metal Materials 3 S Kuang-Hung Tseng、F

The principal objectives of this topic is (I) relative the microstructure of the alloys to their properties, (II) providing description of the structure of different alloys in various fabricated and heat-treated conditions. This course includes (1) Iron-Carbon Alloy, (2) Carbon Steels, (3) Alloy Steel, (4) Aluminum Alloys, (5) Coppers and C.

456013 非破壞檢測技術 3 選 曾光宏、上

本課程目標將介紹非破壞檢測之方法、理論及程序步驟，並於課程中介紹目前非破壞檢測技術之應用現況，以及材料破損分析實務，可使學生獲得相關之知識與實務，使成為日後職場之重要技能。本課程授課內容包括：液滲檢測技術、超音波檢測技術、射線檢測技術、渦電流檢測技術、磁粉檢測技術及破損分析等。

456013 Non-Destructive Testing Technology 3 S Kuang-Hung Tseng、F

The objectives of this course are to introduce to the students the methodology, theory, and procedures of non-destructive test. The course also introduces to the students the application practices in non-destructive testing field. With the background, a course topic on the failure analysis is presented. Students are expected to gain the related practical knowledge and will become their critical skill in the future. Main topics of this course include: liquid penetrant inspection, ultrasonics inspection, radiography inspection, eddy-current inspection, magnetic particle inspection, and failure analysis.

456014 表面處理科技特論 3 選 洪廷甫、上

本課程規劃在讓學生認識表面處理科技的發展和應用，著重在於熱處理、鋼鐵表面處理、防蝕與陽極處理及其他特殊機能表面處理技術理論與實務上的重要性。包含熱處理、鋼鐵表面處理、防蝕處理、陽極處理、功能性表面處理。

456014 Advanced Surface Treatment Technology 3 S Ting-Fu Hong、F

The aim of this course unit is to acquaint the student with the concept and applications of advanced surface treatment technology. The course will focus on teaching the theoretical and practical knowledge of heat treatments, steel surface treatment technologies, corrosion resistance treatments, anodic treatments and other special functional surface treatment

technologies. This course includes Heat treatments、Steel Surface treatments、Corrosion resistance treatments、Anodic treatments、Functional surface treatments.

456015 光電元件物理特論 3 選 楊茹媛、上

本課程包括：能帶及載子、載子傳輸現象、P-N 接面、二極體元件、接面場效電晶體、絕緣閘極場效電晶體。

456015 Physics of optic-electrical devices 3 S Ru-Yuan Yang、F

The contents include : Energy Bands and Carrier、Carrier transport phenomena、p - n junction、Bipolar Device、Field effect transistor、MOSFET.

456016 半導體與光電元件製程與設備 3 選 楊茹媛、上

本課程包括：VLSI 製造技術介紹、晶體成長 晶片製備、微影、氧化、擴散、離子佈值、化學汽相蒸鍍、物理汽相蒸鍍、蝕刻、隔離與金屬化。

456016 Process and Equipment of Semiconductor and Optic-Electrical Devices 3 S Ru-Yuan Yang、F

The contents include : Overview of VLSI fabrication technology、Crystal Growth, Wafer Preparation、Lithography、Oxidation、Diffusion、Ion Implantation、Chemical Vapor Deposition、Physical Vapor Deposition、Etching、Isolation and Metalization.

456017 薄膜技術 3 選 楊茹媛、上

介紹薄膜於現在工業與技術之重要性，探討並檢視薄膜形成之理論，同時介紹各種不同的薄膜技術:如化學氣相沉積、分子束磊晶及濺鍍，使學生能了解薄膜之特性:電、光及機械行為，及薄膜之應用:如電路光電設備及資料儲存。

456017 Thin Film Technology 3 S Ru-Yuan Yang、F

The contents include : Introduce the importance and significance of thin films of materials in modern industries and technology、Explore and examine the theory for thin film formation、Teach various types of thin film technology, such as chemical vapour deposition (CVD), molecular beam epitaxy (MBE) and sputtering、properties of thin films: electrical behaviour, optical behaviour and mechanical behaviour、5. Applications of thin films in such as electronical circuits, optical instruments and data storage.

456018 陶瓷製程 1 選 李英杰、上

本課程的目的是提供有關陶瓷技術和其實際應用的知識，並且強調基本材料和製程所需具備的觀念。將分別探討陶瓷元件的製造過程，說明從選擇原料經過成形、生胚製造、脫脂過程、燒結成形到品質管制等的每一步驟細節，每一個製造步驟都是以其對陶瓷組件成品的性質和品質來加以討論。其授課內容包括陶瓷製程簡介、陶瓷製程-添加劑、漿料配製、生胚製程、燒結製程、電性量測。

456018 Ceramic Processing 1 S Ying-Chieh Lee、F

The transition of ceramics processing to an applied science is the natural result of an increasing ability to refine, develop, and characterize ceramic materials and systems of

additives which aid in processing systems containing hard, brittle particles, improved equipment for processing these materials into products, and advances in understanding ceramic processing fundamentals. The content includes Introduction of ceramic processing、Ceramic processing -- additives、Slurry and slip preparation、Green chip processing、Sintering processing、Electrical properties measurement.

456019 新興科技產業分析 3 選 曹龍泉、下

本課程教學在於培養學生之新興科技產業發展架構的理論基礎及說明五種新興科技發展；其授課內容包括新興科技產業、國家近期重點科技發展、新興科技與經濟關係、產業分析工具、新興科技產業分析（一~五）--智慧化居住、前瞻材料、綠色能源、半導體、生物科技、智慧型機器人及個案研討。

456019 Emerging Technology Industry Analysis 3 S Lung-Chuan Tsao、S

This course will develop the student's capabilities to analyze particular emerging technologies for technology monitoring, forecasting, and assessment, and exploration of five emerging technologies. The content includes fundamentals of the emerging technology、national mid-term and long-term science and technology development plan、economy relationship and emerging technology relationship、industrial analysis tools、emerging technology industry analysis (1~5) — intelligent home、smart materials、green energy、semiconductor、biotechnology、intelligent robotics and case Studies.

456020 X光繞射學 3 選 李英杰、下

本課程主要的目的是建立學生將來可以以 X 光作為研究工具的能力。本課程主要可分成四部份：一是結晶學原理、二是 X 光繞射的原理、三是 X 光繞射的基本應用、四是材料的結構分析。本課程包括：X-Ray 特性、晶體與倒晶格、X-Ray 繞射原理、實驗方法、a. Laue 法 b. Powder 法 c. Diffractometer and Spectrometer 量測、單晶與多晶量測、晶體結構鑑定、化學分析、實例分析。

456020 X-Ray Diffraction 3 S Ying-Chieh Lee、S

Topics covered include properties of X-rays, geometry of crystals, directions of diffracted Beams, intensity of diffracted beams, orientation and quality of single crystals, structure of polycrystalline aggregates, determinations of crystal structure, phase diagram determination, and Experiments. The contents include Properties of X-Ray、Crystallography and Reciprocal Lattice、Principles of X-Ray Diffraction、Experimental Methods、a. Laue Photographs b. Powder Photographs c. Diffractometer and Spectrometer Measurements、Orientation and Quality of Single Crystal、Structure of Polycrystalline Aggregates、Determine of Crystal Structure、Chemical Analysis by X-Ray Diffraction、Case Studies.

456021 生醫工程特論 3 選 洪廷甫、下

本課程規劃在讓學生認識生物醫學工程的發展概念和應用，著重在於生物科技應用、醫療器材與植入物開發及醫療光電設備與系統之整合實務上的重要性。包含醫療科技與倫理、人體解剖學、生物力學、生物技術與組織工程、醫療材料與設備開發。

456021 Advanced Biomedical Engineering 3 S Ting-Fu Hong、S

The aim of this course unit is to acquaint the student with the concept and applications

of biomedical engineering. The course will focus on teaching the practical medical and industrial applications on bio-technology, implant devices, and medical photonic equipments and systems. The content includes Describe the medical technologies and their ethical issues、Understand the concept of anatomy and physiology、Understand the concept of biomechanics、Understand the advanced concept of bio-technologies and tissue engineering、Understand the importance and strategy of developing advanced biomedical materials, devices, equipments and systems.

456022 仿生工程與材料 3 選 苗志銘、下

本課程之教學目標在於培養學生之仿生科技與工程應用所需的力學知識與材料特性。課程發展的架構是以生物科技的介紹為出發點，接著以尺度效應的理論基礎說明生物力學，最後鼓勵學生以仿生工程創意設計的理念完成一個整合系統。

456022 Biomimetic Engineering and Materials 3 S Jr-Ming Miao、S

This course is designed as an introductory course in biomimetic engineering and materials for junior/senior undergraduate and freshman graduate engineering students. Course materials start from understanding how biological systems works and their underlying physical principles, followed by the bio-inspired engineering works, including designs, material selection, mechanisms, and applications from innovation concept to components, to sub-systems and to final integrated systems (such as robot and flapping MAV).

456023 相變化 3 選 林鉉凱、下

本課程討論材料相變化之基本原理與機構、擴散的原子機構滲性相變化、同質結核、核成長、異質結核、界面性質、微觀結構、凝固、析出、非滲性相變化等，及更深入討論相變化程序，包括凝固、晶體成長、析出、共析系統、再結晶體及晶粒成長、有序排列、非有序排列等相變化基礎現象；強調利用熱力學，介面結構及動力學方法探討相變化之行為及其導致形態。

456023 Phase Transformation 3 S Hsuan-Kai Lin、S

The main purposes of this course are to introduce the phase transformations for final year students specializing metallurgy, material science or engineering materials, there are including thermodynamics ,kinetics ,diffusion theory and the structure and properties of interface.

456024 材料接合技術 3 選 曾光宏、下

本課程將介紹材料接合之基本原理，並於課程中介紹目前產業最先進之接合技術與工程實務，以及接合品質管理，使學生能深入了解產業應用此製程技術之核心。授課內容包括接合製程原理、銲接冶金、接頭設計、電弧銲接技術、電阻銲接技術、固態銲接技術、軟銲與硬銲技術、先進接合技術、銲接機器人、銲接檢驗與品質控制。

456024 Materials Joining Technology 3 S Kuang-Hung, Tseng、S

The aim of this course unit is to acquaint the students with the basic principles of materials joining. The course also introduces to the students the advanced technology and engineering practices of joining industry field. With the background, a course section on quality management topic is presented. It is hoped that it will be very useful to students who have to learn about the essential area of this processing technology. The content includes

fundamentals of the joining processes, welding metallurgy, joint design, arc welding technology, resistance welding technology, solid-state welding technology, soldering and brazing technology, advanced joining technology, welding robots, welding inspection and quality control.

456025 熱處理工程特論 3 選 曾光宏、下

本課程將介紹材料熱處理之高等理論，並於課程中介紹目前產業最先進之熱處理技術與工程實務，以及品質工程，使學生能深入了解產業應用此製程技術之核心。授課內容包括熱處理原理、硬化能、熱處理爐及其相關設備、熱處理製程控制、碳鋼熱處理、合金鋼熱處理、不銹鋼熱處理、工具鋼熱處理、鑄鐵熱處理、熱處理品質與製程保證。

456025 Special Topics on Heat Treatment 3 S Kuang-Hung, Tseng、S  
Engineering

The aim of this course unit is to acquaint the students with the advanced principles in heat treatment of materials. The course also introduces to the students the advanced technology and engineering practices of heat treatment industry field. With the background, a course section on quality engineering topic is presented. It is hoped that it will be very useful to students who have to learn about the essential area of this processing technology. The content includes fundamentals of heat treatment, hardenability, furnaces and related equipment for heat treatment, heat treatment processes control, heat treatment of carbon steels, heat treatment of alloy steels, heat treatment of stainless steels, heat treatment of tool steels, heat treatment of cast irons, assuring quality in products and processes of heat treatment.

456026 電子構裝技術 3 選 盧威華、下

電子構裝技術課程是對電子元件的傳統封裝技術及未來先進的封裝技術及材料發展做一深入的介紹。內容包括(1)金線連結技術, (2)導線架/接著劑/錫膏/助錫劑, (3)覆晶構裝技術, (4)可靠性測試, (5)破壞模式分析。

456026 Electronic Packaging technology 3 S Wei-Hua Lu、S  
for Electronics

This topic is to introduce the assembly technology for electronics. The course includes (1) wire bonding, (2) material properties of lead frame, adhesives, solder paste and flux, (3) flip chip assembly, (4) reliability test, (5) failure mode analysis.

456027 複合材料力學 3 選 盧威華、下

計算同軸向及多軸向之複合材料剛性及強度，藉由層板理論分析複合材料內部應力分佈及各項機械性質。授課內容為(1)同軸向複合材料剛性, (2)應力與應變轉換, (3)同軸向複合材料之偏軸剛性, (4)對稱型積層板剛性, (5)對稱型三明治積層板撓曲剛性。

456027 Mechanics of Composite Materials 3 S Wei-Hua Lu、S

The objective of this topic is to introduce the governing principles of the stiffness and strength of uni- and multi-directional composite materials. This course includes (1) stiffness of unidirectional composites, (2) transformation of stress and strain, (3) off-axis stiffness of unidirectional composites, (4) in-plane stiffness of symmetric laminate, (5) flexural stiffness of symmetric sandwich laminates.



456028 積層陶瓷元件

3 選

李英杰、下

本課程的目的是提供有關陶瓷技術和其實際應用的知識，並且強調基本材料和所需具備的性質觀念。將分別探討介電陶瓷的物理性質、熱性質和機械性質，其與原子鍵結、晶體結構和微觀結構的關係。另外也將研究積層陶瓷元件的製造過程，說明從選擇原料經過成形、生胚製造、脫酯過程、燒結成形到品質管制等的每一步驟細節，每一個製造步驟都是以其對陶瓷組件成品的性質和品質來加以討論。

456028 Multilayer Ceramic Device

3 S

Ying-Chieh Lee、S

This course is concerned primarily with understanding the scientific principles and technology involved in processing particulate dielectric ceramic materials into fabricated products. The topic is commonly referred to as ceramics fabrication processes, ceramics processing technology, or simply ceramics processing such as multilayer ceramics capacitor (MLCC). Ceramics processing technology is used to produce commercial products that are very diverse in size, shape, detail, complexity, material composition, structure, and cost. The functions of ceramic products are very dependent on their chemical composition and their atomic and microscale structure, which determines their properties. Compositions of ceramic products vary widely, and both oxide and nonoxide materials are used. Today the composition and structure of grains and grain boundary phases and the distribution and structure of pores is more carefully controlled to achieve greater product performance and reliability. An awareness that improvements in ceramics processing technology can improve manufacturing productivity and expand markets now pervades the industry.

456029 前瞻性太陽能電池設計與趨勢

3 選

楊茹媛、下

本課程的目的是提供有關太陽能電池技術和其實際應用的知識。各章節將分別介紹太陽能電池的原理，性質，及各種不同形式太陽能電池之設計原理。另外也將介紹太陽能電池的製造過程及量測方法與原理。最後，將對台灣與全球之太陽能電池產業之發展趨勢作一介紹。包含晶片型矽基太陽能電池、薄膜型矽基太陽能電池、化合物太陽能電池、染料敏化太陽能電池、有機/無機太陽能電池、奈米結構太陽能電池。

456029 The Design and Trend of Original Solar Cell

3 S

Ru-Yuan Yang、S

This course is focus on the knowledge of solar cell technology and its application. The chapters introduce the principle and the properties of the solar cell and the design rules and principle of different type solar cell, individually. Furthermore, it will be introduced on the process and method of measurement of solar cell. Finally, the trend of industry of solar cell in Taiwan and in global are also introduced. The course includes Silicon wafer based solar cell、Silicon thin film solar cell、Somponund solar cell、Dye-sensitized solar cell、Organic/Inorganic solar cell、Nano-structural solar cell.

456030 高分子材料

3 選

盧威華、下

高分子材料，特別是合成型高分子，是無所不在且必須的。高分子具有複雜的行為模式，這些特性將被反映在環繞興奮氣息中的研究中。本門課分為四大部分：第一部分，簡介，介紹初步的觀念及高分子間的作用力；第二部分，高分子合成，討論高分子合成反應之理論；第三部分，高分子物性，討論高分子形態、轉變現象、鏈結構造；第四部分，高分子流變，討論高分子黏彈特性。

456030 Polymer Science and Engineering

3 S

Wei-Hua Lu、S

Polymers are ubiquitous and essential, especial for Synthetic polymers. Polymers are complex materials that exhibit correspondingly complex behavior patterns. These complexities are reflected in the aura of excitement surrounding their study. This course will be divided into four parts. Part One, Introduction, deals with introductory concepts and intermolecular forces in polymers. Part Two, Polymer Synthesis, presents theoretical analysis of polymerization reactions. Part Three, Physics of Solid State, deals with the physics of solid state of polymer, including morphology, transition phenomena and chain conformation. Part Four, Polymer Rheology, deals with viscoelastic behavior of polymer.

456031 科技英文 3 選 洪廷甫、下

這課程訓練學生撰寫英文技術報告。在開始的階段，此課程將幫助學生建立建造正確英文句子的能力，同時也將通過相關的例子、指導課(tutorial)和練習教導學生不同的寫作技巧，及不同的時態在技術論文中之應用。在後階段，此課程的將介紹學生常見的科技英語文獻格式、技術報告的典型組合以及圖表等的格式。

456031 Technical Writing in English 3 S Ting-Fu Hong、S

This course trains the students to write technical reports in English. In the beginning, the students are taught to develop the basic capability to construct correct sentences. Different writing skills will be introduced with appropriate examples, tutorials, and exercises. The use of different tenses in technical writing will be emphasized. Then, this course will acquaint the students with various forms of technical writing, typical components of a technical report, and presentations of tables, graphs, and schematics.

456032 農業高分子材料 3 選 下

介紹農業高分子材料之構造、機能性、製造方法及其應用。

456032 Agriculture Polymer Materials 3 S S

This course introduces the current topics in the agriculture polymer, including microstructure, mechanical properties, chemical properties, physicochemical properties, biochemistry properties, manufacturing method and application.

456033 生物感測器設計與實作 1 選 下

本課程主要是提供生物感測元件的設計與實作。課程中並將進行生物感測元件實作。

456033 Biosensor Design and Practice 1 S S

The aim of this course is to introduce the design and practice of biosensor. Students will make the biosensor component.

456034 鋼鐵電弧銲接實務 3 選 曾光宏、下

本課程目標主要係介紹鋼鐵料電弧銲接之理論、方法及程序，並於課程中進行鋼鐵銲接實務培訓，以及輔導學生參加技術士技能檢定，可使學生獲得職業證照，並使成為學生日後職場就業之關鍵技能。本課程授課內容包括：(1)安全操作、(2)銲接實務、(3)切割實務、(4)接頭幾何與銲接符號、(5)鋼鐵性質與破壞性試驗、(6)鋼鐵銲接冶金、(7)銲道瑕疵與缺陷、(8)銲道目視檢驗。

456034 Arc welding practices for steels 3 S Kuang-Hung, Tseng、S

The objectives of this course are to introduce to the students the theories, methods, and procedures of arc welding for steels. The practice course also includes training in arc welding for steels. With the objective of practices course, a training topic on the skill test of certified technician is presented. Students are expected to gain the occupational certification and will become their critical skill in the future employment. This course includes: (1) Safe practices, (2) Welding practices, (3) Cutting practices, (4) Joint geometry and welding symbols, (5) Steel properties and destructive testing, (6) Welding metallurgy of steels, (7) Discontinuities and defects of welds, (8) Visual Inspection of welds.

456035 書報討論(1)、(2) 1 選 上&下  
456036

本課程主要以金屬材料、電子材料、陶瓷材料、生醫材料與高分子材料五大主題為架構，期望藉由期刊論文選讀以及分組討論的方式訓練學生接受新知以及邏輯判斷能力。

456035 Reading Seminar (1)、(2) 1 S F&S  
456036

This course includes metal, electronics, ceramic, biomedical and polymeric materials. Students are trained by reading selected journal papers and group discussion to promote their knowledge level and ability of logic judgement.

456037 校外實習 3 選 合授、下

本課程規劃讓學生於國內外產學機構進行實務實習，可有效提升對材料科學與工程實務之認識。本課程期使學生掌握最新之材料科技與產品應用發展趨勢，強化學生實作能力，協助學生提早體驗職場，瞭解產業運作，結合理論與實務，培養正確工作態度，以及提升就業競爭性。

456037 Internship 3 S Joint teaching、S

This course allows students to conduct practical training in the industry or academic institutions at home and abroad, which can effectively enhance their understanding of practical techniques in the material science and engineering fields. This course aims to enable students to: master the cutting edge material technology and related product application development trends, strengthen their practical ability, experience the operation of industry for the combination of theory knowledge and practical techniques, develop their positive work attitude, as well as to enhance their competitive employability.