國立中興大學教學大綱(Syllabus)-大學部

系務會議通過修訂日期：2010/1/13
updated: (year)/(month)/(day)

課程名稱 (course name)	(中) U005 材料機械性質 (Eng.) U005 Mechanical Properties of Materials				
開課系所班級 (dept. & year)	材料科學與工程學系大學部三年級 (Dept. of Mat. Sci. & Engr., Sophomore)	**學分 (credits)**	3	**授課教師 (teacher)**	曾文甲教授 (Prof. Wenjea J. Tseng)
課程類別 (course type)	■必修(Mandatory) □選修(Elective)	**授課語言 (language)**	中文 (Chinese)	**開課學期 (semester)**	上學期 (Fall)
課程目標 (course objectives)	(中) 1. 熟悉基礎材料力學原理 2. 建立將工程材料力學與材料化學、微結構、變形與破壞行為整合之能力 3. 培育將基礎材料力學原理應用至結構材料選用的知識 (Eng.) 1 Fundamental understanding in mechanics of materials. 2 Relate the mechanics of materials to the chemistry, microstructure, and fracture behavior of modern engineering materials. 3 Introductory overview of applying fundamentals of mechanics to the materials selection in mechanical design.				
課程簡述 (course description)	(中) 工業材料的機械性質常是考慮實際應用時，決定材料性能的關鍵因素。當材料元件是直接應用在受力(Load Bearing)情況時，材料的機械性質例如：強度、韌性、楊氏模數、疲勞性質等材料相關參數，是決定何種材料及材料壽命的要因；即使材料元件不是直接應用在受力情況，例如在電子、光電、通訊、生醫等應用領域，材料的機械性質也是材料設計者必須考慮的因素。本課程將由基礎出發，深入淺出地向各位同學介紹材料的力學課程，將其與材料的微結構"力學"結合，最後與巨視的材料破壞(Fracture)互連。 (Eng.) Mechanical property of materials is one of the key factor in determining the material performance. When materials are directly used in load-bearing situation, mechanical properties such as strength, toughness, Young's modulus, fatigue resistance are critically important to the material selection and the prediction of material lifetime. Even if the material is not directly used in load-bearing situation, e.g., in devices used in electronic, optoelectronic, communication, biomedical applications, mechanical property of the material is still a pivotal factor necessary to be considered for material designers. This course is designed to start from the fundamentals of elasticity, followed then by the link between the elasticity with the microstructure defects in materials, and finally to the macroscopic fracture of materials.				
先修課程(prerequisites)					
課程名稱 (course name)	與課程銜接的重要概念、原理與技能 (relation to the current course)				

教學模式 (teaching methodology) 【請勾選】	講授 (teaching)	討論/報告 (discussion & report)	實驗/參訪 (exp./fab visit)	遠距/網路教學 (remote/web teaching)
	●			

授課內容（週次、單元名稱與內容、習作/考試進度、備註）
(course content and homework/tests schedule)

週次 (week)	單元名稱與內容 (subject and content)	習作/考試進度 (homework and tests)	備註 (remark)
01	Introduction		
02	Tensile response of materials: Atomistic basis of elasticity		
03	Tensile response of materials: Composite materials		
04	Tensile response of materials: Stress-strain curves		
05	Simple tensile and shear structures: Trusses	Quiz 1	
06	Simple tensile and shear structures: Pressure vessels		
07	Shearing stresses and strains		
08	General concepts of stress and strain: The kinematic equations		
09	General concepts of stress and strain: The equilibrium equations		
10		Quiz 2	11/13-22, Shaping 4, Madrid, Spain
11	General concepts of stress and strain: Tensor transformations and Mohr's circle, Constitutive equations, cubic equation, rotation of axes		
12	Yield and plastic flow: Phenomenological aspects of yield		
13	Yield and plastic flow: The dislocation basis of yield in crystalline materials (I)		
14	Yield and plastic flow: The dislocation basis of yield in crystalline materials (II)	Quiz 3	
15	Fracture and fatigue: Statistics of fracture and atomistic fracture model		
16	Fracture and fatigue: Linear elastic fracture mechanics		
17	Fracture and fatigue: Fatigue and S-N curves		
18	The exam week	*Final exam*	

學習評量方式
(evaluation)

Quizzes (3) 60%

Final Exam 30%

Homeworks 10% (One homework set in every other week typically.)

教科書&參考書目（書名、作者、書局、代理商、說明）
(textbook & other references)

教科書

Mechanical Behavior of Materials, William F. Hosford, Cambridge, 2005. (興大圖書館電子書)

參考書目

1. Mechanics of Materials, David Roylance, Wiley, 1996.
2. Mechanical Behavior of Materials, Keith Bowman, 2004.
3. Mechanical Metallurgy, G. E. Dieter, McGraw, 2001.

課程教材（教師個人網址請列在本校內之網址。）
(teaching aids & teacher's website)

Handouts and homework solutions are available on the instructor’s webpage.

課程輔導時間
(office hours)

與學系教育目標之關聯性(材料系)
(relation to educational objective of materials engineering department)

1. 提供材料性質、製程與應用及跨領域知識與訓練
   To provide interdisciplinary know-how and training on materials properties, processing, and applications
2. 培育具獨立思考、創新與實作能力之材料科技人才
   To train materials technology students for independent thinking, innovation, and practical skills
3. 培養團隊合作精神與溝通協調整合能力
   To cultivate the spirit of teamwork and the capacity of integrated cooperation
4. 建立多元價值與國際觀
   To inculcate multifarious values and cosmopolitan worldview
5. 強化綠色材料科技教育
   To implement educational programs in eco-materials technology

與學系教育核心能力之關聯性(材料系)
(relation to educational core abilities for materials engineering department)

(A) 運用數學、科學及材料工程知識能力
Ability to apply knowledge of mathematics, science, and materials engineering
(B) 設計與執行材料實驗及分析數據之能力
Ability to design and conduct experiments, as well as analyze data
(C) 執行材料工程實務所需之技術與能力
Ability to use techniques and skills for materials engineering practices
(D) 製程整合及及元件實作之能力
Ability to integrate process and make devices
(E) 溝通協調之能力與團隊合作之精神
Ability to communicate effectively and cultivate the spirit of teamwork
(F) 獨立思考及解決問題之能力
Ability to think independently and solve problems
(G) 培養國際觀及認識綠色材料對全球環境的影響
Cultivation of cosmopolitan worldview and understanding effects of eco-materials on global environment
(H) 終身學習之習慣與能力
Ability to cultivate life-long learning habit
(I) 瞭解材料工程人員的社會責任與專業倫理
Understanding materials engineers' social responsibility and professional ethics

課程內涵達成學系【核心能力】比對資料(大學部)

授課進度與內容	核心能力								
	A	B	C	D	E	F	G	H	I
	運用數學、科學及材料工程知識能力	設計與執行材料實驗及分析數據之能力	執行材料工程實務所需之技術與能力	製程整合及及元件實作之能力	溝通協調之能力與團隊合作之精神	獨立思考及解決問題之能力	培養國際觀及認識綠色材料對全球環境的影響	終身學習之習慣與能力	瞭解材料工程人員的社會責任與專業倫理
請勾選關聯性☑	☑	☑	☑	☐	☐	☐	☐	☐	☐
Introduction	1	1	1	0	0	0	0	0	0
Tensile response of materials: Atomistic basis of elasticity	1	1	1	0	0	0	0	0	0
Tensile response of materials: Composite materials	1	1	1	0	0	0	0	0	0
Tensile response of materials: Stress-strain curves	1	1	1	0	0	0	0	0	0
No class on Wed. (10/10/2007)	1	1	1	0	0	0	0	0	0
Simple tensile and shear structures: Trusses	1	1	1	0	0	0	0	0	0
Simple tensile and shear structures: Pressure vessels	1	1	1	0	0	0	0	0	0
Shearing stresses and strains	1	1	1	0	0	0	0	0	0
General concepts of stress and strain: The kinematic equations	1	1	1	0	0	0	0	0	0
General concepts of stress and strain: The equilibrium equations	1	1	1	0	0	0	0	0	0
General concepts of stress and strain: Tensor transformations and Mohr's circle	1	1	1	0	0	0	0	0	0
General concepts of stress and strain: Constitutive equations, cubic equation, rotation of axes, and experimental solutions	1	1	1	0	0	0	0	0	0
Yield and plastic flow: Phenomenological aspects of yield	1	1	1	0	0	0	0	0	0
Yield and plastic flow: The dislocation basis of yield in crystalline materials (I)	1	1	1	0	0	0	0	0	0
Yield and plastic flow: The dislocation basis of yield in crystalline materials (II)	1	1	1	0	0	0	0	0	0
Fracture and fatigue: Statistics of fracture and atomistic fracture model	1	1	1	0	0	0	0	0	0
Fracture and fatigue: Linear elastic fracture mechanics	1	1	1	0	0	0	0	0	0
Fracture and fatigue: Fatigue and S-N curves	1	1	1	0	0	0	0	0	0
總計(%)	100%	100%	100%	0%	0%	0%	0%	0%	0%

註：
1. 所有必修課均須填寫此表。
2. 矩陣中請填入關聯性； 1 表示相關，0 表示無相關。