

## 國立中興大學教學大綱

<b>課程名稱</b> (course name)	(中) 氣候及氣候變遷				
	(Eng.) Climate and Climate Change				
<b>開課系所班級</b> (dept. & year)	土壤環境科學系 碩士班	<b>學分</b> (credits)	2	<b>授課教師</b> (teacher)	R. R. Gillies
<b>課程類別</b> (course type)	<input type="checkbox"/> 必修 <input checked="" type="checkbox"/> 選修	<b>授課語言</b> (language)	英文	<b>開課學期</b> (semester)	1082
<b>課程簡述</b> (course description)	<p><b>【注意】</b>本課程為先上課後選課之課程，未事先完成課程的同學請勿選課。</p> <p><b>【NOTICE】</b> Climate and Climate Change had been finished already. Please DO NOT register this course if you have not participated in this course. Thank you for your consideration.</p> <p>本課程在於了解全球氣候系統、氣候變遷及其如何轉換為區域氣候的過程。首先介紹關鍵物理原理和過程以及它們是如何表現於大氣和海洋。同時學習一些應用物理和氣象學的原則。然後介紹全球氣候系統的建構和 研究，討論近年全球各地地理氣候的變遷。如何面對未來的溫室效應氣體排放量提高對氣候變遷的影響。最後整聚焦各區域氣候變異，檢視包括亞洲的主要氣候地區和世界其他地區。探討大氣及海洋控制這些區域氣候的動態模式結合氣象學及天氣圖做為整合解說。最後利用氣候模擬模式討論未來氣候的變化。</p> <p>This class is about understanding global climate system, climate change, and how the processes translate into important regional climates. It begins with key physical principles and processes and how they are manifested in the atmosphere and oceans. This involves learning some applied physics and principles of meteorology. The global climate system is then constructed and studied. Changes in climate in the recent geological past will be discussed. Then we confront the issue of increasing greenhouse gas emissions and effects on future global climate. Feedbacks in the system will be identified and discussed. Processes and simulations of the models that are well understood will be contrasted with areas of uncertainty. Then the focus changes to regional climates. A number of important regional climates will be examined, including major climate regions of Asia and other parts of the world. The dynamics of the atmospheric and oceanic processes that control each of these climate regions will be explored. Connections will be made with synoptic meteorology and weather maps will be used to show examples, and integrate knowledge. Finally, future</p>				

		changes in climate simulated by climate models will be discussed.		
<b>先修課程名稱 (prerequisites)</b>		General physics and calculus.		
<b>課程目標與核心能力關聯配比(%) (relevance of course objectives and core learning outcomes)</b>		<b>課程目標之教學方法與評量方法 (teaching and assessment methods for course objectives)</b>		
<b>課程目標</b>	<b>核心能力</b>	<b>配比(%)</b>	<b>教學方法</b>	<b>評量方法</b>
Understanding Climate and Climate Change	Understand most recent development in Soil and Environmental Sciences	50	<input type="checkbox"/> 講授 <input type="checkbox"/> 討論	<input type="checkbox"/> 測驗 <input type="checkbox"/> 書面報告 <input type="checkbox"/> 口頭報告/課堂討論發表 <input type="checkbox"/> 出席狀況
	Incubate abilities to solve soil and environmental issues	50		
<b>授課內容 (單元名稱與內容、習作/考試進度、備註) (course content and homework/tests schedule)</b>				
<b>Introduction to the Atmosphere and Climate (4 hours)</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Key properties of the atmosphere</li> <li><input type="checkbox"/> Solar and infrared radiation and atmospheric effects</li> <li><input type="checkbox"/> Radiation balance of the Earth. What are temperature and heat?</li> <li><input type="checkbox"/> What is climate?</li> </ul>				
<b>The Global Circulations of Atmosphere and Oceans (4 hours)</b> <i>Coriolis Effect</i> <i>Atmosphere:</i> <ul style="list-style-type: none"> <li><input type="checkbox"/> Processes in tropics;</li> <li><input type="checkbox"/> Hadley cells, subtropical highs</li> <li><input type="checkbox"/> Middle latitudes; thermal wind, jetstreams, baroclinic storms</li> </ul> <i>Oceans:</i> <ul style="list-style-type: none"> <li><input type="checkbox"/> Wind driven currents, Ekman spiral &amp; upwelling</li> <li><input type="checkbox"/> Thermohaline circulation &amp; heat transport</li> <li><input type="checkbox"/> Connections and feedbacks between ocean and atmosphere</li> </ul>				
<b>Greenhouse Gases and Global Warming (6 hours)</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> What are these gases, and why do they alter temperature</li> <li><input type="checkbox"/> Feedbacks that can alter the changes in temperature</li> <li><input type="checkbox"/> Records of air and ocean temperature, ice chemistry and ocean drilling</li> <li><input type="checkbox"/> Climate and weather extreme events</li> </ul>				
<b>Global Network of Climate Observations (6 hours)</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> What Climate Data are Collected and Where</li> <li><input type="checkbox"/> Class Visit to Actual Weather Station</li> </ul>				

- How Climate Data are Organized and Accessed

### **Climate Changes in Recent Geologic History (6 hours)**

- Historical trends in temperature
- Evidence of previous climate changes
- What causes ice ages? Why do we need to know?

### **Introduction to Climate Models (6 hours)**

- History of Atmospheric Models Vilhelm Bjerknes, Lewis Fry Richardson
- Modern History of Climate Models
- Validation of Climate Models – How Do We Know They Work?
- Predictions of Various Climate Models for Future Climate

### **Climate Prediction and Application (4 hours)**

- What is seasonal prediction?
- Uncertainties and Problems
- Difference between weather and climate predictions.

### **學習評量方式**

#### **(evaluation)**

- Problem Sets (Labs) 50%
- Midterm Examinations 20%
- Project / Term Paper 30%

### **教科書&參考書目(書名、作者、書局、代理商、說明)**

#### **(textbook & other references)**

Homework, Discussion, Oral Presentation, Attendance.

Gillies, R. R., and Wang, S., 2011: Climate & Climate Change, Kendall Hunt, U.S.A [ISBN-978-0-7575-8695-8] – this is an e-book

### **課程教材 (教師個人網址請列在本校內之網址)**

#### **(teaching aids & teacher's website)**

自編講義

### **課程輔導時間**

#### **(office hours)**