SEE3201: ATMOSPHERIC SCIENCE - AN INTRODUCTORY SURVEY

Effective Term
Semester A 2022/23

Part I Course Overview

Course Title
Atmospheric Science - An Introductory Survey

Subject Code
SEE - School of Energy and Environment
Course Number
3201

Academic Unit
School of Energy and Environment (E2)

College/School
School of Energy and Environment (E2)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Any one of the following courses:
1. PHY1200 Foundation Physics
2. PHY1201 General Physics I
3. SEE2001 Electromagnetic Principles for Energy Engineers or equivalent
and
Any two of the following MA courses:
1. MA1200 Calculus and Basic Linear Algebra I
2. MA1201 Calculus and Basic Linear Algebra II
3. MA1300 Enhanced Calculus and Linear Algebra I
4. MA1301 Enhanced Calculus and Linear Algebra II

Precursors
Nil

Equivalent Courses

Nil

Exclusive Courses

Nil

Part II Course Details

Abstract

This advanced undergraduate course is designed for undergraduate students majoring in Environmental Science and Management, Energy Science and Engineering, and also those taking the Atmospheric and Climate Science Minor. It will provide students with knowledge of physical processes occurring in the atmosphere and the climate system, and enable them to discover and analyze issues related to the atmospheric environment and global climate change. Special reference will also be made to phenomena prevalent in Hong Kong and the South China region.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the thermal and dynamical structure of the atmosphere, the atmospheric general circulation, and the key components of the Earth’ s climate system	12.5		x	
2	Relate basic thermodynamic and radiative processes in the atmosphere to the underlying physical laws	37.5		x	
3	Relate basic dynamical processes in the atmosphere to the underlying physical laws	37.5		x	
4	Discover and describe some climate change phenomena and explain them in terms of basic physical processes	12.5		x	

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Explain key concepts, such as theories related to weather system	1, 2, 3, 4	

2	Tutorials	Solidify students' concepts with practice (Explain the physical processes occurring in the atmosphere related to the daily weather information)	1, 2, 3, 4	
3	Field trip	Visit to HKO (satellite image, weather map, weather instrument)	4	
4	Group Project	Share different opinions on weather forecasting (cloud observation)	2, 3, 4	

Additional Information for TLAs

Scheduled activities: 2 hrs lecture + 1 hr tutorial. A tutorial will be given following the presentation of each complete topic within a CILO.

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Field trip Students will visit HKO to get some basic understanding of satellite image, weather map, weather instrument	1, 2, 3, 4	10	
2	Assignment Several assignments will be given throughout the semester. Through the assignments, students will demonstrate their understanding of the underlying concepts of the thermal and dynamical processes of the atmosphere	1, 2, 3	20	
3	Group project Students will work together to do weather forecasting based on cloud information.	1, 2	20	

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Additional Information for ATs

Examination duration: 2 hrs
Percentage of coursework, examination, etc.: 50% by coursework; 50% by exam

To pass a course, a student must do ALL of the following:
1) obtain at least 30% of the total marks allocated towards coursework (combination of assignments, pop quizzes, term paper, lab reports and/ or quiz, if applicable);
2) obtain at least 30% of the total marks allocated towards final examination (if applicable); and
3) meet the criteria listed in the section on Assessment Rubrics.

Assessment Rubrics (AR)

Assessment Task

1. Field Trip

Criterion

Ability to analyse questions related to temperature, precipitation and clouds

Excellent (A+, A, A-)

Excellent understanding of concepts and ability to analyse and solve problems related to temperature, precipitation and clouds

Good (B+, B, B-)

Good understanding of concepts and ability to analyse and solve problems related to temperature, precipitation and clouds

Fair (C+, C, C-)

Acceptable understanding of concepts and ability to analyse and solve problems related to temperature, precipitation and clouds

Marginal (D)

Marginally acceptable understanding of concepts and ability to analyse and solve problems related to temperature, precipitation and clouds

Failure (F)

Poor understanding of concepts and ability to analyse and solve problems related to temperature, precipitation and clouds

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Assessment Task

2. Assignment

Criterion

Ability to evaluate and analyse questions related to clouds development and severe weather

Excellent (A+, A, A-)

Excellent understanding of concepts and ability to analyse and solve problems related to clouds development and severe weather

Good (B+, B, B-)

Good understanding of concepts and ability to analyse and solve problems related to clouds development and severe weather

Fair (C+, C, C-)

Acceptable understanding of concepts and ability to analyse and solve problems related to clouds development and severe weather

Marginal (D)
Marginally acceptable understanding of concepts and ability to analyse and solve problems related to clouds development and severe weather

Failure (F)
Poor understanding of concepts and ability to analyse and solve problems related to clouds development and severe weather

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Assessment Task
3. Group Project

Criterion
Ability to analyse questions related to weather system

Excellent (A+, A, A-)
Excellent understanding of concepts and ability to analyse and solve problems related to weather system

Good (B+, B, B-)
Good understanding of concepts and ability to analyse and solve problems related to weather system

Fair (C+, C, C-)
Acceptable understanding of concepts and ability to analyse and solve problems related to weather system

Marginal (D)
Marginally acceptable understanding of concepts and ability to analyse and solve problems related to weather system

Failure (F)
Poor understanding of concepts and ability to analyse and solve problems related to weather system

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Assessment Task
4. Examination

Criterion
Ability to analyse questions related to some climate change phenomena and explain them in terms of basic physical processes

Excellent (A+, A, A-)
Excellent understanding of concepts and ability to analyse and solve problems related to the thermodynamics process of the atmosphere

Good (B+, B, B-)
Good understanding of concepts and ability to analyse and solve problems related to the thermodynamics process of the atmosphere

Fair (C+, C, C-)
Acceptable understanding of concepts and ability to analyse and solve problems related to the thermodynamics process of the atmosphere

Marginal (D)
Marginally acceptable understanding of concepts and ability to analyse and solve problems related to the thermodynamics process of the atmosphere

Failure (F)

Poor understanding of concepts and ability to analyse and solve problems related to the thermodynamics process of the atmosphere

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Part III Other Information

Keyword Syllabus

- The Earth’ Atmosphere
  Composition of the atmosphere, structure of the atmosphere, greenhouse gases, and air pollutants
- The Earth’ Changing Climate
  Radiative transfer, solar and terrestrial radiation, climate change
- Air temperature, Condensation and Clouds
- Cloud development, Precipitation & Severe weather
  The role of water in the atmosphere, Severe weather: Thunderstorm, Tornado and Tropical storm
- Thermodynamics of the atmosphere
  Applications of the first and second laws of thermodynamics, potential temperatures, adiabatic processes, thermodynamic diagrams.
- Atmospheric circulations
  Three cell model: Hadley Cell, Ferrel Cell, Polar Cell, Jet Streams, Air-Sea interaction, Walker circulation, ENSO, NAO, PDO
- Weather System and Weather Forecasting
  Air mass, Frontal system: Cold front, warm front, stationary front, occluded front, Weather map

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	Atmospheric Science–An introductory survey, J.M. Wallace & P.V. Hobbs (Academic press/Elsevier, 2nd edition, 2006)
2	An Introduction to Dynamic Meteorology, J R Holton (Academic Press, 3rd edition, 1992)
3	Atmosphere, Ocean and Climate Dynamics: An Introductory Text, J. Marshall and R. A. Plumb (Academic Press, 2007)
4	The Physics of Atmospheres, J T Houghton (Cambridge, 3rd edition, 2002)
5	Understanding Weather and Climate, E Aguado and J E Burt (Prentice Hall 2001)