

The Hong Kong Polytechnic University

Subject Description Form

Subject Code	AP1D04
Subject Title	Introduction to atmospheric science
Credit Value	3
Level	1
Pre-requisite / Co-requisite/ Exclusion	Nil
Objectives	<p>The main objectives of this subject are:</p> <ul style="list-style-type: none">(a) to introduce basics meteorological concepts in a visual and practical manner to students, while simultaneously providing the students with a comprehensive background in basic meteorology via non-mathematical exposition of its central ideas (namely, a perspective approach for both science and non-science oriented students);(b) to introduce the basics science of weather and climate, their changes due to human activities (i.e., interrelationship between tropical cyclones and global warming) to the students, and hence lead them to perceive the importance of environment protection;(c) to introduce basics weather data acquisition and weather forecasts to the students;(d) to introduce basics knowledge of the practical weather forecast, severe weather and climatology of Hong Kong to the students from experts in the Hong Kong Observatory (HKO).
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ul style="list-style-type: none">(a) apply the basics physics principle to explain some weather and climatic phenomena in real life;(b) interpret weather information from official weather information sharing platform like HKO web site and weather reports from other observatories around the world;(c) understand the basics principle of numerical weather forecast and data acquisition in meteorology;(d) understand the physical origins of climate changes;(e) understand basic operation principles of observational instruments;

	<p>(f) understand the impacts of severe weathers and climate changes on human activities like tropical cyclone, El Nino and La Nina etc; understand the influence of human activities on climate changes and hence aware the important of environmental protection.</p>
<p>Subject Synopsis/ Indicative Syllabus</p>	<p>Subject Synopsis: This subject is to lead students to understand the physical processes governing the weather that we observe every day and the weather, climate and environmental change issues that are so important to the human condition and their social impact.</p> <p>Syllabus:</p> <p>(a) Composition and structure of the atmosphere: Overview of the structure of the atmosphere; weather development in troposphere; ozone depletion in stratosphere; tropical atmospheric circulation and surface ocean currents.</p> <p>(b) Basic concepts of science in atmosphere: the causes of Earth's seasons; solar radiation and Earth's energy balance; atmospheric pressure and wind; global temperature distribution and atmospheric moisture.</p> <p>(c) Severer weather: Stability and cloud development; winds and vertical air motions; precipitation, thunderstorms and tornadoes; middle-latitude cyclones; formation and structure of tropical cyclones; monsoon wind; cold and warm fronts.</p> <p>(d) Weather analysis and forecast: Introduction to weather analysis and forecast in Hong Kong Chek Lap Kok airport; interpretation of weather phenomena by using weather satellites; detection of wind speed; rainfall level and lightning in Hong Kong Observatory; comprehensive introduction of numerical forecast prediction; local severer weather phenomena and public weather alerts.</p> <p>(e) Global climate changes: El Nino and La Nina; oceanic processes; global warming and weather affected by volcanic eruptions; interrelationship between global climate changes and human activities.</p>
<p>Teaching/Learning Methodology</p>	<p><u>Lectures:</u> Basic principles and fundamentals of atmospheric science will be introduced and discussed. In the lecture, scientific reasoning will be presented to assist students in understanding the basic concepts of atmospheric science as well as their applications in weather forecast and analysis. Discussions on some frequent weather phenomena in Hong Kong will be conducted to stimulate their interest and thinking. Students can acquire basic concepts of meteorology and scientific methods in weather forecast, which can further develop their analytical skills as well as critical thinking.</p> <p><u>Tutorials:</u> In the tutorials, some simple calculations and scientific reasoning in weather</p>

phenomena, which are the supporting knowledge to the lectures, will be discussed. Students are required to contribute to discussion by sharing and comparing ideas of some selected topics such as the economic and social impacts of the typhoon, El Nino and La Nina, the important of weather forecast in aviation and shipping, etc., In addition, some severe weathers happened in Hong Kong will also be discussed in tutorials to draw students' interest. Quizzes will be given in the tutorials in order to draw the students' attention in the tutorials and consolidate the concepts that they have learned.

Laboratories:

Simple experiments for detecting various weather-related parameters (with the help of open resources from the HKO and other websites like the World Weather Information) will be introduced. For the laboratory, students are required to collect scientific data like humidity, speed and direction of wind, air pressure, etc., and they can acquire analytical skills for analyzing the experiment data and justify which weather phenomena lead to those weather parameters. For report preparation, students are required to search for information to support their arguments for writing a scientific report with proper referencing of literatures, websites and reference books.

Site visit to the HKO:

Site visit to the HKO headquarter/outstation will be arranged for the students to see practical weather measurements and basic operation of weather analysis. Besides the simple observational instruments like raining gauge, dry bulb and wet bulb etc., students will also have a chance to have an introduction to the operations of on-site earthquake measurement and radiation monitoring by the scientific officer in HKO. Real operations of the weather analysis in the HKO headquarter and aviation weather center may be provided if the situation allows.

Group Project:

Students will be divided into small groups. The project serves the purposes of developing the students' capability of problem solving and application of the knowledge learnt in the lecture. Selected topics in meteorology will be proposed to the groups for designing their topics for in-depth exploration and discussion. In order to stimulate the students' thinking in their project, extra reading materials relating to the global weather problems will be suggested for their self-study. Some of them will be discuss in the tutorials. Their work will be previewed, and guidance and advices will be provided for ensuring the progress as well as the quality of the projects. Discussion will be conducted at the end of each presentation. Their higher order thinking, such as problem analysis, critical thinking and creative thinking, as well as team work can be trained through the group project.

Individual Study:

Study effort is also devoted to reading (see the recommended reading materials). The emphasis in this subject on reading comprehension is designed to give the student an essential experience of empowerment in learning effectively.

Reading & Assessment Feedback:

Assessments will be conducted early for identifying difficulties encountered by the students and allowing the lecturer to modify the way of offering the course

	materials.							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
			a	b	c	d	e	f
	1. Assignment	20%	√	√	√	√		√
	2. quizzes	20%	√	√	√	√		√
	2. Test	40%	√	√	√	√		√
	3. Lab Report	10%	√	√	√	√	√	√
	4. Presentation	10%	√	√	√	√		√
	Total	100 %						
<p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>In this subject, students will have chance to operate simple observational instruments and understand the real weather analysis and forecast in the HKO from the sharing of HKO scientific officers.</p> <p>Group presentation is required at the end of the semester. The students are required to deliver a presentation on their assigned problem, including at least background information, reasoning and conclusions. Their higher order thinking, such as problem analysis, critical thinking and creative thinking, as well as the basic knowledge of atmospheric science will be assessed through the presentations.</p>								
Student Study Effort Expected	Class contact:							
	▪ Lectures						27 h	
	▪ Tutorials						11 h	
	▪ Experiments						3 h	
	Other student study effort:							
	▪ Reading and self-study						81 h	
	Total student study effort						120 h	
Reading List and References	<ol style="list-style-type: none"> 1. E. Aguado and J.E. Burt, "Understanding Weather & Climate", Pearson, Prentice Hall, 2007. 2. Robert A. Ristinen, Jack J. Kraushaar, "Energy and the environment", John Wiley, 2006. 3. J.F.C. DiMento and P. Doughman, "Climate change: what it means for us, our children, and our grandchildren", MIT Press, 2007. 4. W.R. Cotton and R.A. Pielke Sr., "Human impacts on weather and climate", Cambridge University Press, 2007. 5. Links to: <ol style="list-style-type: none"> (i) Hong Kong Observatory of HKSAR, http://www.hko.gov.hk/contente.htm/ 							

	<p>(ii) Environmental Protection Department of HKSAR, http://www.epd.gov.hk/epd/eindex.html/</p> <p>(iii) Greenpeace China, http://www.greenpeace.org/china/</p>
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