GE1321: OUR LIFE IN THE NUCLEAR AGE

Effective Term
Semester A 2022/23

Part I Course Overview

Course Title
Our Life in the Nuclear Age

Subject Code
GE - Gateway Education
Course Number
1321

Academic Unit
Mechanical Engineering (MNE)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

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

GE Area (Primary)
Area 3 - Science and Technology

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

Nuclear technology is widely used in modern day society, ranging from simple smoke detector to more sophisticated PET scan medical equipment. Also, nuclear energy is considered as the only non-greenhouse gas-emitting power source that can effectively replace fossil fuels and satisfy global energy demand. The key element of all these different applications is radiation. Radiation has led to the creation of many useful applications and hence brings many business and career opportunities. However, like many great inventions, it also comes with its risks and controversies. Through examples commonly found in our daily life and visits to some relevant organisations such as Daya-Bay Nuclear Power Station, this course help students from different disciplines, including business, law and social science students, to appreciate the pros and cons of nuclear technology. It will also facilitate students to recognise the opportunities and the risks associated with the nuclear technology in order to benefit their own future careers.

This course aims to introduce the roles of nuclear technology in the modern society. Some typical examples will be used to illustrate how the nuclear technology can be used to enhance our quality of life. Students will also learn the brief history of nuclear technology and the issues of nuclear proliferation. As Hong Kong is using over 23% nuclear energy, and 77 new reactors are under construction and planned in mainland China, the course will discuss why nuclear energy is essential for modern society, even after several severe nuclear accidents in the past. The course is designed to help students to appreciate the basic principles of nuclear energy generation, radiation, medical radiation, radiation protection, nuclear safety, nuclear waste, maintenance engineering, risk engineering, crisis management, nuclear controversy and nanotechnology for nuclear applications. Through real-life examples, aforementioned topics and fieldtrips, students would be able to comprehend the opportunities and also the risks associated with the technology in modern society.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the roles of nuclear technology in modern society.			x	
2	Explain the basic principle of nuclear energy generation, the impact on environment and radiation shielding.			x	
3	Evaluate radiation technology used in different application areas.		x	x	
4	Explain the advantages and disadvantages of nuclear technology.			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	Lectures – delivered by MNE staff and industrial guest speakers Watching relevant films Small group discussions Student presentations	1, 2, 3, 4	3 hrs/week
2	Possible Fieldtrips & Technical Visit(s)	Nuclear power plant (e.g. Daya Bay Nuclear Power Station), Renewable energy plant (e.g. Hong Kong Electric Lamma Wind Power Station), Traditional power plant (e.g. Black Point Gas-fired Combined Cycle Power Station) or Other nuclear related facilities (e.g. Hong Kong Observatory, Radiology & Nuclear Medicine Department of Princess Margaret Hospital).	1, 2, 3, 4	1 hr/week (2-3 trips)

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Group Report	1, 2, 3, 4	20	
2	Oral Presentations	1, 2, 3, 4	10	
3	Radiation Measurement & Related Experiment	1, 2, 3, 4	30	
4	Possible Fieldtrips & Technical Visit(s)	1, 2, 3, 4	10	

Continuous Assessment (%)

70

Examination (%)

30

Examination Duration (Hours)

1.5

Additional Information for ATs

For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

Group Report
Students are required to work in teams to complete a mini-project. The topic of the mini-project is chosen by the students themselves on any related fields. The findings of the mini-projects will be presented in the form of a Microsoft Word file.

Relevant pictures, texts, newspaper articles, technical drawings, etc can be included in the Word file to demonstrate their understanding on the subject matters. Each group's Group Report will be assessed at the end of the semester. However, students are required to make frequent oral presentations about their mini-project and formative feedback will be given to students about their performance and areas which can be strengthened.

Oral Presentations
Oral presentation will be conducted to allow students to present their mini-project results, and radiation measurement and related experiments. The presentation will be in the form group presentation but each student is required to present part of the findings or results.

Radiation Measurement & Related Experiment
Students are required to submit a group report on radiation measurement and related experiments. The report includes two parts: (1) background radiation by Geiger counter and (2) theme research using XRF (X-Ray Fluorescence) Analyzer.

Possible Fieldtrips & Technical Visit(s)
Relevant technical visits will be arranged to allow students to appreciate how the nuclear technology is being used in modern day society. After the visit(s), students will be asked to do , discussion or essay about the technical visit(s). For those students who cannot attend the visits, they will need to submit a longer essay on the related topics.

If field trips cannot be organized due to unexpected circumstances, other self-learning activities can be adopted instead, such as:
- writing an essay on a related topic
- making a video clip introducing a related topic on Youtube or Facebook or Instagram or TikTok
- making a storyboard for introducing a related topic to primary or secondary school students
- making a presentation on a related topic, etc

All assessment tasks will be marked according to the performance assessment rubric.

Examination
Examination will be conducted to assess the students' basic factual knowledge on the subject matters.

Assessment Rubrics (AR)

Assessment Task

1. Group Report

Criterion

1.1 Ability to conduct research relevant information for a related topic.
1.2 Ability to evaluate and integrate the information using process(es) of scientific reasoning to identify facts from rumours or speculation.
1.3 Ability to draw conclusions based on valid evidence or proof.
1.4 Ability to apply factual information to formulate views for the future developments and impacts to society.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
2. Oral Presentations

Criterion
Ability to describe and explain the basic principles and factual knowledge of nuclear technology used in modern society; and to organise and present the relevant information and findings clearly, systematically and precisely.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
3. Radiation Measurement & Related Experiment

Criterion
3.1 Ability to conduct experiments in systematic manner.
3.2 Ability to organise measured data in logical manner.
3.3 Ability to evaluate and analyse data comprehensively and critically.
3.4 Ability to draw conclusions logically and sensibly based on measured data.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
4. Possible Fieldtrips & Technical Visit(s)

Criterion
Ability to observe, identify and describe technologies applied in the visited industry.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
5. Examination

Criterion
Ability to describe and explain the fundamental knowledge on the subject.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Additional Information for AR
Note: For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

Part III Other Information

Keyword Syllabus
- Effects and Uses of Radiation such as for food industry and non-destructive testing industry
- Nuclear medicine and medical radiation
- History of nuclear technology development

- Nuclear controversy
- Introduction to energy, energy sources, electricity generation
- Energy impact on environment
- Fundamentals of Nuclear Power
- Nuclear Fuel & Nuclear Waste
- Nuclear Safety and Nuclear Accidents
- Maintenance Engineering and Non-Destructive Testing techniques
- Risk engineering and crisis management, especially on issues related to Natural disaster, Technological crises, Organizational misdeeds, and Terrorist attacks/man-made disasters

Possible Fieldtrips: Daya Bay Nuclear Power Station, Hong Kong Electric Lamma Wind Power Station, Hong Kong Observatory, Black Point Gas-fired Combined Cycle Power Station, Radiology & Nuclear Medicine Department of Princess Margaret Hospital etc.

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	Richard Wolfson, Nuclear choices: a citizen's guide to nuclear technology, Cambridge, Mass.: MIT Press, c1993.
2	Frank L. Bouquet, Nuclear energy simplified: an overview of the nuclear technology of reactors, space, and medicine, Graham, Wash.: Systems Co., c1992.
3	Charles D. Ferguson, Nuclear Energy: What Everyone needs to know, Oxford University Press 2011.
4	Ian Hore-Lacy, Nuclear Energy in the 21st Century : the World Nuclear University Primer, World Nuclear University Press, 2nd ed., 2010.
5	Online Resources: Nuclear proliferation, Detroit, Mich. : Gale, 2008- : http://find.galegroup.com/gic/infomark.do?&searchType=BasicSearchForm&type=portal&prodId=GIC&queryId=Locale(en,US,):FQE=(PI,None,5)G1168%24&portalId=&ver International Atomic Energy Agency: http://www.iaea.org/

Annex (for GE courses only)

A. Please specify the Gateway Education Programme Intended Learning Outcomes (PILOs) that the course is aligned to and relate them to the CILOs stated in Part II, Section 2 of this form:

Please indicate which CILO(s) is/are related to this PILO, if any (can be more than one CILOs in each PILO)

PILO 1: Demonstrate the capacity for self-directed learning

3, 4

PILO 2: Explain the basic methodologies and techniques of inquiry of the arts and humanities, social sciences, business, and science and technology

1, 2, 4

PILO 3: Demonstrate critical thinking skills

3, 4

PILO 4: Interpret information and numerical data

3, 4

PILO 10: Demonstrate the attitude and/or ability to accomplish discovery and/or innovation

3, 4

B. Please select an assessment task for collecting evidence of student achievement for quality assurance purposes. Please retain at least one sample of student achievement across a period of three years.

Selected Assessment Task

Group Report