City University of Hong Kong
Course Syllabus

offered by Department of Physics
with effect from Semester B 2019/20

Part I Course Overview

Course Title:	**Nuclear Reactor Physics**
Course Code:	**PHY4231**
Course Duration:	**One semester**
Credit Units:	**3**
Level:	**B4**
Proposed Area: *(for GE courses only)*	☐ Arts and Humanities ☐ Study of Societies, Social and Business Organisations ☐ Science and Technology
Medium of Instruction:	**English**
Medium of Assessment:	**English**
Prerequisites: *(Course Code and Title)*	**MBE3107 Principles of Nuclear Engineering**
Precursors: *(Course Code and Title)*	**Nil**
Equivalent Courses: *(Course Code and Title)*	**AP4231/JC4231 Nuclear Reactor Physics**
Exclusive Courses: *(Course Code and Title)*	**Nil**

Part II Course Details

1. Abstract

This course aims to give an overview of the physics of nuclear reactors and their behaviour. It also introduces how chain reaction can be used to induce controlled rate of fission in fissile materials for energy generation in reactors. Finally, it describes the factors that affect the design and behaviour of nuclear reactors.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs[#]	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	**Describe** the general principles of reactor configuration required to maintain a self-sustaining chain reaction.		✓	✓	
2.	**Explain** reactor dynamics in both the critical and subcritical core.		✓	✓	
3.	**Analyse** reactivity feedback effects such as temperature effects, fission product poisoning, and fuel burnup.			✓	✓
4.	**Discuss** operational considerations when reactor operates at low and high power conditions.		✓		✓
** If weighting is assigned to CILOs, they should add up to 100%.*		100%			

[#] Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.

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 self-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.

3. Teaching and Learning Activities (TLAs)

(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.				Hours/week (If applicable)
		1	2	3	4	
Lecture	Delivery of the course will be achieved through a series of formal lectures supported by practical case studies.	✓	✓	✓	✓	2 hrs/week
Tutorial	Students will be provided with reading lists to assist their study of the subject, and they will be expected to prepare material in advance ofthe sessions for discussion.		✓	✓	✓	I hr/week

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.				Weighting*	Remarks
	1	2	3	4		
Continuous Assessment: 40%						
Small group discussion		✓	✓	✓	15%	
Mini-project		✓	✓	✓	25%	
Examination: 60% (duration: 2 hours)						
Examination	✓	✓	✓	✓	60%	
** The weightings should add up to 100%.*					100%	

^ For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained.

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Small group discussion	Attitude to attend classes and ask questions.	High	Significant	Moderate	Basic	Not reaching marginal level
2. Mini-project	Ability to complete challenging assignments related to the key concepts, principles, and theories taught in lectures.	High	Significant	Moderate	Basic	Not reaching marginal level
3. Examination	Ability to explain and derive the details of reactor physics.	High	Significant	Moderate	Basic	Not reaching marginal level

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

- Criticality
- Starter sources
- Subcritical multiplication
- Neutron moderators
- Moderators and reactor design
- Delayed neutrons and controllability
- Effects of temperature and voiding on core reactivity
- Long-lived poisons and fuel reprocessing
- Short-lived poisons and controllability
- Uranium enrichment

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

Nil

2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

1.	Weston M. Stacey, "Nuclear Reactor Physics", Wiley-Interscience, ISBN: 0471391271.
2.	Lamarsh J. R. and Baratta A. J., "Introduction to Nuclear Engineering", Prentice Hall, ISBN: 0-201-82498-1.