Form 2B

City University of Hong Kong

Information on a Course

offered by Mechanical and Biomedical Engineering

with effect from Semester A in 2013/2014

Part I

Course Title: **Decommissioning and Waste Management**

Course Code: **MBE6105**

Course Duration: **One Semester**

No. of Credit Units: **3**

Level: **P6**

Medium of Instruction: **English**

Prerequisites: **Nil**

Precursors: **MBE3107 Principles of Fission Reactors / AP3202 Modern Physics or equivalent**

Equivalent Courses: **Nil**

Exclusive Courses: **Nil**

Note:
Students may repeat a course, or an equivalent course, to improve course grade only if the previous course grade obtained is C or below.

Part II

1. Course Aims

This course aims to give students a broad understanding of the management of backend nuclear fuel cycle which includes interim storage of spent nuclear fuels after discharged from the reactors, recycling and reprocessing of spent nuclear fuels, final disposal of spent nuclear fuels and high-level radioactive waste. An overview of the disposal of low-level radioactive waste and decommissioning a nuclear power plant will also be given. The two US geologic repository programs will be used to illustrate the steps of developing a geologic repository program and how to demonstrate its long-term safety after closure.

2. Course Intended Learning Outcomes (CILOs)

Upon successful completion of this course, students should be able to:

No.	CILOs	Weighting* (if applicable)
1.	**Explain** the nuclear fuel cycle and management of backend nuclear fuel cycle - including decommissioning of nuclear power plants, low level radioactive., and spent nuclear fuels after discharged from the reactors; options for management of spent nuclear fuels and proliferation concerns	1
2.	**Explain** the US/France geologic repository programs and the evolution of policy.	2
3.	**Understand** the process of developing a geologic repository for spent nuclear fuels and high level waste and key technical elements involved in a geologic repository program and how to demonstrate its long-term safety after closure using a total system performance assessment (TSPA) methodology. A system dynamic code, GoldSim, will be used as to illustrate performing a complex total system performance assessment (TSPA).	1
4.	**Understand** other international geologic disposal programs.	2
5.	**Conduct** a research topic on the management of backend nuclear fuel cycle.	1

***Weighting ranging from 1,2,3 to indicate the relative level of importance in an ascending order.**

3. Teaching and Learning Activities (TLAs)

(Indicative of likely activities and tasks designed to facilitate students' achievement of the CILOs. Final details will be provided to students in their first week of attendance in this course)

Activity Type	Timetabled Activity (Hours per week)
Lecture/Tutorial Mix	Lecture mixed with tutorial (3)

TLAs	Large Class Activities (Lecture)	Group Work Activities (Tutorial)	Individual Work Activities (Self study)	Total Hours L+T (+S)
CILO 1	6	-	(2)	6 (+ 2)=8
CILO 2	6	-	(2)	6 (+ 2)=8
CILO 3	15	-	(5)	15 (+ 5)=20
CILO 4	3	-	(1)	3 (+ 1)=4
CILO 5	-	9	(15)	9 (+ 15)=24
Total (hrs)	**30**	**9**	**(25)**	**39 (+ 25) =64**

4. Assessment Tasks/Activities

(Indicative of likely activities and tasks designed to assess how well the students achieve the CILOs. Final details will be provided to students in their first week of attendance in this course)

ATs	Examination (2.5 hrs)	Quizzes	Term Paper / Oral Presentations	Total (%)
CILO 1	10	2	-	12
CILO 2	10	2	-	12
CILO 3	30	4	-	34
CILO 4	10	2	-	12
CILO 5	-	-	30	30
Total (%)	**60**	**10**	**30**	**100**

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

5. Grading of Student Achievement:

Examination: 60%
Quizzes: 10%
Term Paper/Oral Presentations: 30%

Grade Table

Letter Grade	Grade Point	Grade Definitions
A+	4.3	Excellent
A	4.0	
A-	3.7	
B+	3.3	Good
B	3.0	
B-	2.7	
C+	2.3	Adequate
C	2.0	
C-	1.7	
D	1.0	Marginal
F	0.0	Failure
P	-	Pass

Please refer the SGS's website for details.

Part III

Keyword Syllabus:

- Overview of the nuclear fuel cycle
- Key components of the management of backend of nuclear fuel cycle
- Decommissioning of nuclear power plants
- Disposal of Low Level Waste
- Spent nuclear fuel interim storage (wet and dry)
- Open fuel cycle versus closed fuel cycle; recycling and reprocessing of spent nuclear fuels and non-proliferation concerns
- Overview of the history of the US policy and regulations of high level waste and spent nuclear fuels
- Main components of a geologic repository program,
- Site characterization and underground research laboratory
- Design of a Geologic Repository System
- Engineered Barrier Systems (EBS) for a geologic repository
- Flow and transport of radionuclides
- Features, events, and processes (FEPs), scenario development
- Post-Closure Safety Analysis of a Repository and total system performance assessment (TSPA), examples of the US Yucca Mountain Project
- A survey of international repository programs
- Challenges of Management of Backend Nuclear Fuel Cycle

Recommended Reading:

Text(s)

1. James H. Saling and Audeen W. Fentiman, “Radioactive Waste Management”, 2nd edition, Taylor & Francis, New York.
2. Robert G. Cochran and Nicholas Tsoulfanidis, “The Nuclear Fuel Cycle: Analysis and Management”, 2nd Edition, 2001, American Nuclear Society, 1999.
3. J. Samuel Walker, “The Road to Yucca Mountain: The development of Radioactive Waste Policy in the United States”, University of California Press, 2009.
4. National Research Council, “The Waste Isolation Pilot Plant: A Potential Solution for the Disposal of Transuranic Waste”, National Academy Press, Washington, D.C., 1996.
5. National Research Council, “Disposition of High-Level Waste and Spent Nuclear Fuel: The Continuing Societal and Technical Challenges”, National Academy Press, Washington, D.C., 2001.

Online Resources

1. Various IAEA reports on Nuclear Fuel Cycle and Waste Management at its website below:
   http://www-pub.iaea.org/MTCD/publications/SubjectAreas.asp

2. OECD Nuclear Enery Agency (NEA) reports on Waste Management and Decommissioning.
Note: some of the NEA reports are for NEA member states only.
   http://www.oecd-nea.org/rwm/