MECH4912 – Green Technologies for Buildings, Energies and Water

Instructor: Prof. Yanguang ZHOU

Target student group: MAE UG students (Year 3&4), priority will be given to ME students.

Quota: **45**

Grading Policy: Letter grade (A – F)
40% Homework, 10% experiment, and 50% final presentation

Course description:
This course introduces principles and technologies for sustainable and traditional cooling technologies for buildings, sustainable energy conversion, water desalination and purification. The first part of the course discusses cooling techniques for building including the traditional air conditioner and sustainable solar driven cooling technologies for buildings. The second part of the course discusses solar to thermal and chemical energy conversion technologies including solar collecting and concentrating technology, photovoltaic cells and solar thermophotovoltaics. The last part of this course will focus on the water harvesting technologies which include water desalination and purification.

Course Outlines:

Week 1	Introduction to green technologies
Week 2	Traditional cooling technologies for buildings
Week 3	Sustainable cooling technologies for buildings (theory and experiments)
Week 4	Introduction to sustainable energy
Week 5	Environmental characteristics
Week 6	Solar to thermal and chemistry energy
Week 7	Photovoltaics (theory and experiments)
Week 8	Site visit
Week 9	Introduction to water harvesting
Week 10	Water desalination technologies
Week 11	Water desalination and purification based on sustainable energy (theory and experiments)
Week 12	Advanced green technologies
Week 13	Presentations by students

Rationale for the course

This course on green technologies for buildings, energies and water is new in HKUST and possibly the first among other universities in Hong Kong. The energy problem has become a global challenge that society has to face in the 21st century. It is commonplace understanding that it is urgent to obtain high-

efficiency energy conversion from renewable sources and/or wasted energy and moderate the global reliance on exhaustible natural resources. Solar energy is almost everywhere in the world, and is among these most popular renewable sources.

In the first week of the course, we will introduce the green technologies to the students, and review the basic knowledge of green technologies all around the world. The students will have a brief knowledge of the theoretical background of green technologies for industrial applications.

In the 2nd to the 3rd week, the teaching will be focused on traditional and sustainable cooling technologies to buildings, including the traditional air conditioner and sustainable solar driven cooling technologies for buildings.

In the fourth week of the course, we will introduce the sustainable energy to the students, and review the basic knowledge of sustainable energy distribution all around the world. The students will have a brief knowledge of the theoretical background of sustainable energy for industrial applications.

In the 5th to the 7th week, the teaching will be focused on solar collecting and concentrating, solar water-heating systems, solar space heating and cooling, Industrial process heat, chemistry applications, and solar dryers, and solar desalination process. The students are expected to be equipped with essential knowledge of solar thermal technologies.

In the 8th week, site visit (The Education Path at the Electrical and Mechanical Services Department (EMSD) Headquarters at Kowloon Bay) and experimental study at DMTR Lab.

In the 8th week, the technologies on converting solar to electricity or heat will be offered to the students. The students will learn the photovoltaic effects, the fundamental of photovoltaic as well as the applications of photovoltaic devices.

In the 9th week to the 11th week, the designing and modeling solar energy systems will be introduced. The students are then expected to have the basic knowledge of how to make use of the modeling techniques to study solar energy conversion.

In the 12th week, I will give two lectures in terms of industrial application examples, and talk about more advanced energy conversion techniques, such as soft thermoelectric electronics, high entropy thermal energy storage devices, and radiation cooling techniques using wood, etc.

In the 13th week, presentations by the students (individual or group).

I will deliver lectures by using both powerpoint slides and lecture notes. Apart from homework, a mid-term will be given.

Course ILOs (Intended Learning Outcome)

Knowledge/Content Related:

C-ILO1: Knowledge of thermodynamics

Recommended book:

Solar Energy Engineering: Processes and Systems