SEE4116: ENERGY AND CARBON AUDITING

Effective Term
Semester A 2024/25

Part I Course Overview

Course Title
Energy and Carbon Auditing

Subject Code
SEE - School of Energy and Environment
Course Number
4116

Academic Unit
School of Energy and Environment (E2)

College/School
School of Energy and Environment (E2)

Course Duration
One Semester

Credit Units
3

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

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
SEE1003 Introduction to Sustainable Energy and Environmental Engineering

Precursors
SEE2204 Principles of Sustainability; AND
SEE3103 Energy Efficiency for Buildings

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This course aims to provide the students with the knowledge of energy and carbon auditing. The students will learn how to measure anthropogenic greenhouse gas (GHG) emissions for major human activities and identify effective GHG mitigation measures for proper GHG control and management. As energy consumption is often one of the dominating factors in carbon footprint analysis, the students will also learn energy auditing and various energy management opportunities (EMOs).

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Explain the sources of greenhouse gas emissions and their climate change effects. Quantify anthropogenic GHG emissions for major human activities.		x	x	
2	Describe the determinants of energy use in a range of sectors. Describe how to compare energy use with targets and ‘Benchmarks’. Describe how to measure energy use and conduct an energy audit.		x	x	
3	Identify, design and analyse innovative, effective GHG mitigation measures.		x	x	
4	Conduct energy audit, identify EMOs and predict energy savings in a range of sectors.			x	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.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Students will attend lectures which discuss key theories and concepts of energy and carbon auditing.	1, 2, 3, 4	
2	Tutorial	Students will practice calculations through case studies and example data sets for energy and carbon auditing.	1, 2, 3, 4	

3	Analysis	Students will analyse data sets to demonstrate critical thinking and interpretation of energy and carbon auditing.	1, 2, 3, 4	

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Assignments	1, 2, 3, 4	40	
2	Mid-term Test	1, 2, 4	20	

Continuous Assessment (%)

60

Examination (%)

40

Examination Duration (Hours)

2

Additional Information for ATs

Examination duration: 2 hrs
Percentage of continuous assessment, examination, etc.: 60% by continuous assessment; 40% by exam

To pass a course, a student must do ALL of the following:
1) obtain at least 30% of the total marks allocated towards continuous assessment (combination of assignments, pop quizzes, term paper, lab reports and/ or quiz, if applicable);
2) obtain at least 30% of the total marks allocated towards final examination (if applicable); and
3) meet the criteria listed in the section on Assessment Rubrics.

Assessment Rubrics (AR)

Assessment Task

1. Assignments

Criterion

Ability to evaluate and solve practical problems related to energy and carbon auditing

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal level

Assessment Task
2. In-class Exercises

Criterion
Ability to analyse and solve problems related to energy and carbon auditing

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal level

Assessment Task
3. Mid-term Test

Criterion
Ability to apply engineering knowledge and skills to analyse, calculate, and solve problems related to energy and carbon auditing

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal level

Assessment Task
4. Examination

Criterion
Ability to apply engineering knowledge and skills to analyse, calculate, and solve problems related to energy and carbon auditing

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal level

Part III Other Information

Keyword Syllabus

Energy auditing; Carbon auditing; Energy benchmarking; Carbon benchmarking; Greenhouse gases; Anthropogenic GHG emissions; Carbon dioxide; Nitrous oxide; Methane; Sulfur exafluoride; Hydrofluorocarbons (HFCs); Perfluorocarbons (PFCs); Climate change; Global warming potential; GHG accounting; GHG mitigation measures; Energy Management Opportunities (EMOs); GHG management; CO_2 equivalent, Carbon footprint; Life cycle analysis; GHG protocol; GHG inventory; Emissions reporting; Emission trading.

Reading List

Compulsory Readings

	Title
1	Tony Eggleton. A Short Introduction to Climate Change. Electronic E book available from City University library
2	Steffen D. Saldana (editor), Sources and Reduction of Greenhouse Gas Emissions, New York : Nova Science Publishers, 2010.
3	Richard Vaillencourt, Simple Solutions to Energy Calculations, Lilburn, 3rd ed.GA: Fairmont Press, 2001
4	Moncef Krarti, Energy Audit of Building Systems: An Engineering Approach, 2nd Edition, CRC Press, Taylor & Francis Group, 2010.
5	Technical Guidelines on Code of Practice for Building Energy Audit. EMSD, HKSAR Government, 2015.
6	Guidelines to Account for and Report on Greenhouse Gas Emissions and Removals for Buildings in Hong Kong, EMSD, HKSAR Government, 2010.

Additional Readings

	Title
1	Code of Practice for Energy Efficiency of Building Services Installation, EMSD, HKSAR Government, 2015.
2	Albert Thumann, Terry Niehus and William J. Younger, Handbook of Energy Audits, 9th ed., Fairmont Press, 2012.
3	Chung, W., Hui, Y. V., & Lam, Y. M. (2006). Benchmarking the energy efficiency of commercial buildings. Applied Energy, 83(1), 1-14.
4	Chung, W. (2011). Review of building energy-use performance benchmarking methodologies. Applied Energy, 88(5), 1470-1479.
5	Carbon Trust (2008), Product Carbon Footprinting: the New Business Opportunity.
6	Ian S.F. Jones, Engineering Strategies for Greenhouse Gas Mitigation, Cambridge University Press, 2011.

7	IPCC Fifth Assessment Report. http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml
8	2013 ASHRAE Handbook – Fundamentals, ASHRAE, 2013.